



Psychometric Properties of the North Carolina Family Assessment Scale (NCFAS) for Vulnerable Preschoolers from Ecuador

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Abstract

Positive parenting and appropriate interaction with children are globally recognized as pivotal in enhancing children's quality of life. Evaluating family intervention programs is therefore vital, particularly in regions that lack reliable tools for assessment. This manuscript details a study conducted in Ecuador, a country noted for its scarcity of validated instruments to assess the impact of such interventions, especially for vulnerable preschool children. We focused on the application of the North Carolina Family Assessment Scale (NCFAS), a well-established measure to evaluate family functioning internationally, to Ecuadorian families with preschool children who are deemed vulnerable. The Spanish translation of the original scale was administered by trained evaluators to 470 preschool children in Machala, Ecuador. Our examination of the psychometric properties of the NCFAS in this context demonstrated high internal consistency. Additionally, factor analysis corroborated the reliability and validity of this adapted version of the NCFAS, albeit with a reduced item count. This research supports the effectiveness of the NCFAS in the Ecuadorian setting and underscores its potential utility in further studies involving varied demographic groups within the country. The results of this study have substantial implications for the enhancement of children's quality of life in Ecuador through family intervention programs.

Keywords NCFAS · Psychometric properties · Preschool children · Family intervention programs · Vulnerable populations

Highlights

- The Ecuadorian study used the NCFAS to assess 470 vulnerable preschoolers' environments.
- High internal consistency and reliability were confirmed in this context.
- The adapted version with fewer items was validated through factor analysis.
- The results are pivotal for designing interventions in areas lacking reliable tools.

Social programs are essential tools for governments that aim to mitigate the effects of socioeconomic disadvantage, vulnerability, morbidity, and mortality (Bernal-Salazar & Rico, 2010; Shahidi et al., 2019). Researching and evaluating these

programs enhances their effectiveness, further benefiting public management (Haefner, 2011; Rossi et al., 2018).

Vulnerability is often characterized by limited economic income, unstable employment, lower education levels, challenges in accessing basic services, inadequate housing, and difficulty in navigating adverse situations. These conditions frequently result in environments marked by violence and family conflict that often have the greatest impact on women and children (Busso, 2001; Ortiz-Ruiz & Díaz-Grajales, 2018). This is a pervasive issue in Latin America (Giacometti & Pautassi, 2014). In Ecuador, for instance, there are alarming statistics regarding child violence; for instance, 47% of afro-descendant parents use physical discipline on their children. Although this trend appears to be declining among the mestizo/white and indigenous populations, it remains a concern (Yumbay, 2019).

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To promote children's well-being and prevent abuse, early intervention and support for vulnerable families that emphasize positive parenting are crucial (Fernandez, 2007). Such programs must be evidence-based, and their designs and evaluations must be firmly grounded in previous research. A significant challenge in non-English-speaking countries arises when psychological tools developed in different cultural contexts are employed without proper adaptation or without understanding of their psychometric properties (Matus et al., 2008). This situation complicates the assessment of programs that target childhood and family functioning (Valencia & Gómez, 2010).

Several instruments assess family functioning. Some instruments primarily highlight problems or dysfunctional family attributes, while others focus on family strengths, balancing the consideration of challenges with resources and resilience (Early & GlenMaye, 2000). Johnson et al. (2008) conducted an exhaustive review of 85 family assessment instruments related to children's well-being. They identified seven scales that were particularly promising: the North Carolina Family Assessment Scale (NCFAS), the North Carolina Family Assessment Scale for Reunification (NCFAS-R), Strengths and Stressors Tracking Device (SSTD), Family Assessment Form (FAF), Family Assessment Checklist (FAC), Ackerman-Schoendorf Scales for Parent Evaluation of Custody (ASPECT), and Dartington Family Assessment System (DFAS). Among these, the NCFAS emerged as the most validated scale for assessing children's well-being and demonstrated excellent suitability for evaluations in such contexts.

The NCFAS emerges as a pivotal scale for assessing family functioning that emphasizes the identification of family strengths and extensive utilization within vulnerable populations. It facilitates in-depth analyses of improvements in family intervention processes, sustained monitoring of user progress, and comprehensive assessment of program efficacy (Johnson et al., 2008). In 1991, following the approval of the Intensive Family Preservation Services (IFPS) program by North Carolina legislation, the NCFAS was developed as part of a state contract. The original authors were assigned to develop an evaluative tool aimed at identifying alterations in family functioning induced by the program. The scale was intended to be ecologically oriented and to align with the primary objective of the IFPS program of preventing unnecessary removal of children from their homes and inducing transformation while maintaining family unity (Kirk & Reed-Ashcraft, 2004). Over the years, several versions of the NCFAS have been introduced: the NCFAS-R for reunification, the NCFAS-G for general services, and the NCFAS G + R, which blends elements from the NCFAS-G and the NCFAS-R. Each version of the scale is distinctly formulated with respect to its intended objective (Kirk, 2012).

These versions of the NCFAS serve as potent tools for a holistic assessment of family well-being. Initially conceived with child welfare issues in mind, the applicability of these scales have been broadened to families that do not necessarily interface with child protection agencies (Kirk, 2012). Several studies, including those by Reed (1998), Reed-Ashcraft et al. (2001), Kirk et al. (2005), Kirk and Martens (2006), Kirk et al. (2007), Valencia and Gómez (2010) and Kirk and Martens (2015), have affirmed the psychometric integrity of the NCFAS across its various iterations. Supported by evidence of its internal consistency and validity, the original NCFAS and its subsequent versions have been a staple in myriad studies, as delineated in Table 1. Examples of these studies include works by Fernandez (2007), Farrell et al. (2010), Gómez et al. (2010), Hurley et al. (2011), Conner and Fraser (2011), and Olsen et al. (2015).

Lee and Lindsey (2010) investigated the measurement properties of the NCFAS within the realm of youth mental health services. They found that the NCFAS did not operate identically between child mental health contexts and child welfare frameworks. This pivotal revelation underscores the necessity of tailoring the NCFAS when deploying it for specific cohorts, such as vulnerable preschool-aged children, to ensure its potency and pertinence.

An agreement between the National Family Preservation Network (NFPN) and the Child Protector of Chile facilitated the translation of the NCFAS into Spanish. The Spanish rendition was developed using expert evaluations from both the NFPN and the Faculty of Education and Family Sciences of the Finis Terrae University of Chile. The translated version encompasses five components: scale and definitions; frequently asked questions; goal establishment; case studies; and a PowerPoint presentation for training purposes. The Spanish iteration of the NCFAS exhibited sound psychometric properties when applied to the Chilean populace. The Chilean exploration centered on children and adolescents who averaged 9.4 years of age ($SD = 4.2$) and were enrolled in programs that catered to families with high-risk indicators for child maltreatment (Valencia & Gómez, 2010).

The NCFAS has been extensively used in contexts characterized by elevated risks with the aim of preventing family disintegration. In Ecuador, the most culturally proximate environment where the scale received validation was Chile. Researchers investigated the psychometric properties of the scale congruent with the original objectives of its creation with a focus on high-risk children. We propose that in Ecuador, the NCFAS might be suitable for preschoolers who are vulnerable due to their social circumstances, even if they are not explicitly recognized as high-risk or incorporated into the protection system. The Ecuadorian cohort differs from the Chilean cohort both

Table 1 Psychometric Properties of the NCFAS in all its Versions and Various Studies Using the Scale

Authors/year	Population	NCFAS version	Findings
Reed-Ashcraft et al. (2001) and Reed (1998) ^a	414 participants	NCFAS	For the internal consistency component, 3 out of 5 factors were supported (environment, family interactions and child well-being), and a fourth factor emerged (family safety). Cronbach's alpha ranged from 0.71 to 0.94. For the construct validity component, 5 of 6 relationships were statistically supported, with concurrent validity correlations ranging from 0.26 to 0.71.
Kirk et al. (2005) ^a	1279 families	NCFAS	The instrument was found to be highly reliable, with Cronbach's alpha between 0.72 and 0.90 at admission and between 0.79 and 0.91 at closing.
Kirk and Martens (2006) ^a	123 families	NCFAS-G for Social Services	Adequate psychometric properties were found, with Cronbach's alpha values greater than 0.83 in all factors.
Kirk et al. (2007) ^a	332 families	NCFAS-R for reunification	In the analysis of internal consistency, Cronbach's alpha ranged from 0.71 to 0.93.
Valencia and Gómez (2010) ^a	528 families	NCFAS Spanish version	Adequate internal consistency with Cronbach's alpha between 0.78 and 0.86. In this study, the five-factor model explained 44.3% of the total variance.
Kirk and Martens (2015) ^a	170 families	NCFAS G + R	A study of its internal consistency obtained Cronbach's alphas between 0.87 and 0.92, which reflects good internal consistency and reliability.
Fernandez (2007) ^b	51 families	NCFAS	NCFAS helped to present the results of families' participation in a network of family centers, monitoring the interventions for six months.
Farrell et al. (2010) ^b	1720 families	NCFAS	The NCFAS was employed to assess the efficacy of the Supportive Housing for Families (SHF) program.
Gómez et al. (2010) ^b	591 families	NCFAS Spanish version	Describes the characteristics and risk factors for child abuse and neglect in Chilean children and adolescents, served by eight short intervention programs.
Hurley et al. (2011) ^b	107 families	NCFAS	Used to evaluate the effects of the home program on improving the behavior of children and the parental capabilities of their caregivers. The study demonstrated an improvement in families' quality of life.
Conner and Fraser (2011) ^b	104 children and their caregivers	NCFAS	The NCFAS was applied before and after the application of the program in a high-risk population.
Olsen et al. (2015) ^b	415 families	NCFAS	Used to evaluate a program created for families with substance abuse and focusing on home-based interventions. The program was useful for strengthening parenting capacity and child safety.

^aStudies of psychometric properties of the NCFAS

^bStudies using the NCFAS

demographically and in its unique characteristics. Hence, we address two pivotal questions: (1) What is the factorial structure of the NCFAS for Ecuadorian families with vulnerable preschoolers? and (2) How internally consistent is the NCFAS for this sample?

Methods

Participants

Recruitment and Eligibility

We recruited participants for this study through 14 Child Development Center (CDC) coordinators who held degrees in various fields of psychology, including clinical, educational, and child psychology. At the onset of the study, these professionals were already acquainted with the children and had been familiar with their family environments for a minimum of seven months.

The inclusion criteria required the children to belong to vulnerable populations with families that were unable to provide adequate care due to circumstances such as poverty, extreme poverty, unemployment, suboptimal income levels, insufficient parental capabilities, reduced cultural acuity, and/or a lack of educational attainment. We determined eligibility by analyzing the vulnerability forms completed by each family.

Sample Characteristics

A total of 470 children met the inclusion criteria. Table 2 presents the descriptive characteristics of the participants. Due to the constraints of the COVID-19 pandemic, we were able to obtain socioeconomic information for only 413 of the 470 children. From the collected data, 29% of the children reported experiencing insufficient food availability in recent weeks, and 82% of the parents were employed, although 50% were employed in temporary capacities. Of the children's mothers, 62% were employed, with only 22%

Table 2 Descriptive Age of the Participants

	Sex	N	Mean	SE	Median	Mode	SD	Minimum	Maximum
Age	Male	257	2.78	0.0430	2.78	2.00	0.689	1.170	4.06
	Female	213	2.74	0.0473	2.78	2.00	0.690	0.926	4.07

Table 3 Global and Specific Items of the NCFAS Instrument. Original Version

Global items	Specific items
A. Environment	1) housing stability, 2) safety in the community, 3) habitability of housing, 4) income/employment, 5) financial management, 6) food and nutrition, 7) personal hygiene, 8) transportation, 9) learning environment
B. Parental capabilities	1) supervision of child/children, 2) disciplinary practices, 3) provision of developmental/enrichment opportunities, 4) parent/caregiver mental health, 5) parent/caregiver physical health, 6) parent/caregiver use of drugs/alcohol
C. Family interactions	1) bonding with child(ren), 2) expectations of child(ren), 3) mutual support within the family, 4) relationship between parent(s)/caregiver(s)
D. Family safety	1) absence/presence of physical abuse of children, 2) absence/presence of sexual abuse of children, 3) absence/presence of emotional abuse of children, 4) absence/presence of neglect of children, 5) absence/presence of domestic violence between parents/caregivers
E. Child well-being	1) child mental health, 2) child behavior, 3) school performance, 4) relationship with parent(s)/caregiver(s), 5) relationship with sibling(s), 6) relationship with peers, 7) cooperation/motivation to stay in the family

in permanent positions. A substantial 99% of children resided with their biological mothers; however, 33% did not live with both biological parents. It was reported that 15% resided in households where domestic violence was prevalent.

Procedure

We obtained authorization to use the scale by contacting the NFPN, which supplied us with the original Spanish-translated scale package. Subsequently, the Ministry of Economic and Social Inclusion granted approval for the implementation of the NCFAS at the 14 CDCs in Machala, Ecuador. To ensure adherence to the NCFAS, we conducted training using the package supplied by the NFPN involving professionals across all 14 CDCs. Although these professionals developed their assessment skills independently, our team collaborated on completing each NCFAS form to enhance the rigor of the process. We recruited an external evaluator skilled in conducting psychological interviews to enable collaboration with the principal researcher in overseeing, monitoring, and controlling the completion of the NCFAS forms.

We created a Google Forms document to optimize data collection by facilitating online registration and transitioning from paper and pencil to a digital instrument. After obtaining informed consent from the children's representative and the coordinator, we began the information collection process with scheduled visits to each CDC.

Each analysis took approximately 30 min per child. During this time, professionals answered the questions of the scale, relying on their knowledge acquired through daily

interactions and care processes and referring to individual file information. This file contained (a) a record of individuals receiving care at the center, (b) a vulnerability sheet, (c) a general data sheet, (d) a child care sheet, (e) a child nutritional status monitoring sheet, and (f) a comprehensive child development indicators sheet. From July 2019 to February 2020, we meticulously executed data collection. The data were coded to maintain confidentiality and preserve the anonymity of the digital records of cases.

Measurement

We used the original version of the NCFAS, which was translated into Spanish by the NFPN. It features 5 global and 31 specific items as presented in Table 3 (Kirk & Reed-Ashcraft, 2007). This scale is designed to assess difficulties and strengths, with scoring occurring at the commencement and conclusion of the program. Initial ratings assist in developing intervention plans and setting objectives, while final ratings assess changes after program application (Kirk & Reed-Ashcraft, 1998). The evaluation employs a scaling system ranging from -3 to +2, with each value corresponding to a distinct level of family functioning. A score of -3 indicates a "severe problem", showing deteriorating family dynamics. A score of +2 represents a "clear strength" or an optimum level of familial functioning. A score of 0 serves as the baseline, representing an "adequate" level of functioning and suggesting no immediate need for intervention from protective services, although it does not signify the absence of familial challenges. A guideline is provided to aid professionals in the scoring process. For intermediate values such as +1, "minor strength," and -1

Table 4 Distribution of the Scores of the Global Items of the NCFAS

Domain	Items	Observations ^a	<i>n</i>	Mean	Mode	SD	Skewness	Kurtosis
Environment	9	4230	470	3.41	3.00	1.12	0.58	0.35
Parental Capabilities	6	2814	470	3.19	3.00	0.86	1.31	3.21
Family Interactions	4	1880	470	3.17	3.00	1.05	0.97	1.50
Family Safety	5	2350	470	3.21	3.00	0.85	1.54	3.91
Child Well-Being	7	1659	237	3.03	3.00	0.78	1.02	3.53

^aThe number of observations is equivalent to the calculation of the number of participants analyzed by the number of items of each domain.

and -2, representing “minor problem” and “moderate problem,” there are no fixed criteria; therefore, professionals use their judgment and expertise to assign these scores (Kirk & Reed-Ashcraft, 2007).

Kirk and Reed-Ashcraft (2004) found that certain items are not applicable in specific family structures. For instance, when children are not of school age or lack siblings, evaluation is not feasible, and the item is marked NA (not applicable).

Data Analysis

We analyzed descriptive statistics and internal consistency using the Python program (Python, 2022). We ascertained validity through data processing with Jamovi version 2.2 computer software (Jamovi, 2021). The data management necessitated the conversion of rating values from +2 (clear strength) to -3 (serious problem) into positive values ranging from 1 (clear strength) to 6 (serious problem).

We conducted an initial descriptive analysis to ascertain the distribution of the items. In this analysis, we focused on global items, which are equivalent to specific items, and used methodologies similar to those in preceding studies of the same scale. The principal descriptive statistics encompassed the mean, mode, standard deviation, skewness, and kurtosis. We processed the data associated with the child well-being factor using a method that handles listwise deletion, incorporating the items “school performance” and “relationship with sibling(s)” This approach was essential because 233 out of the 470 children were only children, and some were not of age for academic performance measurement.

To validate the Ecuadorian iteration of the NCFAS, we employed both confirmatory factor analysis (CFA) and exploratory factor analysis (EFA). For these analyses, global weighting items were omitted because their outcomes are contingent on the ratings of other items. We first executed CFA on the complete sample ($n = 470$) to confirm the coherence in the item distribution based on the original NCFAS. Following this, cross-validation was instituted by partitioning the study group into two distinct, nonoverlapping subsamples ($n_1 = 235$, $n_2 = 235$). The first subsample underwent a sequence of EFAs with oblique rotation, a

method that is suitable for correlated and uncorrelated factors and yields accessible interpretation (Osborne, 2015). Finally, we applied CFA on the alternate subsample ($n_2 = 235$) to confirm coherence in item distribution in alignment with the EFA outcomes and compared it with the reference values of the EFA adjustment indices: comparative fit index (CFI), Tucker–Lewis index (TLI), standardized root mean square residual (SRMR), and root mean square error of approximation (RMSEA). Indices indicative of optimal fit included CFI values of 0.95 or higher, RMSEA values of 0.05 or lower (Lai, 2021), TLI values greater than 0.90 (Xia & Yang, 2019), and SRMR values below 0.08 (Cho et al., 2020).

We measured the internal consistency of the NCFAS indicators across all factors using Cronbach’s alpha, with the analysis focusing solely on the specific items of each factor. Alpha values between 0.70 and 0.90 are reflective of satisfactory internal consistency (Oviedo & Arias, 2005).

Results

Descriptive Analysis

Table 4 presents the results obtained from applying the original NCFAS to the Ecuadorian population. The mean scores, ranging from 3.03 to 3.41, indicate that on average, the responses aligned within the baseline or appropriate parameter. The standard deviation ranging between 0.78 and 1.12 suggests the presence of family functioning problems. However, on average, it is not a high-risk population that necessitates inclusion in the protection system.

Factor Analysis

We assessed the suitability of the original NCFAS structure for the Ecuadorian sample by conducting CFA using the entire sample ($N = 470$). The results indicated that the original NCFAS structure did not provide a good fit to the data ($\chi^2 = 3029$, $df = 434$, $p < 0.001$, $RMSEA = 0.113$, $SRMR = 0.081$, $CFI = 0.682$, $TLI = 0.659$). Given the inadequate fit, the Ecuadorian sample might have a distinct

factorial structure. As a result, we proceeded with EFAs, followed by a subsequent CFA.

We conducted a series of EFAs on the initial subsample ($n_1 = 235$) to understand the internal structure of the NCFAS among Ecuadorian participants. The primary analysis was undertaken explicitly to determine the number of factors. Initially, a five-factor solution was explored, adhering to the structural foundation of the original scale. Based on the results, items with insufficient loadings (<0.40) were excluded from the subsequent analysis. Similarly, given that Factor 5 consisted only of a single item, an exploration with four factors was subsequently conducted. In this refined analysis, we discerned that the fourth factor comprised two items. Mavrou (2015) suggests that for stable and replicable solutions, a factor should encompass a minimum of three items with loadings (>0.60 – 0.70); therefore, an analysis focusing on three factors was subsequently performed. Based on the findings of the third analysis and in alignment with Mavrou's guidelines (2015), items with loadings >0.65 were retained, with the exception of the item labeled "child mental health," which had a loading <0.65 in Factor 3. This decision was made to maintain a three-factor structure and uphold theoretical consistency. After conducting the fourth EFA and applying the same analytical criteria, the item "transportation" was excluded due to a loading <0.60 . The final EFA established a definitive model consisting of 16 items segmented across three factors. Factor 1 incorporated eight items, Factor 2 integrated five items, and Factor 3 was composed of three items. This conclusive model is delineated in Table 5.

CFA analyses were conducted utilizing the second subsample ($n_2 = 235$). Initially, the 16-item solution produced by the EFA was validated through CFA, resulting in the subsequent model fit: $\chi^2 = 245$, $df = 101$, $p < 0.001$; $RMSEA = 0.07$; $SRMR = 0.052$; $CFI = 0.92$; $TLI = 0.91$. There was substantial evidence of correlated residuals among items: "financial management" and "income/employment" (53.00); "habitability of housing" and "housing stability" (42.55); "financial management" and "housing stability" (32.25); and "absence/presence of neglect of children" and "personal hygiene" (28.17). This refined specification culminated in a noteworthy enhancement in model fit: $\chi^2 = 146$, $df = 97$, $p < 0.001$; $RMSEA = 0.0463$; $SRMR = 0.046$; $CFI = 0.974$; $TLI = 0.968$.

The findings were deemed satisfactory. Hence, the Ecuadorian adaptation for preschoolers conformed to a 16-item model. Factor 1, termed "parental capabilities" comprised eight items (A7, A9, B1, B3, B4, C1, C2, D4); Factor 2, termed "environment" consisted of five items (A1, A2, A3, A4, A5); and Factor 3, labeled "child well-being" encompassed three items (E1, E2, E6). We maintained three designations out of the five original factors from the NCFAS. The final path diagram is illustrated in Fig. 1.

Table 5 Exploratory Factor Analysis—Factor Loadings

	Factor			Uniqueness
	1	2	3	
A. Housing stability		0.691		0.456
A. Safety in the community		0.687		0.576
A. Habitability of housing		0.816		0.353
A. Income/employment		0.866		0.239
A. Financial management		0.739		0.278
A. Personal hygiene	0.685			0.537
A. Learning environment	0.718			0.433
B. Supervision of child/children	0.733			0.429
B. Provision of developmental/enrichment opportunities	0.731			0.402
B. Parent/caregiver mental health	0.677			0.522
C. Bonding with the child(ren)	0.790			0.414
C. Expectations of child(ren)	0.657			0.472
D. Absence/presence of neglect of children	0.756			0.325
E. Child mental health	0.425		0.495	0.423
E. Child behavior			0.867	0.291
E. Relationship with peers			0.737	0.340

Minimum residual extraction method was used in combination with oblimin rotation

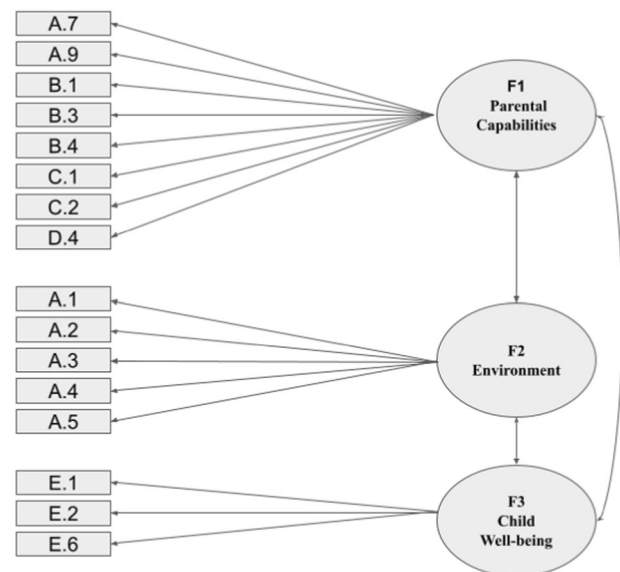


Fig. 1 Confirmatory Factor Analysis Model: NCFAS - Ecuadorian Version

CFA was conducted utilizing the comprehensive sample ($n = 470$) to compare the outcomes. The data fit was notably analogous, as evidenced by $\chi^2 = 228$, $df = 97$, $p < 0.001$; $RMSEA = 0.053$; $SRMR = 0.043$; $CFI = 0.968$; $TLI = 0.960$. The quality of the finalized model was

Table 6 Coefficient Values in the Confirmatory Factor Analysis of the NCFAS

Factor	Indicator	Estimate	SE	Z	p
Factor 1	Personal hygiene	0.679	0.0435	15.6	<0.001
	Learning environment	0.749	0.0409	18.3	<0.001
	Supervision of child/children	0.845	0.0418	20.2	<0.001
	Provision of developmental opportunities	0.616	0.0329	18.7	<0.001
	Parent/caregiver mental health	0.425	0.0274	15.5	<0.001
	Bonding with the child(ren)	0.626	0.0393	15.9	<0.001
	Absence/presence of neglect of children	0.713	0.0358	19.9	<0.001
	Expectations of child(ren)	0.607	0.0353	17.2	<0.001
Factor 2	Housing stability	0.853	0.0533	16.0	<0.001
	Safety in the community	0.793	0.0564	14.1	<0.001
	Habitability of housing	0.884	0.0514	17.2	<0.001
	Financial management	0.837	0.0459	18.2	<0.001
	Income/employment	0.848	0.0463	18.3	<0.001
Factor 3	Child mental health	0.459	0.0261	17.6	<0.001
	Child behavior	0.681	0.0392	17.4	<0.001
	Relationship with peers	0.820	0.0417	19.7	<0.001

Minimum residual extraction method was used in combination with oblimin rotation

analyzed by inspecting the factor loading values, as shown in Table 6. In 14 out of the 16 items, the factor loading values were higher than 0.6 and met an acceptable criterion. In several instances, the factor loadings were above 0.7 and 0.8, indicating exemplary outcomes (Worthington & Whittaker, 2006). In conclusion, the 16-item three-factor model demonstrated reasonable precision, substantiated by its model fit parameters and factor loading values.

Cronbach's Alpha

To evaluate the reliability and internal consistency of the NCFAS scores, we used the full sample ($n = 470$). We found the values for Cronbach's α coefficient across all items to exceed the recommended minimum threshold of 0.8 (Carmines & Zeller, 1979), indicating acceptable reliability. The overall Cronbach's alpha coefficient for the scale was a substantial 0.926, reflecting high internal consistency. Similarly, the separate dimensions of "parental capabilities" and "environment" showed high reliability, with values of 0.918 and 0.919, respectively. Additionally, the "child well-being" dimension demonstrated notable internal consistency with a coefficient of 0.923, underscoring its valuable utility in assessing children's health and well-being.

Discussion

Our research confirms the validity of the NCFAS among a subset of vulnerable preschool children in Ecuador. While sufficient evidence exists regarding the internal consistency and validity of the NCFAS in United States populations (Johnson et al., 2008) and reliability studies are available for the versions translated into Spanish for Chilean populations (Valencia & Gómez, 2010), this represents the first study to examine the psychometric properties of the instrument with vulnerable Ecuadorian preschoolers. The results of the exploratory and confirmatory analyses indicate that the version of the NCFAS adapted for Ecuador yields reliable and valid scores, albeit with a condensed item set (16 vs. 31).

For instance, the component "relationship with sibling(s)" within Factor E, titled "child well-being" did not load any factor from the initial exploratory analysis. This was primarily due to the majority of preschoolers being the only child of younger parents and, consequently, lacking siblings. Likewise, "school performance" is not a pertinent item for preschoolers and, therefore, does not load in the analysis. Within Factor D, "family safety" five out of its six elements were excluded, a phenomenon that can be attributed to the fact that the surveyed population predominantly consisted of vulnerable preschoolers and not children who were part of the family protection system. As a result, responses to these elements were challenging to discern by professionals operating outside of the protection system domain. However, the element "absence/presence of neglect of children" was retained for this demographic because it was more readily identifiable by professionals who observed the care behaviors of families who enrolled their children in these programs. For the Ecuadorian population, the item "absence/presence of neglect of children" properly loaded and was retained in the first factor.

In the adapted Ecuadorian version of the scale, the principal factor consolidated items with substantial factor loadings originating from the four domains of the original instrument, including two items from the environment, three from parental capabilities, two from family interactions, and one from family safety. For theoretical congruence, this principal factor is called as "parental capabilities".

The secondary factor, termed "environment", integrates five out of the nine items from the original "environment" domain. The significant scores of this factor validate its relevance and stability for the Ecuadorian preschool demographic. This component succinctly represents three pivotal facets for the studied population: economic conditions, housing quality, and safety. The items labeled "learning environment" and "personal hygiene" are highlighted as integral elements of parenting skills and are therefore included in the "parental capabilities" factor in the context of the Ecuadorian demographic. The item "transportation" is excluded due to its divergent implication in

Ecuador, where community services are readily accessible and the population density is comparatively lower (INEC, 2010, October 1). The majority of the population commutes conveniently within their communities due to the compactness of distances (Ministerio de Turismo, 2008).

The third factor, termed “child well-being” in the adapted version for Ecuador, prominently retained three integral items: “child mental health”, “child behavior”, and “relationship with peers”. These align with the “child well-being” factor from the original scale. Specifically, in the concluding EFA, the item “child mental health” had a loading of <0.65 . Nevertheless, the decision to retain it was made due to its theoretical significance and to maintain a composition of three items within this factor. The items “school performance” and “cooperation/motivation to stay in the family” which originated from the original NCFAS, did not exhibit substantial loadings in the adapted version for Ecuador. This may be attributed to the distinct characteristics of the studied population. Given the age of the children, they are not currently integrated into the academic system. Moreover, the nature of the programs in which the children are enrolled is caregiving rather than protective, rendering the measurement of motivation to remain within the family incongruent in preschools. This is especially applicable to those who have not experienced familial separation, are not classified as high-risk and are not part of the protection system.

We derived results from implementing the originally translated version of the NCFAS. When applied to the Chilean population, it exhibited a distinct integration of specific items despite possessing the same five-factor structure as the original version (Valencia & Gómez, 2010). In both the original version developed by Kirk (Valencia & Gómez, 2010) and Kirk and Reed-Ashcraft (1998) and the Chilean Spanish adaptation by Valencia and Gómez (2010) and Gómez (2010), the scale encompasses five factors. However, in the adapted version for Ecuador, the model comprises three factors: environment, parental capabilities, and child well-being. The factors related to family interactions and family safety were not substantiated in this study. Several of the elements were omitted due to low factor loadings, with the remaining elements distributed between parental capabilities.

The Ecuadorian adaptation of the parental capabilities factor retains five of the six items found in the Chilean version (Valencia & Gómez, 2010). Notably, the Ecuadorian version preserves the item “parent/caregiver mental health” from the original version, which was omitted in the Chilean adaptation, and integrates two additional items related to parental capabilities: “personal hygiene” and “learning environment”. Regarding the environment factor, eight of the nine items were incorporated in the Chilean version in contrast with five in the Ecuadorian adaptation. In terms of the child well-being factor, the items “child mental health” and “cooperation/motivation to stay in the family” were excluded in the Chilean

version due to factor loadings less than 0.2 across all factors. However, in the Ecuadorian adaptation, “child mental health” was retained despite possessing the lowest factorial load (0.486) within the final structure of the Ecuadorian model, while the item “cooperation/motivation to stay in the family” was omitted. The family interactions factor, which was absent in the Chilean study, was referred to as “caregiver well-being” in Factor 5 and included items about parental capabilities and the environment. This factor was also omitted in the Ecuadorian version, with the items “bonding with the child(ren)” and “expectations of child(ren)” reallocated according to their factor loads and theoretical congruence to the parental capabilities factor, rendering the scale three-factored for the Ecuadorian population.

The present study seeks to assess the psychometric properties of the NCFAS scale within a sample of preschoolers experiencing vulnerability in Ecuador. Our collected data reveal strong internal consistency throughout the scale, as evidenced by a Cronbach’s alpha of 0.926 for the overall instrument. Additionally, certain subscales, such as parental capabilities and child well-being, exhibit remarkable internal consistency within the Ecuadorian sample. These results serve as a foundation for future research endeavors that aim to replicate these initial findings and to assess their broader applicability. We believe this study serves as a stepping stone to gain insight into the reliability and validity of the NCFAS in the unique context of Ecuador. The findings illuminate the need for further nuanced explorations and validations in varied settings to truly grasp the multifaceted implications and applications of the NCFAS.

Practical Implications

The proven psychometric reliability and validity of the NCFAS make it an integral part of various research and intervention programs (Akin & Gomi, 2017; Akin et al., 2018; Conner & Fraser, 2011; Taibo et al., 2018; Farrell et al., 2010; Fernandez, 2007, 2013a, 2013b; Fernandez & Atwool, 2013; Fernandez & Lee, 2011, 2013; Gómez, 2010; Gómez et al., 2012; Hurley et al., 2011; Katsikitis et al., 2013; Malvaso & Delfabbro, 2020; Meadowcroft et al., 2018; Pérez & Santelices, 2016; Yan & De Luca, 2021). By evaluating its psychometric properties and outlining a factorial structure suitable for preschoolers within vulnerable families in Ecuador, we enable the use of the NCFAS in child-centered programs in Ecuador. This allows for the quantification of the outcomes and transformations that families experience during interventions.

Likewise, we can use the scale as a pivotal tool in creating innovative programs aimed at preempting child maltreatment within familial contexts. Historically, there has been a lack of measures dedicated to exploring family dynamics among Ecuadorian preschoolers and evaluating

the effectiveness of intervention schemes. The NCFAS fills this gap as a validated, reliable, concise, and user-friendly tool that is essential for both researchers and practitioners in evaluating familial functions.

Limitations

We recognize the limitations of the current study. Our ability to generalize the findings is potentially constrained by the specific sample, especially in the context of the extensive research on NCFAS. Additionally, the unique characteristics of our sample, which was derived from the CDC of a single city in Ecuador, indicate that our results may not apply to vulnerable preschoolers in other cities or reflect the broader Ecuadorian populace. Despite these limitations, our study provides evidence of internal consistency and reliability within a three-factor model and offers empirical support for the use of the NCFAS in evaluating vulnerable preschoolers. This aids in identifying immediate family functioning issues that require intervention and promotes improvements in family functionality. Seeing this scale as the first instrument to assess family functioning with validated psychometric properties in Ecuador accelerates the evaluation of programmatic outcomes in terms of economic efficacy and societal benefit. Furthermore, it can form a basis for future studies exploring the psychometric properties of the NCFAS in other representative samples, covering various areas and demographic sectors in Ecuador, and including high-risk or nonvulnerable populations.

Data Availability

All data generated or analyzed during this study are included in this manuscript. The data have been deposited in BD INTEGRADA database, <https://docs.google.com/spreadsheets/d/1dCrJ4u75YuvotSCQjwqR-YKHrTtwqzN-2XdG2pBeQ/edit?usp=sharing>. Requests for material should be made to the corresponding authors. The data held by the Ministry of Economic and Social Inclusion, supports our claims. For data access, provide rationale at: <https://bit.ly/NCFAS-EC-2023>.

Code Availability

Stored on Google Docs, access requires ministry authorization and privacy adherence.

Author Contributions K.R.-M. collected information and articulated the research narrative. M.S. co-wrote, revised, and refined content. I.R.-M. managed statistics, ensuring accurate analysis. All authors endorsed the manuscript and vouch for its accuracy.

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Compliance with Ethical Standards

Conflict of interest The authors declare no competing interests.

Ethics approval All protocols with human participants were executed in compliance with the Ethics and Biosafety Committee of the University of Girona. This committee endorsed the project “Development of Positive Parenting via a Virtual Reality and Video Intervention Program—Project Code: CEBRU0033-21,” which includes research on “Psychometric Properties of NCFAS in Vulnerable Ecuadorian Populations.”

Informed consent We uphold ethical standards, ensuring rights protection for all participants. Each provided informed consent, with any identifiable information either anonymized or included for academic purposes with clear consent. We have permissions to publish anonymized data and adhere to the guidelines of the University of Girona and the Journal of Child and Family Studies.

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