ANDES PEDIATRICA
REVISTA CHILENA DE PEDIATRÍA
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Andes pediatr. 2023;94(3):286-296
DOI: 10.32641/andespediatr.v94i3.4468

ORIGINAL ARTICLE

Sociodemographic, biological, and developmental characteristics of preschool children born full-term and preterm

Desarrollo, antecedentes biológicos y características sociodemográficas en preescolares con y sin antecedentes de prematuridad

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Received: July 13, 2022; Approved: November 27, 2022

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

In Chile, as in the rest of the world, preterm birth is considered a public health problem associated with high rates of neonatal mortality and morbidity, and long-term developmental consequences.

What does this study contribute to what is already known?

A description of the main sociodemographic, biological, and psychomotor developmental characteristics of Chilean preschoolers with and without a history of prematurity.

Abstract

In Chile, preterm birth is the main cause of infant mortality and morbidity. However, there is little information on the particular characteristics of preterm-born preschool children. **Objective:** To describe the sociodemographic, biological, and developmental characteristics of Chilean preschool children born full-term and preterm. **Subjects and Method:** A secondary analysis of the databases of the 2010 Longitudinal Survey of Early Childhood (ELPI) was conducted. Children between 2 and 4 years of age with information on gestational age at birth were selected. Late-term infants were excluded. The sample included 8,571 children, of whom 9.78% were preterm newborns. Variables related to sociodemographic characteristics, biological risk factors, and psychomotor development were considered. A descriptive and association analysis (Chi-square) was performed to establish whether the differences between the compared groups were significant. **Results:** No differences were observed regarding the proportion of sex, geographic area of residence, and health prognosis. Most premature infants reside in urban areas and they have higher biological risk factors. In addition, they have lower average scores than those born at term in all development areas. **Conclusions:** The information presented raises the need to analyze the interaction of prematurity with social risk in the development of preterm infants of different gestational ages.

Keywords:
Chilean Children;
Preterm Newborn;
ELPI;
Sociodemographic Characteristics;
Biological Background;
Developmental Outcomes

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Edited by:
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How to cite this article: Andes pediatr. 2023;94(3):286-296. DOI: 10.32641/andespediatr.v94i3.4468

Introduction

According to the World Health Organization, preterm birth is a pregnancy that ends before 37 weeks of gestation. It is associated with high rates of neonatal mortality and morbidity, as well as long-term consequences that may extend into adulthood. Thus, it is considered a public health problem[1-4].

Worldwide, the prevalence of preterm birth accounts for approximately 10%[5]. In Chile, in 2021, 9.49% of deliveries were preterm and 1.4% corresponded to children born at less than 32 weeks of gestational age (GA)[6]. Although the prevalence of preterm birth in Chile is lower than that reported worldwide and there are national public policies focused on its prevention, it continues to be the main cause of neonatal and infant mortality[7]. On the other hand, survival of preterm newborns (PNBs) has improved in recent decades due to advances in mechanical ventilation, use of prenatal corticosteroids, use of exogenous surfactants, and improvements in neonatal care, such as the incorporation of standards that promote comprehensive care for newborns[7,8]. However, as in the rest of the world, prematurity is associated with high morbidity related to pathologies secondary to it[9].

Some common complications in the PNBs include respiratory distress syndrome, sepsis, intraventricular hemorrhage, necrotizing enterocolitis, hypoglycemia, hyperbilirubinemia, and feeding difficulties. In the medium term, there is a risk of presenting developmental deficits and cerebral palsy[2-4,10]. Compared with those born at term, preterm newborns are at greater risk of presenting lower cognitive performance, learning difficulties, and internalizing and externalizing problems[11,12]. Internalizing problems refer to emotional and behavioral difficulties directed toward the subject, which include anxiety and depression, among others; whereas in the case of externalizing problems, difficulties are directed toward others and include disruptive, defiant, or aggressive behaviors[13].

The likelihood of health and developmental problems increases with decreasing GA at birth[1-3]. This is particularly relevant given that the development of technologies favors the viability of high-risk pregnancies and the survival of PNBs from 22 to 24 weeks of GA[14,15]. It should be noted that, in Chile, fetuses under 22 weeks are considered spontaneous abortions and that survival begins at 23 weeks of gestation[7,16]. Although each additional week of gestation increases the probability of survival of the PNBs, the risk of developing any of the mentioned pathologies remains high[17].

For more than 20 years, Chile has had a National Preterm Pregnancy Follow-up Program[18], which focuses on preterm newborns under 32 weeks and/or birth weight ≤ 1,500 grams. Similarly, since 2003, the National Complementary Feeding Program (PNAC) for preterm newborns ensures the delivery of special feeding formulas to all preterm newborns up to one year of corrected age[19]. In addition, clinical guidelines have been developed for some health conditions affecting this population that are included in the Explicit Healthcare Guarantees (GES), such as bronchopulmonary dysplasia, retinopathy of prematurity, and sensorineural hearing loss[20-22]. Considering the above, it is evident that, at the national level, premature birth has become a public health problem and there have been efforts to implement and offer services to reduce the prevalence and negative consequences of this condition.

The current National Health Strategy aims to *reduce the prevalence of children who do not reach their full development according to their potential*[23]. Considering that prematurity is a risk factor that can affect the developmental trajectory of these newborns, it is important to know the characteristics of these children in order to identify which of them could benefit from interventions to promote better development.

Nationally, there are some studies focused on the development of premature newborns[24,25], which have demonstrated the relevance of paying attention to moderate/late preterm newborns (≥ 32 and < 37 weeks of GA, respectively) who are currently left out of the follow-up program. However, there are no studies with national representative samples that would allow us to better approach the local reality to generate information for public policies related to these children.

The Early Childhood Longitudinal Survey (ELPI) is a study conducted in Chile to characterize and analyze the development of children in a nationally representative sample. Several research studies on child development have been developed based on this survey[26-29]but, so far, none has focused on preterm children. The objective of this study was to describe the sociodemographic, biological, and developmental characteristics of Chilean preschool children with and without a history of prematurity.

Subjects and Method

Secondary analysis of the Early Childhood Longitudinal Survey (ELPI) was conducted. This survey analyzes the development of successive cohorts of the Chilean child population born since 2006, considering characteristics of the household and the newborn's close environment[30]. The ELPI design is a complex sample, stratified by clusters in two stages, corresponding to the selection of communes of similar socioeconomic level (SES) as first-stage units and random selection of children as a second-stage variable. To date, the

ELPI survey has information that has been collected in 2010, 2012, and 2017. The databases used in this study correspond to the measurement conducted in 2010.

The study population (2010 cohort) included 15,175 children aged 0 to 4 years born between January 1, 2006, and August 31, 2009[30]. Information from the 2010 ELPI survey is available in 4 databases. For this research, 3 databases containing the information (interview, household, and evaluations) were selected. In addition, according to the objectives of this study, a subsample of children aged between 2 and 4 years was selected. This age range was chosen because the calculation of the age of the participants at the time of the assessment did not consider the adjustment for preterm birth, which implies that the developmental assessments of children younger than 24 months were probably not performed considering the corrected age (adjusted age that corresponds to the age that the preterm child would have had if born at term)[30]. The American Academy of Pediatrics recommends using the corrected age up to 24 months for those born at < 32 weeks of GA, and at a minimum for the first 12 months[31,32]. Therefore, when selecting children from 2 years of age onwards, not using the age adjusted for prematurity does not bias the results of the research conducted.

Infants born post-term (GA ≥ 42 weeks, n = 365) and those with no recorded GA (n = 320) were excluded from the analysis. Thus, the total sample analyzed consisted of 8,571 children, of whom 90.22% (n = 7,733) were full-term and 9.78% (n = 838) were preterm. Of the total sample, 8.51% were moderate-late preterm (MLP), while 1.27% were considered very preterm (VP), i.e., born at less than 32 weeks of GA.

Variables related to sociodemographic characteristics, biological risk factors, and psychomotor development were analyzed. Regarding the sociodemographic variables, we analyzed the healthcare system, area of residence, type of area (urban/rural), per capita household income, main caregiver education, material goods, and type of housing.

Regarding biological risk factors, we analyzed the health history of the mother during pregnancy (presence of biological pathologies and mental health disorders); type of delivery, birth weight, and GA at birth, as well as the BMI profile (nutritional status) of the preschool children.

Information on sociodemographic characteristics and biological risk factors contained in the ELPI databases were obtained by applying a questionnaire addressed to the mother or primary caregiver.

Psychomotor development considers the evaluation with the Psychomotor Development Test (TEPSI), which is currently used for developmental assessment in well-child check-ups performed in primary care at age 3[33,34]. The scores obtained can be qualified as normal (score ≥ 40), risk (30-39), and delay (≤ 29). The test evaluates general development and the language, coordination, and motor domains.

Statistical processing included an exploratory analysis of the databases and selection of variables of interest. Subsequently, statistical analysis was performed according to the objectives of the study, comparing the frequency of variables between term and preterm births with the chi-square test. The R® software was used.

The ELPI survey was approved by the Ethics Committee of the US National Institutes of Health, where it was presented given its relationship with the University of Pennsylvania for the use of the data[29]. At the national level, the ELPI survey was reviewed by the Ethics Committee of the Institute of Nutrition and Food Technology (INTA) of the University of Chile. The ELPI documentation and databases are public and accessible through the website of the Ministry of Social Development. The databases do not contain personal information of the participants[35].

Results

The mean age of the children included in this study was 38.02 months (SD = 8.53, range 24 - 58) and 50.66% were male; the mean GA at birth was 38.48 weeks (n = 8571, median = 39, SD = 1.96), the mean birth weight was 3.389 kilograms (range 2-5, SD = 0.5), and most children lived in the Metropolitan Region and the central area of the country (58.67%) in urban areas (89.87%). Regarding health care, most of the children (87%) were users of the public healthcare system (FONASA) and were born in public hospitals (74.45%) (tables 1 and 2).

When comparing preterm newborns with term newborns, there were significant differences in terms of GA, weight, and mean length at birth (table 1). In the case of preterm newborns, the mean GA at birth was 34.11 weeks (median = 35; SD = 2.56), and, in the case of term newborns, it was 38.96 weeks (median = 39; SD = 1.12). When analyzing the subgroups of preterm newborns, the VP had a mean GA of 28.72 weeks (SD = 2.02), while the MLP had a mean GA of 34.91 (SD = 1.4) (tables 1 and 2). No differences were found in the nutritional status evaluated at preschool age.

Among the groups compared, there was a significant relationship between prematurity and the number of days in an incubator (37.2 in PNBs v/s 4.1 in term newborns); [X^2 (1, N = 8547) = 1222.2; p = < 0.001]. Regarding urban/rural residence, although in both groups most children live in urban areas, there was a

higher percentage of preterm newborns living in these areas (92.24%) compared with those born at term (89.62%); [X^2 (1, N = 8571) = 5.4499; p = < 0.01957]. Tables 2 and 3 describe the preterm subgroups.

Regarding the type of delivery, vaginal delivery predominated in the general population and in those born at term (52.65% and 54.2%, respectively). The prevalence of multiple pregnancies (2 or more fetuses) had a low frequency in the general population and in those born at term (1.93% and 0.93%, respectively). However, in the preterm group, there was a significantly higher frequency of cesarean deliveries (58.83%, p < 0.001) and multiple pregnancies (11.27%) (table 3).

42.54% of the mothers presented some prenatal pathology, with urinary tract infections as the most frequent (11.95%). The prevalence of prenatal pathologies was significantly higher in mothers of preterm newborns (60.02%) compared with those who had children born at term (40.63%); [X^2 (1, N = 8569) = 57,556; p = < 0.001]. Since there was a decreasing trend, it is possible to say that the mothers of VP had a higher prevalence of these pathologies than those of MLP and term newborns (table 3).

The prevalence of mental health disorders during pregnancy was 13.73%, where depression was the most prevalent disorder (10.14%). The prevalence of diagnoses of mental health disorders was higher in mothers of preterm newborns (18.38%) compared with those who had full-term newborns (13.23%); [X^2 (1, N = 8571) = 16,483; p = <0.001].

Most of the population studied (95.01%) was breastfed, however, the PNBs had a lower prevalence of breastfeeding than those born at term (86.28% v/s 95.95%, respectively); [X^2 (1, N = 8571) = 148.54; p = < 0.001]. Since there was an increasing trend, it is possible to say that the mothers of VP newborns had a lower prevalence of breastfeeding than those of MLP newborns and term newborns (table 3).

In this population, the mean per capita income (PCI) was CLP 87,625 (SD = $128,748). No significant differences were observed between the preterm and term group ($t_{(918.31)}$ = 0.91, p = 0.3639). Regarding the educational level of the main caregivers, in the general population (76.18%) and in the groups compared, there was a predominance of an educational level not exceeding high school (preterm 71.48%; term 75.86%). However, there are significant differences between the groups compared, where the caregivers of preterm newborns reported a lower proportion of complete high school and the maximum educational level achieved was also lower than in caregivers of infants born at term; [X^2 (1, N = 8571) = 148.54; p = < 0.001] (tables 1 and 2).

With respect to the material goods available in the households, out of a total of 11 elements evaluated, the average number of available elements was 5.3 (SD = 2.78, median = 5, range 0-11). Consequently, the cut-off point defined was score 5, from which the population would be considered low risk. Considering this criterion, 41.15% (n = 3527) of Chilean newborns live in households with 4 or less of the goods considered (low material goods). Regarding the type of hous-

Table 1. Descriptive characteristics and pscyhomotor development in children with and without a history of preterm birth

Variables	General Population			Preterm	VP	MP	Term	p
	n	X (DE)	Range	X (DE)	X (DE)	X (DE)	X (DE)	
Gestational age	8571	38.5 (2)	24 - 41	34.1 (2.6)	28.7 (2)	34.9(1.4)	39 (1.1)	< 0.001
Weight at birth	7857	3.389 (0.5)	2 - 5	2.856 (0.52)	-	-	3.42 (0.47)	< 0.001
Lenght at birth	7797	49.8 (2.1)	44 - 55	47.8 (2.2)	-	-	49.9 (2.0)	0.0014
Age in months	8571	38.1 (8.6)	24-58	37.7 (8.5)	38.6 (8.)	37.6 (8.6)	38.1 (8.6)	0.182
Per cápita income	8571	87625 (128748)	0 - 4912500	92934 (183207)	110693 (408185)	90279. (117553)	87050 (121392)	0.364
Global development	8490	54.2 (12.3)	19 - 80	52.6 (13.0)	50.1 (13.4)	53. (13)	54.4 (12.3)	< 0.001
Language development	8521	51.6 (11.8)	18 - 82	50.1 (12.4)	48.6 (12.4)	50.3 (12.39)	51.8 (11.7)	< 0.001
Motor development	8490	55.0 (11.4)	17 - 83	54.0 (11.7)	51.9 (12.1)	54.3 (11.6)	55.1 (11.4)	0.008
Coordination	8490	54.5 (13.2)	17 - 83	52.7 (14.0)	49.9 (14.3)	53.2 (13.1)	54.7 (13.1)	< 0.001

Preterm: infants born < de 37 weeks of gestational age. VP: less than 32 gestation weeks. MP 32-36 gestation weeks. Age in months: age at developmental assessment. p values compare the preterm and term groups with t-test for independent simples. The weight and lenght at birth was is not described in preterm subgroups because there are more than 9% of missing data and in the VP group data are inconsistent.

ing, 6.64% live in housing considered precarious. Regarding these variables, PNBs had a significantly lower frequency of low goods available than those born at term.

In general development, the average score of the population studied was 54.24 (n = 8490, median = 55, SD = 12.34, range = 19-80), which is normal for the age of assessment. Preterm newborns had a significantly lower mean score (52.58) than those born at term (54.41), ($t_{(977.68)}$ = -3.8406, p = 0.0001306). For preterm newborns, 5.01% presented delay and 10.15% were at risk for delay, while for term newborns (n = 7672), only 3.05% presented delay and 8.39% were at risk for delay in general development [X^2 (2, N = 8490) = 12.594; p = 0.001842]. When studying the different specific developmental domains, it was observed that all of them show lower scores in the preterm group, especially in VP. When analyzing the developmental domains considering the categories of the instrument, it was observed that the percentage of children rated with normal development decreases as the degree of prematurity increases. In the motor do-

Table 2. Frequencies of sociodemographic variables of Chilean preschool children with and without a history of preterm birth

	General Population	Preterm	VP	MP	Term	
	% (n)	% (n)	% (n)	% (n)	% (n)	p -
Area						
Northe	13.6 (1162)	13.7 (115)	13.8 (15)	13.7 (100)	13.3 (1047)	0.991
Center	20.1 (1725)	20.3 (170)	22.9 (25)	19.9 (145)	20.1 (1555)	
South	27.8 (2381)	27.8 (233)	21.1 (23)	28.8 (210)	27.8 (2148)	
MR	38.5 (3303)	38.2 (320)	42.2 (46)	37.6 (274)	38.6 (2983)	
NA	0					
Area						
Rural	10.1 (868)	7.8 (65)	11.0 (12)	7.3 (53)	10.4 (803)	0.02
Urban	89.9 (7703)	92.2 (773)	89. (97)	92.7 (676)	89.6 (6930)	
NA	0					
Health insurance						
Public	87.0 (7456)	84.8 (711)	89 (97)	84.2 (614)	87.2 (6745)	0.136
Private / Army	10.8 (928)	12.4 (104)	9.2 (10)	12.9 (94)	10.7 (824)	
Oher / None	2.2 (187)	2.7 (23)	1.8 (2)	2.9 (21)	2.2 (164)	
NA	0					
Place of birth						
Public Hospital	74.4 (6356)	77.2 (643)	86.2 (94)	72.6 (549)	74.2 (5713)	0.065
Private Clinic or FFAA	25.1 (2141)	22.1 (184)	11.9 (13)	23.5 (171)	25.4 (1957)	0.004*
Other	0.5 (40)	0.07 (6)	1.8 (2)	0.6 (4)	0.4 (34)	
NA	0.4 (34)	0.6 (5)	0	0.7 (5)	0.4 (29)	
Main caregiver highest education level attained						
High School or less	76.2 (6465)	72.4 (599)	75.2 (82)	70.9 (517)	76.6 (5866)	0.009
Tertiary education	23.8 (2021)	27.6 (228)	24.8 (27)	27.6 (201)	23.4 (1793)	
NA	1. (85)	1.3 (11)	0	1.5 (11)	1.0 (74)	
Material resources						
Low resources	41.2 (3527)	35.2 (295)	37.6 (41)	34.8 (254)	41.8 (3232)	< 0.001
Medium or high resources	58.9 (5044)	64.8 (543)	62.4 (68)	65.2 (475)	58.2 (4501)	
NA	0					
Home						
Precarious	6.6 (569)	6.56 (55)	5.5 (6)	6.72 (49)	6.7 (514)	0.980
House/Appartment	93.4 (7996)	93.44 (783)	94.5 (103)	93.28 (680)	93.4 (7213)	
NA	0.1 (6)	0			0.1 (6)	

MR: Metropolitan Region; Preterm: infants born < de 37 weeks of gestational age. VP: less than 32 gestation weeks. MP 32-36 gestation weeks.NA= non aplicable due to missing data. p values compare preterm with term infants with X2 test. P* compares place of birth between subgroups of preterm infants.

Table 3. Frequencies of biological variables in Chilean preschool children with and without a history of preterm birth

	General Population % (n)	Preterm % (n)	VP % (n)	MP % (n)	Term % (n)	p
Sex						
Femenin	49.34 (4229)	48.33 (405)	45.87 (50)	48.7 (355)	49.45 (3824)	0.562
Masculin	50.66 (4342)	51. 67 (433)	54.13 (59)	51.30 (374)	45.61 (3909)	
NA	0					
Delivery						
Normal	52.74 (4513)	38.47 (322)	35.78 (39)	38.82 (283)	54.29 (4191)	< 0.001
Cesarean	44.75 (3829)	58.90 (493)	62.39 (68)	58.3 (425)	43.21 (3336)	
Assisted	2.51 (215)	2.63 (22)	0.92 (1)	2.88 (21)	2.5 (193)	
NA	0.16 (14)	0.12 (1)	0.92 (1)		0.17 (13)	
Multiple pregnancy						
Yes	1.94 (166)	11.22 (94)	10.09 (11)	11.39 (83)	0.93 (72)	< 0.001
No	98.06 (8405)	88.78 (744)	89.91 (98)	88.61 (646)	99.07 (7661)	
NA	0					
Breastfeeding						
Yes	95.03 (8143)	86.28 (723)	64.22 (70)	89.57 (653)	95.98 (7420)	< 0.001
No	4.97 (426)	13.72 (115)	35.78 (39)	10.43 (76)	4.02 (311)	
NA	0.02 (2)	0			0.03 (2)	
Incubator stay						
Yes	7.31 (625)	37.23(312)	80.73 (88)	30.73 (224)	4.06 (313)	< 0.001
No	92.69 (7922)	62.77 (526)	19.27 (21)	69.27 (505)	95.94 (7396)	
NA	0.28 (24)	0			0.31 (24)	
Prenatal maternal pathologies						
No	57.46 (4925)	39.98 (335)	31.19 (34)	41.29 (301)	59.36 (4590)	< 0.001
Si	42.54 (3646)	60.02 (503)	68.81 (75)	58.71 (428)	40.64 (3143)	
NA	0					
Prenatal maternal mental health problems						
No	86.27 (7393)	81.62 (684)	86.24 (94)	80.93 (590)	86.77 (6710)	< 0.001
Si	13.73 (1177)	18.38 (154)	13.76 (15)	19.07 (139)	13.23 (1023)	
NA	0					

Note: Preterm: infants born < de 37 weeks of gestational age. VP: less than 32 gestation weeks. MP 32-36 gestation weeks.NA= non aplicable due to missing data. p values compare preterm with term infants with X2 test.

main, there was a difference between preterm and term newborns only when comparing subgroups of preterm and term newborns (tables 1 and 4). Given that the screening instruments are not applied to children with diagnosed developmental disorders, such as cerebral palsy, which are more frequent in preterm children[33,34], the preterm children group has a greater amount of missing data in developmental measurements.

Discussion

When analyzing the *general characteristics of the population*, no significant differences were observed between the general population and the groups regarding the proportion of the sex of the newborns, geographic area of residence, and healthcare system. Most of the children resided in the Metropolitan Region and the central areas of the country and were users of the public healthcare system, however, there are some relevant differences.

The higher frequency of preterm newborns residing in urban areas could be partly explained by the fact that high-risk pregnancies and subsequent follow-up care in extremely preterm newborns occur at the secondary level of healthcare, which is located in urban areas[36]. In addition, preterm newborns require more healthcare throughout childhood than term newborns[1]. It is reasonable to think that families prefer to move (if necessary) and/or maintain their residence in

Table 4. Frequencies of nutritional state and psychomotor development in Chilean preschool children with and without a history of preterm birth

	General Population % (n)	Preterm % (n)	VP % (n)	MP % (n)	Term % (n)	p
BMI						
Low weight	1.01 (77)	1.61 (12)	2.08 (2)	1.54 (10)	0.94 (65)	0.204
Normal	78.68 (6008)	78.79 (587)	84.38 (81)	77.97 (506)	78.67 (5421)	
Overweight	20.31 (1551)	19.6 (146)	13.54 (13)	20.49 (133)	20.39 (1405)	
NA	10.91 (935)	11.01 (93)	11.93 (13)	10.93 (80)	10.89 (843)	
Global development						
Normal	88.2 (7488)	84.8 (694)	78.1 (82)	85.8 (612)	88.6 (6794)	0.009
At rish	8.6 (727)	10.2 (83)	17.1 (18)	9.1 (65)	8.4 (644)	
Delay	3.2 (275)	5.0 (41)	4.8 (5)	5.1 (36)	3.1 (234)	
NA	1. (81)	2.4 (20)	4 (4)	2.2 (16)	0.8 (61)	
Lenguage						
Normal	83.51 (7116)	79.52 (656)	73.58 (78)	80.39 (578)	83.94 (6460)	< 0.001
At risk	13.52 (1152)	15.64 (129)	19.81 (21)	15.02 (108)	13.29 (1023)	
Delay	2.97 (253)	4.85 (40)	6.6 (7)	4.59 (33)	2.77 (213)	
NA	0.58 (50)	1.55 (13)	2.75 (3)	1.37 (10)	0.48 (37)	
Motor						
Normal	91.27 (7749)	89.98 (736)	85.71 (90)	90.60 (643)	91.41 (7013)	0.062
At risk	7.13 (605)	7.46 (61)	9.52 (10)	7.15 (51)	7.09 (544)	0.038*
Delay	1.60 (136)	2.57 (21)	4.76 (5)	2.24 (16)	1.5 (115)	
NA	0.95 (81)	2.39(20)	4 (3.67)	2.19 (16)	0.79 (61)	
Coordination						
Normal	85.22 (7235)	80.07 (655)	70.48 (74)	81.49 (581)	85.77 (6580)	< 0.001
At risk	12.34 (1048)	16.14 (132)	23.81 (25)	15.01 (107)	11.9 (916)	
Delay	2.44 (207)	3.79 (31)	5.71 (6)	3.51 (25)	2.3 (176)	
NA	0.95 (81)	2.39(20)	4 (4)	2.19 (16)	0.8 (61)	

Note: Preterm: infants born < de 37 weeks of gestational age. VP: less than 32 gestation weeks. MP 32-36 gestation weeks. NA= non aplicable due to missing data. p values compare preterm with term infants with X2 test. In motor development p* indicates comparison between subgroups.

urban areas that have better access to healthcare centers where preterm newborns attend check-ups, hospitals, and rehabilitation centers given the organization of healthcare networks of our country according to the WHO suggestions[37]. However, when observing the analysis of subgroups of preterm newborns, we see that the percentage of rurality is higher in VP than in MLP, which does not support this initial suggestion and raises the need to investigate this variable, which could be associated with less possibility of prenatal care.

With respect to the *biomedical characteristics*, expected differences were found between the compared groups in the risk factors associated with preterm delivery, such as the presence of a multiple pregnancy and prenatal pathologies of the mother[38]. There were also observed factors less typically described, such as those related to the mental health of the pregnant woman, where a significant association was found between the presence of these disorders and prematurity. This underlines the importance of screening and treating this type of difficulties in the psychosocial risk evaluations of pregnant women. In Chile, screening for depression is currently performed only in pregnant women seen in primary healthcare centers, but not in the private health system.

In terms of sociodemographic characteristics, differences were observed when analyzing the subgroups of preterm newborns regarding material goods. There is a higher frequency of low educational level and low goods available in the VP compared with the MLP. These variables are considered in the psychosocial risk assessment in prenatal check-ups[39] and have been described as risk factors for preterm delivery.

The importance of considering the socioeconomic context in children with a history of prematurity has been previously analyzed. For example, in one study,

at 8 years of age, only 57% of the VP from families with the lowest SES attended regular educational establishments in the grade corresponding to their age compared with 90% of the VP from families with the highest SES[40]. In addition, prematurity has been identified as a risk factor for family functioning, as it causes a high degree of parental stress[41]. Therefore, studying how sociodemographic factors affect premature children is necessary to identify how we can support families at higher risk to promote contexts that are favorable for the development of those infants born prematurely.

Regarding the results in the developmental domain, as described in the literature, lower performance was observed in preterm children. Differences were significant in scores in all developmental areas. In addition, a higher prevalence of developmental deficits was observed in general development, language, and coordination domains. No statistically significant differences were observed in the prevalence of motor developmental deficits when comparing the preterm group in general with those born at term; but when analyzing the subgroups of preterm and term newborns, the VP group was, as expected, the most affected.

It should be remembered that the monitoring of the psychomotor development of preterm newborns is not homogeneous between the different health teams. Although the technical standard for monitoring infant development and the prevention of delaying is covered by the National Child Health Program, it is insufficient for preterm newborns[33]. For example, the well-child check-ups do not consider the application of developmental screening instruments after the age of 3, despite that long-term developmental surveillance is recommended for preterm newborns[40-42]. In addition, although screening instruments, such as TEPSI, are cost and time effective, they are less useful in high-risk populations[43]. Among the most commonly used instruments in preterm newborns, especially in European countries, is the Bayley test, considered a gold standard for the assessment of early infant development[44,45], which has been used in Chile[24]. Another instrument recommended to assess motor development in preterm newborns is the Movement Assessment Battery for Children (MABC-2)[46,47]. Possibly the greater differences in motor development between the compared groups would have been detected if other specific assessment instruments for this domain had been used. However, these recommended instruments are scarcely used in our country. Instead, the Psychomotor Development Evaluation Scale (EEDP), which is part of the national technical standard, is usually used despite criticism of its outdatedness[48]. In this context, the ASQ-3 could be recommended. This screening instrument has been successfully used in our population and has been validated for 8 and 18 months of age, just like the EEDP, but with better psychometric properties.

It Is important to remember that the developmental trajectory of children is influenced by different factors that include biomedical variables such as those described above, as well as psychosocial aspects such as the socioeconomic level of the family, the educational level of the caregivers, and the mental health of the mother, among others[49]. This indicates that the risk related to prematurity is heterogeneous and is determined by multiple factors. In a specific analysis of the interaction between these two variables (prematurity and social risk), the developmental outcome could be more impaired in children at double risk.

In Chile, there are few studies focused on child development in preterm newborns. The existing studies have mainly focused on moderate/late preterm and/or early preterm newborns, up to 24 months of age[24,25,50]. Therefore, although this study has some limitations of the research based on analysis of secondary databases, it has the advantage of containing information collected from a nationally representative random sample[51]. This study contributes to a better understanding of some characteristics of the country's newborns, where most of them are users of the public healthcare system. In addition, most newborns are born in public hospitals, which is especially frequent in VP. Also, although breastfeeding has a high frequency in the general population, it is lower in preterm newborns, especially in the VP group, where most infants require incubators in the neonatal stage, which interferes with the establishment of breastfeeding.

This study provides evidence on the prevalence of developmental deficits in the general population and, specifically, demonstrates that even preterm newborns without diagnosed developmental disorders require close monitoring of their psychomotor development, at least until school age. This is because the screening test used showed that both MLPs and especially VP, even at preschool age, have a higher prevalence of developmental deficits than infants born at term. Finally, the presented results highlight the need to continue studying the characteristics of preterm newborns and to evaluate the interaction between development and social factors in this group, considering preterm children of different GA in order to promote their positive development.

Ethical Responsibilities

Human Beings and animals protection: Disclosure the authors state that the procedures were followed according to the Declaration of Helsinki and the World

Medical Association regarding human experimentation developed for the medical community.

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

Rights to privacy and informed consent: This study was approved by the respective Research Ethics Committee. The authors state that the information has been obtained anonymously from previous data.

Conflicts of Interest

Authors declare no conflict of interest regarding the present study.

Financial Disclosure

The main author is the beneficiary of a grant from the National Agency for Research and Development (ANID)/Scholarship Program/DOCTORATE SCHOLARSHIPS CHILE / 2020 - 21200571.

References

1. Blencowe H, Cousens S, Chou D, et al. Born Too Soon: The global epidemiology of 15 million preterm births. Reprod Health. 2013;10(1):S2. doi:10.1186/1742-4755-10-S1-S2
2. Johnson S, Marlow N. Early and long-term outcome of infants born extremely preterm. Arch Dis Child. 2017;102(1):97-102. doi:10.1136/archdischild-2015-309581
3. Pinto F, Fernandes E, Virella D, et al. Born Preterm: A Public Health Issue. PJP. 2019;37(1):38-49. doi:10.1159/000497249
4. Raju TNK, Pemberton VL, Saigal S, et al. Long-Term Healthcare Outcomes of Preterm Birth: An Executive Summary of a Conference Sponsored by the National Institutes of Health. J Pediatr. 2017;181:309-18.e1. doi:10.1016/j.jpeds.2016.10.015
5. Beck S, Wojdyla D, Say L, et al. The worldwide incidence of preterm birth: a systematic review of maternal mortality and morbidity. Bull World Health Organ. 2010;88(1):31-8. doi:10.2471/BLT.08.062554
6. Departamento de Estadísticas e Información en Salud. MINSAL. Estadísticas de Nacimiento - SAS® Visual Analytics. Estadísticas de Nacimiento. Accessed June 4, 2022. https://informesdeis.minsal.cl/SASVisualAnalytics/?reportUri=%2Freports%2Freports%2Fa39b6235-6172-4b09-a8b1-ab5f87c72ea0&sectionIndex=1&sso_guest=true&sas-welcome=false
7. Ministerio de Salud. Guía Clínica. Prevención Parto Prematuro. Published online 2010.
8. Ministerio de Salud. Norma General N° 0194 para la atención integral del recién nacido en la unidad de Puerperio. Published online 2017.
9. Ministerio de Salud. Análisis Epidemiológico de los Recién Nacidos Menores de 32 Semanas en la Red Pública de Salud de Chile. Quinquenio 2000-2004. Informe técnico. 2006. Published online 2006.
10. Platt MJ. Outcomes in preterm infants. Public Health. 2014;128(5):399-403. doi:10.1016/j.puhe.2014.03.010
11. Maxwell JR, Yellowhair TR, Oppong AY, et al. Cognitive development in preterm infants: multifaceted deficits reflect vulnerability of rigorous neurodevelopmental pathways. Minerva Pediatr. 2017;69(4):298-313. doi:10.23736/S0026-4946.17.04905-2
12. Hack M, Youngstrom EA, Cartar L, et al. Behavioral outcomes and evidence of psychopathology among very low birth weight infants at age 20 years. Pediatrics. 2004;114(4):932-40. doi:10.1542/peds.2003-1017-L
13. Forns M, Abad J, Kirchner T. Internalizing and Externalizing Problems. In: Levesque, R.J.R. (Eds) Encyclopedia of Adolescence. Springer, New York, NY 2011. Https://Doi.Org/10.1007/978-1-4419-1695-2_261.
14. Myrhaug HT, Brurberg KG, Hov L, et al. Survival and Impairment of Extremely Premature Infants: A Meta-analysis. Pediatrics. 2019;143(2). doi:10.1542/peds.2018-0933
15. Frey HA, Klebanoff MA. The epidemiology, etiology, and costs of preterm birth. Sem Fetal Neon Med. 2016;21(2):68-73. doi:10.1016/j.siny.2015.12.011
16. Ministerio de Salud. Orientaciones Técnicas. Para la atención integral de mujeres que presentan un aborto y otras pérdidas reproductivas. Published online 2011.
17. Manuck TA, Rice MM, Bailit JL, et al. Preterm neonatal morbidity and mortality by gestational age: a contemporary cohort. American Journal of Obstetrics and Gynecology. 2016;215(1):103.e1-103.e14. doi:10.1016/j.ajog.2016.01.004
18. Morgues M, Henríquez MT, Tohá D, et al. Sobrevida del niño menor de 1500 g en Chile. Rev Chil Obst Ginecol. 2002;67(2):100-5. doi:10.4067/S0717-75262002000200003
19. Ministerio de Salud. Departamento de Alimentos y Nutrición., de la División de Políticas Públicas Saludables y Promoción. Norma Técnica de los Programas Alimentarios. Published online 2016. https://www.minsal.cl/wp-content/uploads/2015/09/2016.04.20-Norma-T%C3%A9cnica-Prog.-Alimentarios-aprobada-por-Jur%C3%ADdica.pdf
20. Ministerio de Salud. Guía Clínica DISPLASIA BRONCOPULMONAR DEL PREMATURO. Published online 2009. http://www.bibliotecaminsal.cl/wp/wp-content/uploads/2016/04/Displasia-Broncopulmonar-del-Prematuro.pdf
21. Ministerio de Salud. Guía Clínica RETINOPATÍA DEL PREMATURO. Published online 2010. https://www.minsal.cl/portal/url/item/721fc45c973b9016e04001011f0113bf.pdf
22. Ministerio de Salud. Guía Clínica Hipoacusia Neurosensorial Bilateral del Prematuro Santiago. Published online 2010. https://www.minsal.cl/portal/url/item/721fc45c97379016e04001011f0113bf.pdf
23. Ministerio de Salud. Estrategia Nacional de Salud para los Objetivos Sanitarios al 2030. Published online 2022. https://www.minsal.cl/wp-content/uploads/2022/03/Estrategia-Nacional-de-Salud-2022-MINSAL-V8.pdf
24. Schonhaut L, Armijo I, Pérez M. Gestational Age and Developmental Risk in Moderately and Late Preterm and Early Term Infants. Pediatrics. 2015;135(4):e835-e841. doi:10.1542/peds.2014-1957
25. Schonhaut L, Pérez M, Muñoz S. Asociación entre morbilidad neonatal, edad gestacional y déficit de desarrollo psicomotor en prematuros moderados y tardíos. Rev Chil Pediat. 2015;86(6):415-25. doi:10.1016/j.rchipe.2015.08.001
26. Coddington CH, Mistry RS, Bailey AL. Socioeconomic status and receptive vocabulary development: Replication

of the parental investment model with Chilean preschoolers and their families. Early Child Res Quart. 2014;29(4):538-49. doi: 10.1016/j.ecresq.2014.06.004
27. Narea M, Toppelberg CO, Irarrázaval M, et al. Maternal and non-maternal care in infancy and later child cognitive, language and motor development in Chile: Does type of care matter? Early Child Res Quart. 2020;51:204-14. doi:10.1016/j.ecresq.2019.10.010
28. Ugarte E, Narea M, Aldoney D, et al. Family Risk and Externalizing Problems in Chilean Children: Mediation by Harsh Parenting and Emotional Support. Child Develop. n/a(n/a). doi:10.1111/cdev.13464
29. Ulloa Vidal N, Cova Solar F, Bustos NC. Nivel Socioeconómico y conductas externalizadas en preescolares: el rol del mediador parental. Rev Chil Pediat 2017;88(3):340-7. doi:10.4067/S0370-41062017000300005
30. Ministerio de Desarrollo Social. Manual de Usuario de Bases de Datos. Encuesta Longitudinal de Primera Infancia (III Ronda). Published online 2018. http://observatorio.ministeriodesarrollosocial.gob.cl/storage/docs/elpi/2017/Manual_de_usuario_2017_ELPI.pdf
31. D'Agostino JA. An Evidentiary Review Regarding the Use of Chronological and Adjusted Age in the Assessment of Preterm Infants. J Special Pediatr Nurs. 2010;15(1):26-32. doi:https://doi.org/10.1111/j.1744-6155.2009.00215.x
32. Ministerio de Salud. Norma Técnica para la supervisión de niños y niñas de 0 a 9 años en la Atención Primaria de Salud. Published online 2014. https://www.minsal.cl/sites/default/files/files/2014_Norma%20T%C3%A9cnica%20para%20la%20supervisi%C3%B3n%20de%20ni%C3%B1os%20y%20ni%C3%B1as%20de%200%20a%209%20en%20APS_web2.pdf
33. Ministerio de Salud. Programa Nacional de Salud de la Infancia con Enfoque Integral. Published online 2013. https://diprece.minsal.cl/wrdprss_minsal/wp-content/uploads/2015/10/2013_Programa-Nacional-de-Salud-de-la-infancia-con-enfoque-integral.pdf
34. Ministerio de Salud. Programa de Salud del Niño. Normas Técnicas de Estimulación y Evaluación del Desarrollo Psicomotor del Niño y la Niña Menor de 6 años. Published online 2004. https://diprece.minsal.cl/wrdprss_minsal/wp-content/uploads/2015/10/2004_Normas_tecnicas_estimulacion_y_evaluacion_desarrollo.pdf
35. Ministerio de Desarrollo Social. Gobierno de Chile. Estándares metodológicos en la aplicación de instrumentos de autoreporte en población infantil Principios guía, aspectos éticos y protocolos Encuesta Longitudinal de Primera Infancia (III Ronda). Published online August 2018. http://observatorio.ministeriodesarrollosocial.gob.cl/elpi
36. ¿Qué es un embarazo de alto riesgo? | Chile Crece Contigo. Accessed June 1, 2022. https://www.crececontigo.gob.cl/faqs/que-es-un-embarazo-de-alto-riesgo/
37. Ministerio de Salud. Subsecretaria de Redes Asistenciales. Informe de Implementación de Estrategia de Redes Integradas de Servicios de Salud (RISS) en el Sistema Pública de Salud. Período 2014 - 2017. Published online 2018. https://www.minsal.cl/wp-content/uploads/2018/03/Informe-de-implementaci%C3%B3n-estrategia-RISS.pdf
38. Institute of Medicine (US) Committee on Understanding Premature Birth and Assuring Healthy Outcomes. Preterm Birth: Causes, Consequences, and Prevention. (Behrman RE, Butler AS, eds.). National Academies Press (US); 2007. Accessed June 5, 2022. http://www.ncbi.nlm.nih.gov/books/NBK11362/
39. Shaw SH, Herbers JE, Cutuli JJ. Medical and Psychosocial Risk Profiles for Low Birthweight and Preterm Birth. Women's Health Issues. 2019;29(5):400-6. doi:10.1016/j.whi.2019.06.005
40. Larroque B, Ancel PY, Marchand-Martin L, et al. Special Care and School Difficulties in 8-Year-Old Very Preterm Children: The Epipage Cohort Study. PLOS ONE. 2011;6(7):e21361. doi:10.1371/journal.pone.0021361
41. Escartí A, Boronat N, Llopis R, et al. Estudio piloto sobre el estrés y la resiliencia familiar en recién nacidos prematuros. Anales de Pediatría. 2016;84(1):3-9. doi:10.1016/j.anpedi.2015.03.001
42. Aylward GP. Neurodevelopmental Outcomes of Infants Born Prematurely. J Develop Behav Pediatr. 2014;35(6):394-407. doi:10.1097/01.DBP.0000452240.39511.d4
43. Johnson S, Marlow N. Developmental screen or developmental testing? Early Hum Develop. 2006;82(3):173-83. doi:10.1016/j.earlhumdev.2006.01.008
44. Lennon EM, Gardner JM, Karmel BZ, Flory MJ. Bayley Scales of Infant Development. In: Haith MM, Benson JB, eds. Encyclopedia of Infant and Early Childhood Development. Academic Press 2008;145-56. doi:10.1016/B978-012370877-9.00018-9
45. Stein MT, Lukasik MK. Chapter 79 - developmental screening and assessment: infants, toddlers, and preschoolers. In: Carey WB, Crocker AC, Coleman WL, Elias ER, Feldman HM, eds. Developmental-Behavioral Pediatrics (Fourth Edition). W.B. Saunders 2009;785-96. doi:10.1016/B978-1-4160-3370-7.00079-1
46. Bolk J, Farooqi A, Hafström M, et al. Developmental Coordination Disorder and Its Association With Developmental Comorbidities at 6.5 Years in Apparently Healthy Children Born Extremely Preterm. JAMA Pediatr. 2018;172(8):765-74. doi:10.1001/jamapediatrics.2018.1394
47. Barra, Lisseth. Desafío diagnóstico e importancia del abordaje clínico del trastorno del desarrollo de la coordinación. Arch Argent Pediatr. 2019;117(3):199-204.
48. Schonhaut BL, Armijo RI, Millán KT, et al. Comparación de la Evaluación Tradicional del Desarrollo Psicomotor versus una Prueba Autoadministrada. Rev Chil Pediat. 2010;81(6):498-505. doi:10.4067/S0370-41062010000600003
49. Wade M, Madigan S, Plamondon A, et al. Cumulative psychosocial risk, parental socialization, and child cognitive functioning: A longitudinal cascade model. Develop Psychol. 2018;54(6):1038-50. doi:10.1037/dev0000493
50. Alegría OA, Pittaluga PE, Mena NP, et al. Evolución neurosensorial en recién nacidos de muy bajo peso de nacimiento a los 2 años de edad corregida. Rev Chil Pediat 2002;73(4):348-56. doi:10.4067/S0370-41062002000400003
51. Donnellan MB, Lucas RE. Secondary Data Analysis. The Oxford Handbook of Quantitative Methods in Psychology;2. doi:10.1093/oxfordhb/9780199934898.013.0028.