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Validation of the Chilean version of the Ages and Stages Questionnaire (ASQ-CL) in Community Health Settings

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ABSTRACT

Objective: To validate the translated and cross culturally adapted Chilean version of the 8 and 18 month Ages and Stages Questionnaire (ASQ-CL) in a community sample.
Methods: Participants: Parents of 1572 term children (82.9%) and 324 children at risk for developmental delay (17.1%) were included. *Instrument*: ASQ-3rd edition translated and culturally adapted for Chilean urban population. *Main measures*: 8 and 18 months ASQ-CL reliability, validity and mean scores. Feasibility was assessed using qualitative methods in healthcare professionals and mothers.
Results: ASQ-CL mean scores were comparable to U.S. normative data. The overall total score and all domains were reliable (Cronbach alpha 0.66–0.85). Test–retest and inter-rater reliability were high (Pearson's r range 0.73–0.94; intraclass correlation r range 0.68–0.93). Early preterm infants were more likely to fail on several criteria. Qualitative methods confirmed ASQ-CL as a feasible tool in this Chilean urban community.
Conclusions: ASQ-CL is a valid, reliable and feasible tool for assessing development in children at 8 and 18 months in Chilean urban population.

1. Introduction

Early detection of developmental delay in infants and children enables timely intervention and treatment, with proven effectiveness [1,2]. Given that accuracy of pediatric care provider's standard clinical assessment for detecting developmental delays has shown low sensitivity, detection of children with developmental delay is a challenge for healthcare providers [3]. Studies have shown that, in the absence of a formal screening program, the specificity of a pediatric care provider for detecting developmental and behavioral problems ranged between 69% and 100% and the sensitivity ranged between 14% and 54% [4]. This implies that based solely on the pediatric care providers' impression, 40 to 80% of cases with possible developmental delay may be missed.

In order to increase accuracy in detecting developmental disorders, the American Academy of Pediatrics (AAP) recommends performing ongoing developmental surveillance during routine health supervision visits, supplemented with standardized screening tools at specified ages, or when there is clinical suspicion of delay [5]. The selection of the most appropriate screening tool is based on its psychometric properties, developmental area(s) of concern, the context in which it is to be applied, and the preference of the health care provider [5]. Another aspect to be considered is the administration method, as some screening measures designed to be administered by trained professionals, whereas others are parent-completed.

In the USA, the use of standardized developmental screening tools has significantly increased in the last few years. From 2002 to 2009, the instruments with highest increase of use were the Ages and Stages Questionnaire (ASQ, from 13% to 40%) and the Parents Evaluation of Developmental Status (PEDS, from 8% to 29%) [6]. While the PEDS directly elicits parents' concern regarding the development and behavior of their children through open questions [7], the ASQ asks parents to observe and report the achievement of observable skills or behaviors of their children using structured and concrete questions [8]. Compared with PEDS, ASQ has shown higher sensitivity and specificity in detecting developmental delay [9].

Following the trend on including parent-completed screening reports, numerous countries have adapted and validated the ASQ [10–13]. However, a lack of validation studies of the ASQ in Latin-American countries is evident, with the exception of the Brazilian version, in Portuguese [14].

In Chile, since 1990, there has been a Program for Psychomotor Development Stimulation and Evaluation, focused on children in the public health system. This program includes two Chilean standardized tests, created in the 1970–1980 decade, both sharing the disadvantage of requiring a trained professional for administration, and both lacking

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updated versions [15]. For this reason, this study proposed to validate the ASQ 3rd edition and determine the feasibility of using it in Chilean urban setting. The 8 and 18 month intervals were chosen, as these are the ages at which standard developmental screening assessment are currently conducted at Chilean Primary Care Centers [15].

The aim of this study is to validate the translated and language adapted Chilean ASQ (ASQ-CL) within a community sample of infants in a real-time clinical context as well as to find answers to questions such as a) is the distribution of ASQ-CL scores comparable to the original validation scores of the ASQ-3?; b) does ASQ-CL achieve reliability, criterion-validity, and feasibility in the Chilean sample? and c) what are the optimal cutoffs scores for detecting potential developmental delay in the Chilean population? Answering these questions allows us to evaluate the accuracy of ASQ-3 in the Chilean context as a valid screening tool for detecting possible developmental delay, with potential impacts on early developmental and intervention programs.

2. Method

2.1. Population

We recruited a convenience cross sectional sample of children from Santiago (the capital of Chile) and surrounding areas, including urban and rural health centers, between 2008–2011. A total of 1896 children at 8 and 18 month participated. Children were recruited from public and private community health centers attending routine Well Child clinic programs, neurology services, preterm follow-up programs and foster care.

This sample consisted of 1572 (82.9%) in the normative sample (i.e. at-term births), and no detected risk indicators, whereas 324 (17.1%) were in the risk sample, including 222 extremely pre-term born children (11.7% of the sample) and 102 children with diagnosed neurological or genetic disease derived from neurology services (5.4%). The children derived from neurology services were recruited to act as a validation criterion group, since it was expected that they would have higher frequencies of abnormal ASQ scores. Of the sample, 49.2% of children were boys; the majority of respondents were mothers (70.2%) aged 20 to 35 years at delivery time. The sample was stratified in order to represent the income distribution of Chilean population. As stated by the OECD Better Life Index website, in Chile, the average household net-adjusted disposable income per capita is 13 762 USD a year (with OECD average being 23,938 USD a year). There is a considerable gap between the richest and poorest — the top 20% of the population earn 38,697 USD a year, 13 times as much as the bottom 20% with an estimated of 2983 a year [16].

Table 1
Demographic and socioeconomic background of the sample.

			Normative sample (Born at term) 37–41 weeks	Preterm sample 24–31[6] weeks	Neurological diagnostic sample	p
Gestational age (weeks)			Mean (SD)	Mean (SD)	Mean (SD)	
	8 m	($N = 950$)	39.1 (1.2)	28.9 (2.2)	37.3 (3.2)	0.00
	18 m	($N = 843$)	39.1 (1.2)	29.1 (2.2)	37.4 (2.2)	
Birth weight	8 m	($N = 876$)	3381.0 (433.0)	1288.3 (416.1)	2934.2 (801.2)	0.00
	18 m	($N = 814$)	3373.2 (486.6)	1356.5 (493.8)	3013.7 (797.6)	0.00
Number of children			N (%)	N (%)	N (%)	
	8 m	($N = 1007$)	823 (81.7)	119 (11.8)	65 (5.4)	
	18 m	($N = 889$)	749 (84.3)	103 (11.6)	37 (3.6)	
	Total	($N = 1896$)	1572 (82.9)	222 (11.7)	102 (5.4)	
Gender	8 m	($N = 1007$)	386 (46.9)	68 (57.1)	40 (61.5)	0.01
N (% of male)	18 m	($N = 889$)	363 (48.5)	52 (50.5)	24 (64.9)	0.14
Educational level mother						
<12 years	8 m	($N = 160$)	130 (32.3)	30 (28.3)	0 (0)	0.00
13–16 years		($N = 222$)	143 (35.5)	57 (53.8)	22 (88.0)	
>16 years		($N = 152$)	130 (32.3)	19 (17.9)	3 (12.0)	
		($N = 534$)				
<12 years	18 m	($N = 180$)	152 (37.0)	26 (31.0)	2 (13.3)	0.00
13–16 years		($N = 238$)	171 (41.6)	54 (64.3)	13 (86.7)	
>16 years		($N = 92$)	88 (21.4)	4 (4.8)	0 (0.0)	
		($N = 510$)				
Family income						
Low	8 m	($N = 498$)	412 (57.6)	69 (61.6)	17 (60.7)	0.00
Middle		($N = 119$)	86 (12.0)	28 (25.0)	5 (17.9)	
High		($N = 238$)	217 (30.3)	15 (13.4)	6 (21.4)	
		($N = 855$)				
Low	18 m	($N = 497$)	421 (62.0)	65 (66.3)	11 (64.7)	00.03
Middle		($N = 135$)	108 (15.9)	22 (22.4)	5 (29.4)	
High		($N = 162$)	150 (22.1)	11 (11.2)	1 (5.9)	
		($N = 794$)				
Mother's age at delivery						
<20	8 m	($N = 141$)	120 (16.4)	16 (14.3)	5 (12.8)	0.17
20–35		($N = 627$)	525 (71.9)	77 (68.8)	25 (64.1)	0.04
36–46		($N = 113$)	85 (11.6)	19 (17.0)	9 (23.1)	
		($N = 881$)				
<20	18 m	($N = 139$)	122 (17.6)	13 (13.3)	4 (18.2)	
20–35		($N = 566$)	490 (70.5)	63 (64.3)	13 (59.1)	
36–46		($N = 110$)	83 (11.9)	22 (22.4)	5 (22.7)	
		($N = 815$)				
Hospitalization of child at birth						
	8 m	($N = 886$)	63 (8.7)	112 (100.0)	24 (52.2)	
	18 m	($N = 815$)	42 (6.1)	96 (98.0)	12 (48.0)	0.00
Twin cases						
	8 m	($N = 1007$)	6 (0.7)	18 (15.1)	0 (0%)	
	18 m	($N = 889$)	8 (1.0)	14 (13.6)	0 (0%)	0.00

Children born at late preterm stages, between the 32nd and 36th week of gestation, were excluded from the analysis, as were children from non-Spanish native speaking families. This strategy allowed us to have a normative sample (with low risk for developmental delay), and a comparison sample (with high risk or with detected developmental delay). Moderate and late preterm samples were not included for determination of norms because there is growing evidence that this group should be considered at risk for developmental delay [17]. General distributions of the sample and socio-demographic characteristics are shown in Table 1.

2.2. Measures

Ages and Stages Questionnaires — Third Edition (*ASQ-3*) [8] is a parent-completed developmental screening tool for children between one month and 5 1/2 years. The 21 intervals making up the series each have 30 scored items divided into five domains: communication, gross motor, fine motor, problem solving, and personal–social development. Response options to the items are "yes", "sometimes", and "not yet" and are scored as 10, 5, or 0, respectively. Scores below cut-off scores indicate referral for further evaluation should be considered. The ASQ-3 also has a set of un-scored items called "overall questions" that can be predictive of potential developmental concern. These un-scored items were not included in our analysis. Each questionnaire was administered to children of the corresponding target ages, with a range of ± 1 month for children up to 2 years old.

2.3. Procedure

The ASQ-CL was adapted from the Spanish version of ASQ-3rd, designed for a broad Hispanic population in the US. A panel of ten professionals, including pediatricians, nurses, neurologists, psychologists, pre-school teachers and national public policy makers reviewed the adapted form. Minimal changes were made to language styles and some examples were attached in order to enhance understandability for Chilean Population. Efforts were made to keep the exact meaning of the original items via back translation method to English, and were revised by English native speakers comparing the original and translated version of each item [18]. Subsequently, a pilot trial was conducted on a group of 30 mothers with their respective children, taken from the normative population. This trial tested the applicability of the test, evaluating the linguistic appropriateness of the item's translation, the ease of use and distributions in the scoring system, the time needed for the test completion, and the environmental conditions provided in the primary health center for completing the questionnaire. No changes were detected as needed after this trial.

Several ethical committees, including the National Fund for Health Research (FONIS), National Care Service Centers of Talcahuano, Santiago-South West, Santiago-East, and the Faculty of Medicine of Clínica Alemana, Universidad del Desarrollo approved the study proposal. Parents, or primary caregivers, were invited to participate at the time of attending regular health visits at public and private community health centers, neurology services, and preterm follow-up programs and foster care. Data were collected between the years 2008 and 2011.

Parents completed the ASQ-CL at home or in the waiting room depending on the situation and the type of procedures at the various medical centers, and the availability of the parents. When completing the questionnaire at the medical centers, the parents/caregivers completed the ASQ-CL in a room where all the necessary materials (such as crayons, cereals, a mirror, a bottle, and a ball) were provided. A health care provider (nurse) was present to give assistance as necessary. Participants also completed a form about the demographic and health history of the child and family.

Table 2
Reliability (Cronbach alphas) for domain scores of the Chilean Ages and Stages Questionnaire (ASQ) 8 and 18 months forms among term children.

ASQ scale	8 months form		18 months form	
	Chile (n = 1007)	US ref. (n = 1362)	Chile (n = 889)	US ref. (n = 616)
Communication	.66	.65	.69	.68
Gross motor	.76	.76	.85	.87
Fine motor	.81	.79	.74	.65
Problem solving	.74	.75	.72	.57
Personal social	.69	.66	.71	.52

Note: US ref. = Published ASQ-3 technical report data.

2.4. Analyses

We assessed the characteristics of the study samples, excluding cases with incomplete data on gestational age, no health information or with an out-of-time administration of ASQ-3, as specified by the ASQ User's Guide [8]. As a consequence, 137 cases of ASQ-CL at 18 months and 161 cases of ASQ-CL at 8 months were excluded. Mean scores of the remaining 1896 ASQ-CL were compared with US norms for the corresponding age. Also, we assessed the reliability of ASQ-CL using three approaches: a) *Internal reliability* was assessed by computing Cronbach alpha coefficients and comparing the results with those reported for US ASQ; b) *Test–retest reliability* was assessed for a subsample of 219 cases of the normative group (113 for ASQ-CL 8 months, and 106 for ASQ-CL at 18 months), in which the parent/primary caregiver was asked to complete a second ASQ, within a period of time that ranged from two days to two weeks after the first completion; and c) *Inter-rater reliability* was assessed in a second subsample of 100 children from the normative sample (50 ASQ-CL at 8 months and 50 ASQ-CL at 18 months) where parents and health care providers completed the questionnaire at separate times on the same day.

To assess validity, we used the following approaches. First, *content validity and cultural appropriateness* were assessed by an expert panel. *Construct validity* was analyzed using biological and environmental factors that evidenced significant associations with child's development in other studies (i.e., early prematurity with gestational age lower than 32 weeks); children diagnosed with genetic or neurologic disease; male gender; lower family income and lower mother's educational level. *Feasibility* was assessed using in-depth interviews and mini focus groups, including health care providers who participated in the study and participating mothers (n = 15). Data were classified in emergent categories, related to the different topics that appeared on the discussion, including general characteristics of the test and its potential use in the public health system; replicability, validity and reliability of

Table 3
Test–retest correlations and t-scores for differences between test–retest applications of Ages and Stages Questionnaire 8 month and 18 month forms.

Scale	8 months (n = 113)	18 months (n = 106)
	r (t)	r (t)
Communication	0.82 (.63)	0.93 (.75)
Gross motor	0.94 (−3.83**)	0.81 (.51)
Fine movements	0.94 (−.87)	0.79 (.21)
Problem solving	0.73 (.87)	0.75 (−1.32)
Personal social	0.92 (−.95)	0.92 (−2.67*)

Note: r = Pearson's correlation.
Parenthesis indicates t-values for differences between scores of first and second application. Negative scores indicate increasing scores.
* $p < 0.05$.
** $p < 0.01$.

Table 4
Pearson's r and Intraclass correlation (ICC) for evaluating Inter rater reliability in the evaluation of the same children using Ages and Stages Questionnaire forms for 8 and 18 months.

	8 months (n = 50)					18 months (n = 50)				
Sub-scale	r	ICC	Parents M (SD)	Trained Prof. M (SD)	t	r	ICC	Parents M (SD)	Trained Prof. M (SD)	t
Communication	.68	.57	53.7 (9.6)	48.7 (13.8)	– 3.84**	.89	.89	32.3 (15.4)	33.6 (16.1)	1.52
Gross motor	.82	.80	38.4 (17.5)	34.6 (17.7)	– 2.84**	.93	.92	53.0 (15.1)	50.9 (16.8)	−2.93**
Fine motor	.72	.66	53.1 (12.1)	48.9 (16.9)	– 3.22**	.78	.73	49.0 (14.9)	43.9 (16.8)	−4.01**
Problem solving	.88	.81	53.3 (12.8)	48.9 (16.9)	– 4.13**	.79	.75	44.1 (13.0)	41.4 (16.9)	−2.21*
Personal–social	.76	.69	53.0 (10.7)	49.7 (15.1)	−2.6*	.87	.69	52.2 (12.9)	47.4 (16.3)	−4.93**

Note: Trained-Prof = Trained Professional.
r = Pearson's correlation, ICC = Intraclass correlation.
M = Mean, SD = Standard Deviation.
t = paired t score, negative scores indicates higher ASQ scores by parents.
* = p < −05.
** = p < 0.001.

risk detection; reliability of self-report technique, and effects of using ASQ-CL for parent's role in development surveillance.

3. Results

3.1. Cultural appropriateness

After the evaluation of the expert panel and the pilot study, some minor changes on the writing of items were considered necessary for better understandability of the test. The changes included on the 8 month interval:

- Included “she/he” instead of him or her as a subject for all the phrases
- Corrected grammatical construction of phrases to match South-American Spanish
- Changed Cheerios as a reference for breakfast cereal to generic “breakfast cereal”, because that brand is barely known in Chile.

On 18-month interval:

- Included she/he instead of him or her as a subject for all the phrases
- Changed words not used in Chilean Spanish (i.e. “cobija” was changed to “pañal”).

3.2. Reliability evaluation

Reliability analysis of ASQ-CL included three dimensions: Internal consistency, temporal stability, and inter-rater agreement.

3.2.1. Internal consistency

Cronbach alpha for the total sample of ASQ-CL scores were computed for all subscales. Item deletion did not improve alpha coefficients in any scale. Scores ranged from 0.66 (communication—8 month) to 0.85 (gross motor — 18 month). Those results indicated an acceptable-to-good consistency in all subscales and were comparable with the original US study results (10), as shown in Table 2.

3.2.2. Test–retest reliability

Repeated parents' completion of the 8 and 18 month ASQ-CL, blind to the results of the first completion showed high positive correlation in all domains, with Pearson's r ranging from 0.73 to 0.94. There was a tendency to obtain increased scores, but no statistical significant differences were found, with the exception of gross motor — 8 month, and Personal Social — 18 month (See Table 3). These results support temporal stability for both intervals.

3.3. Inter-rater reliability

Inter-rater reliability was evaluated comparing the subscale scores of the trained professional and parent's for the same child in the normative sample. We found acceptable levels of agreement between them. All subscales correlations were statistically significant ($p < 0.01$) and ranged from 0.68 to 0.93. ICC mean scores, which represented the percentage of variation attributed to cases for the mean of items by the mean of raters, ranged from 0.57 to 0.92. Differences between ICC mean score and Pearson's r found in Communication (8 month) and Personal-Social (18 month) may indicate a possible skew in evaluation in that scales. Statistically significant differences were found for all

Table 5
Normative mean, standard deviation and cutoff scores for Ages and Stages Questionnaire Chilean form in the normative sample compared to US norms. Italics indicates the cutoff point for each domain.

	8 months		18 months	
Domain	Chilean Normative sample M (SD)–cutoff	US ref. M (SD)–cutoff	Chilean Normative sample M (SD)–cutoff	U.S. M (SD)–cutoff
Communication	53.38 (7.65)–*37.9*	52.4 (9.67)–*33.1*	39.33 (12.79)–13.7	42.3 (14.62)–13.1
Gross motor	44.82 (12.73)–*19.5*	52.09 (10.74)*–*30.6*	56.74 (5.77)–45.1	55.46 (9.04)–37.4
Fine movements	54.85 (7.88)–*39.1*	55.75 (7.8)–*40.2*	50.72 (9.58)–33.5	52.44 (9.06)–34.3
Problem solving	54.74 (7.26)–*40.4*	53.92 (8.87)–*36.2*	47.34 (10.07)–27.1	45.99 (10.13)–25.7
Personal social	52.19 (9.19)–*33.8*	53.35 (8.75)–*35.8*	51.59 (7.88)–35.8	47.9 (10.35)*–27.2

Note: Cutoff scores were calculating using Mean — 2SD criteria.
US ref. = Published ASQ-3 technical report data.
M = mean; SD = standard deviation.
* Indicate statistical significant difference between Chilean and U.S. means scores ($p < 00.05$).

Table 6
At risk cases detection using 2-SD Chilean Cut-Off scores at 1 and 2 domains for Ages and Stages Questionnaire Chilean (ASQ-CL) version, at 8 and 18 months.

ASQ-CL		Born at term	Pre-term	Neurological diagnostic
8 months	Total N	847	119	70
	At risk (1 domain) n (%)	146 (17.2%)	30 (25.2%)	64 (91.4%)
	At risk (2 domains) n (%)	40 (4.7%)	16 (13.5%)	60 (85.7%)
18 months	Total N	762	103	40
	At risk (1 domain) n (%)	131 (17.2%)	36 (35.0%)	37 (92.5%)
	At risk (2 domains) n (%)	37 (4.9%)	20 (19.4%)	30 (75.0%)

subscales, with the exception of the Communication domain at 18 months, with higher scores assigned by parents (See Table 4).

3.4. Sample mean and cutoff scores for ASQ-CL domains

No statistically significant differences were found in the majority of the domains when comparing U.S. and Chile mean domain scores, except for gross motor at 8 months and Personal Social at 18 months. Table 5 summarizes the cutoff points obtained for ASQ-CL using the methodology of 2 SD below the mean score for normative population mean, similar to developers' guidelines.

As shown in Table 6, when we consider one-domain fail criteria (a score below cutoff in at least one developmental area), we found a prevalence of 170.2% of children having a suspected developmental delay in both the 8 and 18-month interval normative group. This prevalence dropped to 4.9% and 4.7% respectively in both groups when we consider 2 fail domains criteria (a score below cutoff in at least two developmental areas). As expected, in the criterion sample (diagnosed neurological illness), cases with abnormal scores reached up to 91%.

3.5. Construct validity

Children born early preterm (<32 weeks) failed on the total, fine motor, and personal social scores significantly more often than normative sample at 8 months (OR 2.64–4.16) and on the total, fine motor, problem solving and personal social at 18 months (OR 3.24–5.29). Girls performed better than boys in communications at 8 months (OR 4.31) and on fine motor and total scores at 18 months (OR 2.65 and 1.45 respectively). Results are summarized in Table 7. The neurological diagnostic sample was excluded from this analysis because they represented a clearly skewed sample with evident developmental delay that may have altered the interpretation of the other factors, commonly present in the general population.

3.6. Feasibility

Based on parent and professional feedback, general opinion was that the ASQ-CL was a good and useful instrument for incorporating parent's perception and for formalizing feedback to parents about their children's development. Health professionals and pediatricians emphasized the clinical efficiency of ASQ-CL, broadening the viewing scope from the clinic to the home environment, and allowing an "insight effect" on parents as a guide on "what to look for" when talking about their children's development. Mothers recognized the ASQ-CL as a way for assuming a more active role to team up with the health system on development surveillance. This effect was also detected by health professionals who highlighted a potential empowering effect of broad scale of the ASQ-CL in the Chilean Public Health System. Health care professionals manifested some concerns about the possibility of bias in the test over estimating children's development reported by parents.

4. Discussion

This study assessed the reliability and validity of the ASQ-CL (8 and 18 month intervals) as a screening instrument for Chilean children. Cutoff scores for the adapted version for this population were compared with the original ASQ-3 cutoff scores. As shown by our results, from a psychometric perspective, ASQ-CL was highly reliable both in terms of internal consistency, over-time stability and inter-rater reliability. ASQ-CL scores were comparable to the US standard sample in most domains, except in gross motor skills at 8 months (with a lower cutoff score for Chilean population) and socio-emotional domain at 18 months (with a higher Chilean cutoff score) [8].

In our study, 17.2% of our normative sample was identified as at-risk for developmental delay. This was an expected prevalence according both to national and international reports [19,20]. In high-risk groups (extremely preterm children and children with neurological impairment), the ASQ-CL detected a higher rate of developmental delay risk,

Table 7
Logistic regression analysis for at risk sample detection ASQ8-CL and ASQ18-CL (Odds-ratio and 95% confidence intervals).

Criterion (ASQ 8)	Communication	Gross motor	Fine motor	Problem solving	Personal social	Total
Gestation < 32 (vs. 37–42 weeks)	0.89 (0.23–3.39)	0.17 (0.06–0.50)**	3.64 (1.45–9.13)**	2.14 (0.90–5.06)	4.16 (1.58–10.9)**	2.64 (1.41–4.94)**
Male (vs. female gender)	4.31 (1.37–13.63)*	0.59 (0.21–1.66)	1.15 (0.47–2.79)	1.26 (0.63–2.51)	1.09 (0.48–2.49)	1.15 (0.69–1.92)
Low maternal education (vs high)	1.66 (0.39–7.02)	0.31 (.08–1.17)	0.67 (.25–1.81)	0.89 (0.33–2.37)	0.39 (0.10–1.51)	0.86 (0.44–1.68)
Criterion (ASQ 18)	**Communication**	**Gross motor**	**Fine motor**	**Problem solving**	**Personal social**	**Total**
Gestation < 32 (vs. 37–42 weeks)	0.22 (0.05–0.87)*	0.26 (0.12–0.56)**	3.37 (1.59–7.13)**	3.24 (1.33–7.88)*	5.29 (2.04–13.8)**	3.62 (1.97–6.62)**
Male (vs. female gender)	4.25 (0.90–20.11)	1.17 (0.61–2.27)	2.65 (1.23–5.71)*	1.33 (0.59–2.95)	1.97 (0.85–4.59)	1.45 (0.89–2.36)*
Low maternal education (vs. high)	1.52 (0.33–7.07)	0.90 (0.42–1.92)	1.03 (0.50–2.12)	1.65 (0.67–4.03)	0.32 (0.10–1.01)	1.06 (0.60–1.88)

Note: A child is considered at risk when at least 1 domain is bellow cut-off score.
* $p < .05$.
** $p < .01$.

using both proposed risk detection criteria (one or two domain below proposed cut scores).

The qualitative approach used to evaluate the feasibility of use for ASQ-CL in the regular clinical setting showed good acceptability of the ASQ-CL, with clear advantages identified over the current evaluation tools. The main strengths of ASQ detected in our study were an empowering effect of parents, its ease of application, and the possibility to observe child skills in a non-threatening environment. Other authors have also described that parent report screening establishes a common language with the health care professional and promotes an insight in parents arising from the observation of development in their children, and could be considered as an intervention tool [21–23].

The possibility of parental bias was raised by health care professionals, especially concerning families with increased socio-cultural risk factors. This is not supported by the inter-rater reliability evaluation. Other international authors have reported that in spite of the level of education, socioeconomic group or geographical location of the parents or caregivers, the parent's report is reliable for identifying those children at risk for developmental delay, [24–26]. Various studies report that the ASQ-3 performs well in children with biological risk factors, and with environmental risk factors such as foster care placement [27–30]. This study contributes to validating ASQ in a different cultural environment and adds to the transcultural validity of this test.

One of the main limitations of this study was that the sample was not random and therefore not necessarily representative of the overall Chilean population. We also acknowledge that the study reports the reliability, criterion-validity, and feasibility of a single point in time and that the test was not compared to a gold standard. A related study in a Chilean population including children with different degrees of prematurity found adequate correlation between ASQ-3 and Bayley Scales of Infant and Toddler Development, 3rd edition [31].

5. Conclusions

The translated and language adapted ASQ-CL demonstrated that the distribution of scores is comparable to the original validation scores of the ASQ-3, achieving reliability, criterion-validity, and feasibility in the Chilean sample. Given the psychometric properties of the ASQ-CL at 8 and 18 month intervals, we provided evidence that this test can be used in a Chilean urban community setting to identify children at risk for developmental delay. It is not farfetched to speculate that ASQ-CL has demonstrated sufficient transcultural validity and could be expected to perform equally well in other Spanish speaking cultural settings.

Conflict of interest

The authors declare no conflicts of interest.

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