

Comparison of the Survey of Well-being of Young Children (SWYC) with the Ages and Stages Questionnaires (ASQ-3): Parents Report questionnaires

Comparación del Survey of Well-being of Young Children (SWYC) con Ages and Stages Questionnaires (ASQ-3): cuestionarios de reporte de padres

Luisa Schonhaut B.^a, Ivan Armijo R.^b, Paula Rojas B.^a, Roberto Boisier E.^a, Leonardo Cabrera J.^a

^aClínica Alemana, Facultad de Medicina Universidad del Desarrollo. Santiago, Chile.

^bInvestigador independiente.

Received: July 24, 2025; Approved: September 09, 2025

What do we know about the subject matter of this study?

There is an international trend toward using questionnaires based on parent/primary caregiver reports for electronic screening of child development. In Chile, the Ages and Stages Questionnaire (ASQ-3) has been validated; however, licensing costs limit its universal implementation. In contrast, the Survey of Well-being of Young Children (SWYC) has the advantage of being open source and free to use.

What does this study contribute to what is already known?

In this pilot study, conducted among families of middle-upper socioeconomic status, it was demonstrated that, when used online, the Developmental Milestones Questionnaire of the Survey of Well-being of Young Children (DM-SWYC) correlate adequately with the ASQ-3 in Spanish, and their sensitivity and specificity adjusted for local performance are adequate. It is concluded that the DM-SWYC could be used to monitor psychomotor development, but should be complemented with the ASQ-3 to avoid over-screening children with possible developmental difficulties.

Abstract

The American Academy of Pediatrics (AAP) recommends the use of parent-report questionnaires to monitor child development. Licensing costs are a limitation to the universal implementation of the Ages and Stages Questionnaire (ASQ-3) validated in Chile. The Developmental Milestones of the Survey of Well-being of Young Children (DM-SWYC) are free and available to use. There are no validation studies in the Hispanic population outside the United States. **Objective:** To evaluate the validity of the DM-SWYC compared to the ASQ-3 for the assessment of psychomotor development in Chilean infants in their first year of life. **Methodology:** Cross-sectional diagnostic tests pilot study. Parents of children aged 4-8-12 months seen at *Clínica Alemana* in Santiago sequentially completed the ASQ-3 and SWYC online between March 2023 and March 2025. Incomplete

Keywords:

Ages and Stages Questionnaire; Survey of Well-being of Young Children; Developmental Delay; Developmental Screening; Psychometric Properties

questionnaires were excluded. The reliability, concurrent validity, and psychometric properties of the DM-SWYC were analyzed, using the ASQ-3 as a reference. **Results:** A total of 1,470 valid assessments were obtained. Cronbach's alpha was 0.59 for the DM-SWYC and 0.81 for the ASQ-3. A significant correlation of $r = 0.67$ was observed, with areas under the curve (AUC) between 82.1 and 83.7%. The sensitivity of the DM-SWYC was 0.77-0.81, and the specificity was 0.68-0.73, after adjusting the cutoff point. When comparing repeated or similar questions from both questionnaires, there was a tendency toward more positive responses with the ASQ-3 and more "sometimes" responses with the DM-SWYC. **Conclusions:** The electronic DM-SWYC demonstrated psychometric properties that support its use in monitoring the development of infants of upper-middle socioeconomic backgrounds in Chile. Further studies are needed to validate it in a nationally representative population.

Introduction

Health monitoring or well-child checkups are excellent opportunities to detect psychomotor and socio-emotional developmental difficulties, as early detection foreables effective intervention¹. For this reason, various scientific societies, such as the American Academy of Pediatrics (AAP), recommend monitoring to identify children who may be at risk for developmental delays. Screening is carried out by assessing the achievement of age-appropriate milestones² and should be complemented with standardized screening scales when developmental deficits are suspected and/or at specific ages to improve the accuracy of the assessment^{2,3}. Children identified as having deficits through this process should undergo an objective evaluation to identify specific developmental disorders and plan an intervention³.

To facilitate the developmental screening process and empower parents, the AAP recommends the use of questionnaires based on parent or primary caregiver reports, such as the Ages and Stages Questionnaires (ASQ); the Parents' Evaluation of Developmental Status (PEDS) with its complement Developmental Milestones (PEDS-DM); and the Survey of Well-being of Young Children (SWYC), which among its three components includes the Developmental Milestones Questionnaire (DM-SWYC)^{3,4}. These questionnaires have been translated, adapted, and validated in a wide range of linguistic and cultural contexts⁵⁻⁷. Studies comparing the psychometric properties of these instruments have not been able to demonstrate any advantages of one over the others^{8,9}.

In Latin America, multiple instruments are used for developmental monitoring and screening¹⁰. Although there is a preference for direct assessment scales¹¹, parental report instruments have been developed and/or validated^{12,13}, which have been strengthened given advances in and easy access to digital technology, especially in the post-COVID-19 pandemic era¹⁴⁻¹⁶.

In systematic reviews, the ASQ has been recommended as the best tool for screening multiple domains of development, and is widely used in the Americas^{17,18}. In Chile, more than 15 years ago, validation studies of the ASQ-3 were initiated for ages 8, 18, and 30 months, demonstrating adequate reliability, validity, and feasibility of application, both in the paper-based and electronic -based versions¹⁹⁻²¹. In the long term, it has also shown adequate predictive capacity for cognitive and/or academic difficulties²². The limitation for the national implementation of the ASQ is the license fee for its use, which is the reason why it has only been possible to apply it in some health centers²¹.

The SWYC was developed and validated in the US for infants up to 65 months of age, and has the advantages of being easily accessible and interpretable, open-source, and free to use, both in its original version and in its translations into several languages^{7,23}. In the US, the SWYC in Spanish was validated for the Spanish-speaking population, and in Latin America, its Portuguese translation was approved in Brazil^{9, 24}. Although the instrument was designed as a comprehensive monitoring and screening tool for psychomotor, socio-emotional, and family dynamics development, it is acceptable to use the SWYC dimensions separately⁷.

The objective of this study is to evaluate the validity of the developmental milestones (DM-SWYC) compared to ASQ-3, administered electronically for the assessment of psychomotor development in Chilean infants in their first year of life, in a middle-upper socioeconomic context. Given the low representativeness of the sample and the lack of prior cultural validation, this is considered a pilot study.

Methodology

Pilot study of a non-experimental, cross-sectional design, using diagnostic tests.

Participants

The study population consists of infants from a middle-upper socioeconomic status, aged between 3 and 13 months, who were born at and/or attended routine health check-ups at *Clínica Alemana* in Santiago between March 2023 and March 2025 and who voluntarily enrolled to receive and complete developmental questionnaires through the monitoring program implemented at the institution, known as “ScreenPed”. In 2019, the institution signed a license agreement for the use of the ASQ-3 in Spanish, translated by Brookes Publishing in an online version. The use of SWYC is free and does not require a license for its application.

All children aged 3 to 13 months with Spanish-speaking parents who completed the ASQ-3 and DM-SWYC questionnaires online were included. Incomplete questionnaires were excluded.

Procedure

After registering their children in ScreenPed, parents receive developmental assessment questionnaires at 4, 8, 12, 18, 24, and 30 months. Only the 4-, 8-, and 12-month questionnaires were included in this study. At those ages, parents administered the ASQ-3 and were then asked if they agreed to continue completing the SWYC, which was in the testing phase.

After completing both questionnaires, parents received automatic feedback regarding their children’s development. When developmental concerns arose, an alert was sent to the primary pediatrician and the study coordinator. At the same time, the pediatrician has access to the stored information, which requires specific authorizations to maintain confidentiality. The forms and their submission dates were set in REDCap (Research Electronic Data Capture)²⁵.

According to the submission sequence, parents received the ASQ-3 questionnaires corresponding to the ages of 4, 8, and/or 12 months at 3 months and 2 weeks, 7 months and 2 weeks, and 11 months and 2 weeks, respectively, and were able to complete each questionnaire with deadlines of 4 months and 30 days, 7 months and 30 days, and 12 months and 30 days, respectively. Until 2 years of age, the age for sending questionnaires to premature infants was based on the probable date of delivery, thus accounting for the corrected gestational age²⁶.

Instruments and variables

Survey of Well-being of Young Children (SWYC)^{7,23}

A series of 12 short questionnaires for children under 65 months of age, considering guidelines for assessing psychomotor development, socio-emotional development, and family questions, in addition to the Edinburgh Postnatal Depression Scale.

In this study, only the developmental milestones (DM-SWYC) were considered to assess psychomotor development, which includes a list of 10 questions on motor, linguistic/speech, social, and cognitive development. There are specific forms for each age group starting at 4 months.

The DM-SWYC has cut-off points for each questionnaire according to the exact age of the child at the time of completion.

*Ages and Stages Questionnaire 3rd edition translated into Spanish (ASQ-3)*²⁷

Parental report scale regarding the psychomotor development achievements of children at different life stages, from 2 to 60 months of age, in five areas: communication, gross motor skills, fine motor skills, problem solving, and personal-social skills. It has been validated in Chile with good psychometric properties and evidence of use feasibility, both in the original and the online version¹⁹⁻²².

According to the ASQ-3 manual, the presence of at least one domain below the cut-off point (<-2 SD) is considered a risk of developmental deficit. For this study, the cut-off points reported by the publisher were considered, as they are extrapolatable to the national reality¹⁹.

The DM-SWYC and ASQ-3 were used as translated by the respective publishers, without modification.

Parents completed a biodemographic survey that included questions about gestational age, type of delivery, perinatal morbidity, family history, and developmental interventions.

The study was approved by the Clinical Ethics Committee of the *Universidad del Desarrollo*.

Statistical analysis

Descriptive analysis of general data, with central tendency statistics for continuous variables (mean and standard deviation for normally distributed variables) and proportions for the analysis of variables expressed in absolute numbers.

Cronbach’s alpha was calculated to determine the reliability of the DM-SWYC. In addition, the alpha coefficient was recalculated in the ASQ-3 for reference. The coefficient was considered excellent if it was > 0.93; robust > 0.81; good > 0.71; moderate > 0.61; satisfactory > 0.58; and sufficient > 0.45²⁸.

The concurrent validity and psychometric properties of the DM-SWYC were analyzed using the ASQ-3 as a reference. The correlation between the two scales was measured using Pearson’s coefficient, considering a strong correlation > 0.8, moderate > 0.4, and weak > 0.1²⁹. ROC (Receiver Operating Characteristic) curves were constructed, and the area under the curve (AUC) was measured, taking the ASQ-3 deficit screen-

ing as reference. The AUC was classified as acceptable > 60%; good > 70%; and excellent > 90%³⁰. The point of highest sensitivity and specificity of the DM-SWYC for detecting deficits in the ASQ-3 was adjusted according to Youden's criterion. The psychometric properties of the DM-SWYC were analyzed.

Given that this is a pilot study, it was planned to recruit at least 100 children in each age group. The power of the results was then analyzed.

Finally, the repeated questions in both questionnaires were reviewed, and the distribution of "always", "sometimes", and "not yet" responses was analyzed.

All calculations were performed using R 4.5.0, with the pRoc and ggplot2 libraries.

Results

During the study period, 2,122 ASQ-3 assessments were completed; 570 assessments were excluded due to refusal to participate in the study, and 82 were excluded because they were incomplete (Figure 1), resulting in a sample of 1,470 valid assessments corresponding to 1,166 participants. 282 cases completed two assessments, and 11 completed three assessments.

Each assessment was considered an independent unit because, in some cases, guardians accepted the assessment on one occasion but not on another. When

comparing the valid assessments included with those excluded, it is noteworthy that in the included group, there was a significantly higher percentage of children who were born prematurely (16.60%) and first children (62.13%). There was no difference in the mean age of the parents or in the percentage of higher education, which was 95.08% for mothers and 92.24% for fathers (Table 1). The biogeographical characteristics were comparable across age groups of 4, 8, and 12 months (Table 2).

The reliability of the DM-SWYC, measured using Cronbach's alpha, was satisfactory (0.59) and lower than that of the ASQ-3, which was robust (0.81). Although there was a tendency toward greater reliability with older children, these differences were not statistically significant (Table 3). The correlation between the DM-SWYC and the ASQ-3 was moderate at all ages, ranging from 0.59 at 4 months to 0.73/0.74 at 8 and 12 months (Figure 2).

Taking as a reference the presence of a deficit in at least one developmental domain in ASQ-3, ROC curves were constructed for each of the three ages studied, highlighting a good AUC (82.1 to 83.7) (Figure 3).

With the cut-off point validated by the publisher, using ASQ-3 as a reference, sensitivity was high (0.88 to 0.94), but specificity was low (0.52-0.61). When adjusting the cut-off point according to Youden's criterion, sensitivity remained acceptable (0.77 to 0.81) while

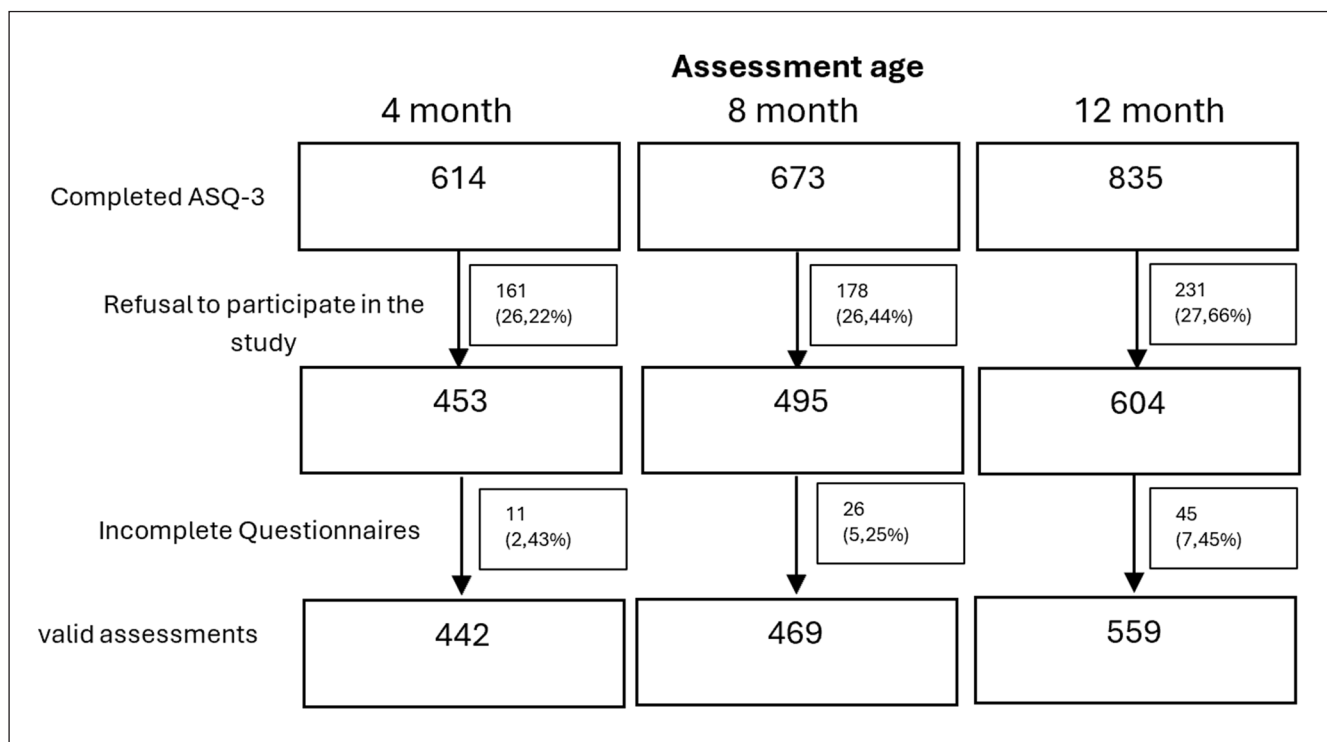


Figure 1. Enrollment Flowchart.

Table 1. Comparison between characteristics of enrolled patients and those who refuse to participate in each of the evaluations**

		Enrolled n%		Refuse to participate n%		p
		n	%	n	%	
N		1470	100	570	100	
Gender	Male (n,%)	771	52,45	293	51,40	NS
Premature	Yes (n,%)	244	16,60	64	11,23	0,002
Type of delivery	Vaginal (n,%)	563	38,30	212	37,19	NS
Neonatal hospitalization	Yes (n,%)	241	16,39	75	13,16	0,07
Age at birth	Mother (average, SD)	34,32	3,91	34,40	4,29	NS
Age at birth	Father (average, SD)	36,40	4,80	36,43	4,88	NS
Mother schooling	Complete university and/or postgraduate (n,%)	541/569	95,08	541	94,91	NS
Father schooling	Complete university and/or postgraduate (n,%)	523/567	92,24	523/567	92,24	NS
Paid job mother	Yes (n,%)	1351/1465	92,22	518/568	91,20	NS
Paid job father	Yes (n,%)	1415/1442	98,13	551/562	98,04	NS
Older siblings	No (n,%)	722/1162	62,13	230/447	51,45	0,001

**Each assessment was considered as an independent unit, as on some occasions for the same case, the tutors accepted the assessment on one occasion, but not on another. SD: standard deviation.

Table 2. Biodemographic characteristics of the sample

		4 months		8 months		12 months		p
		n	%	n	%	n	%	
N		442	100	469	100	559	100	
Gender	Male (n,%)	220	49,77	263	56,08	288	51,52	NS
Premature	Yes (n,%)	76	17,19	85	18,12	83	14,85	NS
Type of delivery	Vaginal (n,%)	171	38,69	177	37,74	215	38,46	NS
Neonatal hospitalization	Yes (n,%)	81	18,32	78	16,63	82	14,67	NS
Age at birth	Mother (average, SD)	34,21	3,84	34,47	3,81	34,34	3,78	NS
Age at birth	Parent (average, SD)	36,23	4,79	36,43	4,75	36,5	4,86	NS
Mother schooling	Complete university and/or postgraduate (n, %)	420	95,02	448	95,52	532	95,17	NS
Father schooling	Complete university and/or postgraduate (n, %)	408/435	93,79	437/464	94,18	510/551	92,56	NS
Paid job mother	Yes (n, %)	400	90,49	428	91,26	523	93,56%	NS
Paid job father	Yes (n, %)	419	94,80	454	96,80	542	96,96%	NS
Older siblings	Yes (n, %)	135/348	38,79	136/370	36,76	167/445	37,53	NS
Developmental interventions	Yes (n, %)	50/439	11,39	72/463	15,55	77/554	13,90%	NS

SD: standard deviation

Table 3. Reliability and concurrent validity of the Developmental Milestones Questionnaire of the Survey of Wellbeing of Young Children (DM-SWYC), taking as a reference the deficit in at least one developmental domain in ASQ-3, comparing different cut-off points

	4 months		8 months		12 months	
	Original validation	Chile Validation	Original validation	Chile Validation	Original validation	Chile Validation
Cut-off point	13	12,5	16	15,5	12	11.5
Sensitivity	0,94	0,81	0,88	0,79	0,89	0,77
Specificity	0,52	0,68	0,61	0,73	0,58	0,73
VPP	0,15	0,18	0,52	0,59	0,32	0,39
VPN	0,99	0,98	0,91	0,88	0,96	0,94
Likelihood ratio test +	1,97	2,53	2,23	2,98	2,11	2,90
Likelihood ratio test -	0,11	0,29	1,08	0,29	0,47	0,31
Prevalence of developmental delay according to DM-SWYC	51,81	35,74	55,01	43,71	50,62	35,78
Prevalence of developmental delay according to ASQ-3	8,14		32,62		18,07	
DM-SWYC Reliability Alpha Cronbach	0,59 IC95% [0,53;0,64]		0,62 IC95% [0,56;0,67]		0,64 IC95% [0,60;0,69]	
ASQ-3 Reliability Alpha Cronbach	0,78 IC95%[0,75;0,81]		0,78 IC95%[0,75;0,81]		0,84 IC95%[0,82;0,86]	

PM- SWYC: Pautas Madurativas del Survey of Well-being of Young Children, ASQ-3: Ages and Stages Questionnaires. VPP: Valor Predictivo Positivo; VPN: Valor Predictivo Negativo.

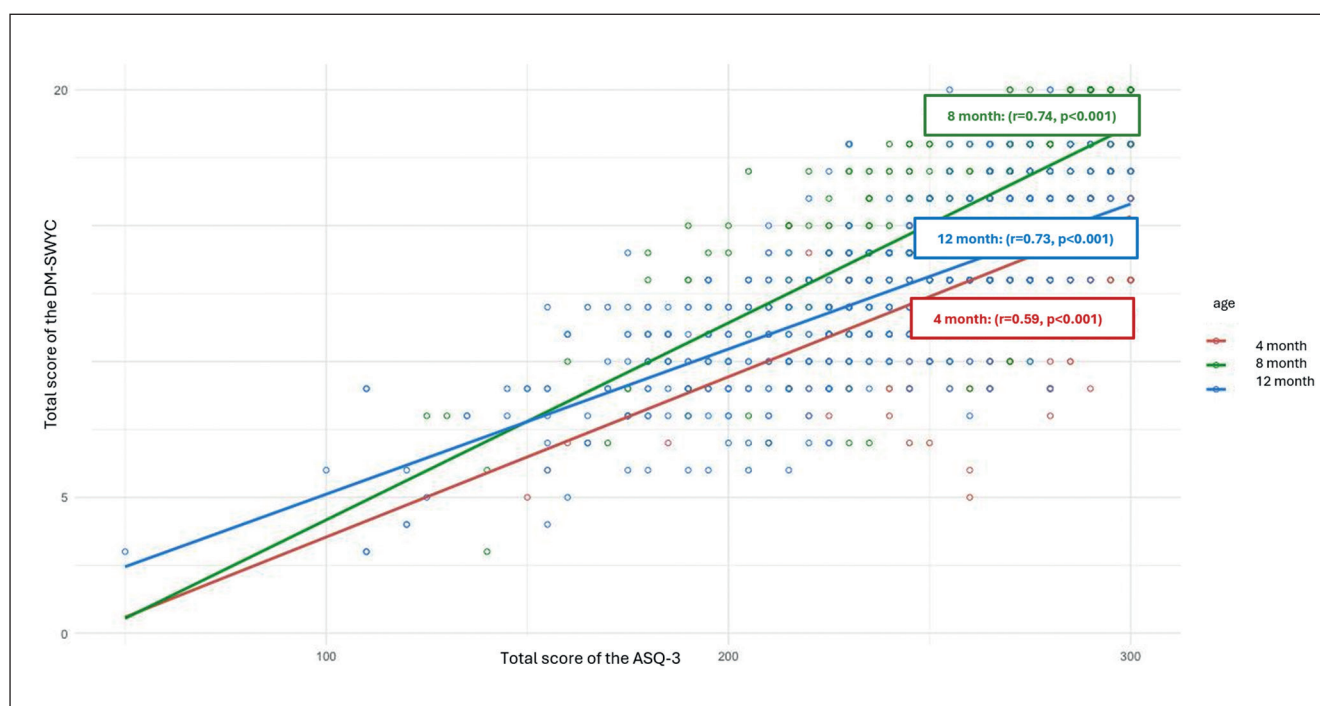


Figure 2. Pearson correlation between the total score of the Developmental Milestones Questionnaire of the Survey of Wellbeing of Young Children (DM-SWYC) and the total score of the ASQ-3, according to the age of the assessment.

specificity rose to (0.68 to 0.73) (Table 3). The cut-off point at all three ages was 0.5 points lower than that indicated by the publisher. (Figure 3) The prevalence of psychomotor development deficits was significantly higher according to the DM-SWYC, being close to 50% in the three ages evaluated, compared to the ASQ-3, whose prevalence ranged from 8.14 at 4 months to 32.62 at 8 months. Considering the cut-off point defined in the ROC curves, the prevalence of deficits according to the DM-SWYC decreased to 35.74-43.71 (Table 3).

Given that the SWYC is applied based on corrected age in months, and some evaluations were completed days before reaching the age indicated in the questionnaire, defining a universal cut-off point, the performance of children who had not yet reached the age was compared with those who had, with no differences found between the two groups (Table 4).

The test power was calculated for the ROC analyses stratified by age. For 4 months, a test power of 0.99 was observed (AUC of 82.1, 36 cases and 406 controls, sig=0.001). In the case of 8 months, a power of 1 was recorded (AUC = 82.1, 153 cases, 316 controls, sig = 0.001). In the case of 12 months, a power of 1 was found (AUC = 83.7, 101 cases, 458 controls, sig=0.001).

Finally, the developmental milestones included in each of the questionnaires were compared, and the percentage of achievement was analyzed, highlighting that at 4 and 12 months, 2 milestones were repeated in both questionnaires, and at 8 months, 5 milestones were repeated. When comparing the repeated milestones, agreement in responses was high, but there was a greater tendency toward absolute responses in ASQ-3 and a greater frequency of “sometimes” in DM-SWYC (Table 5).

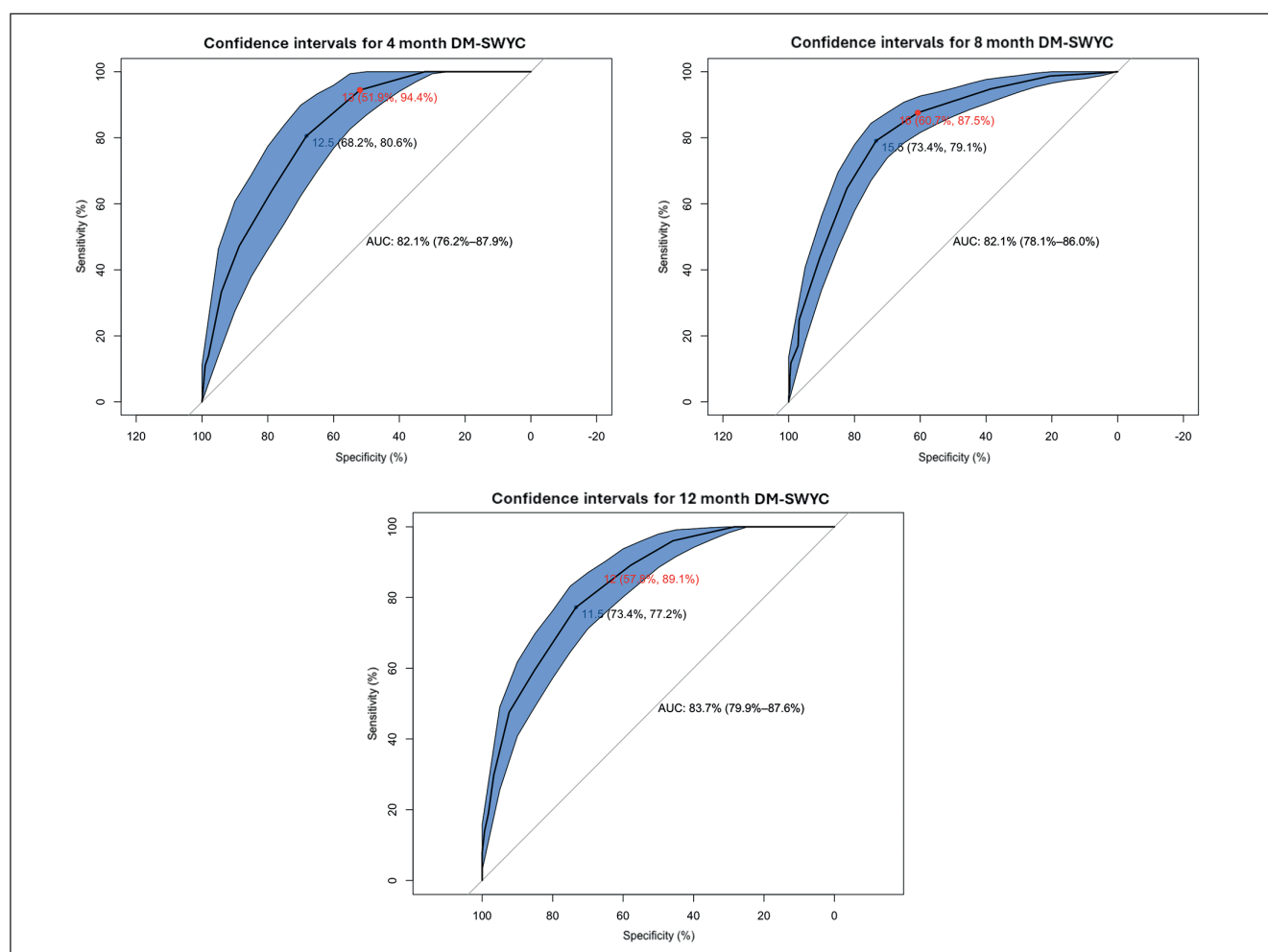


Figure 3. ROC curve with confidence interval for the area under the curve. NOTE; The cut-off points of the original version of the Developmental Milestones Questionnaire of the Survey of Wellbeing of Young Children (DM-SWYC) are shown (in red), and those that best balance specificity and sensitivity for each age studied are shown (in black), using as reference the Ages and Stages Questionnaires 3° edition (ASQ-3)

Table 4. Exact age analysis at the time of completion of the Developmental Milestones Questionnaire of the Survey of Wellbeing of Young Children (DM-SWYC)

DM-SWYC: 4 month questionnaire				
Age	n*	Average score	SD	p
3 months	97	13,44	2,42	NS
4 months	315	13,32	2,63	
DM-SWYC: 8 month questionnaire				
Age	n**	Average score	SD	p
7 months	268	15,54	3,00	NS
8 months	190	15,58	2,98	
DM-SWYC: 12 month questionnaire				
Age	n***	Average score	SD	p
11 months	215	12,56	2,90	NS
12 months	300	12,25	2,96	

*7 children were over 4 months old and in 23 the exact age could not be verified at the time of evaluation. **5 children were over 8 months old and in 6 the exact age could not be verified at the time of evaluation. ***19 children were older than 12 months and in 25 the exact age could not be verified at the time of evaluation.

Discussion

Following the global trend of including and empowering parents and primary caregivers in monitoring child development (3, 31), a pilot study was conducted to validate the DM-SWYC translated by the publisher in a large sample of Chilean infants aged 4, 8, and 12 months from middle-upper socioeconomic status with parents who had higher education.

The reliability of the DM-SWYC was satisfactory, while the overall reliability of the ASQ-3 was robust, similar to other analyses carried out in our country using both the paper based and electronic versions of the test²¹. In this regard, it is important to consider that Cronbach's alpha depends largely on the number of items in a scale and the sample's variability³².

Regarding concurrent validity, when using the on-line ASQ-3 in Spanish as a reference, a moderate correlation was reported, consistent with the findings of the original DM-SWYC validation study⁷. The DM-

Table 5. Response analysis on repeated milestones between the two questionnaires

Age (months)	Instrument	Milestone	Not yet	Some-what	Very Much
4	DM- SWYC	Laughs	0,5	10,6	88,9
4	ASQ-3	Does your baby laugh?	0,9	4,5	94,6
4	DM- SWYC	Keeps head steady when held in a sitting position	1,6	9,7	88,7
4	ASQ-3	When you hold him in a sitting position. does your baby hold his head steady?	0,9	6,6	92,5
8	DM- SWYC	Makes sounds like "ga" "ma" or "ba"	5,3	18,8	75,9
8	ASQ-3	Does your baby make sounds like "da" "ga" "ka" and "ba"	5,3	10,2	84,4
8	DM- SWYC	Rolls over	6,6	19,0	74,4
8	ASQ-3	Does your baby roll from his back to his tummy. getting both arms out from under him?	7,0	9,2	83,8
8	DM- SWYC	Passes a toy from one hand to the other	2,8	16,8	80,4
8	ASQ-3	Does your baby pass a toy back and forth from one hand to the another?	2,6	6,8	90,6
8	DM- SWYC	Gets into a sitting position by him or herself	18,6	17,1	64,4
8	ASQ-3	When you put your baby on the floor, does she lean on her hands while sitting?	5,8	6,6	87,6
8	DM- SWYC	Picks up food and eats it	9,0	29,2	61,8
8	ASQ-3	Does your baby feed himself a cracker or a cookie?	34,3	10,9	54,8
12	DM- SWYC	Looks around when you say things like "Where's your bottle?" or "Where's your blanket?"	5,7	20,8	73,5
12	ASQ-3	When you ask "Where is the ball?" does your baby look at the object	13,2	16,8	70,0
12	DM-SWYC	Follows directions like "Come here" or "Give me the ball"	4,7	47,6	52,8
12	ASQ-3	Does your baby follow one simple command. such as "Come here" "give it to me" or "Put it back" without your using gestures?	7,9	26,1	66,0

PM- SWYC: Pautas Madurativas del Survey of Well-being of Young Children; ASQ-3: Ages and Stages Questionnaires. 3º edición.

SWYC showed good overall discriminatory power in detecting the risk of developmental deficits. However, the cut-off point had to be slightly modified to reduce the overdetection of children with possible difficulties, which, without modification of the point, was close to 50%. This aspect is very relevant given that the objective of the DM-SWYC seems to be more oriented toward developmental surveillance, being recommended to complement the parents' responses with the clinical evaluation performed by the professional's clinical evaluation during the consultation⁷. In this regard, the DM-SWYC validation study by Moreira et al. showed significant differences in milestone achievement between the Brazilian and North American samples²⁴, highlighting the importance of validations across countries in sufficiently large and culturally representative samples.

Adjusting the cut-off point resulted in better sensitivity and specificity, which, according to the AAP recommendation, should be close to 70-80%², and which is reported in the original validation of the DM-SWYC^{7,23}. In the absence of a gold standard for reference, the study could be considered a non-inferiority analysis of the DM-SWYC compared to the ASQ-3, which has extensive validation experience in Chile and worldwide (5, 6, 19–22, 33). The comparative advantage of SWYC over ASQ-3 is its open, free use, easy access, and interpretation^{7,23}. Research comparing the DM-SWYC and ASQ-3 with reference standards, both in the English version and the translated version applied to the Spanish-speaking population in the United States, reports adequate levels of sensitivity and specificity, with no clear advantage of one questionnaire over the other^{8,9}.

The age range for the SWYC is broader than that of the ASQ-3, which means that more difficult or demanding questions for the age group are included^{7,27}. Between 20% and 50% of the SWYC questions are repeated in both questionnaires, but the way they are asked in the ASQ-3 is more illustrative, with drawings and more explanatory, highlighting that, in similar questions, there were more "sometimes" responses in the DM-SWYC than in the ASQ-3, where the responses tended to be more absolute and positive. This could be related to the way the questions are asked, or to a bias in the study, in which parents answered the ASQ-3 first and then the SWYC, without knowing the results until they had completed both questionnaires. The order of the questionnaires could introduce a bias in the responses due to conditioning by prior knowledge or rethinking. In addition, a "museum effect" or fatigue is possible, leading to lower-extremity scores in the responses³⁴. It is important to consider this point for future comparisons or validations between instruments.

Our study has multiple limitations, such as a lack of external validity due to its application in a population of middle-upper socioeconomic status, the order in which the questionnaires were administered could skew the results, and the lack of a reference standard, although the ASQ-3 has been widely validated in our country²¹. It should also be noted that the definition of developmental delay risk in ASQ-3 is based on the detection of deficits in at least one domain, while DM-SWYC focuses on the overall score, leading to significant differences in the interpretation of the results^{7,27}. Another limitation is that the SWYC was not culturally validated for our population. For this reason, this study was considered a pilot study, with the strength of having been applied to a large sample in the context of health monitoring.

Additional studies should be planned in large samples of children from different sociocultural backgrounds to establish the validity of the DM-SWYC administered digitally. In contexts with lower levels of schooling, parental assessment can be supported by health professionals or fieldworkers, an experience that has been widely documented^{31,35,36}.

Conclusions

The psychometric properties of the DM-SWYC when administered electronically would allow it to be used for developmental surveillance, while the ASQ-3 is a more formal screening tool, combining both tests in the monitoring of child development in infants of middle-upper socioeconomic status in Chile. Additional studies should be planned to validate it in a more representative population at the national level.

Ethical Responsibilities

Human Beings and animals protection: Disclosure the authors state that the procedures were followed according to the Declaration of Helsinki and the World Medical Association regarding human experimentation developed for the medical community.

Data confidentiality: The authors state that they have followed the protocols of their Center and Local regulations on the publication of patient data.

Rights to privacy and informed consent: The authors have obtained the informed consent of the patients and/or subjects referred to in the article. This document is in the possession of the correspondence author.

Conflicts of Interest

Authors declare no conflict of interest regarding the present study.

Financial Disclosure

Chilean Society of Pediatrics (SOCHIPE) Research Grant, 2022.

References

- Rao N, Sun J, Chen EE, Ip P. Effectiveness of early childhood interventions in promoting cognitive development in developing countries: A systematic review and meta-analysis. *HK J Paediatr (new series)*. 2017;22(1):14-25.
- Council on Children with Disabilities; Section on Developmental Behavioral Pediatrics; Bright Futures Steering Committee; Medical Home Initiatives for Children With Special Needs Project Advisory Committee. Identifying infants and young children with developmental disorders in the medical home: an algorithm for developmental surveillance and screening. *Pediatrics*. 2006;118(1):405-20. doi: 10.1542/peds.2006-1231. Erratum in: *Pediatrics*. 2006;118(4):1808-9.
- Lipkin PH, Macias MM, Council on children with disabilities, section on developmental and behavioral pediatrics. Promoting Optimal Development: Identifying Infants and Young Children With Developmental Disorders Through Developmental Surveillance and Screening. *Pediatrics*. 2020;145(1):e20193449. doi: 10.1542/peds.2019-3449.
- Cibralic S, Hawker P, Khan F, et al. Developmental screening tools for identification of children with developmental difficulties in high-income countries: a systematic review. *Front Child Adolesc Psychiatry*. 2023;2:1074004. doi: 10.3389/frcha.2023.1074004.
- Rousseau M, Dionne C, Savard RT, Schonhaut L, Londono M. Translation and Cultural Adaptation of the Ages and Stages Questionnaires (ASQ) Worldwide. *J Dev Behav Pediatr*. 2021;42(6):490-501. doi: 10.1097/DBP.0000000000000940.
- Rah SS, Jung M, Lee K, et al. Systematic Review and Meta-analysis: Real-World Accuracy of Children's Developmental Screening Tests. *J Am Acad Child Adolesc Psychiatry*. 2023;62(10):1095-1109. doi: 10.1016/j.jaac.2022.12.014.
- Perrin EC, Sheldrick RC, Visco Z, Mattern K. The Survey of Well-Being of Young Children (SWYC) user's manual. [Revisado 07.2025]. Disponible en: <https://www.floatinghospital.org/The-Survey-of-Wellbeing-of-Young-Children/ManualTraining-Resources>.
- Sheldrick RC, Marakovitz S, Garfinkel D, Carter AS, Perrin EC. Comparative Accuracy of Developmental Screening Questionnaires. *JAMA Pediatr*. 2020;174(4):366-374. doi: 10.1001/jamapediatrics.2019.6000. Erratum in: *JAMA Pediatr*. 2024 May 1;178(5):509. doi: 10.1001/jamapediatrics.2024.0423.
- Gerdes M, Garcia-Espana JF, Webb D, Friedman K, Winston S, Culhane J. Psychometric Properties of Two Developmental Screening Instruments for Hispanic Children in the Philadelphia Region. *Acad Pediatr*. 2019;19(6):638-45. doi: 10.1016/j.acap.2018.10.002.
- Seibel BL, Lerner R, Bacelar RC, Linhares MBM. Child development assessment in Latin American countries: A systematic review. *Revista Brasileira de Avaliação*. 2024;13(1):e130224. <https://www.rbaval.org.br/doi/10.4322/rbaval202412002>
- Schonhaut L, Valdés A, Oppenheimer I, Rizzoli-Córdoba A, Rivera R. Early developmental screening tools constructed in Latin American countries: umbrella review. *Bol Med Hosp Infant Mex*. 2025;82(Supl 1):5-24. doi: 10.24875/BMHIM.24000161.
- da Silva M, de Mendonça Filho E, Bandeira D. Development of the Dimensional Inventory of Child Development Assessment (IDADI). *Psico-USF*. 2019;24(1):11-26. Doi: <https://doi.org/10.1590/1413-8271201924010>
- Giraldo-Huertas J. Parental developmental screening with CARE: A pilot hybrid assessment and intervention with vulnerable families in Colombia. *PLoS One*. 2023 2023;18(6):e0287186. doi: 10.1371/journal.pone.0287186.
- Baker J, Kohlhoff J, Onobrakpor SI, et al. The acceptability and effectiveness of web-based developmental surveillance programs: Rapid review. *JMIR Mhealth Uhealth*. 2020;8(4):e16085. doi: 10.2196/16085.
- Curfman A, McSwain SD, Chuo J, et al. Pediatric telehealth in the COVID-19 pandemic era and beyond. *Pediatrics*. 2021;148(3):e2020047795. doi: 10.1542/peds.2020-047795.
- Abreu RWF de, Lima CRG, dos Santos AN, Rocha NACF. Remote screening protocol for functioning and contextual factors (e-Followkids) in Brazilian children with biological risk in the first 2 years: A longitudinal prospective study. *Infant Behav Dev*. 2025;79:102054. doi: 10.1016/j.infbeh.2025.102054.
- Burgess A, Luke C, Jackman M, et al. Clinical utility and psychometric properties of tools for early detection of developmental concerns and disability in young children: A scoping review. *Dev Med Child Neurol*. 2025;67(3):286-306. doi: 10.1111/dmcn.16076.
- Romero Otalvaro C, María A, Argel M, Nereida M. Instrumentos de evaluación de pesquisa de neurodesarrollo en la intervención temprana. *Tesis Psicológica*. 2016;11(2):54-71.
- Armijo I, Schonhaut L, Cordero M. Validation of the Chilean version of the Ages and Stages Questionnaire (ASQ-CL) in Community Health Settings. *Early Hum Dev*. 2015;91(12):671-6. doi:10.1016/j.earlhumdev.2015.10.001.
- Schonhaut L, Armijo I, Schönstedt M, Alvarez J, Cordero M. Validity of the ages and stages questionnaires in term and preterm infants. *Pediatrics*. 2013;131(5):e1468-74. doi: 10.1542/peds.2012-3313.
- Schonhaut L, Armijo I, Rojas P, Cabrera L, Boisier R. Reliability and acceptability of web-based administration of Spanish ages and stages questionnaires third edition ®. *Inf Child Dev*. 2023; 32(4): e2425. <https://doi.org/10.1002/icd.2425>
- Schonhaut L, Pérez M, Armijo I, Maturana A. Comparison between Ages & Stages Questionnaire and Bayley Scales, to predict cognitive delay in school age. *Early Hum Dev*. 2020;141:104933. doi: 10.1016/j.earlhumdev.2019.104933.
- Sheldrick RC, Perrin EC. Evidence-based milestones for surveillance of cognitive, language, and motor development. *Acad Pediatr*. 2013;13(6):577-86. doi: 10.1016/j.acap.2013.07.001.
- Moreira RS, Magalhães L de C, Siqueira CM, Alves CRL. Cross-cultural adaptation of the child development surveillance instrument "Survey of Wellbeing of Young Children (SWYC)" in the Brazilian context. *J Hum Growth Dev*. 2019;29(1):28-38. <http://dx.doi.org/10.7322/jhgd.145001>
- Harris PA, Taylor R, Minor BL, et al. The REDCap consortium: Building an international community of software platform partners. *J Biomed Inform*. 2019;95:103208. doi: 10.1016/j.jbi.2019.103208.

26. Davis BE, Leppert MO, German K, Lehmann CU, Adams-Chapman I; Council on Children with Disabilities; Committee on Fetus and Newborn. Primary Care Framework to Monitor Preterm Infants for Neurodevelopmental Outcomes in Early Childhood. *Pediatrics*. 2023;152(1):e2023062511. doi: 10.1542/peds.2023-062511.
27. Squires J, Bricker D. *Ages and Stages Questionnaires User's Guide* [Internet]. third edit. Baltimore, USA: PAUL H. Brookes Publishing Co; 2009. [Revisado 02.07.2025] Disponible en: <https://www.rch.org.au/uploadedFiles/Main/Content/immigranthealth/Ages and Stages 3 Master Set.pdf>
28. Taber KS. The Use of Cronbach's Alpha When Developing and Reporting Research Instruments in Science Education. *Res Sci Educ*. 2018 ;48(6):1273-96.
29. Akoglu H. User's guide to correlation coefficients. *Turk J Emerg Med*. 2018;18(3):91-93. doi: 10.1016/j.tjem.2018.08.001.
30. Swets JA, Swets JA. Measuring the accuracy of diagnostic systems. *Science*. 1998;240:1285-93.
31. Gandini ALA, Salmah AU, Stang, Arsin AA, Mallongi A. The Role of Parents in Monitoring the Growth and Development of Toddlers: A Systematic Review. *Pharmacogn J*. 2024; 16(3): 682-686
32. Streiner DL. Starting at the beginning: An introduction to coefficient alpha and internal consistency. *J Pers Assess*. 2003;80(1):99-103. doi: 10.1207/S15327752JPA8001_18.
33. Schonhaut L, Maturana A, Cepeda O, Serón P. Predictive Validity of Developmental Screening Questionnaires for Identifying Children With Later Cognitive or Educational Difficulties : A Systematic Review. *Front Pediatr*. 2021;24;9:698549. doi: 10.3389/fped.2021.698549.
34. Morii M, Sakagami T, Masuda S, Okubo S, Tamari Y. How does response bias emerge in lengthy sequential preference judgments? *Behaviormetrika*. 2017;44(2):575-91. <https://doi.org/10.1007/s41237-017-0036-6>
35. Shrestha M, Schwinger C, Hysing M, et al. Agreement Between Mothers and Fieldworkers While Assessing Child Development Using Ages and Stages Questionnaires, Third Edition in Nepal. *Front Psychol*. 2020;11:579412. doi: 10.3389/fpsyg.2020.579412.
36. Lockhart M, Chaux R, Chevin M, et al. Classification Performance of the Ages and Stages Questionnaire: Influence of Maternal Education Level. *Children*. 2023;10(3):449. doi: 10.3390/children10030449