

# BMJ Open Psychometric properties of the Spanish version of the Activities Scale for Kids (ASK): reliability, validity and the Rasch model

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## ABSTRACT

**Aims** To evaluate the psychometric properties of the Spanish version of the Activities Scale for Kids capability (ASKc) and ASK performance (ASKp) questionnaires.

**Design** It includes an analysis of different types of reliability (internal consistency, test–retest, inter-rater, Rasch model) and validity (convergent and discriminant) values.

**Settings** The sample was recruited in schools, associations and one hospital in Spain.

**Participants** The main sample comprised 448 children (114 with disabilities); and 96 parents of the group of 114 children with disabilities, along with 2 therapists.

**Methods and procedure** Children with physical disabilities completed questionnaires at two different time points; while healthy children only once. Both ASK questionnaires were also administered to parents. Therapists observed 69 children in 15 of the 30 activities listed in the ASKc.

**Primary and secondary outcome measures** ASKc and ASKp were used to measure physical disability among children. The Childhood Health Assessment Questionnaire (CHAQ), The Screening For and Promotion of Health-Related Quality of Life in Children and Adolescents – a European Public Health perspective (KIDSCREEN), Gross Motor Function Classification System (GMFCS), Manual Ability Classification System (MACS) and Functional Mobility Scale (FMS) were used to analyse convergent validity.

**Results** Excellent values were obtained for the reliability of the scale. Internal consistency was  $>0.95$  (Cronbach's  $\alpha$ ) for both questionnaires. The intraclass correlation coefficient test–retest reliability was 0.94 (ASKc) and 0.93 (ASKp). Correlations between parents' and children's scores were 0.91 (ASKc) and 0.90 (ASKp); and the correlation between therapists' and children's scores was 0.78. The Rasch analysis indicated that the Spanish version had a unidimensional structure. Furthermore, the results revealed adequate validity indices. Both ASK questionnaires correlated significantly with the CHAQ, three dimensions of the KIDSCREEN and the GMFCS, MACS and FMS. Finally, children without disabilities had higher ASKc and ASKp scores than children with disabilities ( $p=0.0001$ ).

**Conclusions** Both the ASKc and the ASKp versions are reliable and valid instruments that can be used to

## STRENGTHS AND LIMITATIONS OF THIS STUDY

- ⇒ This quantitative study used a cross-sectional, descriptive and correlational method.
- ⇒ It applied sound, validated data analysis methodologies for testing the reliability and validity of both Activities Scale for Kids questionnaires.
- ⇒ Most psychometric properties, including item response theory, were analysed.
- ⇒ The information was gathered not only from children, but also from parents and clinical health professionals.
- ⇒ The limitations of the study are related to the convenience sampling method used and, consequently, to the lack of representativeness of the sample.

measure the capabilities of Spanish-speaking children, whose responses also demonstrate their own reliability as informants of the impact of disability on the activities of daily living.

## INTRODUCTION

The ability to perform a task independently is an important indicator of the impact of illness on the activities of daily living (ADLs) among people living with medical disorders.<sup>1</sup> ADLs are defined in relation to the performance of specific tasks that are, in turn, specific to each stage of development, and include activities such as walking, playing or other basic pursuits.<sup>2</sup> According to recent estimates, the global morbidity rate, which measures child disabilities (0–14 years old), is 95 million (5.1% of the entire child population), with 13 million (0.7%) having a 'serious disability'.<sup>3</sup> It is therefore necessary to quantify the impact of functional limitations on ADLs using instruments that are useful and have been validated in the clinical environment.

Recently, several measures have been developed specifically for children with functional diversity.<sup>4</sup> The Activity Scale for Kids (ASK) is a self-administered measurement instrument



designed to determine children's functional level through interviews with parents and children. Devised by Young *et al*<sup>5</sup> in Canada in the 1990s, it was later validated with a population of 200 children and adolescents aged between 5 and 15 years living with functional limitations to their ADLs as a result of musculoskeletal disorders. The expressions employed by the children themselves to describe their disabilities were used to formulate the ASK questions. The 30 items selected were used to evaluate the status of each child at a single point in time and to monitor any changes associated with therapeutic interventions. The instrument also included seven subdimensions (personal care, dressing, other skills, locomotion, play, standing up and movement) to further explore limitations on activity. ASK is available in two versions: capability (ASKc) and performance (ASKp). Responses to capability-related items measure what the child could do, whereas responses to performance-related items measure what the child has actually done. ASKc therefore measures what children might do in a specific theoretical situation, whereas ASKp is suitable for measuring what children usually do in their daily lives.<sup>6</sup>

ASK has been used in multiple samples with a variety of diagnoses related to musculoskeletal issues, such as fractures, amputations and tumours,<sup>7-9</sup> among others, as well as in the case of neurological pathologies such as cerebral palsy, spina bifida and cognitive disorders.<sup>10-14</sup> Moreover, two systematic reviews have recently demonstrated that this measure has good psychometric properties<sup>15 16</sup> and has been widely used in the previous literature.<sup>15 16</sup> Its reliability and construct, concurrent and discriminant validity have also been confirmed,<sup>17 18</sup> even when administered over the internet or by email.<sup>19 20</sup>

ASK has been translated into Italian,<sup>14 21</sup> Spanish,<sup>22</sup> Portuguese,<sup>23</sup> Brazilian,<sup>24</sup> Persian or Farsi,<sup>25</sup> German<sup>26</sup> and Nepali,<sup>27</sup> and analyses of the psychometric properties of all versions yielded adequate results. However, there are at present no validated versions of ASKc and ASKp in Spanish.

ASK is one of the few questionnaires that measure children's perceptions of their own disabilities and limitations. It is considered a valid and reliable option for evaluating capability and performance and for assisting clinicians in the decision-making process. Moreover, it requires no specific training.<sup>12</sup> The aim of the present study is to evaluate the validity and reliability of the ASKp and ASKc questionnaires.

## METHODOLOGY

### Study design

The study followed a quantitative, cross-sectional, descriptive and correlational design.

### Sample

Prior to the data collection process, all parents and/or legal guardians signed an informed consent form.

The sample was recruited using incidental consecutive (non-randomised) sampling, based on a desire to participate in the study. Four subsamples were established: healthy children (n=334), children with disabilities (n=114), parents of children with disabilities (n=96) and therapists who observed the performance of a subgroup of children with disabilities (n=69 children observed by two therapists). The inclusion criteria for the sample of children with disabilities were: (a) to be aged between 5 and 15 years, (b) to be living with a disability that affects the musculoskeletal system, (c) to understand written and oral language, (d) parents have been a resident of Spain for at least 10 years and (e) to have a parent or guardian who had signed the informed consent form. In turn, the exclusion criteria were: (a) to be of an age outside the age range at which ASK is targeted; (b) to have no pathology that directly affects the musculoskeletal system; and (c) to be unable to understand either oral or written language and/or unable to communicate clearly and functionally. The same inclusion and exclusion criteria were established for the sample of children with no disabilities, except for criterion (b), since this group was assumed not to have any kind of disability or functional diversity, and the presence of such a condition was therefore an exclusion (rather than an inclusion) criterion. The inclusion criteria for the subsample of parents with children with disabilities were: (a) to have a child that met the inclusion criteria; and (b) to speak Spanish as their mother tongue. The inclusion criteria for therapists were to have more than 2 years of experience working with children with disabilities.

The sample of children with disabilities was used to calculate all the psychometric properties analysed in this study; the parent and therapist samples were used to test concurrent validity; finally, the sample of healthy children contributed to the analyses of reliability (Huyhn-Feldt procedure) and discriminant validity.

### Instruments

The following evaluation instruments were used.

#### Activities Scale for Kids

ASK<sup>22 28</sup> is made up of two 30-item subscales that evaluate capability (ASKc) and performance (ASKp) on a Likert-type scale with a response range from 0 'I could not' to 4 'with no problem'. The theoretical structure proposed by the initial authors for both ASKc and ASKp included seven dimensions for each scale: personal care (three items), dressing (four items), other skills (four items), locomotion (seven items), play (two items), skills at standing up (five items) and movement (five items). Informants are the children themselves, who must have a cognitive level that allows them to understand the questions and determine an answer. If a child does not have reading skills, an adult may read the questions to them, although they must ensure that it is the child who answers. Scores range from 0 to 100, with a score of 100 representing the highest possible functional level. The validity of ASKc and ASKp

in English was confirmed for children aged between 5 and 15 years through a correlation of 0.81 ( $p < 0.0001$ ) with scores on the Childhood Health Assessment Questionnaires completed by their parents, and a correlation of 0.92 ( $p < 0.0001$ ) with clinical observation.<sup>28</sup> The scale generates a single score based on the arithmetic mean of all the items and has been found to have good test–retest reliability at 2 weeks (intraclass correlation coefficient (ICC)=0.98 for ASKc and ICC=0.97 for ASKp) and a high Cronbach's  $\alpha$  of 0.99. Its ability to discriminate between different levels of disability has also been demonstrated.<sup>29</sup>

The Spanish adaptation of ASK was used in the present study. The process followed for the translation and cultural adaptation of ASK to Castilian Spanish has been fully explained by Santamaría-Vázquez *et al.*<sup>22</sup>

#### Gross Motor Function Classification System for Cerebral Palsy

The Gross Motor Function Classification System (GMFCS)<sup>30</sup> is used to evaluate functional performance. The age range encompassed by the GMFCS includes children aged between 2 and 18 years. It includes a question with a 5-level classification of functional mobility and activity limitations. Responses are given on a Likert-type scale ranging from lesser to greater degrees of limitation: Level I: Capable of walking without difficulties; Level II: Walks sometimes with difficulty; Level III: Walks using a hand-held mobility device; Level IV: Limited independent mobility (powered mobility system); and Level V: head and trunk postures are limited (transported in a wheelchair). The Cohen's kappa ratio for the GMFCS was 0.75 and 0.55 for children aged between 2 and 12 years and under 2 years, respectively.<sup>10 30</sup> The instrument has been found to have good test–retest reliability ( $\kappa=0.79$ ) and acceptable positive and negative predictive values of 0.74 and 0.90, respectively.<sup>31</sup>

#### Manual Ability Classification System

The Manual Ability Classification System (MACS)<sup>32</sup> was first designed to qualify children in accordance with their skills at manipulating objects in daily life. It includes a single item with responses on five levels, ranging from less to more serious: Level I: Handles objects easily and successfully; Level II: Handles most objects but with somewhat reduced quality and/or speed of achievement; Level III: Handles objects with difficulty; needs help to prepare and/or modify activities; Level IV: Handles a limited selection of easily managed objects in adapted situations; and Level V: Does not handle objects and has severely limited ability to perform even simple actions. The original version was found to have good reliability and validity values, with an ICC of 0.96 (between therapists) and 0.96 (between parents and therapists).

#### Functional Mobility Scale for children with cerebral palsy

The Functional Mobility Scale (FMS)<sup>33</sup> measures the functional mobility of children with cerebral palsy (CP) between the ages of 4 and 18 years. The FMS employs a 6-level Likert-type scale that is used to evaluate mobility

over three distances (5 m, 50 m and 500 m). A classification from 1 to 6 is given for each distance (1: Uses a wheelchair; 2: Uses a walker or framer; 3: Uses crutches; 4: Uses sticks, one or two; 5: Independent on level surfaces; 6: Independent on all surfaces). The FMS has been found to have good psychometric properties for children with CP: ICC=0.95 between orthopaedic surgeons and a construct validity of  $r=0.75$ – $0.89$ . In this study, reliability was  $\alpha=0.97$ .

#### Childhood Health Assessment Questionnaire

The Childhood Health Assessment Questionnaire (CHAQ)<sup>34</sup> includes 20 items that measure functional capability in eight ADLs. The scale has four possible response categories: 0: unable to do; 1: with much difficulty; 2: with some difficulty; 3: without any difficulty. A Disability Index (DI) score can be calculated within a range of 0–3, with higher scores indicating less disability. The Spanish version has been found to have acceptable test–retest reliability ( $r=0.89$ ) and validity values ( $r=0.87$ ).<sup>35 36</sup> The reliability of the scale in the present study was  $\alpha=0.95$ .

#### KIDSCREEN-27

The Screening For and Promotion of Health-Related Quality of Life in Children and Adolescents – a European Public Health perspective scale (KIDSCREEN)<sup>37 38</sup> is a measure of quality of life related to child and adolescent health. In the present study, we used the short version, which comprises 27 items and 5 dimensions: physical well-being (five items), psychological well-being (seven items), autonomy and parent relations (seven items), social support and peers (four items) and school environment (four items). Responses are given on a 4-point Likert-type scale (0: *not at all*; 1: *slightly*; 2: *moderately*; 3: *very*; and 4: *extremely*). A scoring algorithm is used in each dimension to calculate T scores, with higher scores indicating better health-related quality of life. The scale has been found to have good psychometric properties (Cronbach's  $\alpha$  of between 0.78 and 0.84 for individual dimensions).<sup>39 40</sup> The Spanish version yielded adequate validity and reliability indices (between 0.77 and 0.82) and test–retest reliability values (between 0.52 and 0.79).<sup>41</sup> In this study, the reliability values were: physical well-being  $\alpha=0.77$ , psychological well-being  $\alpha=0.75$ , autonomy and parents relations  $\alpha=0.75$ , social support and peers  $\alpha=0.79$  and school environment  $\alpha=0.72$ .

#### Observation of 15 behaviours included in ASKc

Replicating the procedure followed by Young *et al.*,<sup>28</sup> professionals from the field of rehabilitation observed 15 of the 30 activities listed in the ASKc scale. The tasks selected for observation were the same as those observed in the initial version. The observations were carried out with only part of the sample of children with disabilities ( $n=69$ ).

#### Procedure

The sample population was accessed through various centres and associations working with people living with functional diversity, including the University Hospital of





Burgos (Spain). The scales were individually completed by children, with the evaluator being present to resolve any doubts. At the same time, participating parents completed the same scales in another room. The questionnaires took approximately 40 min to complete. Among those children who completed the ASK re-test, the average interval between the administration of both tests (T1 and T2) was 2½ weeks. Sociodemographic and clinical data were provided by the children's parents or legal guardians.

### Data analysis

Participants' characteristics were summarised using descriptive statistics in accordance with the type of variable in question (means, SD, frequencies and percentages). The distribution of scores and their frequency on the scale were analysed to prove the existence of ASKc and ASKp-related ceiling and floor effects. Since ASK is an instrument that measures physical disability, in the case of children living with functional diversity, scores of 100 (best function) were expected to account for less than 10% of all scores on both scales.<sup>42</sup> In contrast, this percentage was expected to be higher among participants with no disabilities, since optimum levels of functioning were expected in this group. Furthermore, we also did not expect to find over 10% of participants without disabilities to have DI scores of 3 (total disability), as these participants were assumed not to have any kind of functional diversity.

The reliability of the scale was measured through four procedures: (a) Internal consistency was tested using Cronbach's  $\alpha$ , with values higher than or equal to 0.70 being considered acceptable<sup>43</sup>; (b) Test-retest reliability was measured to analyse the temporal stability or degree of internal consistency between responses on the ASKc and ASKp scales at T1 and T2, and the ICC was calculated; (c) Inter-rater reliability was calculated to analyse the degree of agreement between children's and parents' responses (ASKc and ASKp), as well as between children's responses and the clinical scores awarded by professionals (ASKc), by applying the ICC. Values greater than or equal to 0.70 were considered acceptable. In the case of professionals, the score for the 15 tasks under observation was calculated by summing the individual scores awarded for each item and the Pearson correlation was used to compare this sum with the total score obtained on ASKc; (d) Finally, the Rasch model (Item Response Theory) was applied. This analysis offers a parameter (log) that determines the structure and difficulty of each ASK item and the degree to which each element contributes to the estimation of the individual scores obtained by each child (each subject's score on the scale). Estimates were calculated using the maximum common property similarity method (MCPHD). The fit of each element to the Rasch model was evaluated by calculating the following descriptors for each item: log, SE, infit and outfit. The infit reflects unexpected response patterns when the items present the same difficulty as the skill of the participant.

The outfit is sensitive to unexpected responses from respondents, indicating tasks that may be considered very easy or very difficult for each person. Values between 0.05 and 1.70 are considered acceptable.<sup>44</sup>

Two procedures were used to examine the convergent and discriminant validity of the Spanish version of the ASK instrument. Convergent validity was determined by calculating the correlation between the indices of the two ASK subscales (ASKc and ASKp) and the KIDSCREEN, CHAQ, GMFCS, MACS and FMS. The hypothesis was that higher scores for quality of life (KIDSCREEN-27) and less functional disability (CHAQ) would correspond to better capability and functioning levels (ASK). The CHAQ was chosen because it is the most comparable measurement instrument applicable to children aged between 1 and 19 years. Similarly, children with neuromuscular disorders and/or who needed support to move around (GMFCS, MACS and FMS) were expected to score lower on the ASK scale. Discriminant validity was determined to detect differences between ASKc and ASKp scores in accordance with whether or not there was a diagnosis of functional diversity.

The SPSS software programme V.24.0 for Windows was used for most of the statistical analyses. P values lower than 0.05 were considered statistically significant. The CI was set at 95% for all analyses. The R Software programme was used for the Rasch model and the Feldt W test.

### Patient and public involvement

None.

## RESULTS

### Sample analysis

The sample comprised n=448 participants (n=235 boys, 52.5% and n=213 girls, 47.5%). Of the total sample, 334 had no disability (boys: n=165, 49.4% and girls: n=169: 50.6%) and 114 had some sort of disability (boys: n=70, 61.4%, girls: n=44, 38.6%). The average age was 10.74 years ( $SD=3.33$ ), with a range of 5–18 years. The information on the group living with functional diversity is shown in [table 1](#).

### Distribution of the scores

The distributions of both the ASKc and ASKp scores for participants with and without disabilities are shown in [figure 1](#). The average scores for ASKc and ASKp on the global scale were median=96.66,  $SD=15.11$  and  $var=228.59$  (minimum range of 4.17 up to 100), and median=95,  $SD=16.74$ ,  $var=280.26$  (minimum=2.50 and maximum=100), respectively.

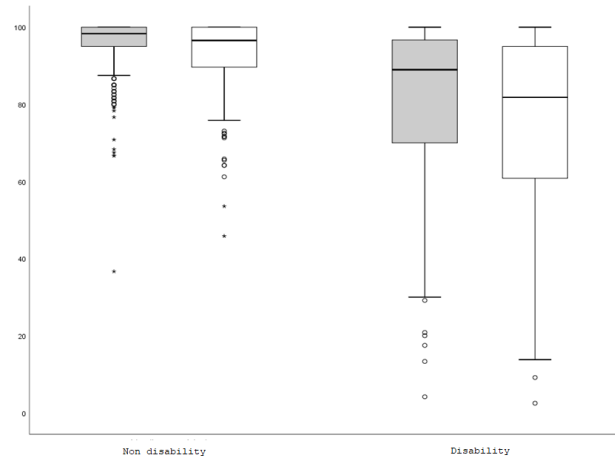
In relation to the group of children with no disabilities, the average scores for ASKc and ASKp were median=98.33,  $SD=7$ ,  $var=49.11$  (minimum: 36.67, maximum: 100), and median=96.55,  $SD=8.69$ ,  $var=75.43$  (minimum: 45.83, maximum: 100), respectively. In the case of children with some kind of disability, the average scores for ASKc and ASKp were median=88.97,  $SD=23.39$ ,  $var=547$  (minimum:

**Table 1** Characteristics of the sample with disabilities

	N (%)		
Boys	70 (61.4)		
Girls	44 (38.6)		
Diagnoses of the sample with disabilities	114		
Congenital anomalies, deformities and/or chromosomal anomalies	51 (42.9)		
Central nervous system disorders	30 (25.2)		
Endocrine and/or metabolic illnesses	5 (4.2)		
Upper limb fractures	18 (15.1)		
Lower limb fractures	4 (3.4)		
Rheumatic illnesses	1 (0.8)		
Unspecified	5 (4.2)		
GMFCS			
1. No limitations	71 (62.3)		
2. With limitations	16 (14)		
3. Mobility device	8 (7)		
4. Mobility with limitations	8 (7)		
5. No mobility	4 (3.5)		
Losses	7 (6.1)		
MACS			
Level I	58 (50.9)		
Level II	28 (24.6)		
Level III	12 (10.5)		
Level IV	9 (7.9)		
Level V	2 (1.7)		
Losses	5 (4.4)		
FMS: n (%)	5 m	50 m	500 m
1. Wheelchair	12 (10.5)	12 (10.5)	17 (14.9)
2. Walker	6 (5.3)	4 (3.5)	1 (0.9)
3. Crutches	2 (1.8)	2 (1.8)	2 (1.8)
4. Sticks (one or two)	1 (0.9)	3 (2.6)	1 (0.9)
5. Independent (level surfaces)	22 (19.2)	21 (18.5)	21 (18.5)
6. Independent (all surfaces)	65 (57)	64 (56.1)	65 (57)
Losses	6 (5.3)	8 (7)	7 (6)

Note: Only the data corresponding to participants with disabilities are shown, since participants with no type of disability did not complete the GMFCS, MACS and FMS questionnaires. FMS, Functional Mobility Scale; GMFCS, Gross Motor Function Classification System; MACS, Manual Ability Classification System.

4.17, maximum: 100), and median=81.81, SD=24.96, var=622.79 (minimum=2.50, maximum=100), respectively. As expected, the scores corresponding to children with disabilities were lower than those corresponding to


**Figure 1** Distribution of scores for children with and without disabilities.

children with no disabilities, indicating that the former group had more problems linked to physical functioning.

The score indicating the ceiling effect in both ASKc and ASKp was 100. In ASKc, 126 (37.7%) participants in the group without disabilities obtained this score, along with 12 participants (10.5%) in the group with disabilities. In the case of ASKp, 101 children with no disabilities (30.2%) and 12 (10.5%) with disabilities scored 100. The floor effect was 0% for both scales and in both groups (see figure 1).

#### Reliability: internal consistency, stability and inter-rater agreement

The reliability indices (dimensions, means, SD, and test–retest reliability) are shown in table 2. The internal consistency (Cronbach's  $\alpha$ ) for both the capability and performance subscales was 0.95 at T1 and 0.98 at T2. The W-statistic or Huynh-Feldt procedure (calculated using the ALPHA TEST programme)<sup>45</sup> revealed differences in the  $\alpha$  obtained at T1 for children with and without disabilities, on both ASKc ( $\chi^2=43.46$ ,  $p=0.0001$ ) (no disability:  $\alpha=0.87$ ; disability:  $\alpha=0.96$ ) and ASKp ( $\chi^2=63.37$ ,  $p=0.0001$ ) (no disability:  $\alpha=0.86$ ; disability:  $\alpha=0.97$ ).

Test–retest stability was measured by administering the questionnaire again 2½ weeks later. N=66 participants with disabilities (39 boys and 27 girls) participated at T2. The ICC revealed strong test–retest reliability for both subscales. The paired sample t-test indicated no significant differences between the T1 and T2 test scores on the two subscales: capability and performance (see table 2).

Regarding inter-rater reliability, consistency between the responses given by parents and children with disabilities (n=96) had an ICC=0.91 (95% CI, 0.86 to 0.94) for ASKc and an ICC=0.90 (95% CI, 0.84 to 0.93) for ASKp.

Scores for 15 items on the ASKc scale obtained by the 69 children with disabilities who were later observed were compared with the observations of the professional clinicians. The Pearson correlation and ICC for this paired comparison were 0.65,  $p=0.0001$  and 0.78 (95% CI, 0.45 to 0.87), respectively.

**Table 2** Descriptive, reliability and test-retest stability values for ASKc and ASKp

ASK	T1		T2		t	P value	ICC (95% CI)	Test-retest
	$\alpha$	M (SD)	$\alpha$	M (SD)				
1. Capability	0.95	76.81 (24.49)	0.98	77.49 (27.22)	-4.45	0.651	0.94 (0.91 to 0.97)	0.90***
2. Performance	0.95	71.57 (24.82)	0.98	72.09 (27.49)	-0.31	0.757	0.93 (0.88 to 0.96)	0.87***

P significant  $\leq 0.05$ ; \*\*\* $p \leq 0.0001$ .

ASK, Activities Scale for Kids; ASKc, ASK capability; ASKp, ASK performance; ICC, intraclass correlation coefficient.

### Reliability: Rasch model (item response theory)

The Rasch model was applied to ASKc and ASKp independently, with the sample of children with some type of functional limitation ( $n=114$ ) (see table 3). The results confirmed that the items reliably measured both the ASKc and ASKp scales. The Rasch analysis also identified

**Table 3** Rasch analysis results ASKc/ASKp

ASKc/ASKp	Log	SE	Outfit	Infit
13/13	-2.17/-2.27	0.52/0.48	0.51/0.62	1.39/1.35
8/22	-1.29/-1.35	0.42/0.38	0.34/0.81	0.77/0.74
23/8	-0.96/-1.21	0.39/0.37	0.50/1.32	0.78/0.96
14/14	-0.96/-1.16	0.39/0.37	0.74/1.29	1.01/0.95
1/21	-0.81/-1.02	0.37/0.35	0.76/.29	0.67/0.62
20/23	-0.81/-0.85	0.37/0.35	0.58/0.46	0.94/0.73
22/2	-0.81/-0.71	0.37/0.33	1.59/0.68	0.78/0.84
21/20	-0.67/-0.60	0.36/0.33	0.60/0.68	0.89/0.96
4/1	-0.67/-0.39	0.36/0.31	0.63/0.96	0.91/1.11
2/5	-0.54/-0.29	0.34/0.31	0.31/0.52	0.67/0.78
5/30	-0.41/-0.19	0.33/0.30	0.43/0.77	0.72/0.81
28/7	-0.17/-0.09	0.33/0.30	0.60/1.14	0.92/1.14
6/6	-0.17/-0.09	0.33/0.30	0.64/0.81	0.95/1.09
27/12	-0.06/-0.08	0.33/0.30	0.69/1.41	1.04/1.28
12/18	0.05/-0.04	0.32/0.30	1.7/0.83	1.30/1.03
18/4	0.15/-0.01	0.32/0.30	0.79/0.71	1.02/0.92
10/10	0.17/0.17	0.32/0.29	0.56/0.99	0.86/0.92
30/16	0.26/0.27	0.32/0.29	0.55/0.77	0.79/0.94
19/15	0.36/0.29	0.31/0.29	0.87/0.48	0.77/0.65
24/28	0.36/0.37	0.31/0.29	0.93/0.81	0.92/0.97
7/24	0.46/0.43	0.31/0.28	1.08/0.99	1.11/1.02
26/17	0.46/0.47	0.31/0.29	2.06/0.85	1.68/1.07
29/27	0.46/0.48	0.31/0.29	1.06/0.74	1.17/0.71
16/19	0.55/0.62	0.30/0.28	0.43/0.52	0.65/0.73
25/29	0.57/0.71	0.31/0.28	1.41/1.83	1.16/1.41
17/26	0.66/0.78	0.30/0.31	0.98/1.95	1.09/1.38
15/25	0.74/0.79	0.29/0.29	1.39/1.16	0.27/1.08
3/3	1.17/1.01	0.20/0.26	1.24/0.81	1.17/0.98
11/9	1.80/1.94	0.28/0.29	0.98/1.62	1.09/1.43
9/11	2.32/2.02	0.18/0.29	1.68/0.84	1.46/0.95

ASK, Activities Scale for Kids; ASKc, ASK capability; ASKp, ASK performance.

a hierarchical structure between the elements. These results are shown in table 3.

The items were ordered by difficulty, with the most difficult being placed in the first rows. The difficulty level of each element in relation to the rest was expressed as a logit value (maximum range: -4 to 4). A negative indicator described a more difficult item and a positive value indicated an easy item (see online supplemental annex 1 with the scale). In general, both the outfit and infit values were lower than 1.7 (ASKc: outfit and infit logit ranges between 1.7 and 0.31 and between 1.68 and 0.27, respectively; ASKp: outfit and infit logit ranges between 1.62 and 0.29 and between 1.43 and 0.62, respectively), except for item 26 ('I think I could have played some sports by myself or with a few friends') on ASKc and ASKp and item 29 ('When I ran (or wheeled) around outside, I think I could have kept up with my friends...') on ASKp.

### Validity: convergent and discriminant validity

The convergent validity analyses revealed that, in the case of children with motor limitations, the results of the ASKc and ASKp scales correlated closely with each other at T1 ( $r_{(114)} = 0.95$ ,  $p=0.0001$ ) and T2 ( $r_{(66)} = 0.97$ ,  $p=0.0001$ ). A positive and significant association was also found between ASKc, ASKp and the CHAQ, as well as between the two ASK scales and the quality-of-life dimensions linked to physical health, peer relations and the school environment (KIDSCREEN-27). However, neither of the ASK scales was found to be associated with the psychological well-being or parent relations dimensions of this measure (see table 4).

ASKc and ASKp were negatively and significantly associated with both the GMFCS and the MACS, and were

**Table 4** Convergent validity. Correlations between ASKc, ASKp, CHAQ and KIDSCREEN

	CHAQ	KD-1	KD-2	KD-3	KD-4	KD-5
ASKc	0.79***	0.48***	-0.07	0.11	0.23*	0.27*
ASKp	0.79***	0.55***	-0.03	0.15	0.27**	0.34**

\*\*\* $p \leq 0.0001$ , \*\* $p \leq 0.001$ , \* $p \leq 0.05$ .

ASK, Activities Scale for Kids; ASKc, ASK capability; ASKp, ASK performance; CHAQ, Childhood Health Assessment Questionnaire; KD-1, physical dimension; KD-2, psychological well-being; KD-3, relations with parents; KD-4, peer relations; KD-5, school environment; KD, KIDSCREEN; KIDSCREEN, Screening For and Promotion of Health-Related Quality of Life in Children and Adolescents – a European Public Health perspective.



**Table 5** Convergent validity. Correlations between ASKc, ASKp, GMFCS, MACS, and FMS

	GMFCS	MACS	FMS (5m)	FMS (50m)	FMS (500m)
ASKc	-0.75***	-0.65***	0.76***	0.67***	0.62***
ASKp	-0.75***	-0.59***	0.77***	0.69***	0.63***

\*\*\* $p \leq 0.001$ , \*\* $p \leq 0.001$ , \* $p \leq 0.05$ .

FMS (5m, 50m, 500m), Functional Mobility Scale for Children with Cerebral Palsy; ASK, Activities Scale for Kids; ASKc, ASK capability; ASKp, ASK performance; GMFCS, Gross Motor Function Classification System for Cerebral Palsy; KIDSCREEN, Screening For and Promotion of Health-Related Quality of Life in Children and Adolescents – a European Public Health perspective; MACS, Manual Ability Classification System.

positively and significantly associated with the FMS for the 5m, 50m and 500m measures (see table 5).

The discriminant validity results revealed differences in ASKc and ASKp scores between children with and without disabilities: ASKc (no disability:  $M=95.78$ ,  $SD=7.01$ , 95% CI (95.02 to 96.53); disability:  $M=78.99$ ,  $SD=23.40$ , 95% CI (74.65 to 83.33),  $F(1,446) = 136.49$ ,  $p=0.0001$ ) and ASKp (no disability:  $M=93.20$ ,  $SD=8.68$ , ICC 95% (92.26 to 94.13); disability:  $M=74.48$ ,  $SD=24.96$ , 95% CI (69.84 to 79.11),  $F(1,446) = 139.11$ ,  $p=0.0001$ ).

## DISCUSSION

The aim of the present study was to validate the Spanish version of both the ASKc and ASKp scales. The results of the analysis yielded evidence on the reliability and validity of the scales, both of which were considered adequate for a test of these characteristics and were consistent with the data obtained from both the original version and other versions.<sup>13 14 21 23–27</sup> These results therefore indicate that ASK is an ideal instrument for evaluating problems of functionality and/or disability among children in the field of clinical rehabilitation in Spain.

The results confirm that both ASKc and ASKp are sensitive to differences in children's capacities, establishing clear scores that reflect the presence or absence of functional diversity. Less than 10% of the sample of children with disabilities were expected to score 100 and the data revealed that this figure was actually 10.5% in both questionnaires. The lowest scores were 0%. Therefore, although the floor effect was the same as in the original version, the ceiling effect of the Spanish version was higher. In the original version, the values were 0% (floor effect: ASKp) and 4% (ceiling effect: ASKp).<sup>28</sup> However, given that a ceiling effect is deemed significant only when more than 15% of the participants achieve the highest possible score,<sup>43</sup> the data indicated that the scale had adequate variability in its range, and that this did not affect its reliability. Moreover, the scale is able to identify changes in clinical tests, meaning that it can detect an improvement following an intervention or a deterioration over time.<sup>43</sup> Among healthy children, the ceiling

effects were 37.7% (ASKc) and 30.2% (ASKp). As stated in the study by Plint *et al*,<sup>4</sup> healthy children's responses to the ASKc and ASKp questionnaires may hinder the interpretation of the data by decreasing the likelihood of the instrument accurately measuring the functional level of these children.

The analyses yielded adequate reliability indices of between 0.95 and 0.98 for both ASKc and ASKp, at both time points. These results were similar to those found for the Italian (ASKp:  $\alpha=0.91$ ),<sup>14</sup> Portuguese (ASKc:  $\alpha=0.97$ ; ASKp:  $\alpha=0.98$ ),<sup>23</sup> Persian ( $\alpha=0.997$ ),<sup>25</sup> German (ASKp:  $\alpha=0.91$  to  $\alpha=0.97$ )<sup>26</sup> and Nepali (ASKc and ASKp:  $\alpha=0.98$ )<sup>27</sup> versions, as well as for the original version, which had a reliability value of 0.99.<sup>29</sup> Adequate reliability values were also obtained in the tests performed with the subsamples of children with disabilities ( $\geq 0.96$ ) and without disabilities ( $\geq 0.86$ ). In terms of test-retest stability, the ICC for the original version was 0.97,<sup>29</sup> with this value being 0.97 (ASKc) and 0.98 (ASKp) for the Portuguese version,<sup>23</sup> 0.998 (ASK) for the Persian version,<sup>25</sup> between 0.90 and 0.96 (ASKp) for the German version<sup>26</sup> and 0.92 (ASKc) and 0.93 (ASKp) for the Nepali version.<sup>27</sup> The values found for the Spanish version were also acceptable (0.94 ASKc and 0.93 ASKp).

The inter-rater reliability of the scale was confirmed. The correlation between the responses given by parents and children in the version used by Young<sup>29</sup> was 0.96, and the values for the version analysed in the present study were 0.91 for ASKc and 0.90 for ASKp. The difference between these values may be explained by the size of the sample, since Young *et al* compared only 18 sets of responses, whereas we compared 96, although the data continued to indicate a strong correlation between both types of respondents. The results also revealed a high degree of consistency between the scores obtained by children with disabilities and the assessment completed by clinicians and professionals (ICC=0.78). This result is consistent with previously reported findings, and points to the validity of the data for detecting dysfunctionality when respondents include children rather than only professional clinicians and family members. Indeed, in both this and previous studies, the results of the ASK questionnaire seem to point towards very similar conclusions in terms of dysfunctionality and disability levels to those detected in clinical and professional examinations.<sup>16 29</sup>

The results from the Rasch analysis (TRI) for both ASKc and ASKp provided information on the structure and difficulty of the items in each subscale. They also supported the unidimensional structure of the 30-item scales. This is consistent with the proposals made by Young *et al*.<sup>28</sup> The difficulty analysis revealed that, in general, item responses adequately reflected participants' skill level, with the children in our study having no trouble responding to the scale. As an exception, the unexpected outfit values associated with items 26 and 29 may perhaps have been due to the fact that these items referred to physical activities that were difficult for some of the participants with motor dysfunctions to carry out (responses to items



located some distance away from participants' skill level). These results indicate that both the ASKc and the ASKp scales are appropriate for measuring the musculoskeletal disorder-linked limitations experienced by children when performing activities.

The present study also provides evidence regarding the adequate validity of the Spanish version of the ASK questionnaire. The strong correlations observed between both versions of ASK, the CHAQ and quality of life related to physical health, peer relations and the school environment (KIDSCREEN-17) suggest that ASK is consistent with the dysfunctionality measures of other scales. Likewise, the GMFCS and the MACS indicated greater functional deficits linked to mobility, quality of movement and handling objects when ASK scores were lower (the lower the score, the greater the dysfunctionality). The relationship between the FMS and the ASK measures revealed improvements in mobility associated with capabilities over distances of 5, 50 and 500 m.

Lastly, as in the study by Costi *et al.*<sup>13</sup> the results confirmed the scale's capacity to discriminate between those with and those without disabilities, since children with no disabilities scored higher on both ASKc and ASKp than their counterparts with some kind of disability.

One of the strengths of this study is the completeness of its design. We analysed most psychometric properties, including item response theory, and information was gathered not only from children, but also from parents and clinical health professionals. Moreover, the sample included a wide variety of disorders and types of disability. It is also worth pointing out that this is the first scale in Spanish to incorporate the perspectives of children and parents into an evaluation of paediatric disability.

The study has some limitations. First, the purposive sampling method applied (with participants being recruited mainly from a single province) limits the generalisability of the results. Second, despite the wide variety of diagnoses reported by the sample with disabilities, most had one of three types of dysfunctions (congenital or chromosomal anomalies and deformities, central nervous system disorders and upper limb fractures). The representativeness of the other illnesses (endocrine and/or metabolic and rheumatic diseases or lower limb fractures) may be considered marginal.

## CONCLUSIONS

The Spanish versions of the ASKc and ASKp have excellent psychometric properties and were found to have adequate internal consistency and temporal stability values, a unidimensional structure, good correlations between responses given by children, their parents, and professionals, and adequate convergent and discriminant validity. We can also confirm that children with functional diversity are quite capable of reporting the impact of their disability on their ADLs.

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