

## RESEARCH ARTICLE

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# Predictive value of the Ages and Stages Questionnaire® for school performance and school intervention in late preterm- and term-born children

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## Abstract

**Background:** The new health supervision guidelines emphasize the importance of surveillance or a formal developmental screening test at 4 years, one of the most used tests is Ages & Stages Questionnaire. Nevertheless, there is still not enough evidence whether these tools will be useful to predict future school performance (SP).

**Objectives:** The objectives of this study were to evaluate the Ages & Stages Questionnaire 3rd edition 48-month interval (ASQ3-48) translated to Spanish for predicting the need for school intervention (SI) and poor SP at 8–9 years of age, in late preterm infants (LPIs) and term-born infants (Terms) and to compare the prevalence of SI and poor SP in the two groups.

**Methods:** Data were collected from a cohort of 75 LPIs and 58 Terms assessed with ASQ3-48 and with a further assessment of academic results at 8–9 years, through a standardized school test of the Education Department of Catalonia. SI data were obtained through a parent report. Area under the curve (AUC), sensitivity, specificity and predictive values were calculated, and logistic regression analysis was used.

**Results:** The prevalence of poor SP was 12.8%, without statistically significant differences between LPIs and Terms. LPIs had higher SI than Terms (29.3% vs. 10.3%,  $P = 0.001$ ). AUC for poor SP was 0.73 and for receiving SI was 0.56 without differences between the two groups. The sensitivity of the ASQ3-48 for poor SP was 41%, for specificity 92%, and for receiving SI 14% and 89%, respectively. Poor SP was related to having positive screening in the ASQ3-48 (OR 6.5 [95% CI, 1.9–22.2]) while having received SI was related to late prematurity (OR 3.6 [95% CI, 1.3–9.6]).

**Conclusions:** The ASQ3-48 shows acceptable predictive properties for poor SP but not for receiving SI. No differences were found in SP between LPI and Term cohorts, but LPIs are likelier to require SI.

## KEYWORDS

ASQ-3, late preterm infants, neurodevelopment, school intervention, school performance

## 1 | INTRODUCTION

Developmental delay (DD) in young children is associated to poor school performance (SP), learning difficulties and behavioural

problems. The follow-up and early detection of DD is aimed at the inclusion of children at risk of delays in specific interventional therapies and serves to prevent or diminish school failure (Guralnick, 2014; Nordhov et al., 2010).

It is known that the incidence of learning difficulties and behavioural problems varies between 5% and 15% depending on the specific disorder (Boyle et al., 2011; Chan, Leong, Malouf, & Quigley, 2016) being higher in those children with biological risk factors such as prematurity (Allotey et al., 2018; Huddy, Johnson, & Hope, 2001; Johnson et al., 2015; Morse, Zheng, Tang, & Roth, 2009). Late preterm infants (LPIs), born between 34<sup>0/7</sup> and 36<sup>6/7</sup> weeks of gestation, are the most prevalent group of preterm, accounting for approximately 70% of preterm births (García Reymundo et al., 2019; Raju, 2017).

A systematic review that evaluates long-term development of LPIs concluded that they show small but significant adverse performance across a range of cognitive and educational measures compared with their term peers, so that LPIs may benefit from increased monitoring of neurodevelopment, academic performance and behaviour (Chan, Leong, Malouf, & Quigley, 2016). In fact, the recommendation of scientific associations of several countries is to evaluate neurodevelopment during infancy with a developmental screening test. In the United States, the American Academy of Pediatrics (AAP) recommended developmental screening at 9, 18 and 30 months of age (Hagan, Shaw, & Duncan, 2017; Richerson et al., 2019) while in European countries at least before or around 2 years of age as in England (NICE guideline, 2017) and Spain, where the policies of the Spanish Society of Neonatology group SEN34–36 recommend screening in LPIs at 2 years and also follow-up at 48 months (García Reymundo et al., 2019). The updated clinical report of the AAP recommends special attention to surveillance and administration of a formal screening test at the 4- or 5-year visit when developmental risks, concerns or problems occur, for the risk of emerging problems in development, being this age the last point for the detection of subtle delays that can benefit from intervention. The screening tests that are focused on parent-completed tools are highly recommended (Lipkin & Macias, 2020).

The Ages and Stages Questionnaire is one of the most commonly used screening developmental tests (Radecki, Sand-Loud, O'Connor, Sharp, & Olson, 2011). The ASQ 3rd edition (ASQ-3) was translated to Spanish by Brookes Publishing and validated in its psychometric properties for the Latin population of the United States (Pomés, Squires, & Yovanoff, 2014); in addition, it was adapted and validated in Chile (Armijo, Schonhaut, & Cordero, 2015; Schonhaut, Armijo, Schönstedt, Álvarez, & Cordero, 2013), Peru (Chong et al., 2017) and Argentina (Otalvaro et al., 2018), requiring minimal contextual adaptations. In Spain, the ASQ was validated for the Galician and Catalan population, showing that the scores had a similar profile to those of the United States (Sarmiento Campos, Squires, & Ponte, 2011; Schonhaut, Martínez-Nadal, Armijo, & Demestre, 2019). ASQ-3 was first used by our researcher group in 2013 in a cohort of LPIs and term-born infants (Terms) 48 months old, demonstrating that the ASQ-3 is reliable and allows discriminating groups of risk (Demestre et al., 2016; Martínez-Nadal, Demestre, Schonhaut, Muñoz, & Sala, 2018; Schonhaut, Martínez-Nadal, Armijo, & Demestre, 2019).

It is not known how SP is in the LPIs group and what the ability of the ASQ is to predict later academic performance. There are few

### Key Messages

- Having a positive screening in the ASQ3-48 predicts acceptably poor school performance at 8–9 years but not receiving school intervention.
- No differences were found in school performance between LPIs and Terms, but LPIs received a higher percentage of school intervention.

publications that analyse the predictive value of the ASQ to predict later cognitive results, school difficulties or the need for special education in preterm-born children (Halbwachs et al., 2014) and the general population (Charkaluk et al., 2017; Schonhaut, Pérez, Armijo, & Maturana, 2020).

The objectives of the present study were to evaluate the predictive validity of the ASQ-3 questionnaire 48-month interval (ASQ3-48) for receiving school intervention (SI) during childhood and for predicting poor SP at 8–9 years, in LPIs and Terms, and to compare the prevalence of SI and poor SP in the two groups.

## 2 | METHODS

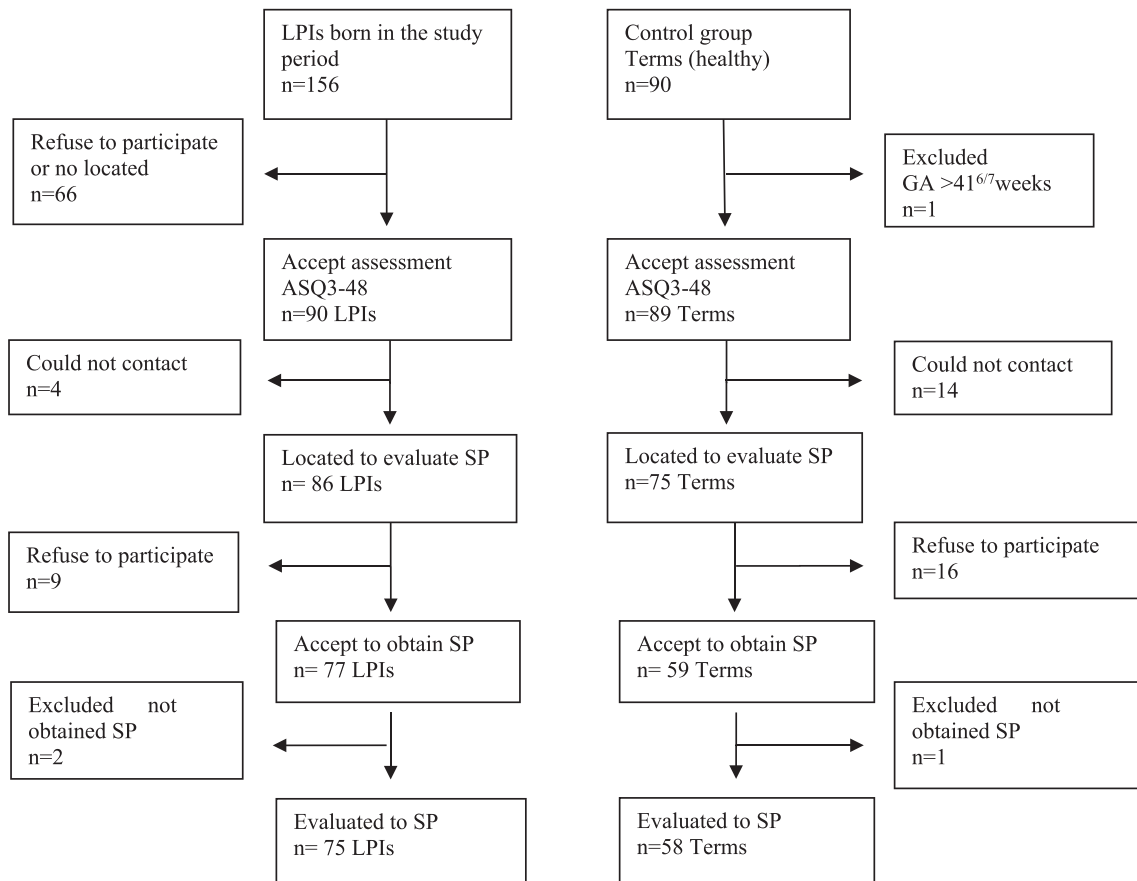
A prospective cohort study was carried out including LPIs (GA 34<sup>0/7</sup>–36<sup>6/7</sup> weeks) and Terms (GA 37<sup>0/7</sup>–41<sup>6/7</sup> weeks), born 2008–2009 in a private hospital in Barcelona, Spain. A sample of 90 out of 156 LPIs born in the study period, and a control group of 89 Terms matched by date of birth, were enrolled (Figure 1).

These children were assessed at 4 years of age with the ASQ-3 48-month interval. Parents received qualitative feedback from researchers.

The sample included LPIs and Terms whose parents were able to be located and, after phone contact, agreed to participate by completing an informed consent form and the ASQ3-48. Parents of LPIs were offered the opportunity to complete the questionnaire by email or through the visit of a non-health professional who only acted as a document holder and counsel. Parents of the term-born children could complete it at the paediatrician's office or by email. Excluded were children with malformation syndromes or with known genetic or metabolic diseases and, in the Terms cohort, those who needed to be admitted to the hospital during the neonatal period.

All parents were contacted again when the children were 8–9 years old. The parents who agreed to participate signed an informed consent form, agreeing that researchers communicate with the Department of Education of the Government of Catalonia to obtain the academic results of the Primary Diagnostic Evaluation Test, carried out when children are in the third grade.

The following perinatal and socio-demographic variables were recorded: weight at birth, gestational age, twinning, form of delivery



**FIGURE 1** Flow chart of the population analysed. LPIs: late preterm infants; Terms: term-born infants; GA: gestational age; ASQ3-48: Ages & Stages Questionnaire 3rd edition, 48-month interval; SP: school performance

(vaginal or caesarean), admission to neonatal intensive care unit and gender. Breastfeeding, maternal age at birth, maternal education and family socio-economic status were classified in accordance with data of the Statistics Institute of Catalonia as low ( $\leq\text{€}20\,000/\text{year}$ ), medium ( $\text{€}30\,000\text{--}\text{€}40\,000/\text{year}$ ) or high ( $\geq\text{€}50\,000/\text{year}$ ).

## 2.1 | Instruments

The Ages and Stages Questionnaires® 3rd edition 48-month interval translated to Spanish by Brookes Publishing (Squires & Bricker, 2009) is a validated, parent-completed developmental screening tool. Twenty-one questionnaires are available for 1 to 66 months of age. Parents answer 30 questions covering five domains of development, including communication, gross motor, fine motor, problem solving and personal-social domain. Each domain contains six questions that can be answered with a 'yes' (10 points), 'sometimes' (5 points), or 'not yet' (0 points); these are the total scores for each domain. Children assessed with the ASQ3-48 are considered at risk of DD if they score below 2 SDs below the mean in any of the evaluated domains for the ASQ validation in

Barcelona, considered then as a positive screening (Schonhaut, Martínez-Nadal, Armijo, & Demestre, 2019).

## 2.2 | School performance evaluation

Academic results at 8–9 years of age were assessed with the Primary Diagnostic Evaluation Test and classified according to the requirements of the Department of Education in communicative and linguistic competence, in which oral, reading and written expression are evaluated, as well as mathematics competence. The schools where the children attended were classified as low, medium and high complexity. Schools in Catalonia are classified according to the characteristics of the children who attend, the neighbourhood in which they are located, their functioning and organization. Usually children with families with financial difficulties or a lower level of education attend high-complexity schools, and these schools also show greater difficulties in their functioning and organization compared with the low complexity schools that are attended by families with a high socio-economic level. The assessment of the SP score according to the complexity of the schools was taken into account.

The results were measured dichotomously according to whether they obtained expected SP or poor SP, determined by whether they scored low on at least in one of the competences measured by the test: communicative-linguistic and mathematics, determined by the norms dictated by the Superior Council of Evaluation of the Educational System, which is an organization that belongs to the Department of Education and controls the level of the schools of Catalonia by means of some standardized tests that realize all the public schools, concerted and some private centres to third and sixth grade, and adjusting for school complexity.

### 2.3 | School intervention

Parents provided information regarding SI enrolment and having received of developmental intervention therapies (e.g., child psychologist, speech-language pathologist, psycho-pedagogical, physical therapist or other specialists) between 4 and 8–9 years of age in order to

classify children as receiving (or not) SI. No information about the kind, quality or duration of the interventional therapies is available.

## 3 | STATISTICAL ANALYSIS

The perinatal and socio-demographic variables and the screening results with ASQ3-48 were compared among the children who agreed to participate based on the LPIs and Term cohorts.

The prevalence of poor SP and SI groups in the total sample is described. Student's *t* test and analysis of variance were used to compare average ASQ3-48 scores for expected poor SP and for receiving SI, according to whether they belonged to the LPI or Terms groups.

Receiver operating characteristic curves were generated to discriminate children with poor SP and children receiving SI using the total ASQ3-48 score as a continuous variable, comparing the AUC of LPIs and Terms, based on the DeLong method. Diagnostic properties of ASQ3-48 for receiving SI and for poor SP were calculated.

**TABLE 1** Perinatal and socio-demographic variables and developmental delay risk, comparison between late preterm and term infants

	Late preterm <i>n</i> = 75	Terms <i>n</i> = 58	<i>P</i> value
<b>Perinatal and socio-demographic variables</b>			
Weight (g), M ± SD	2506.9 ± 434.1	3375.7 ± 428.2	<0.000*
Male gender, <i>n</i> (%)	47 (62.6)	36 (62.1)	NS
GA weeks, M ± SD	35.5 ± 0.64	39.5 ± 1.1	<0.000*
Twinning, <i>n</i> (%)	26 (34.6)	0 (0)	<0.000*
Maternal age years, M ± SD	39.2 ± 3.9	38.19 ± 3.1	NS
Mother >35 years, <i>n</i> (%)	66 (88)	50 (86.2)	NS
Maternal education:			
University, <i>n</i> (%)	58 (77.3)	50 (86.2)	
Secondary, <i>n</i> (%)	16 (21.3)	8 (13.8)	NS
Primary, <i>n</i> (%)	1 (1.31)	0 (0)	
Socio-economic status			
Low: ≤20 000€/year	4 (5.5)	1 (1.8)	
Medium: 30 000–40 000€/year	35 (48)	20 (36.4)	NS
High: ≥50 000€/year	34 (46.5)	34 (61.8)	
Caesarean, <i>n</i> (%)	48 (64)	20 (34.5)	0.001*
Breastfeeding, <i>n</i> (%)	48 (64)	42 (72.4)	NS
Breastfeeding time months, M ± SD	5.66 ± 5	5.6 ± 4.7	NS
NICU admission, <i>n</i> (%)	46 (61.3)	0 (0)	<0.000*
<b>ASQ3-48</b>			
Communication deficit, <i>n</i> (%)	1 (1.3)	0 (0)	NS
Gross motor deficit, <i>n</i> (%)	1 (1.3)	1 (1.7)	NS
Fine motor deficit, <i>n</i> (%)	4 (5.3)	2 (3.4)	NS
Solving problems deficit, <i>n</i> (%)	2 (2.6)	1 (1.7)	NS
Personal social deficit, <i>n</i> (%)	3 (4)	3 (5.2)	NS
1 domain under cut-off point, <i>n</i> (%)	9 (12.0)	7 (12.1)	NS

Note: Deficit domain: domain score <−2SD respect the mean; 1 domain under cut-off point: at least 1 domain score <−2SD respect the mean.

Abbreviations: GA, gestational age; M, mean; NICU, neonatal intensive care unit; SD, standard deviation.

\**P* < 0.05.

Univariate regression analysis was performed to evaluate the factors associated with SP and receiving SI.

All tests were considered to be statistically significant if  $P < 0.05$ . The analyses were performed in Statistical Package R® version 3.5.2.

## 4 | RESULTS

The final study population consisted of 133 children (74% of those who had been evaluated with ASQ-3 at 4 years of age), 75 LPs and 58 Terms. Eighteen children could not be contacted, 25 refused to participate and three were excluded for not having obtained the results of the SP (Figure 1). No significant differences were found in perinatal or socio-demographic variables, nor ASQ3-48 scores comparing participants and nonparticipants.

When comparing the perinatal and socio-demographic characteristics and ASQ3-48 deficit scores of LPs and Terms that participated, significant differences were observed in birth weight, gestational age, twinning, rate of caesarean delivery and admission to neonatal intensive care unit. No significant differences were found in deficit by domains or total score on the ASQ3-48 (Table 1).

## 5 | SCHOOL PERFORMANCE AND ASQ3-48

Some 54.9% ( $n = 73$ ) of participants attended low complexity schools and 45.1% ( $n = 60$ ) medium complexity schools, without differences between LPs and Terms. No child was enrolled in a high complexity school. The prevalence of poor SP at 8–9 years of age was 12.8%, without statistically significant differences between LPs and Terms (14.6% vs. 10.3%),  $P = 0.23$ . The total frequency of SI was 21%; this was significantly greater in the LPs than in the Terms group (29.3% vs. 10.3%,  $P = 0.0014$ ). The SI they received was speech-language therapy (9.8%), psychological intervention (9%), psycho-pedagogical intervention (8.3%) and physical therapy (1.5%), either alone or in combination.

Significant differences were detected in total ASQ3-48 score between the expected SP ( $281.5 \pm 17.0$  points) compared with the poor SP ( $267.4 \pm 19.61$  points) groups ( $F_{(1,129)} = 9.71$ ,  $P = 0.002$ ). No statistically significant differences were found between SI groups in ASQ3-48 total scores ( $F_{(1,129)} = 0.89$ ,  $P = 0.345$ ).

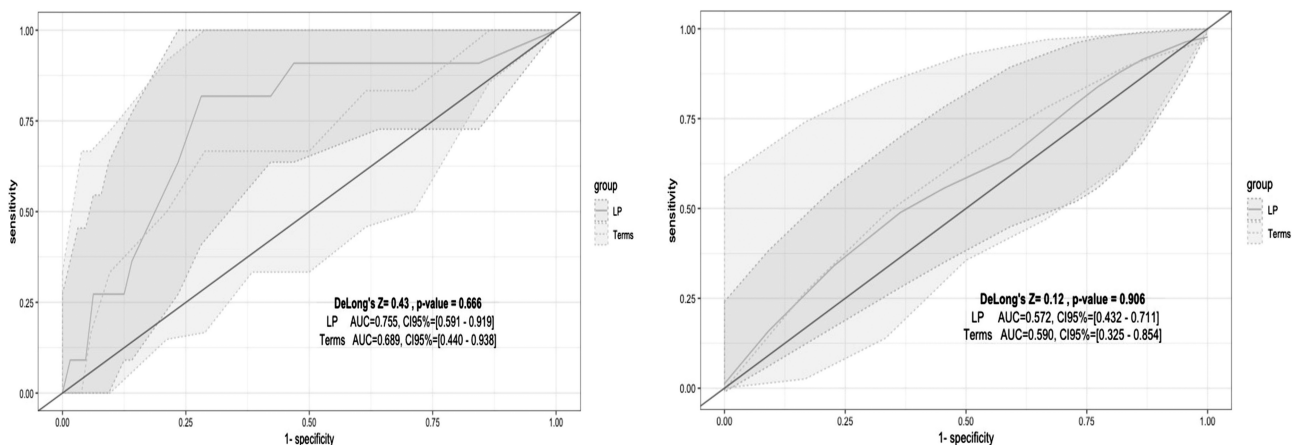
The AUC of ASQ3-48 for poor SP was 0.73 and was higher in LPs than in Terms (0.75 vs. 0.69), even though no statistically significant differences were found ( $P = 0.666$ ). The AUC for receiving SI was 0.56, without significant differences when comparing LPs and Terms (0.57 vs. 0.59,  $P = 0.906$ ) (Figure 2). The sensitivity and specificity of a positive ASQ3-48 screen for SP were 41% and 92%, PPV 44% and NPV 91%, whereas for receiving SI, sensitivity was 14%, specificity 89%, PPV 25% and NPV 79% (Table 2).

## 6 | ASSOCIATION WITH POOR SCHOOL PERFORMANCE

In the univariate logistic regression model, the following variable was significant, in relation to poor SP: positive screening with the ASQ3-48 assessment (OR 6.48 [95% CI, 1.9–22.2],  $P = 0.002$ ), whereas for receiving SI, it was significantly late prematurity (OR 3.6 [95% CI, 1.3–9.6],  $P = 0.01$ ) (Table 3). A significant association was found between poor SP and receiving SI,  $P = 0.005$ .

## 7 | DISCUSSION

In our cohort of children followed from birth to school age, we found that the developmental assessment performed at the age of 4 years with ASQ-3 showed an adequate capacity to predict the SP between 8 and 9 years (AUC 0.73), without significant differences between LPs and Terms. The ASQ3-48 scores show low sensitivity and PPV, and high specificity and NPV. These results agree with those of Halbwegs et al. (2014), who reported an AUC of 0.66–0.77 for evaluation at 18, 24 and 36 months with ASQ for



**FIGURE 2** ROC curve of ASQ3-48 total score related (a) to poor school performance and (b) to receiving school intervention, comparison between late preterm and term infants. LP: late preterm; Terms: term-born infants

**TABLE 2** Diagnostic properties of ASQ3-48 to predict poor school performance and to predict receiving school intervention, comparison between late preterm and term infants

	Total sample <i>n</i> = 133	Terms <i>n</i> = 58	Late preterm <i>n</i> = 75
<b>School performance</b>			
Sensibility	41%	50%	36%
Specificity	92%	92%	92%
PPV	44%	43%	44%
NPV	91%	94%	89%
<b>School intervention</b>			
Sensibility	14%	33%	9%
Specificity	89%	90%	87%
PPV	25%	29%	22%
NPV	79%	92%	70%

Abbreviations: NPV, negative predictive value; PPV, positive predictive value.

**TABLE 3** Variables related to poor school performance and receiving school intervention analysed by univariate logistic regression model

Univariate analysis	School performance		School intervention	
	OR (95% CI)	<i>P</i> value	OR (95% CI)	<i>P</i> value
Late prematurity vs. term-born	1.48 (0.5–4.4)	NS	3.6 (1.3–9.6)	0.01*
Male vs. female gender	1.12 (0.8–3.3)	NS	2.1 (0.8–5.3)	NS
Maternal age >35 years vs. <35 years	2.50 (0.3–21.5)	NS	2.2 (0.4–10.1)	NS
Maternal education—university vs. no university	1.39 (0.4–4.7)	NS	2.1 (0.8–5.5)	NS
Caesarean vs. vaginal delivery	0.83 (0.3–2.3)	NS	1.3 (0.6–3.1)	NS
Twinning vs. singleton	1.31 (0.4–4.5)	NS	0.9 (0.3–2.5)	NS
No breastfeeding vs. breastfeeding <sup>a</sup>	0.85 (0.3–2.6)	NS	0.9 (0.4–2.4)	NS
NICU admission vs. no admission	1.03 (0.3–3.1)	NS	1.9 (0.8–4.4)	NS
At least 1 domain at risk zone in ASQ3-48 <sup>b</sup> vs. no risk	6.48 (1.9–22.2)	0.002*	1.4 (0.4–4.9)	NS
School complexity low vs. medium	0.4 (0.1–1.26)	NS	0.89 (0.4–2.1)	NS

Abbreviation: NICU, neonatal intensive care unit.

<sup>a</sup>Any breastfeeding time months.

<sup>b</sup>Ages and Stages Questionnaire 3rd version in Spanish 48 months interval. At least 1 domain under cut off point ASQ3-48: 1 or more domain score < –2SD respect the mean.

\**P* < 0.05.

the detection of school difficulties in preterm children at the age of 5 years, and of Charkaluk et al. (2017), who reported an AUC of 0.78 for the ASQ 36 months in the general population for prediction of intellectual quotient at 5–6 years of age. Both clearly show higher sensitivity, 77–80%. Kerstjens et al. (2009) also describe greater sensitivity and specificity (89% and 80%) of ASQ measured at 4 years of age to predict special education at 5 years of age. Nevertheless, Schonhaut, Pérez, Armijo, and Maturana (2020) reported an AUC of 0.77 in evaluating the results of ASQ 8- to 18-month and 30-month interval for predicting low intellectual quotient in school age, with high specificity and NPV with low sensitivity and PPV as in our study. It must be taken into account the trade-offs between sensitivity and specificity (Sheldrick

& Garfinkel, 2017); additionally, the follow-up time influences the predictive capacity of the tests (Halbwachs et al., 2014; Schonhaut, Pérez, Armijo, & Maturana, 2020).

When analysing the diagnostic capacity of the developmental questionnaires, it is important to take into account factors that can modify the development of stability and the children's natural history, particularly developmental interventions and the rapid developmental change (Aylward, 2009; Cioni, Inguaggiato, & Sgandurra, 2016; Valla, Birkeland, Hofoss, & Slinning, 2017). There are no other studies comparing the diagnostic properties of ASQ in children with different biological risks, such as prematurity. It is to be expected that there would be differences in higher risk groups, such as extremely preterm babies, because they have low stability in their development, with greater risk

of emerging problems (Hornman, De Winter, Kerstjens, Bos, & Reijneveld, 2017).

In our study, having a positive screening in ASQ3-48 was significant as a predictor of poor SP, with an OR of 6.48 (95% CI, 1.9–22.2). Curiously, assessment with ASQ3-48 and the qualitative feedback was not associated with requiring SI. Published evidence clearly shows that paediatricians typically do not refer all children who screen positive. Among these studies, referral rates range from 10% to 86% (Sheldrick et al., 2016).

The prevalence obtained in this study of poor SP in children evaluated at 8–9 years of age was 12.8%, as published elsewhere in the literature (Boyle et al., 2011; Chan, Leong, Malouf, & Quigley, 2016). There were differences between LPIs and Terms (14.6% vs. 10.3%), but these were not statistically significant, probably due to a B error given by the sample size. It would be useful to design studies with a larger sample size. In this respect, there are studies that have found significant differences (Chyi, Lee, Hintz, Gould, & Sutcliffe, 2008; Lipkind, Slopen, Pfeiffer, & McVeigh, 2012) and others that have not (Gurka, LoCasale-Crouch, & Blackman, 2010; Harris et al., 2013). A possible explanation for this is that prematurity per se is not inevitably to be related to poor neurodevelopmental outcomes; it is likely that there are protective factors and negative factors in the neonatal period that play a role (Cioni, Inguaggiato, & Sgandurra, 2016; Kalia, Visintainer, Brumberg, Pici, & Kase, 2009). We thought that the privileged characteristics of the population evaluated could be a protective factors, because of their socio-economic status, and the large percentage of mothers with university studies, as well as the high level of participation in interventional therapies among LPIs.

In this study, late prematurity was associated with a greater risk of requiring SI (29.3% vs. 10.3%;  $P = 0.0014$ ), and in fact, there was an association between poor SP and receiving SI, in agreement with the results of other studies (Chyi, Lee, Hintz, Gould, & Sutcliffe, 2008; Lipkind, Slopen, Pfeiffer, & McVeigh, 2012; Odd, Emond, & Whitelaw, 2012). It has been reported that improvement in the developmental results is due to receiving SI; therefore, several studies have recommended developmental screening in order to detect the need for early intervention (Chyi, Lee, Hintz, Gould, & Sutcliffe, 2008; Guralnick, 2014; Hornman, De Winter, Kerstjens, Bos, & Reijneveld, 2017). Referring to this, Shah, Kaciroti, Richards, Oh, and Lumeng (2016) consider it beneficial to monitor development before entering a school, especially in children with risk factors such as LPIs, because late detection reveals a poorer response to a specific treatment.

The main limitations of this study are the sample size and the fact that the SI was not standardized and referred by parents. Therefore, the external validity is limited, as the participants were from medium to high socio-economic levels in Barcelona, which precludes generalizing these results. However, these are preliminary and solid steps towards studies with a larger numbers of more diverse children as well as methodology without internal validity limitations.

It is important to highlight that at the time the study was carried out, there were no recommendations in Spain regarding special

follow-up for LPIs, although it was known that this group of preterm was more vulnerable than term-born children. A strength of the study is that it involved a prospective cohort of LPIs, followed-up from the neonatal period to 8–9 years of age and matched with a term-born control group. We would also like to highlight the introduction into clinical practice of the use of a screening test, validated for our population, for the early detection of DD risk, and the monitoring of the evolution of development between preschool and school of LPIs and term-born cohorts in a local sample. Also, it is important to continue this important research and to point to the value of developmental screening before school entry as a testing point that can be helpful to both professionals and parents in medical and school settings.

## 8 | CONCLUSIONS

The ASQ-3 questionnaire at 4 years of age predicts poor SP at age 8–9 years reasonably well, without differences between LPIs and Terms. No statistically significant differences were found in SP between the LPIs and Term cohorts, but the LPIs received a greater percentage of SI. These results support the use of ASQ as a developmental screening tool at 4 years of age.

### CONFLICT OF INTEREST

All authors disclose any financial and personal relationship with other people or organizations that could inappropriately influence the work.

### ETHICAL APPROVAL

Approval of the Ethics Committee of the (Blinded<sup>1</sup>) to carry out the study was obtained and Confidentiality Agreement of the Department of Education was signed.

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<sup>1</sup>The Department of Education of the Generalitat de Catalunya is contacted and informed of the objectives of the study and collaboration is requested to obtain the results of the Primary Diagnostic evaluation Test of the participants, which is accepted. A copy of each of the informed consents signed by the child's parent or legal representative is required by the Department of Education and the necessary data of the student to search for the results of the Test, being necessary the signature of the researchers of a Confidentiality Agreement document regarding the treatment of the academic data of the student and the school they attend.

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