Análise Psicológica (2023), 1 (XLI): 127-142 doi: 10.14417/ap.1991

Psychometric properties of the Portuguese teacher-version of the Inventory of Callous-Unemotional Traits in Preschoolers

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Abstract: Several authors suggest that Callous-Unemotional (CU) traits may be useful in identifying adolescents who exhibit initial, severe, chronic, and aggressive conduct problems. The Inventory of Callous-Unemotional Traits (ICU) was developed to assess these traits, later associated with psychopathy, in children and adolescents. This study aims to analyze the psychometric properties of the Portuguese version of the teacher-report ICU for preschool-age children. The sample was collected in public schools and comprised the responses of 46 preschool teachers concerning 131 children (62 girls) between 3 and 6 years of age. Results indicate that a two-factor model revealed the best fit to our data, including a Callous and an Uncaring factor, resorting to 12 of the original 24 items. Additionally, the results of this study also provide evidence of measurement invariance across sex for the ICU, allowing us to compare mean levels of CU traits between boys and girls. The results of the present study showed that the Portuguese version of the ICU scale (teacher's version) seems reliable and valid for evaluating CU traits in preschool children.

Keywords: Factor analysis, Psychometric properties, Callous-Unemotional traits, Preschool children, ICU.

Callous-Unemotional (CU) traits are considered an early affective component of psychopathy including callousness/lack of empathy, lack of remorse/guilt, and shallow affect (Hawes, Byrd et al., 2014). CU traits can be associated with specific components related to difficulties in developmental processes. These traits also predict antisocial or aggressive behavior, as well as future psychiatric difficulties, and can be essential to identify children and adolescents who demonstrate severe, chronic, and aggressive behaviors (Frick et al., 2014; Viding et al., 2007). CU traits are moderate to highly stable (Barry et al., 2008; Dadds et al., 2005; Frick, Kimonis et al., 2003; Obradovic et al., 2007). However, some studies reveal the malleability of these traits in childhood and show that children may follow developmental trajectories characterized by increasing or decreasing levels of CU traits (Fontaine et al., 2011; Frick, Cornell et al., 2003; Hawes & Dadds, 2007; Kolko et al., 2009; Pardini & Loeber, 2008).

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In general, the studies have progressively analyzed the role of CU traits in children and adolescents and reported evidence that CU traits could be identified at preschool age (e.g., Bansal et al., 2020; Ezpeleta et al., 2013; Graziano et al., 2016; Kimonis, Frick, Boris et al., 2006; Kimonis, Frick, Fazekas et al., 2006; Kimonis et al., 2015; Willoughby et al., 2011). Specifically, Willoughby et al. (2011) found that the characteristics of CU traits were stable between the ages of three and five and could differentiate a group diagnosed with Opposition Defiant Disorder (ODD) from children with CU traits. Thus, children with CU traits are characterized as less fearful, having a greater capacity for recovery under challenging events, and having lower negative reactivity (Willoughby et al., 2011). Kimonis, Frick, Fazekas et al. (2006) had already found an association between CU traits and aggression in a sample of children aged 2 and 5 years and noticed that differences in feelings of guilt and empathy could contribute to behavioral problems.

In fact, despite more evidence of CU traits in adolescence, aggressive behavior seems to be more prominent in preschool years, when empathy and feelings of guilt begin to develop (Kochanska et al., 2002). Assary et al. (2015) suggest that even young children may have excessive dominance, lie strategically and intentionally (Evans et al., 2011; Fu et al., 2012), and deceive others deliberately (Hsu & Cheung, 2013). Therefore, some psychopathy-like characteristics could emerge in preschool children, such as being superficially charming, simplistic, arrogant, manipulative, and misleading toward others (Talwar & Crossman, 2011). However, research on CU traits in this age group is still scarce, partly due to the lack of tools for measuring callous manifestations and emotional deficits in preschoolers.

The Inventory of Callous-Unemotional traits (ICU) was developed by Frick (2004) to measure CU traits in children and adolescents. The ICU comprises 24 items, rated on a 4-point Likert scale, from 0 (*Not at all true*) to 3 (*Definitely true*). There are five versions of the ICU, relating to age (youth or preschool) and who completes the ICU (self, parent, or teacher). These versions consist of the same items that assess the same construct and content but show only minor wording differences. These five versions of the ICU are named (a) Youth Self-Report; (b) Parent Report; (c) Teacher Report; (d) Parent Report (Preschool version); and (e) Teacher Report (Preschool version). Although ICU was developed by Frick (2004), the first validation study of the ICU was carried out by Essau et al. (2006) in an adolescent sample and proposed three dimensions: (a) Callousness; (b) Uncaring; and (c) Unemotional.

Previous works on the ICU's properties have been carried out with adolescent samples, mainly using the self-report version. These studies have indicated similar structures across cultures (e.g., America, Europe, and Asia) and provided favorable evidence on the validity of the questionnaire, both in the general population (e.g., Pechorro et al., 2019; Roose et al., 2010) and in young offenders (e.g., Kimonis et al., 2008; Pechorro et al., 2016, 2018; Pechorro, Hawes et al., 2017; Pechorro, Ray et al., 2017). However, given the severity of the behaviors associated with CU traits, there is increasing interest in identifying these traits as early as possible.

Ezpeleta et al. (2013) explored the psychometric properties of the ICU teacher report in preschool children from the general population in Spain and confirmed the three proposed dimensions of ICU (Essau et al., 2006) in 3- and 4-year-old preschool children. The ICU total score was moderately stable over one year and correlated with teachers' reports of prosocial behavior, executive functions, conduct problems, and verbal, relational, and physical aggression. Similarly, Ciucci et al. (2014), resorting to a self-report version of ICU, found CU traits best described as three subfactors (Callousness, Uncaring, and Unemotional) with an overarching higher-order factor in a sample of children in grades 6 and 8.

Alternative models of the ICU have also been proposed. A two-factor model was suggested to have a good fit (Carvalho et al., 2018; Kimonis et al., 2015; Willoughby et al., 2014). Willoughby et al. (2014), using the parent-report version of ICU, found a two-factor structure in a community sample of school-age (first-grade) children, with this model distinguishing Empathic-prosocial (EP) from callous-unemotional behaviors. Lastly, Carvalho et al. (2018) examined the factor structure of

the self-report ICU in a community sample of children and adolescents and proposed a two-factor model comprised of Uncaring and Callousness factors. Kimonis et al. (2015), using 12 of the original 24 ICU items, identified the best fit with a two-factor model (i.e., Callous and Uncaring) in a mixed community and clinical preschool sample using parent- and teacher-reported data. Years later, the results of Bansal et al. (2020) and Zumbach et al. (2021) show good psychometric properties for the same model, resorting to parent- and teacher-report preschool versions of the ICU, respectively.

Analyses were conducted, in some studies, to investigate potential sex differences for ICU dimensions and the total score (Carvalho et al., 2018; Essau et al., 2006; Ezpeleta et al., 2013; Houghton et al., 2012). Studies with adolescents revealed that boys report significantly higher total and subscale scores in the ICU (Carvalho et al., 2018; Ezpeleta et al., 2013). However, no statistical differences across sex were found in children aged three and four (Ezpeleta et al., 2013), nor in children between the ages of 7 and 12 (Houghton et al., 2012). Thus, there is scarce evidence of sex differences regarding CU traits in preschool children.

It should be noted that, specifically in Portugal, research on CU traits with preschool children is limited based on the need for instruments developed for this developmental stage. Validated for the Portuguese population, Carvalho et al. (2018) examined the factor structure of the parent-report ICU in a community sample of children and adolescents, and Pechorro et al. (2019) provided validation of ICU self-report and a short form among a normative sample of community youths. The remaining validations are intended to evaluate CU traits in detained juvenile offenders (Pechorro et al., 2016, 2018; Pechorro, Howes et al., 2017; Pechorro, Ray et al., 2017). To date, no validation study has been found to evaluate CU traits in preschool children and use teachers as informants. Resort to teachers can be an asset in the evaluation of CU traits. As stated by Campbell (2002), the experience of teachers as educational figures allows a better distinction between normative and inappropriate characteristics and behaviors for the age group, decreasing the parents' tendency to report desirably expected characteristics.

Considering preschool age, self-report measures are unsuitable (e.g., Conijn et al., 2020; Eddy et al., 2011), and an assessment with multi-informant is needed (e.g., parents and teachers; e.g., Dirks et al., 2012; Taber, 2010). As recommended by the DSM-5 (American Psychiatric Association [APA], 2013), teacher-report serve as one of the multiple sources of relevant information about children's behavior. In fact, they spend the most time with children, having the opportunity to observe them either in structured (e.g., classroom) or unstructured (e.g., cafeteria) environments, in interaction with peers and authority figures (Abikoff et al., 1993; Curhan et al., 2014; Farrell et al., 2018). Thus, it seems relevant to develop a new version that allows using these informants to assess ICU traits in preschool-age children (Abikoff et al., 1993).

Earlier identification of children with high CU traits can lead to earlier intervention efforts and more promising outcomes across the lifespan (e.g., Bansal et al., 2020). Considering the low number of studies assessing CU traits in early life, specifically in Portugal, more research is necessary on the ICU structure, validity, and relation to other variables of interest. The main aim of this study is to examine the psychometric properties through factor structure analysis of the Portuguese version of the teacher-report ICU, expecting a good adjustment to a two- or three-factor structure, using data referring to a community sample of preschool children.

Method

Participants and procedures

Forty-six preschool teachers provided behavioral ratings of one hundred and thirty-one children between 3 and 6 years of age (M_{age} = 4.66, SD = 0.87), subdivided into male (n = 69; M_{age} = 4.61,

SD = 0.91) and female (*n* = 62; M_{age} = 4.71, *SD* = 0.81) participants, recruited and randomly selected from public schools and preschools. Each preschool teacher provided information for at least one and at most eight children in their classes, which consisted of approximately 20 children. Schools were selected based on proximity, accessibility, and availability. Children were included in the present study if they met all the inclusion criteria, namely (a) aged between 3 and 6 years old; (b) Portuguese nationality; and (c) no psychopathological diagnosis (e.g., Autism Spectrum Disorder). Children with neurological or neuropathological problems, as well as motor, sensory, or cognitive deficits, were excluded. These problems were reported by their preschool teachers. The children's participation rate was 91%. The remaining dropout was due to a lack of authorization from parents or a lack of interest from preschool teachers.

The study was approved by the Ethics Committee of the first author institution (Reference number 2018/11-8), and all procedures were in accordance with the 1964 Helsinki declaration. An informed consent was provided to parents and preschool teachers of the eligible children. When it was impossible to contact the children's parents directly, the authorizations and consents were obtained through the preschool teachers' contact with the parents of each child.

Measures

Inventory of Callous-Unemotional Traits – Teacher Report (Preschool version) (ICU-Preschool Teacher; Essau et al., 2006; Frick, 2004). The ICU-Preschool Teacher is a teacher-report inventory for preschool children, composed of 24 items for assessing callous-unemotional traits, answered on a 4-point Likert scale, ranging from 0 (= *Not at all true*) to 3 (= *Definitely true*). The minimum score possible is zero and the maximum is 72. Twelve positively worded items (items 1, 3, 5, 8, 13, 14, 15, 16, 17, 19, 23, and 24) required reverse scoring before calculating the total score. The first validation study of the ICU, by Essau et al. (2006), found satisfactory to adequate internal consistency values, with Cronbach's α between .64 and .73 for subscales and .77 for the total score. The present study used the translated and adapted Portuguese version of the ICU, as explained in the Translation and Adaptation Procedures section.

Child Problematic Traits Inventory (CPTI; Colins et al., 2014). The CPTI is used to assess psychopathic personality traits in children. This measure is a teacher-report questionnaire composed of 28 items, each classified on a 4-point Likert scale, ranging from 0 (= *Does not apply at all*) to 3 (= *Applies very well*). The CPTI Grandiose-Deceitful (GD) dimension comprises eight items, the CU dimension of 10 items, and the Impulsivity-Need of Stimulation (INS) dimension includes 10 items. The total score varies between zero and 84, ranging from zero to 30 for CU and INS dimensions and ranging from zero and 24 for GD dimension. The Confirmatory Factorial Analysis (CFA) of the Portuguese version of the CPTI (Barroso et al., in press) confirmed the presence of the Interpersonal, Affective, and Behavioral factors, which showed good internal consistency values (α range .88 – .92). The internal consistency for the current study was between α = .87 and α = .95.

Social Skills Rating System (SSRS; Gresham & Elliott, 1990). The SSRS is a questionnaire on the assessment of the teachers of children between preschool and sixth grade of middle school. It comprises 54 items, the first 48 of which are classified on a 3-point *Likert* scale, ranging from 0 (= *Never*) to 3 (= *Often*). The last six items (*Academic competence* dimension) are classified on a 5-point *Likert* scale, with 1 indicating the lowest or least favorable performance and 5 indicating the highest or most favorable performance. The SSRS comprises three scales: (a) *Social Skills*; (b) *Behavior Problems*; and (c) *Academic Competence*. The *Social Skills* scale includes 30 items that assess three dimensions, namely Cooperation, Assertion, and Self-Control. The *Behavior*

Problems scale, through 18 items, assesses three types of inappropriate behavior problems, namely Externalizing Problems, Internalizing Problems, and Hyperactivity. Finally, the *Academic Competence* scale, consisting of six items, assesses critical behaviors such as performance in reading and mathematics, motivation, global cognitive functioning, and parental support. The Portuguese version of the SSRS (Lemos & Meneses, 2002) shows Cronbach's alpha values between .86 and .93 for *Social Skills* subscales and between .83 and .92 for *Behavior Problems.* In the current study, the subscales present Cronbach's alpha values between .88 and .90 for *Social Skills* subscales and between .88 and .92 for *Behavior Problems.* Only *Behavior Problems, Externalizing Problems, Internalizing Problems,* and *Hyperactivity* subscales were used in the present study.

Translation and adaptation procedures

According to ITC Guidelines for Translating and Adapting Tests (ITC, 2017), the English version of the ICU was adapted and translated. Two independent researchers (authors of the present study) translated the scale from the original language (English) to Portuguese and was provided a detailed review of the translated items by a third bilingual expert with training in psychology. In addition, the back-translation was carried out by a language specialist. Differences in the original and back-translated versions were discussed and resolved by consensus. A pilot test was conducted, with 10 elementary school preschool teachers, to understand how the translated version performed in a real-world scenario. After filling out the translated scale by preschool teachers, they were asked for feedback on the difficulty and clarity of each item, the administration procedure, and the purpose of the test in their opinion. In the end, a final version of the ICU-Preschool Teacher was obtained.

Statistical analyses

Initially, the assumption of normality was evaluated using the Shapiro-Wilk test, and when violated, it was complemented by the analysis of the asymmetry and kurtosis coefficients. It was found that the absolute values of these coefficients ranged between 2 and 7, as Kim (2013) suggested. The ICU factor structure was examined using CFA. The CFA was carried out using AMOS 26.0 (Arbuckle, 2019), with maximum likelihood estimation, according to Emrich and Urfer (2004), because of the sample size (n = 131). Model fit was assessed using the Tucker-Lewis Index (TLI), Comparative Fit Index (CFI), and the Root Mean Square Error of Approximation (RMSEA), as recommended by Sharma et al. (2005). RMSEA values below .05 indicate good adjustment, while values between .05 and .08 indicate an acceptable fit. A CFI and TLI index of .95 or higher indicates excellent fit, and a CFI and TLI of .90 or higher indicate good fit (Hu & Bentler, 1999). In addition, due to sample size sensitivity, Jöreskog and Sörbom (1993) propose using χ^2/df, which should be as small as possible for a good fit of the model. Although no absolute standard is established, a value between two and three represents a "good/acceptable" adjustment (Schermelleh-Engel et al., 2003). The measurement invariance of the defined model across the gender subgroups was analyzed through multi-group confirmatory factor analysis (MGCFA). Measurement invariance can be analyzed across: (a) configural invariance, and (b) metric invariance (Jöreskog & Sorbom, 1993). To provide invariance, the hierarchic differences of model-data fit indices (RMSEA, RMR, CFI, GFI, and TLI) and the differences of model-data fit χ^2 statistics between the dimensions were considered. When the differences of the model-data fit indices were more than 0.01 and/or χ^2 statistics were statistically significant ($p < .05$), these findings were interpreted as a violation of invariance. Otherwise, it was decided that measurement invariance was provided across subgroups. Cronbach's alpha coefficients were computed to

analyze the internal consistency of the factors obtained and interpreted according to Kline (2005), who suggested that values above .70 are acceptable. Pearson's correlation coefficients were used to investigate intercorrelations between the subscales of the ICU. Correlations below .70 indicate an acceptable independence of subscales for correlations within the evaluator (Nunnally & Bernstein, 1994). Pearson's correlations and Fisher' *z* were also calculated to assess the convergent validity of the ICU with CPTI and SSRS scales.

Results

Confirmatory factor analysis

The CFA was conducted to study the adequacy of the ICU with the two models previously tested on preschool children and resort to a teacher – or parent-report. The first model comprises two factors, namely *Callous* and *Uncaring,* using 12 items of the original version of ICU (Kimonis et al., 2015), while the second model comprises three factors, adding the unemotional dimension to the previous two (Ezpeleta et al., 2013; see Table 1). Both models were subject to adjustments. The adjustment of the model was estimated from the Modification Indices (MI) produced by AMOS. The MI estimates the reduction of χ^2 statistics of the model, being a sequential process. The parameters with higher MI are successively released until the parameter of the smallest MI is reached. Only the parameters with MI greater than 11 were modified, as suggested by Marôco (2021). The goodness-of-fit indices resulting from these models revealed the strongest support for the two-factor model based on the 12-item ICU measure (Kimonis et al., 2015), adjusted to a sample of 131 children, revealed a good adjustment quality (χ^2/df = 1.740; CFI = .951; GFI = .911; RMSEA = .076), after correlating the measurement errors of the items 4, 6, 9, 16, 17, 18, 21 (see Figure 1). Any item of this model was deleted.

Table 1

Fit indices for the models tested before and after items errors correlation

		$\chi^2(df)$	*p*	CFI	TLI	RMSEA	GFI
Before items errors correlation	Kimonis et al. (2015)	128.40 (53)	.00	.89	.87	.11	.86
	Ezpeleta et al. (2013)	815.99 (249)	.00	.70	.64	.15	.62
After items errors correlation	Kimonis et al. (2015)	85.31 (49)	.00	.95	.93	.08	.91
	Ezpeleta et al. (2013)	803.99 (244)	.00	.70	.66	.13	.67

Note. CFI=comparative fit index; TLI=Tucker-Lewis coefficient; RMSEA=Root Mean Square Error of Approximation; GFI=goodness of fit index.

Regarding the measurement invariance across sex, the configural invariance was initially tested to verify whether the factor structure was a good fit for both groups. The results show that this factor structure was a good fit for each group (χ^2/df = 1.881; CFI = .900; RMSEA = .080). The measurement weights comparison shows the number of constrained factor loadings. The obtained data for the metric factor structure of boys or girls fit fairly well (χ^2/df = 1.78; CFI = .90; RMSEA = .07). In addition, the chi-square test to find the difference between the configural structure and the metric constrained structure concerning gender provided a *p*-value 0.06 which is greater than 0.05. It implies that the result is non-significant and means that there is no difference in the response of the items of the construct in boys and girls groups simultaneously.

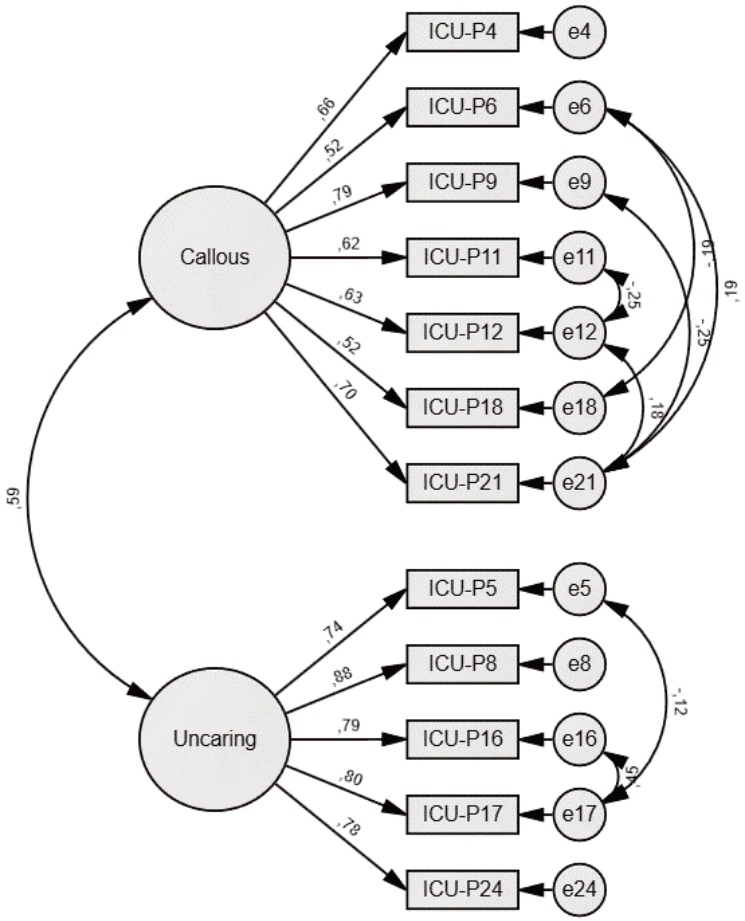

Figure 1. Confirmatory factor analysis of the Inventory of Callous-Unemotional Traits, two-factor structural model with standardized estimates

Internal consistency

In the present study, the ICU total score demonstrated a Cronbach's α = .88. The mean Inter-Item Correlation was .39 and corrected Item-to-Total Scale Correlations were >.30 for all items. Alpha coefficients for subscale score were excellent (α = .90 for *Uncaring* and .82 for *Callous*).

Convergent validity

Psychopathic traits. ICU scores were correlated with CPTI scores to test whether ICU scores were associated with measures of psychopathic traits. The ICU total score correlated positively and significantly with the CPTI total score, as well as with the *Interpersonal*, *Affective*, and *Behavioral* dimensions of the CPTI (*r* range between .70 – .81, all statistically significant at $p < .001$). Similar results were obtained for both sexes. For both girls and boys, the ICU total score correlated positively with the CPTI total score, as well as with the *Interpersonal*, *Affective*, and *Behavioral* dimensions of the CPTI (*r* range between .64 – .84, all statistically significant at $p < .001$). Similar results were found concerning the ICU subscales (*r* range between .48 – .84, all statistically significant at $p < .001$; see Table 2).

Table 2

Correlations (Pearson' r and Fisher' z correlations) between the ICU and CPTI and SSRS

	ICU								
	Uncaring			Callous			Total		
	Total *r/z*	Boys *r/z*	Girls *r/z*	Total *r/z*	Boys *r/z*	Girls *r/z*	Total *r/z*	Boys *r/z*	Girls *r/z*
CPTI									
Total	.73 **/.93	.71**/.89	.73**/.93	.84**/1.22	.61**/.71	.75**/.97	.80**/1.10	.77**/.1.02	.84**/.1.22
Interpersonal	.63**/.74	.60**/.69	.62**/.73	.59**/.68	.48**/.52	.72**/.91	.70**/.87	.64**/.76	.76**/1.00
Affective	.72**/.91	.73**/.93	.68**/.83	.70**/.87	.65**/.78	.76**/.1.00	.81**/1.13	.80**/.1.10	.81**/.1.13
Behavioral	.68**/.83	. 65**/.78	.69**/.85	.58**/.66	.56**/.63	.57**/.65	.73**/.93	.71**/.89	.73**/.93
SSRS									
Behavior problems	.44**/.47	.64**/.76	.23/.23	.42**/.45	.56**/.63	.25/.26	.48**/.52	.70**/.87	.26/.27
Externalizing problems	.36**/.38	.53**/.59	.16/.16	.35**/.37	.40**/.42	.25/.26	.40**/.42	.55**/.62	.20/.20
Internalizing problems	.34**/.35	.60**/.69	.16/.16	.28*/.29	.46**/.50	.16/.16	.36**/.38	.62**/.73	.17/.17
Hyperactivity	.45**/.49	.55**/.62	.35*/.37	.48**/.52	.61**/.71	.29/.30	.53**/.59	.67**/.81	.36*/.38

Note. *$p < .05$; **$p < .001$.

Behavior problems. Significant correlations were found between the ICU and the subscales of the SSRS (see Table 2). Concerning total ICU score, positive and significant correlations were found with *Behavior Problems*, *Externalizing Problems*, *Internalizing Problems*, and *Hyperactivity* subscales of the SSRS (r range between .36 – .53, all statistically significant at $p < .001$). Similarly, positive and significant correlations were found between both ICU subscales – *Uncaring* and *Callous* – and *Behavior Problems*, *Externalizing Problems*, *Hyperactivity* scales (r range between .28 – .44, all statistically significant at $p < .001$), and internalizing problems ($r = .45$, $p < .001$ for Uncaring and $r = .48$, $p < .05$ for Callous). A similar pattern of results was obtained for boys (r range between .40 – .70, all statistically significant at $p < .001$). Regarding girls, positive and significant correlations were found between the ICU scores (total and *Uncaring* subscale) and score on the *Hyperactivity* subscales ($r = .36$ for ICU total score and $r = .36$ for *Uncaring* subscale, all statistically significant at $p < .05$).

Gender and age differences

Normative data are presented in Table 3. Sex and age-group differences in the mean score of the ICU were also examined. Separate two-way ANOVAs were conducted to examine the effects of *sex* (male, female) and *age-group* (3/4 and 5/6 years) on the total and subscale scores of the ICU. The results showed a significant main effect of *sex* $F(3, 123) = 6.36$, $p = .01$, $g = .44$ on the total scale of ICU, revealing that girls ($M = 7.85$, $SD = 5.92$) have lower CU traits than boys ($M = 10.57$, $SD = 6.34$). By subscale, the results showed a significant main effect of sex $F(1, 129) = 4.60$, $p = .034$, $g = .37$, and age $F(3, 127) = 6.01$, $p = .001$, $g = .12$, on the *Uncaring* subscale, revealing that girls ($M = 5.98$, $SD = 3.84$) have lower CU traits than boys ($M = 7.46$, $SD = 4.04$). Regarding the *Callous* subscale, results showed a significant main effect of sex, $F(1, 129) = 5.08$, $p = .026$, $g = .39$, revealing that girls ($M = 1.87$, $SD = 2.89$) have lower CU traits than boys ($M = 3.10$, $SD = 3.31$). For age, results show a significant main effect on the *Uncaring* subscale, $F(1, 129) = 13.08$, $p < .001$; $g = .65$, and ICU total score, $F(1, 129) = 6.26$, $p = .01$, $g = .44$, revealing that children aged 3/4 years old have higher CU traits than children aged 5/6 years old. No interaction effect between sex and age for the total ICU score and subscales was found.

Table 3

Means and standard deviations of all scales by gender and age effects

	Uncaring			Callous			Total ICU		
	Total *M*(*SD*)	Boys *M*(*SD*)	Girls *M*(*SD*)	Total *M*(*SD*)	Boys *M*(*SD*)	Girls *M*(*SD*)	Total *M*(*SD*)	Boys *M*(*SD*)	Girls *M*(*SD*)
Age									
3/4 years old	8.33 (2.85) *n* = 49	9.04 (2.90) *n* = 25	7.58 (2.65) *n* = 24	2.69 (3.61) *n* = 49	3.00 (3.57) *n* = 25	2.38 (3.69) *n* = 24	11.02 (5.57) *n* = 49	12.04 (5.73) *n* = 25	9.95 (5.30) *n* = 24
5/6 years old	5.83 (4.30) *n* = 82	5.57 (4.33) *n* = 44	4.97 (4.15) *n* = 38	2.41 (2.89) *n* = 82	3.16 (3.19) *n* = 44	1.55 (2.24) *n* = 38	8.24 (6.46) *n* = 82	9.72 (6.57) *n* = 44	6.53 (5.96) *n* = 38
Total age	6.76 (4.00) *n* = 131	7.46 (4.03) *n* = 69	5.98 (3.83) *n* = 62	2.52 (3.17) *n* =1 31	3.10 (3.31) *n* = 69	1.87 (2.89) *n* = 62	9.28 (6.27) *n* = 131	10.57 (6.34) *n* = 69	7.85 (5.92) *n* = 62
Effects									
Sex	$F(1, 129) = 4.60$, $p = .03$; $g = .37$			$F(1, 129) = 5.08$, $p = .03$; $g = .42$			$F(1, 129) = 6.36$, $p = .013$; $g = .44$		
Age	$F(1, 129) = 13.08$, $p < .001$; $g = .65$			$F(1, 129) = .24$, $p = .63$; $g = .09$			$F(1, 129) = 6.26$, $p = .01$; $g = .45$		
Sex*Age	$F(3, 123) = .01$, $p = .92$; $\eta^2 = .00$			$F(1, 127) = .75$, $p = .39$; $\eta^2 = .006$			$F(1, 127) = .264$, $p = .61$; $\eta^2 = .002$		

Discussion

There is a need to fill the gap regarding psychometric instruments assessing Callous-Unemotional (CU) characteristics in younger children, which are associated with later traits of psychopathy (Ezpeleta et al., 2013; Kimonis et al., 2015). This study aimed to test the factor structure, psychometric properties, and validity of an instrument to measure CU traits filled out by preschool teachers – the teacher report version of the Inventory of Callous-Unemotional Traits (ICU).

Most factor analytic work has been conducted with older childhood and adolescent samples, raising questions about the structure of the ICU during early childhood. In our data from children aged 3 to 6, a confirmatory factor analysis supported a two-factor structure of the ICU, as in other studies (Carvalho et al., 2018; Houghton et al., 2012). This analysis fits well with the two dimensions proposed by Kimonis et al. (2015) and Hawes, Price et al. (2014): *Callous and Uncaring,* comprising 12 of 24 original ICU items. Contrary to most factor analytic studies with older children and adolescents using self-report scores that support a three-factor bifactor structure, this study does not support the concept of three ICU subscales (callousness, uncaring, and unemotional). As supported by Zumbach et al. (2021), especially in childhood, a differentiated measurement of CU traits is only possible if other developmental factors are incorporated. Thus, established models cannot simply be transferred to different age groups due to the possibility that the structure of factors changes development (see Kimonis et al., 2015).

In our data, the analysis of the construct validity of the ICU showed excellent countable adjustment indices to the two-factor model, as presented by Kimonis et al. (2015) and, more recently, Zumbach et al. (2021). This evidence supports the construct validity as a measure of callous and uncaring indicators with Portuguese preschoolers. The *Uncaring* factor refers to a lack of feelings toward other people, as well as is associated with empathy deficits. The *Callous* factor concerns a lack of empathy, guilt, and remorse for misdeeds. On the reliability of the instrument, good internal consistency results were obtained, as the literature points out (Marôco, 2021).

Additionally, the results of this study also provide evidence of measurement invariance across sex for the ICU. Through the analysis of structural and metrical invariancy, it was possible to demonstrate that the assumed model presents an equivalent structure and construct meaning for both sexes. As stated by Pechorro et al. (2019), evidence of invariancy across these two groups is important to ensure that findings reflect "true differences" in a psychological construct (i.e., CU traits). Thus, these results allow us to compare mean levels of CU traits between boys and girls.

Therefore, it is possible to verify significant differences in the mean scores of boys and girls. Specifically, boys scored significantly higher in the ICU, both on the total scale and on the scores of the subscales. These results align with other studies (e.g., Essau et al., 2006; Pechorro et al., 2019), indicating that CU traits are more present in male samples (Vitale & Newman, 2001). Regarding age, there are significant differences in ICU total score, with the total ICU score of 6-year-old children being lower than that of 3- and 4-year-old children. This could reflect that young children show a lack of caring for important activities and for the feelings of others, which may be part of the developmental process.

Similarly, Kimonis et al. (2015) found that children under age six score high in the 12-item and 24-item ICU. This could be supported by poorer recognition of facial expressions and less attentional orientation to distress cues, particularly in children who also score high on conduct problems relative to those who score low on CU traits and conduct problems (Kimonis et al., 2015), which suggests a developmental stage where the social interaction skills of children are not well developed. In future studies, it may be necessary to follow preschool children longitudinally, both to analyze factors of the social context, such as attachment and interpersonal relationships, and to understand whether callous-unemotional features reflect stable personality traits or cognitive/affective development and social learning. This underlines the potential utility of the ICU for the assessment of young children.

Some limitations should be taken into account in the interpretation of these results. Children with neurological or neuropathological problems, as well as motor, sensory, or cognitive deficits, such as children with autism and/or attention deficit hyperactivity disorder (ADHD), were not part of the total sample. The sample concerns very young children with neurotypical development recruited from regular preschool institutions. Thus, disorders such as ADHD were not considered, although there is evidence of associations between such diagnoses and CU traits, which are worthy of further analysis. Furthermore, it should be noted that only the preschool teachers' reports were used. It would be useful to turn to the parents' reports and analyze the consistency between the responses, given the different results found for different informants (e.g., Matlasz et al., 2020, 2023; Roose et al., 2010). Nevertheless, we emphasize that preschool teacher ratings are extremely helpful when assessing behavioral disorders in preschoolers because they can intensely observe children in many different interaction situations (Dirks et al., 2012).

Moreover, even though the factor structure of the ICU shows a good fit for preschool children, it is also necessary to analyze its sensitivity in children of these age groups. As Kimonis et al. (2015) explain, certain items can be interpreted in light of callous-unemotional and carelessness but are instead the result of limited attention and restlessness (e.g., item 11). Therefore, it would be important to train the responders to recognize the characteristics that reveal CU traits. Finally, it should be pointed out as a limitation that only 46 preschool teachers had assessed 131 students, which influences the perceived independence of the students' ratings. Ideally, it would be important to resort to a Multilevel Confirmatory Factor Analysis (MCFA) to obtain unbiased parameter estimates and statistical inferences. For a MCFA approach is recommended cluster sizes are between five and 30 (McNeish & Stapleton, 2014). However, in our data, there are preschool teachers with at least one and at most eight children assessed, resulting in insufficient cases evaluated by a preschool teacher to generate robust analyses. Despite being considered a limitation, this method is common. Several other studies resort to this method, in which teachers assessed multiple students on various variables (e.g., Farrell et al., 2018; Lopez-Romero et al., 2019; Sointu et al., 2012; Stoppelbein et al., 2020; Wang et al., 2019).

Overall, our results support the use of ICU to identify and measure Callous-Unemotional traits in preschool children. Previous research suggests these characteristics seem important for understanding conduct problems (Blair et al., 2014; Frick et al., 2014; Herpers et al., 2012), which can further develop into antisocial behavior. Thus, the early identification of children with CU characteristics may be critical in preventing antisocial behaviors at older ages (Frick et al., 2014). As Kimonis et al. (2015) point out, interventions administered in early child development stages may be more successful than later interventions when more serious behavioral problems are already noticeable.

Declaration of conflicting of interests

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Ethical Approval

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Funding

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Authors contribution

Conceptualization: PF; Data curation: PF; Formal analysis: PF; Funding acquisition: PF; Investigation: PF; Methodology: PF, ER, DM; Project administration: PF, FB, RB; Resources: PF; Software: PF; Supervision: FB, RB; Validation: FB, RB; Visualization: PF; Writing – Original draft: ER, DM; Writing – Review & editing: PF, FB, RB.

All the authors read and approved the final manuscript.

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Propriedades psicométricas da versão portuguesa para professores do *Inventory of Callous-Unemotional Traits* para Crianças Pré-Escolares

Resumo: Vários autores sugerem que os traços de frieza emocional podem ser úteis na identificação de adolescentes que apresentam problemas de conduta iniciais, graves, crónicos e agressivos. O *Inventory of Callous-Unemotional Traits* (ICU) foi desenvolvido para avaliar estes traços, mais tarde associados à psicopatia, em crianças e adolescentes. Este estudo tem como objetivo analisar as propriedades psicométricas da versão portuguesa do ICU, reportada pelo professor, para crianças em idade pré-escolar. A amostra foi recolhida em escolas públicas e incluiu as respostas de 46 professores do ensino pré-escolar relativamente a 131 crianças (62 raparigas) entre os 3 e os 6 anos de idade. Os resultados indicam que um modelo de dois fatores foi o que melhor se ajustou aos nossos dados, incluindo o fator Callous e o fator Uncaring, recorrendo a 12 dos 24 itens originais. Além disso, os resultados deste estudo também fornecem evidências de invariância de medição entre sexos para o ICU, permitindo comparar os níveis médios de traços de frieza emocional entre rapazes e raparigas. Os resultados do presente estudo mostraram que a versão portuguesa do inventário ICU (versão do professor) parece ser fiável e válida para avaliar os traços de frieza emocional em crianças em idade pré-escolar.

Palavras-chave: Análise fatorial, Propriedades psicométricas, Traços de frieza emocional, Crianças em idade pré-escolar, ICU.

Submitted: 08/07/2022 *Accepted:* 13/03/2023