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Psychometric evaluation of the Italian version of the adverse childhood experiences international questionnaire (ACE-IQ) in more than a thousand of community adults

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Abstract
Adverse Childhood Experiences (ACEs) are potentially traumatic events linked to health issues and public health costs. The World Health Organization (WHO)'s ACE International Questionnaire – International Questionnaire (ACE-IQ) is a widely used tool to screen ACEs, though its factorial structure remains debated. This study addresses gaps in ACE-IQ research being the first examining factor structures invariance across gender, age, and educational levels, considering both binary and frequency scores. Through convenience sampling, 1205 participants were recruited. The Italian version of the ACE-IQ, validated through back-translation, was administrated. Data were analyzed using exploratory and confirmatory factor analyses. Category-based analysis using binary scoring suggested a two-component model: At-risk environment and Maltreatment, showing good fit after adjustments, and with the frequency scoring system yielded unsatisfactory results with two excluded categories. Item-based binary scoring analysis identified five factors with good fit, but issues persisted across gender and education levels with one factor. The category-based analyses revealed a two-factor solution for both ACE-IQ's scoring systems, consistent with previous research. The binary scoring system's category-based structure demonstrated invariance across gender and age, but not educational levels, while the frequency scoring system's structure showed potential weaknesses. The item-based analysis suggested a five-factor solution and emphasized the distinctiveness of sexual abuse.

Keywords ACE-IQ · Adverse childhood experience · Factorial structure · Invariance · Italian version

Introduction

Adverse childhood experiences (ACEs) are potentially traumatic events occurring before age 18 (Afifi, 2020; Felitti et al., 1998) and international meta-analyses indicate that around 70% of adults have encountered at least one ACE (Madigan et al., 2023; Pace et al., 2022). Moreover, the ACEs are linked to adverse health and well-being outcomes, such as an increased risk of suicide, violence, risky sexual behaviors, substance abuse, and poorer mental health (Hughes et al., 2017; Kaminer et al., 2022; Mozafari et al., 2024). They are also associated with physical health conditions like diabetes, obesity, and cardiovascular diseases, impacting public health costs significantly (Bellis et al., 2019).

Many countries emphasize screening for ACEs at the community level, advocating for reliable psychometric tools (WHO, 2018). One such tool is the Adverse Childhood Experiences International Questionnaire (ACE-IQ), developed by the WHO based on the original ACE grid (Felitti, 2019). The ACE-IQ consists of 31 questions covering 13 categories of adversities grouped into four macro-categories: Abuse, Parents, Family Dysfunction, and Violence outside the home. It employs two scoring methods: a binary system assigning scores of 0 or 1 and a frequency system giving scores based on repeated exposure.

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Studies support the ACE-IQ's psychometric properties. It has shown mostly satisfactory internal reliability, i.e., the statistically evaluated consistency of items within a measurement tool in assessing the same construct (Christoforou & Ferreira, 2020; Gette et al., 2022; Santelices et al., 2025; Tarquinio et al., 2023) and concurrent and convergent validity with other ACE measures (Christoforou & Ferreira, 2020; Kazeem, 2015); Petrikova et al., 2021; Santelices et al., 2025; Swingen, 2020), i.e., the assessment of alignment with a simultaneous criterion (e.g., test comparison) and the correlation with related constructs, respectively. Notably, it correlates with the Childhood Trauma Questionnaire (CTQ), the Behavioral Risk Factor Surveillance System (BRFSS) and the Marshall Trauma Scale (MTS). It also effectively distinguishes depressive symptoms, self-injury, and predicts depression, anxiety, risky behaviors, substance misuse, poor mental health, and suicidality (Christoforou & Ferreira, 2020; Kidman et al., 2019; Pace et al., 2022, 2024; Hughes et al., 2017).

However, the ACE-IQ's factorial structure is debated (see Table 1 of Appendix A in Supplementary Material). Defining ACEs and selecting items lacked psychometric analysis support (Afifi, 2020; McLaughlin et al., 2021), and the WHO (2011) encouraged further psychometric studies. Six studies examined the ACE-IQ's factorial structure, yet consensus on the optimal structure remains elusive (Christoforou & Ferreira, 2020; Gette et al., 2022; Kidman et al., 2019; Santelices et al., 2025; Swingen et al., 2020; Tarquinio et al., 2023). These studies presented diverse and conflicting factorial structures and had limitations preventing testing the questionnaire's invariance across gender, age, or socio-educational levels. Notably, gender imbalance was significant, with female proportions ranging from 70 to 78% in three out of six samples (Christoforou & Ferreira, 2020; Gette et al., 2022; Tarquinio et al., 2023). Only two studies included participants over 36 years old (Santelices et al., 2025; Tarquinio et al., 2023), and none examined educational level invariance. Most studies focused on the binary scoring system, with only Swingen et al. (2020) and Santelices et al. (2025) exploring the frequency scoring system.

Given the above, this study uses the authorized Italian translation of the ACE-IQ in a sample covering a wide age range, balanced in binary gender and educational levels. The first aim was to examine the factorial structures of the 13 categories and 31 items using both binary and frequency scoring systems, to address literature gaps regarding category-based structures in community adults aged 18–60+, binary item-based scoring in adults older than 23 years, and frequency-scored item structures. The second aim was assessing configural invariance (i.e., the same factor structure across groups in measurement models) of the structures identified across gender, age, and, for the first time, educational levels. Based on existing results, we hypothesized a 3- or 2-factor solution on 13 categories and 6-factor at an item-level analysis with the binary scoring system (Gette et al., 2022; Tarquinio et al., 2023), and a 3- or 4- factor at a categorical-level was expected with the frequency system (Santelices et al., 2025).

Methods

Participants and procedure

Participants were enrolled using a convenience sampling method by Psychology BSc students trained to administer self-report assessments for evaluating early adverse life events by the lead author as supervisor. These students recruited individuals from their personal circles, provided a detailed explanation of the study's purpose, and ensured participants were informed about anonymity and privacy. Those who agreed to take part were required to sign an informed consent form before completing the questionnaires outlined in the following section. Participants did not receive any compensation. The maximum time for completion of the procedure was estimated to be 30 min. This study is part of a broader research project that adheres to the ethical guidelines set forth by the American Psychological Association and has been approved by the University of Genoa's Research Ethics Board under protocol number 2022/44.

A total of 1205 questionnaires were gathered and analyzed with no attrition (0%) observed. The participants reported an average age of 40.68 years (Standard Deviation [SD] = 17.57), with 630 of them identifying as females. Information on the demographic profile of the sample, including educational attainment and marital status, along with the prevalence rates of adverse childhood experiences (ACEs), can be found in Table 2 of Appendix A.

Measures

The Adverse Childhood Experiences International Questionnaire (ACE-IQ; WHO, 2018).

The Italian version of the Adverse Childhood Experiences International Questionnaire (ACE-IQ; WHO, 2018; Muzi et al., 2011) was utilized to assess the occurrence and frequency of various Adverse Childhood Experiences.

In October (World 2020), the authors reached out to two representatives of the ACE-IQ development task force (J. Passmore and R.A. Butchart) to inquire about authorized Italian translations of the questionnaire. The delegates granted permission for the authors to translate the questionnaire. E. Cotton, an English native-speaker and Linguistics

researcher at the Department of [Blinded], translated the questionnaire into Italian and then back into English. The first and last authors reviewed the translations to ensure congruence in meaning and the appropriateness of the items based on psychological expertise.

The questionnaire contains a sheet collecting social-demographic information of the respondents. Later, the ACE-IQ contains 31 questions on 13 categories grouped in the macro-categories of Abuse (including 8 items from A1 to A8 in the three categories Emotional Abuse, Physical Abuse, Contact Sexual Abuse), Parents (including 5 items from P1 to P5, in the categories Emotional Neglect and Physical Neglect), Family Dysfunction (including 8 items F1 to F8 into five categories of Parental alcohol/substance abuse, Parental mental illness, Incarcerated family member, Parental separation or loss, and Domestic violence), and Violence including manifestations of violence outside the household (including 10 items V1 to V10 in the dimensions Peer violence, Community violence, and Collective violence).

In line with the official binary system, each item is assigned a rating of 0 (No or never) or 1 (Yes or any response once/sometimes/many times). If a respondent scores 1 on at least one question within a category, they receive a score of 1 for the entire category. This cumulative score contributes to a total ACEs score ranging from 0 to 13, reflecting the presence or absence of each specific category of adverse childhood experiences in their life before the age of 18.

Regarding the frequency scoring system, the score assigned is again 0 (No) or Yes (1), with the 1 assigned only if the respondent selects the highest level of frequency in response to questions P3-P5, A1-A4, F6, V1, V4-V6; selects one of the two highest levels of frequency in response to questions F7-F8; selects one of the two lowest levels of frequency in response to questions P1-P2; reports any ACEs measured by items F1-F5, A5-A8 and V7-V10 regardless of their frequency. As in the binary official system, the final score ranges from 0 to 13, with higher scores indicating that the respondent repeatedly experiences each category scored with 1 (at least in the questions that explicitly refer to more than one time).

Analytic approach

Data underwent scrutiny for outliers and missing values. Any case with missing data on at least one ACE-IQ item was excluded. Frequencies for individual items, categories, and domains were calculated.

Exploratory factor analyses were conducted on polychoric correlation matrices (to accommodate the binary nature of the variables) with oblimin oblique rotations utilizing the psych package in Rstudio software for Mac. Bartlett's test of sphericity (Bartlett, 1950) was executed, and the Kaiser–Meyer–Olin (KMO) criterion was assessed. To determine the number of components to retain based on eigenvalues, Horn's parallel analyses were employed as per Velicer et al.'s (2000) recommendations, utilizing the R function developed by Revelle (2019). Once the factor count was determined, item loadings were scrutinized, with loadings of 0.35 or higher considered significant. If items displayed substantial loadings on multiple factors without a clear theoretical rationale, they were removed. If a factor comprised over 50% of items loading on other factors, reducing the number of factors was contemplated.

After identifying the final model, we proceeded to assess configural invariance across gender, age, and education categories. Dummy variables were generated using the median or cumulative frequencies. For testing configural invariance across age groups, a dummy variable was established by dividing the sample into two groups based on the median age (36 years). Concerning education levels, the first group encompassed individuals with no degree to a high school diploma; the second group comprised participants with a university or postgraduate degree. A a confirmatory factor analysis was conducted using the lavaan package in Rstudio software (Rosseel, 2012) and employing the Weighted Least Squares Mean and Variance (WLSMV) estimation method for ordered data. Model fit was assessed, with Root Mean Square Error of Approximation (RMSEA) values below 0.08 and a Comparative Fit Index (CFI) of at least 0.90 considered indicative of acceptable fit. Configural invariance was examined through a series of multi-group analyses.

Results

13 categories structures

Binary scoring category-level structure

The test of sphericity ($p<.001$) and the KMO measure (.8) indicated that the data was suitable for factorial analyses. Parallel analyses recommended extracting two components (Table 1). The first component, explaining 21% of the variance, was labeled "At-risk environment" and encompassed eight categories: Sexual abuse, Parental substance use, Incarcerated family member, Parental mental illness, Parental separation, Physical neglect, Community violence, and Collective violence. The second component, explaining 19% of the variance, was named "Maltreatment" and included the remaining categories: Physical and Emotional abuse, Emotional neglect, Domestic violence, and Peer violence.

A confirmatory factor analysis was conducted using the identified model, yielding a good fit based on the RMSEA

Table 1 Factorial structure and loadings on ACE-IQ categories with the binary scoring

	F1	F2
Physical abuse	−0.06	**0.74**
Emotional abuse	0.01	**0.86**
Sexual abuse	**0.41**	0.15
Parental substance use	**0.79**	0.10
Incarcerated family member	**0.82**	0.00
Parental mental illness	**0.43**	0.19
Domestic violence	0.21	**0.60**
Parental separation	**0.48**	−0.17
Emotional neglect	0.14	**0.49**
Physical neglect	**0.43**	0.14
Peer violence	−0.01	**0.53**
Community violence	**0.46**	−0.31
Collective violence	**0.48**	−0.01

F1 = At-risk environment, F2 = Maltreatment

Table 2 Factorial structure and loadings on ACE-IQ categories with frequency scoring

	F1	F2
Physical abuse	**0.87**	−0.10
Emotional abuse	**0.96**	0.05
Sexual abuse	0.34	0.27
Parental substance use	−0.07	**0.98**
Incarcerated family member	0.09	**0.67**
Parental mental illness	0.25	**0.40**
Domestic violence	**0.56**	0.32
Parental separation	0.02	**0.39**
Emotional neglect	**0.42**	**0.40**
Peer violence	**0.70**	−0.27
Community violence	**0.56**	0.16
Collective violence	0.11	0.32

F1 = Abuse and Violence, F2 = Parental inadequacy

(0.063), but not the CFI index (0.86). Modification indices were reviewed, leading to a re-specification of the model. Specifically, residual errors for the Community violence category were permitted to covary with the residual errors of both the Parental Separation and Collective Violence categories. The revised model demonstrated a satisfactory fit with RMSEA (0.054) and CFI (0.90) values. However, upon examining the significance of loadings, it was found that the Community Violence category did not significantly contribute. Consequently, this manifest variable, along with the previously added specifications, was removed from the model. The final model achieved a good fit (RMSEA = 0.052; CFI = 0.92), with no anomalies observed in the loading inspection.

Configural invariance The model concerning invariance across gender demonstrated a good fit (RMSEA = 0.051; CFI = 0.93), and loadings inspection revealed positive and statistically significant loadings in both groups. However, given the chi-square difference ($\Delta\chi^2$ = 180.88, $\Delta df = 10$, $p < .001$), along with a notable increase in RMSEA (ΔRMSEA = 0.017) and a substantial decrease in CFI (ΔCFI = –0.129), weak invariance across gender was not supported, as these changes indicate a significant decline in model fit compared to the configural model.

The multigroup confirmatory factor analysis testing invariance across age yielded a good fit (RMSEA = 0.044; CFI = 0.94). Going on with the test of metric invariance, we observed that, considered *t*he chi-square difference ($\Delta\chi^2$ = 218.33, $\Delta df = 10$, $p < .001$), along with an increase in RMSEA (ΔRMSEA = 0.019) and a substantial decrease in CFI (ΔCFI = –0.137), weak invariance across age levels was not supported, as these values indicate a significant worsening of model fit compared to the configural model.

Lastly, configural invariance across education levels was examined, resulting in an excellent fit for the model (RMSEA = 0.041; CFI = 0.95). Notably, all loadings were positive and significant, except for Collective violence, which did not load significantly on its latent variable in the group with a higher level of education. Regarding metric invariance, based on the reported values — a chi-square difference ($\Delta\chi^2$) of 172.04 with 10 degrees of freedom, a significant p-value ($p < .001$), an increase in RMSEA of 0.018, and a decrease in CFI of 0.129 — weak invariance across education levels was not supported, as these differences indicate a substantial deterioration in model fit compared to the configural model.

Frequency scoring category-level structure

Preliminary analyses revealed that the Physical neglect category remained constant, leading to its exclusion from subsequent analyses. The Bartlett test ($p < .001$) and the KMO index (0.7) indicated that the data was suitable for factor analyses. Additionally, parallel analysis recommended extracting two components. Details of factor loadings are presented in Table 2. The first factor, explaining 27% of the variance and labeled “Abuse and violence”, comprised six categories (Physical and Emotional Abuse, Domestic, Peer, and Community violence), with Emotional neglect cross-loading on the other factor. The second factor, explaining 19% of the variance and labeled “Parental inadequacy”, included five categories (Parental substance use, Parental mental illness, Incarcerated family member, Parental separation). Notably, these two categories did not load significantly on either factor. Due to unsatisfactory results in this exploratory factor analysis, with two categories excluded from the final structure, no further analyses were conducted to assess configural invariance.

Item-level structures

Binary scoring item-level structure and invariance

The analyses were conducted on 29 items of the ACE-IQ, with item V2 excluded as it was not assessable by the scoring system, and item F5 omitted due to the low occurrence of parents' death during the participants' first 18 years of life in the Italian population (less than 0.001%, estimated at around 1039 out of 8,854,519 children in 2022, ISTAT 2022a, 2022b).

The results indicated satisfactory outcomes for the test of sphericity ($p<.001$) and KMO (0.8), prompting the execution of a parallel analysis to determine the optimal number of components. The analysis revealed that the ideal solution comprised five components. Factor loadings from the rotated solution are presented in Table 3. The first factor, explaining 16% of the variance and encompassing nine items, was labeled "Maltreatment". This factor included descriptions of physical and emotional abuse, exposure to domestic violence, and incidents of bullying (V1). The second factor, explaining 12% of the variance, was named "Sexual abuse", as it comprised four items detailing instances of sexual abuse. The third factor, explaining 11% of the variance, was designated "Community and Collective violence", incorporating items related to community and collective violence, along with bullying (engagement in fights, V3). The fourth factor, explaining 9% of the variance, was labeled "Parental inadequacy", consisting of six items describing various forms of parental inadequacy such as mental illness, substance abuse, or parental incarceration. The final factor, explaining 8% of the variance, was termed "Precarious living conditions", including three items depicting extremely challenging life circumstances like insufficient food or homelessness. Three items did not load significantly on any factor, and the first item loaded significantly on both the Maltreatment and Parental inadequacy factors. Given that this item described parental behaviour associated with both emotional abuse and parental inadequacy, it was retained in the solution without deletion.

Following the analysis plan, a confirmatory factor analysis of the identified model was conducted, yielding a good fit based on both the RMSEA (0.017) and the CFI (0.98) indices. All loadings were as expected and statistically significant.

Configural invariance To assess invariance across binary gender, the (V9) item was removed from the model due to its constant values among males (i.e., zero). The model demonstrated a good fit; however, none of the items from the fourth latent variable (Parental inadequacy) significantly loaded on the factor in both groups. While the fit indices for the original model remained adequate without significant differences, a closer examination revealed that items related to the fourth factor (Parental inadequacy) did not load significantly on the latent variable in either group ($p>.05$).

Likewise, a multigroup confirmatory analysis was conducted using education level as a grouping variable. The results mirrored those observed for invariance across age groups, with good fit indices but non-statistically significant item loadings on the fourth factor (Parental inadequacy) in both groups. Of note, metric invariance was not achieved for these models because the estimated model failed to converge, suggesting potential issues with model specification or parameter instability.

Frequency scoring item-level structure

Prior to conducting factorial analyses, frequency scores were reviewed, revealing that scores on the fourth item were constant, leading to its exclusion from subsequent analyses. Results from Bartlett's test and the KMO estimation indicated that factorial analysis was appropriate ($p<.001$ and 0.7, respectively). Parallel analyses recommended identifying four components. Post-rotation factor loadings are presented in Table 4. Three items did not load significantly on any factors, and three factors exhibited significant loadings on two factors.

The first component, labeled "Maltreatment", comprised 11 items addressing physical neglect, family, peer, and collective violence, explaining 20% of the variance, with three items cross-loaded on other factors. The second factor, named "Sexual abuse", included four items related to sexual abuse and sexual contacts, explaining 14% of the variance. The third factor, termed "Antisocial environment", explained 13% of the variance and encompassed eight items assessing parental incarceration, collective and community violence, with two items on experiences of physical violence witnessing and home destruction significantly loading on other factors. The final factor, labeled "Parental inadequacy", explained 9% of the variance and consisted of four items.

Due to unsatisfactory results in this exploratory factorial analysis, involving the deletion of several items due to low frequencies and others due to inadequate loading strengths, no further analyses were conducted to test configural invariance.

Discussion

This study aimed to enhance understanding of the factorial structures from the 13 categories of the ACE-IQ's binary and frequency scoring systems. It is the first to investigate

Table 3 Factorial structure and loadings on ACE-IQ items rated according to the binary official scoring

	F1	F2	F3	F4	F5
Did your parents/guardians understand your problems and worries?	**0.37**	0.06	0.10	**0.39**	−0.06
Did your parents/guardians really know what you were doing with your free time when you were not at school or work?	0.14	−0.03	0.26	0.26	−0.02
How often did your parents/guardians not give you enough food even when they could easily have done so?	−0.06	−0.07	0.23	0.25	**0.37**
Were your parents/guardians too drunk or intoxicated by drugs to take care of you?	−0.01	0.03	0.00	**0.93**	−0.01
How often did your parents/guardians not send you to school even when it was available?	0.09	0.21	0.20	−0.03	0.23
Did you live with a household member who was a problem drinker or alcoholic, or misused street or prescription drugs?	0.06	0.10	−0.03	**0.80**	0.06
Did you live with a household member who was depressed, mentally ill or suicidal?	0.16	0.12	−0.08	**0.46**	−0.02
Did you live with a household member who was ever sent to jail or prison?	0.01	0.23	0.33	**0.36**	0.21
Were your parents ever separated or divorced?	0.28	0.18	−0.22	0.12	0.07
Did you see or hear a parent or household member in your home being yelled at, screamed at, sworn at, insulted or humiliated?	**0.78**	−0.02	0.03	0.15	0.03
Did you see or hear a parent or household member in your home being slapped, kicked, punched or beaten up?	**0.75**	−0.02	0.00	0.15	−0.13
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.?	**0.49**	0.04	0.11	0.13	−0.16
Did a parent, guardian or other household member yell, scream or swear at you, insult or humiliate you?	**0.82**	−0.01	0.04	0.01	−0.04
Did a parent, guardian or other household member threaten to, or actually, abandon you or throw you out of the house?	**0.68**	0.17	−0.03	−0.07	0.23
Did a parent, guardian or other household member spank, slap, kick, punch or beat you up?	**0.77**	0.04	0.03	−0.19	0.01
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?	**0.67**	−0.02	0.03	−0.02	0.15
Did someone touch or fondle you in a sexual way when you did not want them to?	0.01	**0.87**	−0.02	0.04	0.02
Did someone make you touch their body in a sexual way when you did not want them to?	0.01	**0.90**	0.01	0.01	−0.06
Did someone attempt oral, anal, or vaginal intercourse with you when you did not want them to?	0.07	**0.82**	0.06	0.09	−0.04
Did someone actually have oral, anal, or vaginal intercourse with you when you did not want them to?	0.00	**0.86**	0.01	−0.01	0.06
How often were you bullied?	**0.45**	0.13	−0.10	0.00	0.05
How often were you in a physical fight?	0.11	−0.01	**0.61**	−0.15	−0.08
Did you see or hear someone being beaten up in real life?	0.11	0.13	**0.60**	−0.08	0.01
Did you see or hear someone being stabbed or shot in real life?	0.02	0.06	**0.71**	−0.02	−0.03
Did you see or hear someone being threatened with a knife or gun in real life?	−0.07	0.21	**0.75**	−0.06	0.00
Were you forced to go and live in another place due to any of these events?	0.04	−0.08	−0.03	0.00	**0.98**
Did you experience the deliberate destruction of your home due to any of these events?	−0.02	0.08	0.03	0.01	**0.90**
Were you beaten up by soldiers, police, militia, or gangs?	0.11	−0.29	**0.73**	0.21	0.07
Was a family member or friend killed or beaten up by soldiers, police, militia, or gangs?	−0.03	−0.01	**0.44**	0.02	0.30

F1 = Maltreatment; F2 = Sexual abuse; F3 = Community and Collective violence; F4 = Parental inadequacy; F5 = Precarious living conditions

Table 4 Factorial structure and loadings on ACE-IQ items rated according to the frequency official scoring

	F1	F2	F3	F4
Did your parents/guardians understand your problems and worries?	0.15	0.17	0.27	0.31
Did your parents/guardians really know what you were doing with your free time when you were not at school or work?	0.09	−0.05	**0.46**	0.30
How often did your parents/guardians not give you enough food even when they could easily have done so?	**0.47**	−0.05	0.18	−0.08
How often did your parents/guardians not send you to school even when it was available?	**0.46**	−0.07	0.17	0.00
Did you live with a household member who was a problem drinker or alcoholic, or misused street or prescription drugs?	−0.23	0.22	**0.53**	**0.41**
Did you live with a household member who was depressed, mentally ill or suicidal?	0.09	0.20	0.15	**0.36**
Did you live with a household member who was ever sent to jail or prison?	−0.08	0.10	**0.75**	0.24
Were your parents ever separated or divorced?	0.00	0.16	−0.03	0.26
Did you see or hear a parent or household member in your home being yelled at, screamed at, sworn at, insulted or humiliated?	**0.44**	0.25	0.02	**0.53**
Did you see or hear a parent or household member in your home being slapped, kicked, punched or beaten up?	0.19	−0.03	0.01	**0.79**
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.?	**0.38**	−0.02	0.14	**0.50**
Did a parent, guardian or other household member yell, scream or swear at you, insult or humiliate you?	**0.62**	0.13	0.04	0.26
Did a parent, guardian or other household member threaten to, or actually, abandon you or throw you out of the house?	**0.66**	0.13	−0.13	0.30
Did a parent, guardian or other household member spank, slap, kick, punch or beat you up?	**0.88**	−0.08	−0.14	0.14
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?	**0.78**	0.11	0.04	0.15
Did someone touch or fondle you in a sexual way when you did not want them to?	−0.03	**0.90**	−0.02	−0.01
Did someone make you touch their body in a sexual way when you did not want them to?	0.08	**0.89**	−0.09	0.00
Did someone attempt oral, anal, or vaginal intercourse with you when you did not want them to?	−0.08	**0.92**	0.08	0.11
Did someone actually have oral, anal, or vaginal intercourse with you when you did not want them to?	0.09	**0.90**	−0.03	−0.15
How often were you bullied?	**0.67**	0.04	−0.40	−0.01
How often were you in a physical fight?	0.30	0.11	0.33	−0.19
Did you see or hear someone being beaten up in real life?	**0.54**	0.08	**0.36**	−0.10
Did you see or hear someone being stabbed or shot in real life?	**0.76**	0.06	0.30	−0.04
Did you see or hear someone being threatened with a knife or gun in real life?	**0.68**	0.28	0.26	−0.23
Were you forced to go and live in another place due to any of these events?	0.23	−0.23	**0.56**	−0.21
Did you experience the deliberate destruction of your home due to any of these events?	**0.38**	−0.11	**0.53**	−0.28
Were you beaten up by soldiers, police, militia, or gangs?	0.04	−0.07	**0.71**	0.00
Was a family member or friend killed or beaten up by soldiers, police, militia, or gangs?	0.04	0.05	**0.59**	−0.15

F1 = Maltreatment; F2 = Sexual abuse; F3 = Antisocial environment; F4 = Parental inadequacy

invariance across gender, age, and socio-educational levels in a large, diverse Italian sample.

Using the binary system, categorical-based analysis revealed a 2-factor solution, overlapping with Gette et al. (2022), but differing in the categorization of Community and Collective Violence. Our Factor 1 ("At-risk environment") closely resembled Gette et al.'s Factor 2 ("Household dysfunction"), with the only major difference being the Contact Sexual Abuse category. Discrepancies in category distributions, such as the removal of Community Violence,

likely stem from differences in respondent populations and data collection methods. Our study involved a general population assessed over one month, contrasting with Gette et al.'s focus on local university students over two-and-a-half years. Despite these variations, both studies suggest a similar model, where categories related to household violence and external peer violence co-occur.

Contrary to the hypothesis based on Santelices et al. (2025) results, category-based factorial structure using the frequency scoring system yielded similar findings, indicating a two-factor solution. One factor linked violence from parents and peers with collective violence, while the second grouped categories related to inadequate parenting, termed "Parental Inadequacy." However, the results were largely unsatisfactory, highlighting potential shortcomings in the frequency system. Notably, Santelices et al. (2025) study was the only study where the category-based structure with the official frequency scoring showed satisfactory fit values and the one on binary scoring did not. One possible explanation -already advanced by the authors - can be due to the absence of younger adults in their 37–66 years old sample, different than almost all other factorial studies. This would suggest an important role of the younger age group in the ACE-IQ factor structure that has not been confirmed by findings in our study, nor by Santelices et al. (2025) who did not explore age invariance, calling for future studies stratified for age group. Alternatively, given recognized cultural differences in ACEs patterns and implications (Lam-Hine et al., 2023), another possible explanation is due to cultural specificity of this South American sample to be further investigate through intercountry studies.

Comparing the four factorial structures—two using the binary system (our study and Gette et al., 2022) and two using the frequency system—reveals key findings. Methodologically speaking, the total proportion of variance explained by category-based structures identified in this study, 40% with the binary scoring and 46% with the frequency one, fell into the 35–58% range of similar structures in literature (see Table 1 in Appendix A), being slightly higher than 35.08% of the 2-factor solution identified by Gette et al. (2022). Instead, the 56% proportion of variance explained by the item-based structure here identified was lower than 67% explained by the 6-factor solution identified by Gette et al. (2022), suggesting further studies on replicating this study item-based structure on the current sample or others.

Narrowing specificities, similarities and differences in factors identified, categories associated with exposure to violence (abuse and peer violence) consistently clustered with Domestic Violence, suggesting a reevaluation of its placement within the questionnaire's structure. Except for Domestic Violence, all models support the co-occurrence of categories under Household dysfunction. Notably, Physical Neglect exhibited a stronger association with household dysfunction categories than with those concerning neglect by parents. This observation underscores how neglect of a child's physical needs—safe shelter, adequate food, proper supervision—often stems from parental unawareness due to factors like mental illness, substance abuse, or incarceration, rather than intentional harm (Zhang & Topitzes, 2022). Along with the inclusion of physical and emotional neglect in a unique, distinct factor proposed by Santelices et al. (2025), these findings emphasize the necessity for a more comprehensive exploration of physical neglect and its associated factors, crucial for appropriately structuring its assessment.

This study revealed notable findings in the factorial structures of the ACE-IQ, particularly regarding the placement of Contact Sexual Abuse. Unlike other forms of abuse, it was included within the Household Dysfunction category rather than the Abuse macro-category. This may stem from the questionnaire's wording, which does not specify the perpetrator as a family member, thus capturing a broader range of abusers, often non-relatives with family access (60%; Whealin & Barnett, 2022). Consequently, sexual abuse may frequently occur in environments with dysfunctional and neglectful parenting. Analyses also identified Sexual Abuse as a distinct factor, suggesting it should not be solely viewed as part of a broader risk profile, consistent with findings that sexual abuse can occur without other environmental risks (Matta Oshima et al., 2014).

Due to methodological limitations, the positions of Physical Neglect and Contact Sexual Abuse couldn't be explored using the frequency scoring system. However, findings from this study, Gette et al. (2022) and Santelices et al. (2025) suggest reducing the macro-categories from four to two: one for direct maltreatment by relatives and peers, and another for adversities from inadequate parental supervision or care.

The item-based factorial structure revealed a 5-factor solution, aligning with Chistoforou and Fereira (2020) and differing from the common 3-factor solution (Kidman et al., 2019; Swingen et al., 2020). Both our study and Christoforou and Fereira (2020) identified a factor for Contact Sexual Abuse, highlighting its distinctiveness from Emotional and Physical abuse. A factor incorporating items from the Household Dysfunction macro-category was also identified, confirming the clustering of parental mental illness, substance misuse, and incarceration, while separating witnessed domestic violence. Additionally, a factor for broad exposure to external violence was noted, excluding specific violence categories.

There are distinctions between the models. Our study identified a distinct factor for physical and emotional abuse, domestic violence, and bullying frequency (F1,

"Maltreatment"), explaining significant variance, whereas Christoforou and Fereira (2020) separated Physical and Emotional Abuse into different factors. Additionally, some items in our study either did not load on any factor or created a new factor, "Precarious living conditions" (F5), encompassing shelter and nutrition instability. These differences warrant further investigation to identify contributing variables.

Despite the unsatisfactory preliminary item-based EFA using the frequency system, it consolidated items related to violence from parents and peers, along with domestic violence, into one factor, and grouped the Sexual Abuse items into another factor. This reinforces previous observations regarding item categorization into macro-categories and underscores the effectiveness of items in capturing contact sexual abuse. However, the significant number of deleted items and methodological constraints highlight the need for further psychometric research on the frequency system to better understand its strengths and limitations.

Binary gender, age and level of education invariance across different factorial structures.

This study assessed the invariance of factorial structures from the ACE-IQ's binary scoring system across gender, age, and educational levels, filling a gap in previous research. The category-based structure was consistent across genders and age groups, but Collective Violence was less prevalent among higher-educated respondents, reflecting disparities in exposure (Walsh et al., 2019). The item-based factorial structure showed invariance across these variables, though some factors did not load significantly. These findings validate the robustness of the factorial structures, particularly the category-based structure, regardless of gender and age, and for most categories across educational levels. The established invariances contribute new insights to a literature often featuring imbalanced samples skewed towards females. However, it is also important to consider that focusing on a sample with such a broad age range—aimed at addressing a gap in the literature—may have limited detection of specificities in subgroup suggested as vulnerable to ACEs by the literature, e.g., younger individuals or non-binary individuals (Craig et al., 2023). This underscores the need for further larger or population-specific studies on the invariance of structures identified in prior research.

Conclusion and limitations

This study introduces new insights into the ACE-IQ's factorial structures, reinforcing the robustness of certain aspects from the binary official system, such as the reliability of the Contact Sexual Abuse category and invariance across gender and age groups. It also highlights the need to reconsider the categorization of Domestic Violence and Bullying under a broader Abuse or Violence macro-dimension. Some items may not effectively capture intended categories, resulting in varied structures and new factors based on the population studied. Cross-loadings and unaligned items, observed in similar studies, further complicate the ACE-IQ assessment.

Despite unsatisfactory results from the frequency system pilot, these findings emphasize the need for further psychometric research to ensure the ACE-IQ's reliability.

In conclusion, establishing psychometric validity for both official scoring systems could enhance flexibility, allowing selection of the optimal approach based on objectives—e.g., using the binary exposure-based system for community epidemiological research or prevalence screening, and frequency-based scoring for clinical applications such as trauma-focused therapy, perhaps refining the latter as unofficially proposed by Christoforou and Ferreira (2020) who rated the responses from "never" to "always" on a 4-point range to better capture incremental frequency of respondent's exposure (McLaughlin et al., 2021).

However, limitations include regional and cultural homogeneity, potential sampling biases, and lack of representation for non-binary individuals (Craig et al., 2023). The convenience sampling method may not fully represent the entire population. In particular, one key limitation of this study is the use of convenience sampling through students' personal networks, which may have introduced sampling bias. This approach potentially overrepresents individuals who are more engaged and accessible and may skew the sample toward urban populations, given students' likely geographic and social circles. Furthermore, we did not collect certain demographic variables—such as participants' income levels or rural versus urban provenience—limiting our ability to assess how representative the sample is compared to the national population. Without these data, we cannot determine whether the sample reflects broader socio-economic or geographic distributions, which restricts the generalizability of our findings. In this vein, the sample was limited to Italian community participants, which—like other Western groups—may exhibit key differences in ACEs compared to non-Western populations. This limits generalizability, as participants may not reflect ACEs prevalence in at-risk Italian subgroups or non-Western backgrounds (Lam-Hine et al., 2023). Moreover, the cross-sectional design prevents exploring developmental timing effects or ACE pathways. Additionally, the division into age groups was somewhat arbitrary, relying on age-range categories that vary across developmental theories and fail to account for culturally-defined developmental tasks. Lastly, we did not check the effects of potential counfounders, e.g., attachment (Velotti et al., 2022)

on respondents' answers. Future studies should replicate this research among vulnerable groups and assess the construct validity of identified factors to determine the most effective scoring method for predicting well-being and psychopathological symptoms.

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G. Rogier: analysis and interpretation of data; drafting the article.
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Data availability The data that support the findings supporting this study are protected and unavailable of this study are protected but are not available due to data privacy laws. The data are, however, available from the corresponding authors upon reasonable request.

Declarations

All procedures were in accordance with the ethical standards of the institutional research committee at [anonymized for review] and with the 1964 Helsinki Declaration and its later amendments.

Informed consent Informed consent was obtained from all participants included in the study.

Conflicts of interest The authors declare they have no conflict of interest.

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