Early intervention and educational needs among school-aged children born preterm

Laura Lacalle ⬚, Sandra Melero ⬚, Yolanda Sánchez-Sandoval *⬚

Department of Psychology, University of Cádiz, Cádiz, Spain
Biomedical Research and Innovation Institute of Cádiz (INiBICA), Puerta del Mar University Hospital, Cádiz, Spain

A R T I C L E   I N F O

A B S T R A C T

Preterm birth increases the risk of developmental difficulties and neurological impairment. The main aim of this work was to know the prevalence of specific educational needs, chronic diseases and disorders, and describe early intervention attendance in children born preterm, as well as the relationship of these variables with individual and socio-family factors. A retrospective cross-sectional study was carried out with 144 children born preterm (<32 weeks of gestation and/or birth weight ≤ 1500 g). The participants were psychologically evaluated at the age of 8 years (M = 8.6; SD = 0.9). The results showed that the studied circumstances were significantly more frequent among the children born preterm compared to the general population. The intelligence quotient (WISC-V) and quality of life at 8 years of age were in the medium range. The cluster analysis of the history of educational and intervention needs revealed differences with respect to the results at 8 years of age. The results of this study highlight the importance of early intervention for children born preterm, as it might improve their developmental outcomes. Moreover, these findings lay the groundwork for future research and the enhancement of early intervention programmes.

Children born preterm (before 37 weeks of gestational age (GA)) are at higher risk of developmental difficulties, both in the short and long term. The medical and technological advances incorporated in the last decades have improved the survival rate of children born preterm, and they have also reduced the prevalence of severe neurological diseases usually associated with premature delivery. However, preterm birth continues to be one of the main public health problems in the long term. At a global scale, it is estimated that one out of ten births are preterm (World Health Organisation [WHO], 2018).

Recent studies indicate that preterm birth continues to increase the probability of prolonged developmental difficulties and neurological impairments (Ream & Lehwald, 2018; Twilhaar, Wade, et al., 2018). Compared to children born at term, children born preterm are at greater risk of suffering from neurosensory, motor, cognitive and behavioural difficulties (Chung et al., 2020; Rogers & Hintz, 2016; Vollmer & Stålnacke, 2019). They may present difficulties in vision and hearing derived from retinopathy, infections, or brain damage. At the motor level, cerebral palsy is observed, as well as movement and coordination disorders, which may involve language difficulties.

The consequences of prematurity are often expressed with manifestations of lack of attention, hyperactivity, anxiety or difficulties in sensory processing during school age, and they are associated with low academic performance and learning difficulties (McBryde et al., 2020). Studies indicate that 78 % of very children born preterm have special educational needs and their academic scores tend to be approximately half a standard deviation lower than that of their peers born at term (Twilhaar, De Kieviet, et al., 2018).

Moreover, in Spain, 106.3 thousand people aged between 6 and 15 years present some type of disability (Spanish Institute of Statistics, INE, 2020), with learning disability being the most common in this age range, followed by communication, interaction, and personal relationship difficulties. The last reports indicate that 8.49 % of non-university students in Spain present some type of learning support (LS) (Ruiz-Benítez, 2022). Intellectual disability (29.2 %), severe behavioural disorders (24.2 %) and global developmental disorder (23.7 %) are the three most common special educational needs in the Spanish Education System (Gómez-Domínguez, 2020). Being born preterm and presenting Special Educational Needs (SEN) diagnosis, are independently related to lower quality of life (Gómez-Vela et al., 2007; Martini et al., 2016). On the other hand, the feeling of social and academic self-competence and self-

---

efficacy can be improved with a successful adaptation to the school context during childhood and adolescence (Verdugo & Sánchez-Sandoval, 2022).

To the best of our knowledge, the prematurity does not determine the presence of difficulties, although it increases their risk. The development of children born preterm tends to be similar to that of full-term children, which highlights their resilience capacity (Poehlmann-Tynan et al., 2014). Specifically, longitudinal studies show that the mean differences in the academic scope decrease in the subsequent school years (Leijon et al., 2018; McBryde et al., 2020).

A recent systematic review on cognitive development in this stage showed that, despite the significant differences with respect to control groups of full-term children, the Full Scale IQ scores (FSIQ) of children born preterm aged 6–12 years was in the medium range according to the normative scale (Lacalle et al., 2023). In addition to associating this fact with the perinatal variables, the studies focus on the contextual variables that accompany the child throughout childhood and which could be playing a protective role in her/his development, contributing to the transitory and non-permanent character of the difficulties related to prematurity, and reducing the impact on the child's quality of life. These variables include those related to the family and early interventions.

Nowadays, there are care services aimed at addressing and preventing developmental difficulties during the first years of life, focusing on the high plasticity and malleability of growth in this important stage (Buttelmann & Karbach, 2017). The efficacy of these early interventions has been demonstrated throughout the last decades, from a bio-ecological model, as well as the benefits they provide to the development of children in the short and long term (Bronfenbrenner, 1974). Similarly, other studies have reported the effect of these treatments on the cognitive results of children born preterm (Benzies et al., 2013; Orton et al., 2009). In Spain, these early interventions are carried out publicly from the Early Intervention (EI) services, which are aimed at the child population in the age range of 0–6 years, their family and their environment (Spanish Federation of Associations of Early Intervention Professionals, GAT, 2005). This service, which is given by psychologists, speech therapists and physiotherapists, is designed for children with or at risk of suffering from developmental disorders, including children born preterm. The children who benefit from these resources are discharged before the age of 6 years if they show development catch-up, or by protocol, due to age limit, at the age of 6 years.

The aim of this research was to analyse the development of children born preterm, assessed during the school years, taking into account perinatal and other contextual variables not studied in depth to date. The specific aims were: (1) to determine whether attending EI in the first years of life, as well as the presence of diagnoses of special educational needs (SEN), chronic diseases, and other disorders during school age in children born preterm are comparable to their prevalence in the general population; (2) to identify different profiles as a function of the intervention received and the current needs, and to relate them to other individual factors such as gestational age (GA), weight, medical risk and socio-family risk at birth; and (3) to analyse cognitive functioning and quality of life during school years, considering the profiles of received intervention and the current needs.

Attendance to EI and the prevalence of SEN diagnoses, diseases and other disorders were expected to be higher among children born preterm than in the general population (Hypothesis 1). Certain vulnerabilities at birth, such as lower GA, lower weight, and greater medical and socio-family risk, were also expected to be associated with greater support needs during childhood and with the presence of diagnoses at school age (Hypothesis 2). In turn, it was expected to find differences in the results of cognitive development and quality of life during school years as a function of the intervention profile and the presence of diagnoses (Hypothesis 3).

1. Method

1.1. Participants

A sample of 144 children (52.8 % boys and 47.2 % girls) and their families participated in the study, from an initial cohort of 199 children born at 32 weeks of gestation or before, and/or with a birth weight of 1.5 kg or lower, in Hospital Universitario Puerta del Mar. They were subjected to a psychological assessment at the age of 8 years. Fig. 1 shows the flow chart of the participants. The GA and birth weight of the children born preterm who participated in the study was significantly lower than that of those who refused to participate (GA: $U = 2854.5$, $p < .05$, $\eta^2 = ,006$; Weight: $U = 2878.0$, $p < .05$, $\eta^2 = 0.006$). No significant differences in gender distribution were observed between the participants and the non-participants.

The characteristics of the sample are shown in Table 1. The participants had a mean GA of 29.8 weeks. A total of 22.2 % were born extremely preterm (<28 weeks of GA), 54.9 % were born very preterm (28–31 weeks of GA), and 22.9 % were moderate-to-late preterm (32–36 weeks of GA). The participants were born with a mean weight of 1289.61 g. Twenty-five percent were born with extremely low birth weight (<1000 g), 51.4 % with very low birth weight (1000-1499 g) and 23.6 % with low birth weight (1500-2500 g). The mean age at the time of psychological assessment was 8.6 years (SD = 0.9).

For comparisons, school and medical data published in recent national (Spanish Ministry of Education and Vocational Training, n.d.; Spanish Institute of Statistics, INE, 2020) and regional (Gómez-Domínguez, 2020; Ruiz-Benítez, 2022) background population reports were used.

1.2. Measurements and instruments

An ad hoc interview was developed for the parents of the participants, which gathered both current and retrospective information. They were asked to verify this information by consulting their medical records and official reports. This interview included the following information: (i) Sociodemographic and family information: data on spoken language, education level, employment status, income level, area of residence, family structure and prenatal maternal history. (ii) Current comorbidities: diagnoses of chronic illnesses and/or disorders, and degree of recognised disability (consultation of official records was requested). (ii) Current academic information: current school year, repetitions so far, diagnosis of special educational needs (SEN diagnosis) and learning support (LS) measures or adaptations. SEN is an educational diagnostic term that refers to children with educational care needs different from ordinary needs due to disabilities or severe disorders, etc., whereas learning supports are measures, resources, strategies and educational practices implemented by schools to ensure equal opportunities for learning success. These two variables were considered separately, based on the understanding that some students with a diagnosis may not be receiving learning support, and students receiving learning support may not have received a diagnosis. (iii) History of EI: whether early care services were used, professionals involved (physiotherapist, speech therapist or psychologist) and age of discharge. (iv) Other services or supports required: Other support required after the age of 6 years.

The data collected were used to calculate the neonatal medical and socio-family risk index variables. The neonatal medical risk index (NMRI) was developed following other scales of neonatal medical risk (Jiménez-Luque et al., 2023; Yaari et al., 2019). This index considers six comorbidities: confirmed necrotising enterocolitis, moderate or severe broncopulmonary dysplasia, ductus with repercussion, grade 3 retinopathy or higher, severe brain damage, and late-onset sepsis. The presence of each of these conditions was scored with 1 point, and their absence was scored with 0 points. NMRI is the sum of comorbidities in each subject, with a possible range of 0 to 6. High neonatal risk was considered with a score of 1 or higher, that is, the presence of at least one
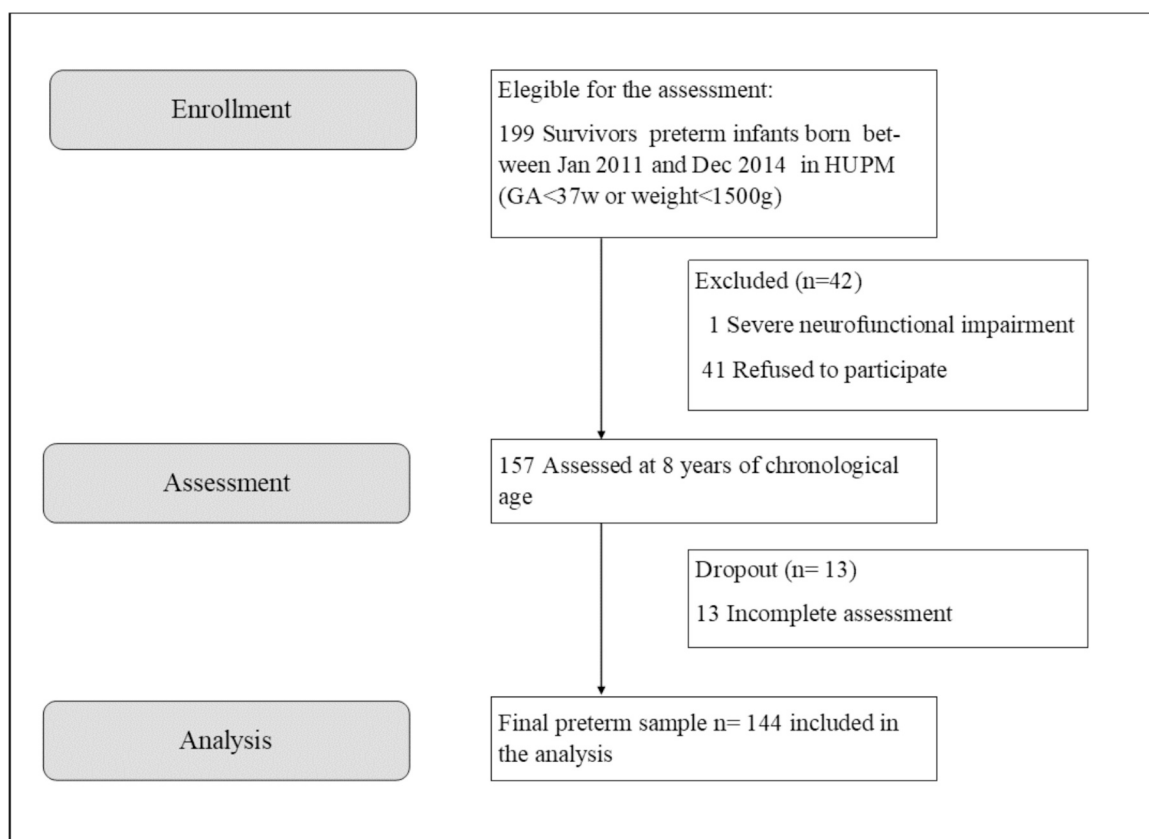
Fig. 1. Flowchart of participants.

Table 1
Characteristics of the Sample.

	$N = 144$
GA (weeks)[a]	29.8 (2.14)
Birth weight (grames)[a]	1289.6 (364.4)
Chronological age (years)[a]	8.6 (0.9)
Sex (female)[b]	68 (47.2)
SGA[b]	17 (12.4)
Multiple birth[b]	64 (46.7)
IVF[b]	36 (26.3)
Caesarean birth[b]	102 (75.6)
Apgar 1[c]	7 [0−10]
Apgar 5[c]	8 [3−10]
Necrotising enterocolitis [b]	0 (100)
Moderate or severe BPD[b]	6 (9.6)
Ductus arteriosus[b]	5 (8.2)
ROP 3 + [b]	3 (4.9)
Severe brain injury[b]	1 (0.77)
Late sepsis[b]	23 (18.1)
High neonatal medical risk[b]	30 (20.8)
Socio-family risk index[a]	2.51 (1.8)

GA: gestational age; SGA: Small for gestational age; IVF: In vitro fertilisation; BPD: Bronchopulmonary dysplasia; ROP: Retinopathy of prematurity.

[a] Mean (SD).
[b] n (%).
[c] Median [min-max].

of these comorbidities.

The socio-family risk index (SRI) was designed taking into account similar indices found in the literature (Fornell et al., 2023; Pennell et al., 2012; Sánchez-Sandoval & Verdugo, 2021; Treyvaud et al., 2012; Yaari et al., 2019). It provides a total risk score (0−12), considering the presence of six sociofamily factors: family structure (0 = two parents, 1 = step family or shared custody, 2 = single parent), education level of the main carer (0 = university studies, 1 = semi-qualified education, 2 = compulsory education or lower), employment situation of the parents (0 = all parents were employed, 1 = one of the parents worked, 2 = none of the parents worked), income level (0 = over 1801€, 1 = 901–1800€, 2 = <900€), language spoken at home (0 = Spanish, 1 = some Spanish, 2 = a language other than Spanish), and maternal age at birth (0 = 21 years or older, 1 = between 18 and 20 years, 2 = 18 years or younger).

Cognitive functioning was assessed with Weschler's Intelligence Scale for Children in its 5th edition (WISC-V; Wechsler, 2015), which had been validated and tested in a Spanish population (Fenollar-Cortés & Watkins, 2019). In standardised scores, it provides total intellectual quotient (FSIQ), five general indices, and three secondary indices: verbal comprehension index (VCI), visual-spatial index (VSI), perceptive reasoning index (PRI), working memory index (WMI), processing speed index (PSI), non-verbal comprehension index (NVCI), general capacity index (GCI), and cognitive competence index (CCI).

Moreover, a multi-informant evaluation of the quality of life of children born preterm was carried out using KIDSCREEN-27 (The KIDSCREEN Group, 2004), which is a questionnaire that assess health-related quality of life in children and adolescents through the report of the parents. It has 27 items, which are scored in a Likert scale of 1–5 points, obtaining information about five dimensions: physical wellbeing, psychological wellbeing, autonomy and family life, friends and social support, and school environment. A mean score obtained from the dimensions was used to facilitate the presentation of the comparative analyses. The reliability index of the scale was excellent ($\alpha = 0.906$), and the subdimensions presented an adequate internal consistency ($\alpha = 0.824, 0.758, 0.798, 0.607, 0.735$, respectively).

The same questionnaire was administered in its version for children, KIDSCREEN-10 (Ravens-Sieberer et al., 2010), which evaluates health-related quality of life in children and adolescents aged 8–18 years. With 10 items scored in a Likert scale of 1–5 points, it assesses the self-

perceived health and wellbeing of the child through a global screening score. The scale presented an acceptable reliability index ($\alpha = 0.709$).

1.3. Procedure

This work is framed within Project PRETERM, which is a larger cross-sectional, retrospective study on the long-term neurodevelopment of children born preterm conducted in Hospital Universitario Puerta del Mar. The project has been approved by the Regional Committee of Research and Bioethics. A cohort of children born preterm in this hospital between the years 2011 and 2014 was selected. Their families were contacted at the children's approximate age of 8 years to inform them about the study. The families that agreed to participate were asked to attend the face-to-face evaluation, where they signed the informed consent. The parents and the children self-completed the study questionnaires, with the help of a trained technician whenever necessary.

1.4. Data analysis

The statistical programme SPSS v24 was used to load, code and analyse the gathered data. Preliminary comparative analyses were carried out between sexes, as well as descriptive analyses on the sample and the sociodemographic data regarding academic information, health-related information, and information about EI and/or other services or supports. Binomial tests were performed with 95 % confidence interval to determine whether the distribution of the sample was similar to that of the national and regional background population. Chi-squared tests were performed to identify correlations between the sociodemographic data and the individual variables, considering the classification by prematurity according to GA (EPT: Extremely preterm infants [GA < 28 weeks]; VPT: very preterm [GA = 28–32 weeks]; MPT: moderate-to-late preterm [GA = 32–37 weeks]) and birth weight (ELBW: Extremely low birthweight [<1000 g]; VLBW: very low birthweight [1000–1500 g]; LBW: low birthweight [1500–2500 g]). Groups of participants with similar EI and educational needs patterns were detected through a cluster analysis with the two-stage cluster node. Furthermore, Mann-Whitney U test and one-way ANOVAs by Kruskal-Wallis ranges were conducted to compare the means of intellectual functioning, and self-perceived and parent-informed quality of life at the age of 8 years, according to the identified clusters. Then, pairwise comparisons were analysed through Bonferroni correction, with 0.05 significance level.

The power analysis showed that, with the total sample of 144 children who participated in the study, there was over 80 % power to detect differences and correlations with moderate-large effect size.

2. Results

2.1. Preliminary analyses by sex

The differences between boys and girls were analysed with respect to the neonatal, EI and school variables. No significant differences were found in terms of GA ($U = 2459.0$, $p > .05$, $\eta^2 = 0.003$) or chronological age at the time of assessment ($U = 2372.5$, $p > .05$, $\eta^2 = 0.042$). However, it was observed that the weight of the girls was lower than that of the boys ($U = 1930.0$, $p < .01$, $\eta^2 = 0.042$). The proportions of referral to EI were significantly greater in the girls than in the boys ($\chi^2 = 10.60$, $p < .01$, $\varphi = -0.271$). No significant differences were found by sex with regard to medical risk, psychosocial risk, intervention area, type of discharge, or the need for support after six years. Similarly, no significant relations were identified for sex with the school variables or with the presence of diagnoses.

2.2. Comparison with national and regional background populations

Data about children born preterm who attended EI in this study (77.8 %) were compared to data published in the Andalusian Childhood

and Adolescence Observatory (Ruiz-Benítez, 2022) about a regional background population (5.92 %). Children born preterm participating in this study attended EI (CI95%: 70.3–83.8) in a greater proportion than the regional background population ($Z = 36.53$; $p < .001$). Data on the diagnoses of chronic diseases or other disorders were compared to the data of a national background population of the same age (11.7 %) published in the Survey on Disability, Personal Autonomy, and Dependent Situations report (Spanish Institute of Statistics, INE, 2020). Children born preterm participating in this study (19.4 %) were also present in a greater proportion compared to the national background population (CI95%: 13.8–26.7; $Z = 2.89$, $p < .01$). We also compared data on SEN diagnoses in the national background population of the same age (8.49 %) from this same report with data from the preterm infants in this study (18.8 %), finding that the latter had a higher proportion of SEN diagnoses than the general national background population (95%CI: 13.2–26.0; Z = 4.42, $p < .00$). Finally, data about school year repetition (7.64 % in this study) were compared to the national background population, considering the proportion of children that repeated at least one school year during the data collection years (3.1 %). Those data are published in EDUCAbase (Spanish Ministry of Education and Vocational Training, n.d.). The comparison revealed a significant difference between both proportions ($Z = 3.14$, $p < .01$), being higher among children born preterm.

2.3. EI received during early childhood

A total of 77.8 % of the participants had been attended to by the EI service. Among these, 88.4 % were attended to by physiotherapists, 48.2 % by psychologists, and 50.9 % by speech therapists. Most of them required attention in more than one service area (28.6 % in two areas; 29.5 % in all three areas), with those who received attention from psychologists being more likely to also receive attention from speech therapists ($\chi^2 = 18.98$, $p < .001$, $\varphi = 0.412$). Most of the children born preterm who were referred to EI were discharged due to catch-up before reaching the age of 6 years (76.8 %), whereas the remaining 23.2 % were discharged when they reached the age of 6 years. A total of 20.1 % of the children born preterm required support after the compulsory EI discharge age of 6 years.

Individual variables such as GA and birth weight did not show significant differences based on referral to EI (GA: $U = 68.0$, $p > .05$, $\eta^2 = 0.052$; weight: $U = 60.0$, $p > .05$, $\eta^2 = 0.096$) or discharge type (GA: $U = 905.0$, $p > .05$, $\eta^2 = 0.075$; weight: $U = 941.0$, $p > .05$, $\eta^2 = 0.113$). In turn, a significant difference was found with the need for support after 6 years (GA: $U = 578.5$, $p < .01$, $\eta^2 = 0.084$; weight: $U = 834.5$, $p < .05$, $\eta^2 = 0.068$), with GA and weight being lower in the cases that required support after 6 years. Nevertheless, in the classification of the participants as a function of their GA (EPT, VPT and MLPT), it was observed that referral to EI was more frequent in EPT (96.9 % of EPT had attended EI), followed by VPT (74.7 %), and MLPT (66.7 %). The differences with regard to referral to EI were statistically significant among the three groups ($\chi^2 = 9.54$, $V = 0.26$, $p < .01$). Likewise, significant differences were found in the classification by birth weight (ELBW, VLBW and LBW). More specifically, significant differences were observed in terms of attending EI ($\chi^2 = 11.24$, $V = 0.28$, $p < .01$), with the group of EBLW children presenting the greatest frequency of attendance (91.7 % of ELBW had attended EI). In regard to the number of areas in which they received intervention, it was observed that the LBW children had mostly been attended to in a single service (70 %). No significant differences were obtained with respect to total NMRI or SRI for EI attendance (NMRI: $U = 1774.0$, $p > .05$, $\eta^2 = 0.013$; SRI: $U = 1482.0$, $p > .05$, $\eta^2 = 0.001$), for the type of discharge received (NMRI: K-W = 0.063, $p > .05$, $\eta^2 = 0.003$; SRI: K-W = 2.516, $p > .05$, $\eta^2 = 0.018$) or for the need for support after 6 years (NMRI: $U = 1594.5$, $p > .05$, $\eta^2 = 0.007$; SRI: $U = 1460.5$, $p > .05$, $\eta^2 = 0.001$). Table 2 shows the distributions for the variables of EI and educational needs of the participants as a function of GA, weight and NMRI.

Table 2

Distribution of Healthcare Services according to the Classification by Perinatal Variables.

	Total N (%)	GA classification				Weight classification				NMRI		
		Frequency (%)			$\chi 2$	Frequency (%)			$\chi 2$	Frequency (%)		$\chi 2$
		EPT (n = 32)	VPT (n = 79)	MLPT (n = 33)		ELBW (n = 36)	VLBW (n = 74)	LBW (n = 34)		High (n = 30)	Low (n = 114)	
Received EI												
yes	112 (77.8)	31 (96.9)	59 (74.7)	22 (66.7)	9.54**	33 (91.7)	59 (79.7)	20 (58.8)	11.24**	4 (13.3)	28 (24.6)	1.73
no	32 (22.2)	1 (3.1)	20 (25.3)	11 (33.3)		3 (8.3)	15 (20.3)	14 (41.2)		26 (86.7)	86 (75.4)	
N° areas in EI[1]												
1 area	47 (42)	8 (25.8)	25 (42.4)	14 (63.6)	9.88*	9 (37.3)	24 (40.7)	14 (70.0)	10.03*	7 (26.9)	40 (46.5)	3.18
2 areas	32 (28.6)	12 (38.7)	14 (23.7)	6 (27.3)		13 (39.4)	17 (28.8)	2 (10.0)		9 (34.6)	23 (26.7)	
3 areas	33 (29.5)	11 (35.5)	20 (33.9)	2 (9.1)		11 (33.3)	18 (30.5)	4 (20.0)		10 (38.5)	23 (26.7)	
Discharge in EI[1]												
due to catch-up	86 (76.8)	21 (67.7)	49 (83.1)	16 (72.7)	2.92	23 (69.7)	47 (79.7)	16 (80.0)	1.32	20 (76.9)	66 (76.7)	0.00
due to age limit	26 (23.2)	10 (32.3)	10 (16.9)	6 (27.3)		10 (30.3)	12 (20.3)	4 (20.0)		6 (23.1)	20 (23.3)	
Need for support after 6 years												
yes	29 (20.1)	12 (37.5)	14 (17.7)	3 (9.1)	8.78*	12 (33.3)	13 (17.6)	4 (11.8)	5.68	7 (23.3)	22 (19.3)	0.24
no	115 (79.9)	20 (62.5)	65 (82.3)	30 (90.9)		24 (66.7)	61 (82.4)	30 (88.2)		23 (76.7)	92 (80.7)	

GA: Gestational age; EPT: Extremely preterm; VPT: Very preterm; MPT: Moderate-to-late preterm; ELBW: Extremely low birth weight; VLBW: Very low birth weight; LBW: low birth weight; NMRI: Neonatal medical risk index; EI: Early intervention. [1] Included only those cases who went to EI.

* = $p < .05$.
** = $p < .01$.

2.4. Educational needs, diseases and chronic disorders at school age

Regarding educational needs and school support, the diagnosis of SEN was present in 18.8 % of cases, being more frequent in the EPT children ($\chi^2 = 8.67$, $V = 0.24$, $p < .05$) (Table 3). According to the information provided by the parents, 4.5 % of the children who presented a SEN diagnosis had not received learning support or intervention at the time of assessment. On the other hand, 31.3 % of the children born preterm received learning support or adaptations, with no SEN diagnosis. Eleven participants had repeated at least one school year. No significant differences were detected in terms of total NMRI or SRI for repeating a school year (NMRI: $U = 676.5$, $p > .05$, $\eta^2 = 0.006$; SRI: $U = 483.5$, $p > .05$, $\eta^2 = 0.021$), receiving learning support or adaptations

(NMRI: $U = 1708.0$, $p > .05$ $\eta^2 = 0.001$; SRI: $U = 1391.0$, $p > .05$, $\eta^2 = 0.016$) or the presence of SEN diagnosis (NMRI: $U = 1594.5$, $p > .05$, $\eta^2 = 0.000$; SRI: $U = 1460.5$, $p > .05$, $\eta^2 = 0.006$). Moreover, the results showed that 19.4 % of the participants presented some diagnosed disease or chronic disorder, and that 15.8 % had a recognised degree of disability.

No associations were found for weight, NMRI or SRI with the presence of diagnoses of chronic diseases or disorders, or disability, except for the recognition of the degree of disability according to the group of prematurity by GA ($\chi^2 = 16.95$, $V = 0.34$, $p < .001$), with the proportion of EPT and MLPT children with disability being greater and lower (37.5 % and 3 %, respectively) than that expected in the sample.

Table 3

Distribution of Educational Needs, Learning Support, SEN Diagnoses at School-age according to Perinatal Variables.

	TOTAL N (%)	GA classification				Weight classification				NMRI		
		Frequency (%)			$\chi 2$	Frequency (%)			$\chi 2$	Frequency (%)		$\chi 2$
		EPT (n = 32)	VPT (n = 79)	MLPT (n = 33)		ELBW (n = 36)	VLBW (n = 74)	LBW (n = 34)		High (n = 30)	Low (n = 114)	
Repeated a school year												
yes	11 (7.6)	3 (9.4)	4 (5.1)	4 (12.1)	1.81	5 (13.9)	4 (5.4)	2 (5.9)	2.66	2 (6.7)	9 (7.9)	0.05
no	113 (92.4)	29 (90.6)	75 (94.9)	29 (87.9)		31 (86.1)	70 (94.6)	32 (94.1)		28 (93.3)	105 (92.1)	
Learning support												
yes	32 (22.2)	12 (37.5)	14 (17.7)	6 (18.2)	5.55	13 (36.1)	14 (18.9)	5 (14.7)	5.59	7 (23.3)	25 (21.9)	0.02
no	112 (77.8)	20 (62.5)	65 (82.3)	27 (81.8)		23 (63.9)	60 (81.1)	29 (85.3)		23 (76.7)	89 (78.1)	
SEN diagnosis												
yes	27 (18.8)	11 (34.4)	14 (17.7)	2 (6.1)**	8.67*	10 (27.8)	13 (17.6)	4 (11.8)	3.08	5 (16.7)	22 (19.3)	0.10
no	117 (81.3)	21 (65.6)	65 (82.3)	31 (93.9)		26 (72.2)	61 (82.4)	30 (88.2)		25 (83.3)	92 (80.7)	

GA: Gestational age; EPT: Extremely preterm; VPT: Very preterm; MLPT: Moderate or late preterm; NMRI: Neonatal medical risk index; EI: Early intervention; ELBW: Extremely low birth weight; VLBW: Very low birth weight; LBW: Low birth weight; SEN: Special educational needs.

* = $p < .05$.
** = $p < .01$.

2.5. Preliminary descriptive analyses on perinatal and cognitive variables and quality of life

Before carrying out the analysis of profiles, the cognitive and quality of life scores of the participants were explored. They presented a FSIQ score of 92.99 (SD = 12.68), falling in the medium range. A total of 2.1 % of the participants obtained FSIQ scores of <70. The participants perceived high quality of life (M = 4.26, SD = 0.52). The mean score of quality of life informed by the parents was 53.07 points (SD = 7.31).

Table 4 shows the correlations of the cognitive and quality of life results with respect to birth weight, GA, NMRI and SRI. Birth weight and SRI were significantly associated with the FSIQ scores at 8 years. The quality of life was only significantly correlated with NMRI.

2.6. Cluster analysis

A two-step cluster analysis was performed to determine the possible existence of different profiles as a function of EI received. The following variables were included: referral to EI (yes/no); type of discharge from EI (no EI, discharged due to catch-up, discharged due to age limit); need for support after 6 years outside of the educational scope (yes/no); SEN diagnosis (yes/no); Learning support or adaptation (yes/no); and recognised degree of disability (yes/no). Fig. 2 shows the predictive importance of each variable for the definition of the clusters. The variable with the greatest predictive importance was the type of discharge from EI.

From these seven variables, the results show three groups of children born preterm. The first group (group 1) ($n = 32$) did not attend EI (100 %), had no SEN diagnoses (96.9 %) or disabilities (100 %), did not require support after 6 years (93.8 %), had no chronic diseases or disorders (93.8 %), and did not need learning support or adaptations (87.5 %). The children of the second group (group 2) ($n = 81$) attended EI (100 %) and were discharged due to catch-up (92.6 %), with no SEN diagnoses (98.8 %), no disability (100 %), no chronic diseases or disorders (92.6 %), no need for support after 6 years (100 %), and no learning support or adaptations at the time of assessment (93.8 %). The members of the third group (group 3) ($n = 31$) attended EI (100 %) and were discharged due to the age limit of 6 years (64.5 %), with SEN diagnoses (80.6 %), recognised disability (71.0 %), support required after 6 years (87.1 %), learning supports or adaptations at the time of assessment (74.2 %) and diagnoses of chronic diseases or disorders (64.5 %). The silhouette cohesion and separation measure confirmed the cluster quality as good (0.7).

The post-hoc contrasts showed, with a large effect size ($\eta^2 = 0.161$), that the groups differed significantly in GA at birth (K-W = 19.21, $p < .001$), with group 3 showing lower GA ($M = 28.32$) with respect to group 1 ($M = 30.77$, $p < .001$) and group 2 ($M = 30.08$, $p < .001$). Groups 1 and 2 did not present significant differences in terms of GA. A different distribution was observed among the groups in terms of weight (K-W = 18.31, $p < .001$), with a moderate size effect ($\eta^2 = 0.133$). In this case,

group 1 presented greater birth weight ($M = 1499.84$) compared to group 2 ($M = 1278.47$) and group 3 ($M = 1101.71$). The gender distribution across the clusters showed significant differences ($\chi^2 = 12.09$, $p < .01$). The percentage of boys was significantly higher (78.1 %, $r_z = 2.1$) than the percentage of girls in group 1 (21.9 %, $r_z = -2.1$). In group 2, the observed proportion of girls (58 %, $r_z = 1.4$) was slightly higher than expected. In group 3, there were no differences in gender distribution compared to the total sample ($r_z = -0.2$, female; $r_z = 0.2$, male). In addition, the distribution in each group was not associated with a high or low NMRI ($\chi^2 = 1.907$, $V = 0.38$, $p > .05$). Similarly, no significant differences were identified in terms of SRI (K-W = 2.24, $p > .05$, $\eta^2 = 0.014$).

Table 5 provides detailed information about cognitive functioning at the age of 8 years for each group. The results show that the distribution of FSIQ scores was significantly different among the groups (K-W = 7.15, $p < .05$), with a moderate effect size ($\eta^2 = 0.068$). The pairwise comparisons showed significant differences in FSIQ scores between group 3 and group 2 ($p < .05$). Similar results were found for the subscales of WMI, PSI, NVCI and CCI, with a moderate-large effect size ($\eta^2 > 0.06$).

The differences among the three groups were analysed for quality of life at 8 years of age, from the perception of the children and their parents (see Table 6). Significant differences were only found according to the perception of the parents in the dimension of school environment between groups 2 and 3 ($p < .05$), with a moderate effect size ($\eta^2 > 0.06$).

Fig. 3 presents the general pattern of results for cognitive functioning and quality of life of the children born preterm according to the resulting groups in terms of EI received. Greater dispersions were observed in quality of life perceived by the parents. In the FSIQ score graph, a tendency toward medium-low scores can be observed (FSIQ <90) for group 3.

3. Discussion

This research provides empirical evidence to the study of child development in scholar age after preterm birth. It contributes to understanding the intervention needs that children born preterm may require during childhood and the risk posed by the prematurity for the presence of diagnoses of chronic diseases and disorders and associated educational needs during school age. Whereas there is substantial knowledge on the development of children born preterm, few studies have cumulatively incorporated medical or socio-family risk factors and consider the important role of treatments (Twilhaar, De Kieviet, et al., 2018). Using retrospective information, the current study defined the EI profile of children born preterm in terms of referral, intervention areas, and type of discharge. Moreover, it examined the prevalence of EI and learning support beyond early childhood among children born preterm. Considering resources and diagnoses, three profiles were determined within the sample, in which quality of life and cognitive functioning were explored. All these results were analysed in relation to individual

Table 4
Correlations between neonatal characteristics, NMRI, SRI, cognitive development and quality of life.

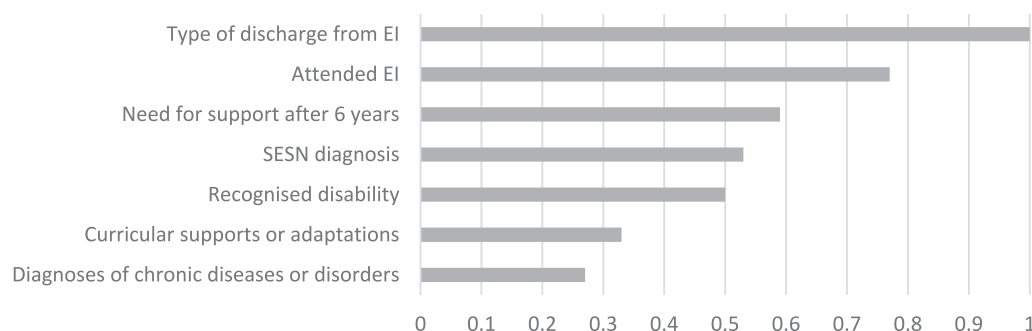|	1.	2.	3.	4.	5.	6.
1. GA						
2. Birth weight	0.648**					
3. NMRI	−0.177*	−0.095				
4. SRI	0.108	−0.049	−0.119			
5. FSIQ	0.122	0.223*	−0.045	−0.345**		
6. Total Kidscreen-10 score[a]	−0.004	−0.053	−0.053	−0.084	−0.025	
7. Total Kidscreen-27 score[b]	−0.034	0.004	0.214*	−0.165	0.055	0.042

GA: gestational age; NMRI: neonatal medical risk index; SRI: socio-family risk index; FSIQ: Full SIQ score.

[a] Self-reported

[b] Informed by the parents.

* = $p < .05$.

** = $p < .01$.

Fig. 2. Predictive importance for the two-step cluster about EI received.
Note: The graph represents the predictive importance of each variable in a range of 0 to 1.

Table 5
Comparison of WISC-V scores across the groups.

	Group 1 (n = 31) M (SD)	Group 2 (n = 81) M (SD)	Group 3 (n = 29) M (SD)	K-W	p	η^2
FSIQ	92.48 (11.09)	96.44 (14.67)	86.41 (13.55)	7.146	.028[2–3]	0.068
VCI	97.39 (9.06)	96.02 (14.75)	90.90 (18.12)	2.876	0.237	0.025
VSI	96.74 (10.63)	95.64 (13.56)	87.45 (19.75)	5.846	0.054	0.055
PRI	91.23 (11.68)	94.84 (12.60)	91.03 (13.71)	2.292	0.318	0.021
WMI	92.48 (11.08)	96.44 (14.67)	86.41 (13.55)	8.960	.011[2–3]	0.078
PSI	93.48 (13.16)	98.35 (11.33)	84.86 (18.49)	12.340	.002[2–3]	0.135
NVCI	91.97 (11.07)	95.93 (13.44)	86.07 (15.49)	8.154	.017[2–3]	0.079
GCI	94.16 (9.99)	94.95 (13.22)	89.52 (14.96)	3.576	0.167	0.027
CCI	91.65 (12.44)	96.67 (12.69)	83.10 (16.62)	14.838	<.001[2–3]	0.136

[2-3]Significant differences between group 2 and group 3 (p < .05).

Table 6
Comparison of the scores of quality of life among the groups.

	Group 1 (n = 31) M (SD)	Group 2 (n = 81) M (SD)	Group 3 (n = 29) M (SD)	K-W	p	η^2
Total Kidscreen-10 score[a]	52.25 (9.33)	55.77 (10.11)	55.89 (8.76)	1.416	0.493	0.023
Total Kidscreen27 score[b]	53.99 (7.54)	53.31 (7.12)	51.32 (7.57)	1.802	0.406	0.016
Physical wellbeing[b]	58.88 (10.52)	59.01 (10.91)	53.87 (11.93)	4.659	0.097	0.034
Psychological wellbeing[b]	35.12 (3.18)	34.18 (4.04)	34.75 (3.57)	1.865	0.394	0.011
Autonomy and interaction with the parents[b]	59.88 (14.58)	55.43 (12.40)	59.41 (14.15)	4.021	0.134	0.025
Social support and peers[b]	56.09 (9.37)	57.68 (9.34)	54.88 (11.06)	1.142	0.565	0.014
School environment[b]	59.99 (10.64)	60.24 (9.41)	53.70 (10.63)	7.716	.021[2–3]	0.064

[a] Scores of self-reported Kidscreen-10.
[b] Scores of Kidscreen-27 informed by the parents. K-W: Kruskal-Wallis test; η2: effect size measurement; *p*: Chi-squared significance.

variables, neonatal medical risks, and socio-family risks.

Regarding the first objective, this study confirms the higher prevalence of diagnoses of special educational needs (SEN), chronic diseases, and other disorders during school age in children born preterm compared to their prevalence in the general population. These findings are in line with previous research showing that, in general, children born preterm are more likely to exhibit low academic performance and learning difficulties, as well as special educational needs (McBryde et al., 2020; Twilhaar, De Kieviet, et al., 2018). Furthermore, the results of our study contribute to a better understanding of these needs by examining the role of other variables involved, which is discussed in this section.

Corroborating our first hypothesis, the results showed an over-representation of preterm children who received EI services during the first six years of life compared to the general population. It is worth pointing out that, in Spain, EI is aimed at 0–6 year-old children with or at risk of suffering from developmental disorders. The criteria to refer children born preterm to EI are not universal, although they have usually been established as a function of GA and birth weight. Some protocols establish the cut-off point at 32 weeks and a birth weight of <1500 g, and they include other medical risk criteria for referral, such as

central nervous system damage, prolonged mechanical ventilation, and congenital or nervous system infections (López et al., 2014). However, even in cases where the criteria are met, and despite the evidence of developmental risk that may derive from preterm birth (Arpi et al., 2019; Twilhaar, Wade, et al., 2018), 22.2 % of the participants did not receive EI.

The results of the present study partially support the second hypothesis, referred to the association of possible initial, medical or social vulnerabilities with a greater need for later support. Specifically, referral to EI was significantly more frequent for EPT and ELBW children compared to those born with greater GA and/or weight. It is known that lower GA and birth weight are associated with greater cognitive and motor affectation (Allotey et al., 2018; Arpi et al., 2019; Arpino et al., 2010; Lacalle et al., 2023), and their relationship with greater referral to EI could thus be hypothesised. However, no relationships were found between initial medical risk or socio-family risk and greater support needs during childhood, or with the presence of diagnoses at school age in this study. Although few studies have analysed the latter aspect, other research suggests that the potential influence of these variables on child outcomes may be mediated by other family-related factors. For example,
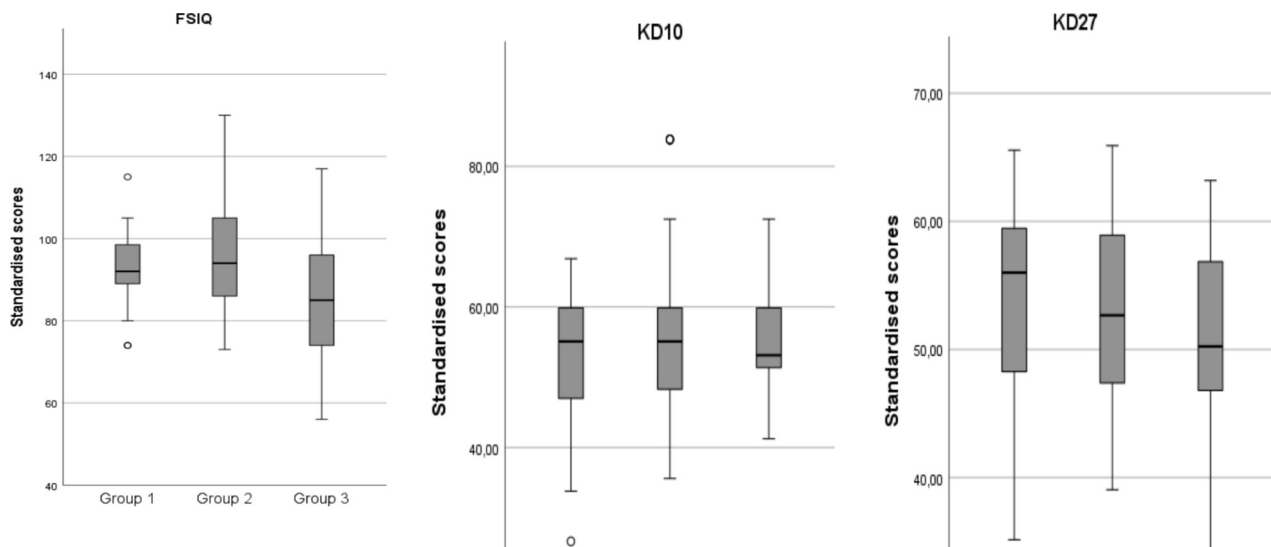
Fig. 3. Cognitive and quality of life results by group.
Note: Comparison of Full Scale IQ (FSIQ), scores of quality of life self-reported (KD-10) and informed by the parents (KD-27) by cluster. The data are presented as box-and-whisker plots of the means.

Martínez-Shaw et al. (2024) showed a direct and negative effect of socio-family risk on the quality of life of children born preterm, with this relationship being mediated by both maternal perceived stress and perceived social support during child-rearing. Regarding the socio-family risk index, negative correlations between SRI and FSIQ corroborate the dynamic interaction between environmental and biological factors throughout the developmental period of the child born preterm (Bilsteen et al., 2021; Doyle et al., 2015). Socio-family factors can mitigate premature risks, fostering improved cognitive performance as the child grows. The reason may be that children with a lower socio-family risk index are more likely to have access to resources that enhance early cognitive development, such as health care, nutrition and stimulating learning environments (Bilsteen et al., 2021; Joseph et al., 2022). These findings highlight the critical need for early interventions and supportive policies aimed at reducing disparities between families to optimise outcomes for preterm children.

In the same line, the prevalence of needs related to the educational scope was also greater than in the general population (18.8 % vs. 8.49 %). Consistent with previous studies, it was found that the EPT children had greater risk of presenting academic difficulties (Pascoe et al., 2021). Regarding the current health state, this work also confirmed a greater prevalence of chronic diseases and disorders among children born preterm compared to the general population (19.4 % vs. 11.7 %). Despite this greater prevalence, it is noteworthy that, in this study, over 80 % of the participants had no diagnosis by the age of 8. Recent studies have also shown similar results, such as the work of Hirschberger et al. (2018), where over 70 % of the children born preterm did not present diagnoses of neurodevelopmental difficulties at 10 years of age. No associations were found for lower GA, weight or greater initial medical complications with later diagnoses, except for greater rates of recognised disability for EPT. Although some authors claim that the neurodevelopment of children born preterm can be predicted from the first days of life or in the first years (Bogičević et al., 2019; Cainelli et al., 2021; Fogtmann et al., 2017), other studies show a decrease of deficits throughout the years (Linsell et al., 2018; Ment et al., 2003). In this sense, García-Martínez et al. (2018) conducted a longitudinal study in which they showed that even children born preterm with high perinatal risk normalised their development at school age.

Addressing the second hypothesis the results were not always conclusive. The data were analysed considering GA and birth weight both continuously and categorically, based on limitations found in

previous studies (Arpino et al., 2010). Although not all associations were significant, the children born with lower GA and lower weight had received longer EI and continued to require support at school age. These conditions have been previously identified by other authors as risk factors for the presence of special educational needs during school age (McBryde et al., 2020). Different studies have found a relationship for alterations at school age with different factors related to the perinatal medical conditions and socio-family characteristics of children born preterm (Doyle et al., 2015; Lacalle et al., 2023; Torres et al., 2016).

Due to the heterogeneity of the sample and the number of variables in this study, we performed a cluster analysis to seek different profiles. Its results identified three patterns. Considering the EI received, the participants were mainly characterised for not having received EI (group 1), having been discharged due to catch-up (group 2), and having been discharged for reaching the maximum age at which the EI service can be received (group 3). The analysis of the current state of the cases of each group showed that the first two groups mainly showed no diagnoses or educational needs during school age. The third group, which received the service until the maximum age, included those children who continued to require support at school age, and those who had been diagnosed with some chronic disease, disorder or disability. These results could be indicating that, rather than concluding at a specific and universal age for everyone (i.e., six years), EI services should be more flexible and allow children to receive it beyond this age if necessary. In any case, these results suggest that special attention should be paid to the transmission of information from EI professionals to the new EI professionals who will attend to each child, regarding their needs, progress and responses to the treatments. As was indicated by Valle-Trapero et al. (2012), one of the greatest problems found by this population is the lack of knowledge about prematurity among other health and education professionals.

With respect to the last hypothesis, which related the received intervention profile to cognitive functioning and quality of life in the medium-term, it was only partially accepted. The differences in FSIQ were greater and more significant between group 2, which attended EI and was discharged due to catch-up, and group 3, which was discharged for reaching the maximum age. The most extreme groups in terms of current IQ were in fact the two groups that received EI. The best mean IQ scores were shown by the group which, after a treatment period, was discharged due to catch-up, showing the potential benefits of EI. The initial characteristics of the third group, i.e., lower GA and birth weight,

may partly predict these worse results at school age, although they are probably not the only reasons. These findings lead to the proposition of different hypotheses, which will have to be explored in future studies, with respect to the suitability or intensity of the type of EI received by these children or the possible greater severity of the disorders of group 3. However, our data did not identify a greater initial medical risk in group 3.

It is difficult to introduce this result in the literature, since there are very few studies about the effect of EI on the development of children born preterm. Nevertheless, in line with Pérez-López et al. (2009), the results corroborate that the progress of the child may be modulated by the biological condition of prematurity and the risk level, although environmental variables such as upbringing and stimulation could be playing a decisive role in their evolution. The most relevant study in this respect is a meta-analysis of 25 studies on EI programmes for the prevention of motor and cognitive deterioration in children born preterm after hospital discharge (Spittle et al., 2015). This meta-analysis demonstrated that EI programmes had a varying effect on the cognitive results during the first stages of development up to the age of 5 years, but not in school age (5–18 years) or in adulthood (>18 years). Another recent systematic review identified 4 studies that evaluated the efficacy of EI in preterm infants, showing improvements in typical developmental behaviours, improvements in state regulation and social interaction (Gómez-Cotilla et al., 2024). In our study, the results obtained in group 2 raise the question of whether receiving early intervention could reduce the FSIQ mean differences of children born preterm compared to their peers born at term, which have been corroborated by numerous studies (Arpi et al., 2019; Brydges et al., 2018; Cheong et al., 2017; Doyle et al., 2015; Kerr-Wilson et al., 2012; Lacalle et al., 2023; Twilhaar, De Kieviet, et al., 2018).

With regard to quality of life, the results were less conclusive, as no significant associations were found among profiles. Exceptionally, it is worth pointing out a possible positive association of EI on quality of life related to school adjustment, in the case of group 2, who was discharged due to catch-up. These data of quality of life came from the evaluation of the parents and, in line with previous studies, the results show positive values in terms of quality of life in these children compared to the normative data (Martínez-Shaw et al., 2024). There are contrasting views in the existing literature regarding the relationship between disability and quality of life. While some studies have found association between the presence of mild or moderate disabilities or disorders and a lower perceived quality of life, particularly for EPT children (Gire, 2020), others suggest that neonatal morbidity of VLBW children was mostly unrelated to quality of life(Vederhus et al., 2010). However, in this study a weak positive correlation emerged between NMRI and quality of life (rated by parents). This finding is somewhat consistent with previous research, where parents tent to rate their children's health high despite initial medical difficulties (Jaworski et al., 2018; Jaworski et al., 2022). According to Jaworski et al. (2022), this might occur because parents focus on wellbeing instead of on disabilities when rating their child's health. In addition, it might reflect families' resilience (Scorgie & Sobsey, 2000). Nevertheless, the data do not support a strong relationship between the two variables.

3.1. Limitations, strengths and future research lines

This work has some limitations. Since it was not initially designed as a longitudinal study, the data about EI services received by the children born preterm were gathered retrospectively and, although it was attempted to collect them from different sources, they may include some errors. Secondly, the data about quality of life were gathered from parents, introducing a potential bias in this variable. Taking this into account, the results should be interpreted with caution. Thirdly, the sample was constituted by children born in the same hospital, that is, in the same geographic area, which could hinder the generalisation of the results. It would be interesting for future studies to include a more varied

sample. Furthermore, despite its advantages, the cluster analysis does not analyse the heterogeneity of each group, focusing more on generality than on details.

In addition to the above mentioned, this work may pave the road for future researches, which could include early or school intervention among the possible variables that mediate or moderate preterm child development in the long term, as was recommended by Rees et al. (2022) in their recent meta-analysis on brain damage and neurodevelopment. As was mentioned above, our findings highlight the importance of early intervention for child development. In this sense, it would be interesting to expand the intervention to subclinical populations (such as children in group 1), as their development might also improve. Moreover, this study highlights the need of part of the analysed sample for a beyond-early-childhood intervention, i.e., beyond the age of 6 years, which was observed in 2 out of 10 children born preterm, considering also the ratios of diagnoses and disabilities.

It would also be interesting to explore the characteristics of the families in each identified group. Authors such as Yu et al. (2017) suggest that the participation and commitment of the parents in EI is key to improve the neurodevelopment of the child. In this sense, other studies highlight the importance of early interventions focused on the family about education, child stimulation and care for cognitive development (Ferreira et al., 2020; Vanderveen et al., 2009). Other authors underline that early interventions for children born preterm must include psychosocial support for the families (Benzies et al., 2013). As was stated by Jiménez-Luque et al. (2023), interventions for the reduction of parental stress (Martínez-Shaw & Sánchez-Sandoval, 2022) and the improvement of parents' emotional state (Bellido-González et al., 2024; Padilla-Muñoz et al., 2024), as well as positive parenthood programmes (Estévez et al., 2022; Prime et al., 2023), are adequate for the prevention and better adaptation of children born preterm. All these studies highlight the importance of supporting and including families in interventions, pointing to an area to be incorporated into future EI programmes.

To conclude, this study shows that the medium-term development, wellbeing and mental health of children born preterm is undoubtedly multifactorial. One of the strengths of this study is that it considered not only biological and environmental neonatal aspects, but also other environmental factors such as the intervention resources that children born preterm and their families usually receive during childhood due to their at-risk status. This aspect is often omitted in other cross-sectional studies on child neurodevelopment during school age, and it is rarely considered in longitudinal studies (Lacalle et al., 2023).

CRediT authorship contribution statement

Laura Lacalle: Writing – review & editing, Writing – original draft, Methodology, Data curation, Conceptualization. **Sandra Melero:** Writing – review & editing, Formal analysis. **Yolanda Sánchez-Sandoval:** Writing – review & editing, Writing – original draft, Resources, Project administration, Methodology, Investigation, Funding acquisition, Conceptualization.

Funding statement

Declaration of competing interest

The authors have no conflict of interest to declare.

Data availability

The data that support the findings of this study are available on request from the corresponding author.

References

Allotey, J., Zamora, J., Cheong-See, F., Kalidindi, M., Arroyo-Manzano, D., Asztalos, E., … Thangaratinam, S. (2018). Cognitive, motor, behavioural and academic performances of children born preterm: A meta-analysis and systematic review involving 64 061 children. *BJOG : An International Journal of Obstetrics and Gynaecology, 125*(1), 16–25. https://doi.org/10.1111/1471-0528.14832

Arpi, E., D'Amico, R., Lucaccioni, L., Bedetti, L., Berardi, A., & Ferrari, F. (2019). Worse global intellectual and worse neuropsychological functioning in preterm-born children at preschool age: A meta-analysis. *Acta Paediatrica, International Journal of Paediatrics, 108*(9), 1567–1579. https://doi.org/10.1111/apa.14836

Arpino, C., Compagnone, E., Montanaro, M. L., Cacciatore, D., De Luca, A., Cerulli, A., … Curatolo, P. (2010). Preterm birth and neurodevelopmental outcome: A review. *Child's Nervous System, 26*(9), 1139–1149. https://doi.org/10.1007/s00381-010-1125-y

Bellido-González, M., Padilla-Muñoz, E. M., Castelar-Ríos, M. J., Díaz-López, M. A., Lozano, J. M., & Lanzarote-Fernández, M. D. (2024). Impact of an mHealth intervention on parents' emotional health and on the neurodevelopment of high-risk infants. *Journal of Health Psychology, 13591053241287035.* https://doi.org/10.1177/13591053241287035

Benzies, K. M., Magill-Evans, J. E., Hayden, K. A., & Ballantyne, M. (2013). Key components of early intervention programs for preterm infants and their parents: A systematic review and meta-analysis. *BMC Pregnancy and Childbirth, 13*(1), 1–15. https://doi.org/10.1186/1471-2393-13-S1-S10

Bilsteen, J. F., Ekstrøm, C. T., Børch, K., & Nybo Andersen, A. M. (2021). The role of parental education on the relationship between gestational age and school outcomes. *Paediatric and Perinatal Epidemiology, 35*(6), 726–735. https://doi.org/10.1111/ppe.12766

Bogičević, L., Verhoeven, M., & Van Baar, A. L. (2019). Toddler skills predict moderate-to-late preterm born children's cognition and behaviour at 6 years of age. *PLoS One, 14*(11), 1–14. https://doi.org/10.1371/journal.pone.0223690

Bronfenbrenner, U. (1974). Is early intervention effective? *Teachers College Record, 76*(2), 1–19.

Brydges, C. R., Landes, J. K., Reid, C. L., Campbell, C., French, N., & Anderson, M. (2018). Cognitive outcomes in children and adolescents born very preterm: A meta-analysis. *Developmental Medicine and Child Neurology, 60*(5), 452–468. https://doi.org/10.1111/dmcn.13685

Buttelmann, F., & Karbach, J. (2017). Development and plasticity of cognitive flexibility in early and middle childhood. *Frontiers in Psychology, 8*, 1040. https://doi.org/10.3389/fpsyg.2017.01040

Cainelli, E., Vedovelli, L., Wigley, I. L. C. M., Bisiacchi, P. S., & Suppiej, A. (2021). Neonatal spectral EEG is prognostic of cognitive abilities at school age in premature infants without overt brain damage. *European Journal of Pediatrics, 180*(3), 909–918. https://doi.org/10.1007/s00431-020-03818-x

Cheong, J. L. Y., Anderson, P. J., Burnett, A. C., Roberts, G., Davis, N., Hickey, L., … Doyle, L. W. (2017). Changing neurodevelopment at 8 years in children born extremely preterm since the 1990s. *Pediatrics, 139*(6). https://doi.org/10.1542/peds.2016-4086

Chung, E. H., Chou, J., & Brown, K. A. (2020). Neurodevelopmental outcomes of preterm infants: A recent literature review. *Translational Pediatrics, 9*(1), S3–S8. https://doi.org/10.21037/tp.2019.09.10

Doyle, L. W., Cheong, J. L. Y., Burnett, A., Roberts, G., Lee, K. J., & Anderson, P. J. (2015). Biological and social influences on outcomes of extreme-preterm/low-birth weight adolescents. *Pediatrics, 136*(6), e1513–e1520. https://doi.org/10.1542/peds.2015-2006

Estévez, R., Román, M., Moreno, C., & Palacios, J. (2022). Programa andaluz para la promoción de la parentalidad positiva en nacimientos prematuros. *Apuntes de Psicología, 107-112.* https://doi.org/10.55414/ap.v34i2-3.601

Fenollar-Cortés, J., & Watkins, M. W. (2019). Construct validity of the Spanish version of the Wechsler intelligence scale for children fifth edition (WISC-V). *International Journal of School & Educational Psychology, 7*(3), 150–164. https://doi.org/10.1080/21683603.2017.1414006

Ferreira, R. D. C., Alves, C. R. L., Guimarães, M. A. P., Menezes, K. K. P. D., & Magalhães, L. D. C. (2020). Effects of early interventions focused on the family in the development of children born preterm and/or at social risk: A meta-analysis. *Jornal de Pediatria, 96*(1), 20–38. https://doi.org/10.1016/j.jped.2019.05.002

Fogtmann, E. P., Plomgaard, A. M., Greisen, G., & Gluud, C. (2017). Prognostic accuracy of electroencephalograms in preterm infants: A systematic review. *Pediatrics, 139*(2). https://doi.org/10.1542/peds.2016-1951

Fornell, R., Ortiz-Bermúdez, A.Ú., Rodríguez-Mora, Á., Verdugo, L., & Sánchez-Sandoval, Y. (2023). Future expectations of adolescents from different social backgrounds. *Anales de Psicología, 39*(2), 294–303. https://doi.org/10.6018/analesps.522701

García-Martínez, M. P., Pérez-López, J., Sánchez-Caravaca, J., & Montealegre-Ramón, M. P. (2018). Prematuridad y capacidad intelectual: Un estudio longitudinal hasta los 11 años en una población española. *European Journal of Health Research, 4*(1), 53–66. https://doi.org/10.30552/ejhr.v4i1.90

Gire, C., Tosello, B., Marret, S., Cambonie, G., Souksi-Medioni, I., Müller, J., Garcia, P., Berbis, J., Auquier, P., Brévaut-Malaty, V., Resseguier, N., & the GPQoL Study Group.

(2020). Specific cognitive correlates of the quality of life of extremely preterm school-aged children without major neurodevelopmental disability. *Pediatric Research, 88*, 642–652. https://doi.org/10.1038/s41390-020-0795-8

Gómez-Cotilla, R., López-de-Uralde-Selva, M. D. L. Á., & Valero-Aguayo, L. (2024). Efficacy of early intervention Programmes: Systematic review and meta-analysis. *Psicología Educativa, 30*(1), 1–10. https://doi.org/10.5093/psed2024a1

Gómez-Domínguez, D. (2020). *Necesidades Específicas de Apoyo Educativo [specific educational support needs]* (17; Cifras y Datos, pp. 0-39). Junta de Andalucía. Ministry of Equality, social policies, and work-life balance. https://www.observatoriodelainfancia.es/oia/esp/documentos_ficha.aspx?id=7336.

Gómez-Vela, M., Verdugo, M.-Á., & González-Gil, F. (2007). Quality of life and self-concept in adolescents with and without special educational needs. *Journal for the Study of Education and Development Infancia y Aprendizaje, 30*(4), 523–536.

Hirschberger, R. G., Kuban, K. C. K., O'Shea, T. M., Joseph, R. M., Heeren, T., Douglass, L. M., … the ELGAN Study Investigators. (2018). Co-occurrence and severity of neurodevelopmental burden (cognitive impairment, cerebral palsy, autism Spectrum disorder, and epilepsy) at age ten years in children born extremely preterm. *Pediatric Neurology, 79*, 45–52. https://doi.org/10.1016/j.pediatrneurol.2017.11.002

Jaworski, M., Janvier, A., Bourque, C. J., Mai-Vo, T.-A., Pearce, R., Synnes, A. R., & Luu, T. M. (2022). Parental perspective on important health outcomes of extremely preterm infants. *Archives of Disease in Childhood - Fetal and Neonatal Edition, 107*(5), 495–500. https://doi.org/10.1136/archdischild-2021-322711

Jaworski, M., Janvier, A., Lefebvre, F., & Luu, T. M. (2018). Parental perspectives regarding outcomes of very preterm infants: Toward a balanced approach. *The Journal of Pediatrics, 200*, 58–63. https://doi.org/10.1016/j.jpeds.2018.03.006

Jiménez-Luque, N., Benavente-Fernández, I., Ruiz-González, E., Lubián-González, S., & Sánchez-Sandoval, Y. (2023). Parental competences in fathers and mothers of very-low-birth-weight preterm infants. *Family Relations, 1-22.* https://doi.org/10.1111/fare.12907

Joseph, R. M., Hooper, S. R., Heeren, T., Santos, H. P., Frazier, J. A., Venuti, L., … Kring, B. (2022). Maternal social risk, gestational age at delivery, and cognitive outcomes among adolescents born extremely preterm. *Paediatric and Perinatal Epidemiology, 36*(5), 654–664. https://doi.org/10.1111/ppe.12893

Kerr-Wilson, C. O., MacKay, D. F., Smith, G. C. S., & Pell, J. P. (2012). Meta-analysis of the association between preterm delivery and intelligence. *Journal of Public Health (United Kingdom), 34*(2), 209–216. https://doi.org/10.1093/pubmed/fdr024

Lacalle, L., Martínez-Shaw, M. L., Marín, Y., & Sánchez-Sandoval, Y. (2023). Intelligence quotient (IQ) in school-aged children born preterm: A systematic review. *Frontiers in Psychology, 14*, 1216825. https://doi.org/10.3389/fpsyg.2023.1216825

Leijon, I., Ingemansson, F., Nelson, N., Samuelsson, S., & Wadsby, M. (2018). Children with a very low birthweight showed poorer reading skills at eight years of age but caught up in most areas by the age of 10. *Acta Paediatrica, 107*(11), 1937–1945. https://doi.org/10.1111/apa.14377

Linsell, L., Johnson, S., Wolke, D., O'Reilly, H., Morris, J. K., Kurinczuk, J. J., & Marlow, N. (2018). Cognitive trajectories from infancy to early adulthood following birth before 26 weeks of gestation: A prospective, population-based cohort study. *Archives of Disease in Childhood, 103*(4), 363–370. https://doi.org/10.1136/archdischild-2017-313414

López, P., Cabrizo, R., & Peña, J. L. (2014). Atención Temprana. *Recursos. Criterios de derivación. Formación Activa en Pediatría de Atención Primaria, 7*(3), 133–138. https://fapap.es/articulo/304/atencion-temprana-recursos-criterios-dederivacion.

Martínez-Shaw, M. L., Evensen, K. A. I., Melero, R., & Sánchez-Sandoval, Y. (2024). Health-related quality of life in children born preterm at school age: The mediating role of social support and maternal stress. *Frontiers in Psychology, 15*, Article 1463804. https://doi.org/10.3389/fpsyg.2024.1463804

Martínez-Shaw, M. L., & Sánchez-Sandoval, Y. (2022). Effective stress intervention programs for parents of children born preterm: A systematic review. *Stress and Health, July..* https://doi.org/10.1002/smi.3194

Martini, J. A., Padovani, F. H. P., & Perosa, G. B. (2016). Quality of life of preterm children: Risk and protective factors. *Paidéia (Ribeirão Preto), 26*(65), 325–332. https://doi.org/10.1590/1982-43272665201610

McBryde, M., Fitzallen, G. C., Liley, H. G., Taylor, H. G., & Bora, S. (2020). Academic outcomes of school-aged children born preterm: A systematic review and meta-analysis. *JAMA Network Open, 3*(4), Article e202027. https://doi.org/10.1001/jamanetworkopen.2020.2027

Ment, L. R., Vohr, B., Allan, W., Katz, K. H., Schneider, K. C., Westerveld, M., … Makuch, R. W. (2003). Change in cognitive function over time in very low-birth-weight infants. *JAMA, 289*(6), 705–711. https://doi.org/10.1001/jama.289.6.705

Orton, J., Spittle, A., Doyle, L., Anderson, P., & Boyd, R. (2009). Do early intervention programmes improve cognitive and motor outcomes for preterm infants after discharge? A systematic review. *Developmental Medicine and Child Neurology, 51*(11), 851–859. https://doi.org/10.1111/j.1469-8749.2009.03414.x

Padilla-Muñoz, E. M., Barbancho-Morant, M. M., Lanzarote-Fernández, M. D., Sanduvete-Chaves, S., & Chacón-Moscoso, S. (2024). Psycho-emotional intervention with parents of very preterm babies during the first year: A single-arm pilot study. *Family Process, famp.13002.* https://doi.org/10.1111/famp.13002

Pascoe, L., Burnett, A. C., & Anderson, P. J. (2021). Cognitive and academic outcomes of children born extremely preterm. *Seminars in Perinatology, 45*(8). https://doi.org/10.1016/j.semperi.2021.151480

Pennell, C., Whittingham, K., Boyd, R., Sanders, M., & Colditz, P. (2012). Prematurity and parental self-efficacy: The Preterm Parenting & Self-Efficacy Checklist. *Infant Behavior and Development, 35*(4), 678–688. https://doi.org/10.1016/j.infbeh.2012.07.009

Pérez-López, J., García-Martínez, M. P., & Sánchez-Caravaca, J. (2009). Riesgo perinatal y desarrollo psicológico en un grupo de niños prematuros. *International Journal of Developmental and Educational Psychology, 1*(1), 657–666.

Poehlmann-Tynan, J., Gerstein, E. D., Burnson, C., Weymouth, L., Bolt, D. M., Maleck, S., & Schwichtenberg, A. J. (2014). Risk and resilience in preterm children at age 6. *Development and Psychopathology, 760*, 843–858. https://doi.org/10.1017/S095457941400087X

Prime, H., Andrews, K., Markwell, A., Gonzalez, A., Janus, M., Tricco, A. C., … Atkinson, L. (2023). Positive parenting and early childhood cognition: A systematic review and meta-analysis of randomized controlled trials. *Clinical Child and Family Psychology Review, 26*(2), 362–400. https://doi.org/10.1007/s10567-022-00423-2

Ravens-Sieberer, U., Erhart, M., Rajmil, L., Herdman, M., Auquier, P., Bruil, J., … Kilroe, J. (2010). Reliability, construct and criterion validity of the KIDSCREEN-10 score: A short measure for children and adolescents' well-being and health-related quality of life. *Quality of Life Research, 19*(10), 1487–1500. https://doi.org/10.1007/s11136-010-9706-5

Ream, M. A., & Lehwald, L. (2018). Neurologic consequences of preterm birth. *Current Neurology and Neuroscience Reports, 18*(8), 48. https://doi.org/10.1007/s11910-018-0862-2

Rees, P., Callan, C., Chadda, K. R., Vaal, M., Diviney, J., Sabti, S., … Sutcliffe, A. (2022). Preterm brain injury and neurodevelopmental outcomes: A meta-analysis. *Pediatrics, 150*(6), Article e2022057442. https://doi.org/10.1542/peds.2022-057442

Rogers, E. E., & Hintz, S. R. (2016). Early neurodevelopmental outcomes of extremely preterm infants. *Seminars in Perinatology, 40*(8), 497–509. https://doi.org/10.1053/j.semperi.2016.09.002

Ruiz-Benítez, B. (2022). *Estado de salud y hábitos de vida. Informe OIA-A 2022 [State of health and lifestyle. OIA-A Report 2022]*. Junta de Andalucía, Ministry of Social Inclusion, youth, families, and equality. Andalusian Observatory of Childhood and Adolescence. https://www.observatoriodelainfancia.es/oia/esp/documentos_ficha.aspx?id=8108.

Sánchez-Sandoval, Y., & Verdugo, L. (2021). School adjustment and socio-family risk as predictors of adolescents' peer preference. *Frontiers in Psychology, 12*, Article 645712. https://doi.org/10.3389/fpsyg.2021.645712

Scorgie, K., & Sobsey, D. (2000). Transformational outcomes associated with parenting children who have disabilities. *Mental Retardation, 38*(3), 195–206. https://doi.org/10.1352/0047-6765(2000)038<0195:TOAWPC>2.0.CO;2

Spanish Federation of Associations of Early Intervention Professionals, GAT. (2005). *Libro Blanco de la Atención Temprana* (Royal Board on Disability).

Spanish Institute of Statistics, INE. (2020). Encuesta de discapacidad, autonomía personal y situaciones de dependencia, EDAD 2020 [Survey on Disability, Personal Autonomy, and Dependent Situations]. Retrieved from https://www.ine.es.

Spanish Ministry of Education and Vocational Training. (n.d.). *Students enrolled: Repetition rates and statistics. EDUCAbase*. Statistics on Education Retrieved November 28, 2024, from Statistics on Education. Retrieved November 28, 2024, from https://estadisticas.educacion.gob.es/EducaDynPx/educabase/index.htm?type=pcaxis&path=/no-universitaria/alumnado/matriculado/series/gen-repetidores&file=pcaxis&l=s0.

Spittle, A., Orton, J., Anderson, P. J., Boyd, R., & Doyle, L. W. (2015). Early developmental intervention programmes provided post hospital discharge to prevent motor and cognitive impairment in preterm infants. *Cochrane Database of Systematic Reviews, 2015*(11). https://doi.org/10.1002/14651858.CD005495.pub4

The KIDSCREEN Group. (2004). The KIDSCREEN questionnaires. *Quality of life questionnaires for children and adolescents*. https://www.kidscreen.org/english/questionnaires/.

Torres, C., Salvador, J., Flores, J., & Ricardo, J. (2016). Inteligencia general en niños nacidos prematuramente. *Cuadernos de Neuropsicología, 10*(2), 142–164.

Treyvaud, K., Doyle, L. W., Lee, K. J., Roberts, G., Lim, J., Inder, T. E., & Anderson, P. J. (2012). Social-emotional difficulties in very preterm and term 2 year olds predict specific social-emotional problems at the age of 5 years. *Journal of Pediatric Psychology, 37*(7), 779–785. https://doi.org/10.1093/jpepsy/jss042

Twilhaar, E. S., De Kieviet, J. F., Aarnoudse-Moens, C. S. H., Van Elburg, R. M., & Oosterlaan, J. (2018). Academic performance of children born preterm: A meta-analysis and meta-regression. *Archives of Disease in Childhood. Fetal and Neonatal Edition, 103*(4), 322–330. https://doi.org/10.1136/archdischild-2017-312916

Twilhaar, E. S., Wade, R. M., De Kieviet, J. F., Van Goudoever, J. B., Van Elburg, R. M., & Oosterlaan, J. (2018). Cognitive outcomes of children born extremely or very preterm since the 1990s and associated risk factors: A meta-analysis and meta-regression. *JAMA Pediatrics, 172*(4), 361–367. https://doi.org/10.1001/jamapediatrics.2017.5323

Valle-Trapero, M., Mateos, R., & Gutiez, P. (2012). Niños de alto riesgo al nacimiento: Aspectos de prevención. Atención temprana neonatal y programas de seguimiento en niños prematuros. *Revista de Psicología Educativa, 18*(2), 135–143. https://doi.org/10.5093/ed2012a14

Vanderveen, J. A., Bassler, D., Robertson, C. M. T., & Kirpalani, H. (2009). Early interventions involving parents to improve neurodevelopmental outcomes of premature infants: A meta-analysis. *Journal of Perinatology, 29*(5), 343–351. https://doi.org/10.1038/jp.2008.229

Vederhus, B. J., Markestad, T., Eide, G. E., Graue, M., & Halvorsen, T. (2010). *Health related quality of life after extremely preterm birth: A matched controlled cohort study., 8* (53).

Verdugo, L., & Sánchez-Sandoval, Y. (2022). Psychological and social adjustment as antecedents of high school students' future expectations. *Journal of Psychologists and Counsellors in Schools, 32*(1), 39–53. https://doi.org/10.1017/jgc.2020.1

Vollmer, B., & Stålnacke, J. (2019). Young adult motor, sensory, and cognitive outcomes and longitudinal development after very and extremely preterm birth. *Neuropediatrics, 50*(04), 219–227. https://doi.org/10.1055/s-0039-1688955

Wechsler, D. (2015). *Escala de inteligencia de Wechsler para niños-V*. Pearson Educación.

World Health Organization [WHO]. (2018). Nacimientos prematuros. https://www.who.int/es/news-room/fact-sheets/detail/preterm-birth.

Yaari, M., Treyvaud, K., Lee, K. J., Doyle, L. W., & Anderson, P. J. (2019). Preterm birth and maternal mental health: Longitudinal trajectories and predictors. *Journal of Pediatric Psychology, 44*(6), 736–747. https://doi.org/10.1093/jpepsy/jsz019

Yu, Y.-T., Hsieh, W.-S., Hsu, C.-H., Lin, Y.-J., Lin, C.-H., Hsieh, S., … Jeng, S.-F. (2017). Family-centered care improved neonatal medical and neurobehavioral outcomes in preterm infants: Randomized controlled trial. *Physical Therapy, 97*(12), 1158–1168. https://doi.org/10.1093/ptj/pzx089