ISSN online 1688-4221

Ciencias Psicológicas January-June 2025; 19(1), e-3974
DOI: 10.22235/cp.v19i1.3974

Risk and protective factors for the development of children aged 0 to 6 years in Brazil: A systematic review

Fatores de risco e proteção ao desenvolvimento de crianças de 0 a 6 anos no Brasil: uma revisão sistemática

Factores de riesgo y protección para el desarrollo de niños de 0 a 6 años en Brasil: una revisión sistemática

Thaís da Glória Messias[1]
Katiane Janke Krainski[1]
Leonan Ferrari Felipin[1]
Tatiana Izabele Jaworski de Sá Riechi[1]

[1] Universidade Federal do Paraná

Received: 03/23/2024
Accepted: 04/26/2025

Correspondence:
Thaís da Glória Messias
thaismessiasg@gmail.com

How to cite:
Messias, T. da G., Krainski, K. J., Felipin, L. F., & Riechi, T. I. J. de S. (2025). Risk and protective factors for the development of children aged 0 to 6 years in Brazil: A systematic review. *Ciencias Psicológicas*, *19*(1), e-3974. https://doi.org/10.22235/cp.v19i1.3974

Abstract: This study aimed to examine the biopsychosocial factors that impact the child development in Brazil through a systematic review. The methodology adopted the PRISMA protocol and used a detailed search strategy in major databases. It selected empirical articles published between 2012 and 2024 that included samples of Brazilian children from 0 to 6 years old, describing risk and protective variables using standardized instruments for development assessment. The analysis resulted in the selection of 43 empirical studies, identifying 66 risk and protective factors, of which 78.78 % were classified as risks. The main risk factors identified were socioeconomic vulnerability, preterm birth and male sex. The findings suggest that variables such as maternal education and socioeconomic level are significantly associated with child development, serving as risk or protective factors depending on the context. The analysis underscores the need for early, multidisciplinary interventions to strengthen protective factors and reduce risks. It also suggests expanding research on protective factors. The results highlight the importance of biopsychosocial factors in child development, emphasizing the need for integrated policies in health, education, and social assistance to enhance human development from childhood and reduce inequalities.

Keywords: child development; neuropsychology; adverse childhood experiences

Resumo: Este estudo objetivou examinar os fatores biopsicossociais que impactam o desenvolvimento de crianças no Brasil, por meio de uma revisão sistemática. A metodologia adotou o protocolo PRISMA, com uma estratégia de busca detalhada nas principais bases de dados, selecionando artigos empíricos publicados entre 2012 e 2024 que incluíam amostras de crianças brasileiras de 0 a 6 anos e que descreviam variáveis de risco e proteção utilizando instrumentos padronizados de avaliação do desenvolvimento infantil (DI). A análise resultou na seleção de 43 estudos empíricos, identificando 66 fatores de risco e proteção, dos quais 78,78 % foram classificados como riscos. Os principais fatores de risco identificados foram: vulnerabilidade socioeconômica, nascimento pré-termo e sexo masculino. Os achados sugerem que variáveis como escolaridade materna e nível socioeconômico estão significativamente associadas ao DI, servindo como fatores de risco ou proteção dependendo do contexto. A análise sublinha a necessidade de intervenções precoces e multidisciplinares para fortalecer fatores protetivos e reduzir riscos, além de sugerir a expansão das pesquisas sobre fatores de proteção. Os resultados apontam a importância dos fatores biopsicossociais no DI, destacando a necessidade de políticas integradas em saúde, educação e assistência social para potencializar o desenvolvimento humano desde a infância e diminuir desigualdades.

Palavras-chave: desenvolvimento infantil; neuropsicologia; experiências adversas da infância

Resumen: Este estudio tuvo como objetivo examinar los factores biopsicosociales que impactan el desarrollo de los niños en Brasil, a través de una revisión sistemática. La metodología adoptó el protocolo PRISMA, con una estrategia de búsqueda detallada en las principales bases de datos, seleccionó artículos empíricos publicados entre 2012 y 2024 que incluían muestras de niños brasileños de 0 a 6 años y que describían variables de riesgo y protección utilizando instrumentos estandarizados de evaluación del desarrollo infantil. El análisis condujo a la selección de 43 estudios empíricos, se identificaron 66 factores de riesgo y protección, de los cuales el 78.78 % se clasificaron como riesgos. Los principales factores de riesgo identificados fueron: vulnerabilidad socioeconómica, nacimiento prematuro y sexo masculino. Los hallazgos sugieren que variables como la educación materna y el nivel socioeconómico están significativamente asociadas al desarrollo infantil y sirven como factores de riesgo o protección dependiendo del contexto. El análisis subraya la necesidad de intervenciones tempranas y multidisciplinares para fortalecer factores protectores y reducir riesgos, además de sugerir la expansión de las investigaciones sobre factores protectores. Se señala la importancia de los factores biopsicosociales en el desarrollo infantil, se destaca la necesidad de políticas integradas en salud, educación y asistencia social para potenciar el desarrollo humano desde la infancia y disminuir las desigualdades.
Palabras clave: desarrollo infantil; neuropsicología; experiencias adversas de la infancia

Child Development (CD) is a dynamic process and the result of a set of interconnected factors, with a highlight on biologic, genetic, psychologic, social, and environmental factors, which might have a negative or positive impact on each other (Mancini et al., 2004; Pilz & Schermann, 2007). In general, CD can be understood as a complex transformation, dynamic and characterized by the progressive achievement of cognitive, motor, behavioral, emotional, and psychosocial skills (Costa et al., 2015; Miranda & Malloy-Dini, 2018; Papalia et al., 2013). During a child's early years, the nervous system presents greater brain plasticity compared to later developmental stages. Thus, during early childhood, the brain is equipped with high capacity for recovery, in addition to organic and functional reorganization (Gazzaniga et al., 2018; Semrud-Clikeman & Elisson, 2011).

Risk factors are understood as biological and environmental factors that are related to an increase in the probability for the occurrence of negative symptoms or adverse outcomes in an individual's life (Kraemer et al., 2005). Children that live in stressful contexts, for instance, demonstrate more elevated levels of cortisol, the hormone involved in the regulation of stress, than children that are not exposed to these factors (Slopen et al., 2014). Cortisol is linked to specific areas of the central nervous system, such as memory, learning, emotions and the immunologic system (Shonkoff et al., 2012). Within developmental psychology, there is widespread use of multiple indicators to understand risk factors. Concerning such aspect, previous research have defended the view that exposure to multiple risk factors rather than a single factor present different consequences in development, with a highlight on negative effects in the analysis of cumulative risk (Kraemer et al., 2005; Rutter, 1981; Sameroff, 2006). On the other hand, protective factors are individual or social mechanisms that mitigate or neutralize the negative effects of the risk factors. Thus, they are regarded as positive promoters of development (Haggerty, 1996; Rutter, 2006).

From a globalized perspective, children exposed to risk conditions must be monitored by health, education, and social service professionals. Monitoring children is critically important because, based on the identification of possible delays in any domain, it becomes possible to produce a specialized assessment in order to investigate possible alterations in development (Hassano, 2011). These processes must be addressed by multidisciplinary, interdisciplinary, or transdisciplinary teams in order to strengthen protective factors during the confrontation of adverse situations that may compromise full development (Valiati et al., 2011). Early intervention proves relevant because it significantly improves these children's quality of life and reduces the risk for delays in development and alterations in learning (Walker et al., 2011).

The Child and Adolescent Statute (Estatuto da Criança e do Adolescente – ECA) is Brazil's legal framework for the comprehensive protective of children and adolescents. This legislation guarantees that all individuals in this age group enjoy the full range of fundamental rights intrinsic to human dignity, enabling the development of their physical, mental, moral, spiritual, and social potential in conditions of freedom and dignity (Law No. 8.069, 1990). According to an estimate by the Instituto Brasileiro de Geografia e Estatística (IBGE), or Brazilian Institute of Geography and Statistics, in August of 2022, there are about 215 million residents in Brazil. 19 million (8.83 %) are children aged from 0 to 6 years (IBGE,

2022). In low- and middle-income countries, it is estimated that more than 250 million children under the age of five may not reach their full developmental potential, mainly due to risk factors such as poverty, nutritional deficits, and inadequate learning conditions (Black et al., 2017; Grantham-McGregor et al., 2007; McCoy et al., 2016; Walker et al., 2007). Development in early childhood was included in the global agenda of the United Nations as one of the goals of the Sustainable Development Objectives (SDO) for the promotion of quality development for all children (Black et al., 2017; United Nations, 2023). Monitoring CD is a priority in the current Brazilian health context and a major concern for parents and legal guardians. It aims to identify problems in the developmental process of children and adolescents, and to correct and/or mitigate their adverse biopsychosocial effects (Amorim et al., 2009; Ribeiro et al., 2010; Ribeiro et al., 2014b; Santa Maria-Mengel & Linhares, 2007). One of the priorities for future research aimed at reducing early childhood developmental inequalities in low- and middle-income countries is to identify protective factors that promote adequate child development (Walker et al., 2011).

In light of this, understanding how biopsychosocial risk and protective factors interact and relate to child development (CD). In Brazil, although some evidence exists regarding these determinants (Maia & Williams, 2005; Morais et al., 2016), there is still a lack of studies that systematically integrate protective factors and CD domains within the national context. Thus, it becomes necessary to compile updated evidence on the main biopsychosocial factors that influence the development of Brazilian children. This more integrative approach provides a solid basis for the formulation and improvement of early interventions and intersectoral public policies, as recommended by The Legal Framework for Early Childhood [Marco Legal da Primeira Infância] (Law No. 13.257/2016) and other national guidelines for the full benefit of children such as the Happy Child Program [Programa Criança Feliz] (Decree no. 8.869, 2016; and altered by Decree no. 9.579, 2018).

In view of this gap, the present study aims to investigate biopsychosocial risk and protective factors associated with CD in Brazilian children aged 0 to 6 years, based on a systematic review of national literature.

Method

The use of methods for systematic review in this study followed the Preferred reporting items for systematic reviews and meta-analyses (PRISMA) protocol (Page et al., 2021). The PECO strategy was used to identify the Population (P), Exposure (E), Comparison (C, when applicable), and Outcomes (O) to be assessed. The objective was to investigate, in Brazilian children aged 0 to 6 years (P), the identification of risk and protective factors associated with child development (E), in order to evaluate their impact on developmental outcomes (O). For the selection and extraction of the articles, two researchers conducted electronic searches for original works, initially in April of 2022 and, subsequently, in March of 2025, in the following data bases: Scopus, LILACS, Scielo, PubMed Central, PsycINFO and Web of Science, with the following search strategy: ("risk factor*" OR "protective factor*" OR "biopsychosocial factor*") AND ("psychological" OR "social" OR "biological" OR "cognition" OR "emotional" OR "intelligence" OR "language development" OR “language” OR "motor development") AND ("preschool child" OR "child development" OR "child behavior" OR "infant behavior"). The second one had the objective to update and amplify the comprehension of the systematic review, including the Scopus data base and articles published until 2024. The complete electronic search strategy can be found in this article’s Appendix A. According to eligibility criteria, researchers included: (a) empirical articles; (b) articles in English, Spanish, or Portuguese; (c) articles published between 2012 and 2024; (d) a sample of Brazilian children aged 0 to 6 years; (e) description of risk and protective variables in CD; (f) the use of standardized instruments for the assessment of CD. The exclusion criteria were: (a) lack of clarity in the description of the instrument used in the assessment of CD; (b) literature review articles and meta-analyses; (c) articles rated as having a high risk of bias.

First, the articles were imported into the Rayyan Software. After the identification of duplicated articles, they were removed from the data bases. The process of identification and selection of relevant articles was realized by means of a reading of the title and abstract by two researchers working independently by the blinded model, with a verification whether they fit into the inclusion or exclusion criteria. Articles classified as accepted or accepted with restrictions by both independent researchers were included into the sample. When researchers disagreed on the inclusion of an article into the sample, the methods used in such studies were read by the two researchers together in an online

conference in order to reach a consensus whether the article should be included or not, without the need for a third researcher. In order to verify the agreement between the two researchers, Cohen's Kappa coefficient was calculated in statistical analysis (Cohen, 1960), which indicated almost perfect agreement among the judges (k = .81, p < .001; agreement = 97 %) (Landis & Koch, 1977).

The data extraction process was carried out independently by two authors, who retrieved and fully reviewed the articles included in the review. After this phase, researchers realized a conference for checking collected and general agreement among authors. The results were imported into an Excel worksheet, which made it possible to collect all data that were relevant for the interpretation of studies.

Assessment of the methodologic quality of the included studies

The checklist for methodologic, critical assessment by the Joanna Briggs Institute (JBI) (Aromataris & Munn, 2020) was used for the assessment of bias risk in the studies that were included in this research work. Thus, it was possible to verify the methodologic quality of observational, cross-sectional, cohort, quasi-experimental, and randomized experimental studies. The risk for bias refers to the extent to which a study might be systematically incorrect or present distortions in its results due to failure in design, in realization, or in analysis (Aromataris & Munn, 2020). The Joanna Briggs Institute (JBI) checklist is widely used in the assessment of bias risk in systematic reviews, considering issues such as clarity in selection criteria, integrity in randomizing methods, completeness in the follow-up of participants, and precision in measurement of outcomes. The JBI is equipped with separate tools for the assessment of research works according to outline, cross-sectional (8 criteria), cohort studies (11 criteria), quasi-experimental (9 criteria) and controlled randomized essays (13 criteria). The analysis of the methodologic quality of each study was independently realized by two authors and divergencies were resolved through discussion within the review team. Researchers attributed 0 (absence/insufficiency) or 1 (satisfactory presence) for each item in the checklists. Scores were counted and, later on, the studies were classified as low bias risk by means of the minimum scoring and the absence of failures in items that are considered critical, according to outlining (Information on the detailed description of the critical items can be obtained in the Appendix A). Given that risk and protective factors are complex, multifactorial, and often interdependent, there is a need for studies to adopt robust strategies for controlling confounding variables, in order to produce more accurate and theoretically grounded results. This approach guaranteed balance between methodological rigor and feasibility of inclusion of studies that were conducted in applied contexts, which led to the selection of research works with enough scientific validity to sustain the review conclusions. Later, there was the Kappa calculation, indicating the almost perfect agreement among the judges regarding the investigated items (k = 0,80, p < 0,001; agreement = 94 %) (Landis & Koch, 1977).

Results

The selection of articles was conducted in accordance with the flowchart presented in Figure 1. Concerning the identification of studies by database, consultation by means of the search strategy resulted in 4127 articles. After removing duplicates, screening for eligibility by peers, and assessing risk of bias, a total of 43 articles were included in this systematic review.

Figure 1

Flowchart of the systematic search process

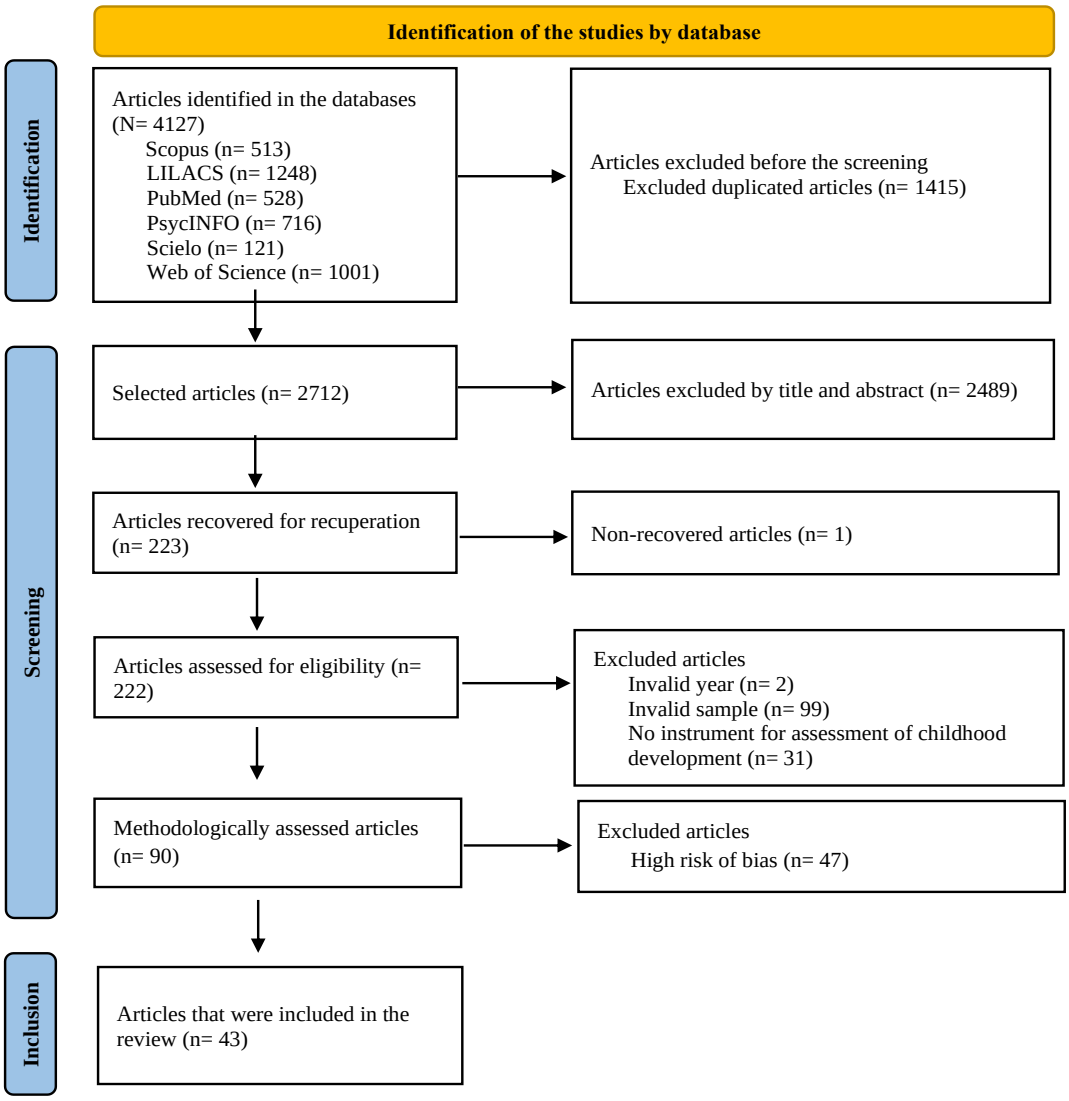

Table 1 shows the characteristics of the studies that were included in this review. Considering the division of Brazil into five geographical regions (IBGE, 1992), it was possible to verify that the samples in the studies were collected under the following regional distribution: North (*n* = 1), Northeast (*n* = 6), Mid-west (*n* = 3), South (*n* = 14), Southeast (*n* = 19). Thus, the southeast was the region of 44.18 % of the studies, and the state of São Paulo was the one with the greatest number of studies included in this review (*n* = 13; 30.23 %).

It was found that 62.80 % of the included samples used a cross-sectional design (*n* = 27) (Table 1). The results of the risk of bias assessment for each included article, based on the JBI checklist (Aromataris & Munn, 2020), are also presented in Table 1. The average total scores and item-by-item analyses are provided in the table available in the Appendix A. The most frequently observed sources of bias in cross-sectional studies were related to the reliability and validity of outcome measurement, as well as the use of strategies to control for confounding factors during the conduct of the study. These were followed by issues in the objective description of sample participants, including demographic characteristics and time frame. In cohort studies, concerns regarding the validity or reliability of outcome measurement were the most frequently identified sources of bias. After that, researchers found the adopted measurements for the management of the confusion factors and presented the reasons why there was a loss participant follow-up and how such data was explored. Based on the analyses, in general the most relevant limitations that were found in the studies include the research design, lack of

reliability in the collection of data, which is especially linked to the fact that the studies do not indicate who was responsible for such phase or whether there was any training, in addition to inadequacy in the adoption of measurements for the adjustment of confusion variables.

The total number of participants across all studies was 36,365 (*SD* = 1,324.56). Table 1 also presents the age range of the assessed populations in months, based on chronological age—and, in some studies, corrected age—when referring to children born preterm, with the data reported separately. Table 1 also includes the mean and standard deviation of children's ages (in months) at the time of assessment for each study, sample size, percentage of boys in each sample, and the instruments used to assess development. The most frequently used instrument was the Bayley Scales of Infant Development (39.53 %, *n* = 17), followed by the Developmental Screening Test [Denver-II] (18.60 %, *n* = 8).

The variables of CD risk and protective were categorized in accordance with the biological, psychological or social domain. Table 2 provides a detailed description of the groups of categories that were identified in the studies as elements of risk and protective for CD. Overall, researchers identified 66 types of risk and protective variables. 78.78 % (*n* = 52) were identified as risk factors, with a predominance in the biological domain (36.36 %, n = 24), followed by the social (34.84 %, *n* = 23) and psychological domains (7.57 %, n = 5). Regarding protective factors, the percentage was 13.63 % (*n* = 9) of social variables, 6.06 % (*n* = 4) of biological variables and 1.51% (*n* = 1) of psychological variables.

The risk factor referring to socio-economic vulnerability/low income was the most frequently reported variable across all studies, corresponding to 19.69 % (*n* = 13), followed by the preterm birth, biological risk factor, representing 15.15 % (*n* = 10) and the male sex with 13.63 % (*n* = 9). Regarding psychological factors, among the five identified psychological risk variables, the most recurrent risk variable was the mother with mental disorder 6.06 % (*n* = 4). Among the protective factors, stimulating maternal interaction and practices was the most frequently cited protective factor, representing 12.12 % (*n* = 8), followed by breastfeeding 6.06 % (*n* = 4).

Table 1

Characteristics of the studies

Study	State	Study Design	JBI *	Size of the Sample	Chronologic age group of the population in months	Child's chronological age in months (average±SD)	Male N (%)	Assessment Instrument**
NORTHERN REGION								
Weisleder et al. (2018)	RR	Randomized study	12	EG: 279 CG: 287	24-48	EG: 37.2 ± 6.6 CG: 37.6 ± 6.6	EG: 141 (50.7%) CG: 153 (53.5%)	TVIP; BNT; SON-R; TIMT; ITSEA; CBCL
NORTHEASTERN REGION								
Silva, A. C. D et al. (2015)	PB	Cross-sectional	8	112	6-18	14.4 ± 3.0	56 (50%)	Denver-II
Correia et al. (2020)	CE	Cross-sectional	8	3566	2-72	31.8 ± 23.1	1786 (50%)	ASQ-3
Rocha et al. (2021)	CE	Cross-sectional	8	3566	0-72	31.8 ± 23.1	1786 (50%)	ASQ-3
Lima and Cáceres-Assenço (2022)	RN	Cross-sectional	6	EG: 36 CG:27	18-36	EG: 26 ± 5.14 CG: 27 ± 4.91	37 (58.7%)	Bayley-III
Silva et al. (2023)	RN	Cross-sectional	7	EG: 27 CG:27	1-12	NI	EG: 14 (51.9%) CG: 14 (51.9%)	SWYC
Santos, C. A. D. et al. (2024)	RN	Cohort	11	EG: 69 CG: 68	A1: 4 A2: 6 A3: 12	A1EG: 4.10 ±0.48 A2EG: 6.70 ±0.56 A3EG: 12.53 ±0.41	EG: 39 (56.5%) CG: 32 (47.1%)	IMCI; ASQ-3
MID-WESTERN REGION								
Caldas et al. (2014)	MT	Cross-sectional	7	77	24-36	NI	NI	Denver-II; ELM
Kofke et al. (2022)	DF	Cross-sectional	8	437	0-24	9.03 ± 6.40	210 (48.05%)	Denver-II
Santos, J. A. T. et al. (2024)	DF	Cross-sectional	8	201	6-72	24.61 ±18.1	121 (60.2%)	Denver-II
SOUTHEAST REGION								
Saccani et al. (2013)	RS	Cross-sectional	7	561	0-18	NI	291 (51.9%)	AIMS
Camargo-Figuera et al. (2014)	RS	Cohort	10	3523	0-83	81.0 ± 2.7	1821 (51.7%)	WISC-III
Domingues et al. (2014)	RS	Cohort	11	4147	3-48	NI	2157 (52.0)	BDI; WPPSI
Pereira et al. (2016)	RS	Cohort	11	49	2-16	A1: 8.02 ± 2.63 A2: 10.02 ± 2.63 A3: 12.02 ± 2.63	27 (55.1%)	AIMS; Bayley-II
Araujo et al. (2017)	PR	Cross-sectional	7	77	6-36	NI	40 (52%)	Denver-II

Study	State	Study Design	JBI *	Size of the Sample	Chronologic age group of the population in months	Child's chronological age in months (average±SD)	Male N (%)	Assessment Instrument**
Yamaguchi et al. (2019)	PR	Cross-sectional	8	444	0-5	NI	234 (52.7%)	Denver-II
Caruzzo et al. (2020)	PR	Cross-sectional	7	357	42-60	NI	185 (51.82%)	MABC-2; EMMC
Panceri et al. (2020)	RS	Cross-sectional	7	184	12 ICO	13.15 ± 5.40	NI	Bayley-III
Santos et al. (2020)	SC	Cross-sectional	8	199	48-60	NI	107 (53.76%)	THCP
Hass et al. (2023)	RS	Cohort	11	33	4-12	A1ICO: 4.24± 0.40 A2ICO: 8.40± 0.58 A3 ICO: 12.42± 0.76	23 (69.7)	Bayley-III
Zago et al. (2023)	RS	Cross-sectional	8	756	3	NI	361 (47.8%)	Bayley-III; AIMS
Pedrotti et al. (2024)	RS	Cross-sectional	7	212	4-36	≤ 12: 7.94 ±2.71 > 12: 23.73±7.68	≤ 12: 28 (49.1 %) > 12: 75 (58.4 %)	IDADI
Sánchez-Luquez et al. (2024)	RS	Cohort	11	3513	0-83	NI	1815 (51.7%)	WISC-III
Silva et al. (2024)	RS	Cohort	10	3603	24-48	48.3 ±1.2	1839 (51.0%)	BDI
SOUTHEASTERN REGION								
Fernandes et al. (2012)	SP	Cross-sectional	8	58	18-24 ICO	20.6±1.8 ICO	28 (48.27%)	Bayley-III
Ferreira et al. (2014)	RJ	Cohort	11	194	0-12	NI	91 (46.9)	Bayley-II
Ribeiro et al. (2014a)	SP	Cross-sectional	7	65	11,65-12,65	NI	32 (50.3%)	Denver-II
Ribeiro et al. (2014b)	SP	Cross-sectional	6	65	11,66-12,66	NI	32 (50.3%)	Denver-II
Góes et al. (2015)	RJ	Cross-sectional	8	104	17-30 ICO	23 ± NI ICO	47 (45.2%)	Bayley-III
Silva, J. et al. (2015)	MG	Cross-sectional	7	112	18-42	29.28 ± 7.4	53 (47.3%)	PEDI
Neves et al. (2016)	MG	Cross-sectional	8	92	24-36	NI	53 (57.6%)	Bayley-III
Campos et al. (2016)	SP	Cohort	11	EG: 33 CG:22	1-12	A1: 5.5 ± 1.4 A2: 9.8 ± 1.9	EG: 11 (33.3%) CG: 7 (31.8%)	Bayley-III
Tella et al. (2018)	SP	Cross-sectional	7	444	6-9	NI	211 (47.52%)	Bayley-III
Fink et al. (2018)	SP	Cohort	10	900	12	12.47 ± 1.8	405 (45%)	ASQ-3
Shephard et al. (2019)	SP	Cross-sectional	7	31	6	6.2 ±0.3	16 (51.6%)	Bayley-III; IBQ-R

Study	State	Study Design	JBI *	Size of the Sample	Chronologic age group of the population in months	Child's chronological age in months (average±SD)	Male N (%)	Assessment Instrument**
Machado et al. (2019)	MG	Cross-sectional	8	EG:23 CG: 22	12	EG: 12.6 ± 0.5 CG: 12.5 ± 0.3	EG: 16 (72.7%) CG: 9 (39.1%)	TSFI; Bayley-III
Negrão et al. (2020)	SP	Cohort	11	1006	13-30	GNC: 22.5 ±3.3 GAC: 21.9 ±2.8 GTC: 22.5 ±3.8 GACTC: 21.3 ±2.9	494 (49.1%)	Bayley-III
Fatori et al. (2021)	SP	Randomized Study	11	80	3-24	NI	NI	Bayley-III
Aristizábal et al. (2023)	SP MA	Cohort	11	SP: 1.840 MA: 1.050	12-36	SP: 20.62 ± 4.42 MA: 17.44 ± 3.65	SP: 923 (50.2%) MA: 555 (52.9%)	Bayley-III
Abreu et al. (2024)	SP	Cross-sectional	7	56	2-12	5.80 ± 2.44	32 (57.14%)	AIMS
McCoy et al. (2024)	SP	Quasi-experimental	8	3241	36	41.05 ± 7.35	1523 (47%)	ECBQ; SDQ; PRIDI
Orioli et al. (2024)	SP	Cross-sectional	8	41	0-6	NI	21 (51.2%)	Bayley-III
Pinheiro et al. (2024)	MG	Cohort	11	449	6-12	NI	NI	SWYC-BR

Note. N: Number; *SD*: Standard Deviation; NI: indicates data that was not provided or that could not be extracted; TG: Total Group; EG: Experimental Group; CG: Control Group; CA: Chronological Age; ICO: Corrected Age; EG1: Experimental Group 1; CG1: Control Group 1; EG2: Experimental Group 2; CG2: Control Group 2; G1: Group 1; G2: Group 2; G3: Group 3; A1: Assessment 1; A2: Assessment 2; GNC: Group of mothers that did not smoke tobacco or drink alcohol during pregnancy; GAC: Group of mothers that only drank alcohol during pregnancy; GTC: Group of mothers that only smoked tobacco during pregnancy; GACTC: Group of mothers that simultaneously drank alcohol and smoked tobacco during pregnancy; PA: Pará; RR: Roraima; BA: Bahia; CE: Ceará; PB: Paraíba; PE: Pernambuco; RN: Rio Grande do Norte; GO: Goiás; MT: Mato Grosso; PR: Paraná; SC: Santa Catarina; RS: Rio Grande do Sul; MG: Minas Gerais; SP: São Paulo; RJ: Rio de Janeiro; The abbreviations of the instruments used to assess child development, behavior, and risk/protective factors are detailed in the tables provided in the Appendix A.

*Joanna Briggs Institute (JBI) Checklist; **Instruments for assessing CD.

Table 2

Child Development Risk and Protective factors per studies

Risk Factors				N
Biological	1	Preterm birth <37 weeks	Caldas et al. (2014); Fernandes et al. (2012); Ferreira et al. (2014); Fink et al. (2018); Hass et al. (2023); Machado et al. (2019); Orioli et al. (2024); Panceri et al. (2020); Saccani et al. (2013); Zago et al. (2023)	10
	2	Male sex	Camargo-Figuera et al. (2014); Correia et al. (2019); Fernandes et al. (2012); Fink et al. (2018); Goés et al. (2015); Pereira et al. (2016); Santos et al. (2020); Santos, C. A. D. et al., (2024); Yamaguchi et al. (2019)	9
	3	Low birth weight (LBW) <2500g	Araujo et al. (2017); Caldas et al. (2014); Fernandes et al. (2012); Ferreira et al. (2014); Kofke et al. (2022); Panceri et al. (2020); Silva, J. et al. (2015); Zago et al. (2023)	8
	4	Cesarean section	Caldas et al. (2014); Pinheiro et al. (2024); Zago et al. (2023)	3
	5	Vaginal delivery	Silva, A. C. D. et al., (2015)	1
	6	Height deficit	Camargo-Figuera et al. (2014); Neves et al. (2016); Panceri et al. (2020)	3
	7	Intrauterine exposure to SARS-CoV-2	Pinheiro et al. (2024); Santos, C. A. D. et al., (2024); Silva et al. (2023)	3
	8	Time of hospitalization at the Neonatal Intensive Care Unit	Hass et al. (2023); Kofke et al. (2022)	2
	9	Low APGAR	Panceri et al. (2020)	1
	10	Periventricular hemorrhage	Caldas et al. (2014); Panceri et al. (2020)	2
	11	Periventricular leukomalacia	Fernandes et al. (2012); Panceri et al. (2020)	2
	12	Alterations in cranial ultrasound	Santos, C. A. D. et al., (2024)	1
	13	Cardiorespiratory diseases	Campos et al (2016)	1
	14	Deficit in the cephalic perimeter	Camargo-Figuera et al. (2014)	1
	15	Bronchopulmonary Dysplasia	Fernandes et al., (2012).	1
	16	Simultaneous exposure to alcohol and tobacco/ exclusive exposure to tobacco during pregnancy	Negrão et al. (2020); Camargo-Figuera et al. (2014)	2
	17	High Biopsychosocial Risk Index (BRI)†	Santos, J. A. T. et al. (2024)	1
	18	Neonatal Near Miss *	Aristizábal et al. (2023)	1
	19	Presence of pathology (child)	Silva, J. et al. (2015).	1
	20	Neonatal pneumonia	Goés et al. (2015);	1
	21	Neonatal Sepsis	Ferreira et al. (2014)	1
	22	Twin-twin transfusion syndrome (TTTS)	Campos et al (2016)	1
	23	Phototherapy use	Silva, A. C. D. et al. (2015)	1
	24	Prolonged mechanical ventilation	Panceri et al. (2020)	1
Psychological	1	Mother with mental disorder	Ribeiro et al. (2014a); Rocha et al. (2021); Pinheiro et al. (2024); Shephard et al. (2019)	4
	2	Exposure to multiple adverse childhood experiences (ACEs)	Rocha et al. (2021).	1
	3	Maternal symptoms of ADHD	Shephard et al. (2019)	1
	4	Negative maternal perception regarding the child's health	Camargo-Figuera et al. (2014)	1
	5	Mother as victim of violence by partner	Rocha et al. (2021).	1

	Risk Factors			N
Social	1	Socioeconomic vulnerability/low income	Araujo et al. (2017); Camargo-Figuera et al. (2014); Campos et al (2016); Caldas et al. (2014); Correia et al. (2019); Fernandes et al. (2012); Hass et al. (2023); Neves et al. (2016); Panceri et al. (2020); Pereira et al. (2016); Saccani et al. (2013); Santos et al. (2020); Tella et al. (2018).	13
	2	Parental low schooling	Abreu et al., (2024); Camargo-Figuera et al. (2014); Lima e Cáceres-Assenço (2022); Panceri et al. (2020); Ribeiro et al. (2014b); Silva et al. (2024); Shephard et al. (2019); Tella et al. (2018)	8
	3	Single-parent family	Araújo et al. (2017); Goés et al. (2015)	2
	4	Precarious dwellings	Neves et al. (2016)	1
	5	Both parents identified as non-white	Camargo-Figuera et al. (2014)	1
	6	Scarce access to parks and pharmacy	Neves et al. (2016).	1
	7	Children from black or mixed ethnic/racial groups	Sánchez-Luquez et al. (2024)	1
	8	Father is unemployed at the time of childbirth	Camargo-Figuera et al. (2014)	1
	9	Mother is unemployed during the chill's first year of life	Camargo-Figuera et al. (2014)	1
	10	Enrolled in a public school	Santos et al. (2020).	1
	11	Families with three or more children	Camargo-Figuera et al. (2014)	1
	12	Part-time attendance at early childhood education centers	Yamaguchi et al. (2019)	1
	13	Attendance to nurseries during the first year of life	Saccani et al. (2013)	1
	14	High Social Risk Index (SRI)†	Santos, J. A. T. et al. (2024)	1
	15	Food insecurity	Correia et al. (2019)	1
	16	Larger number of people for each room at home at the first twelve months of age	Camargo-Figuera et al. (2014)	1
	17	Multiple maternity	Kofke et al. (2022)	1
	18	Lack of school attendance	Santos et al. (2020).	1
	19	Perceived neighborhood insecurity	Neves et al. (2016).	1
	20	Recent exposure to community violence	McCoy et al. (2024)	1
	21	Use of digital media with non-educational content	Pedrotti et al. (2024)	1
	22	Non-mediated use (without interaction with an adult) of digital media	Pedrotti et al. (2024)	1
	23	Simultaneous use of screens (exposure to more than one device at the same time)	Pedrotti et al. (2024)	1

Protective factors				N
Biological	1	Breastfeeding	Camargo-Figuera et al. (2014); Hass et al. (2023); Kofke et al. (2022); Orioli et al. (2024)	4
	2	Physical Activity during Pregnancy	Domingues et al. 2014	1
	3	More advanced maternal age	Abreu et al. (2024);	1
	4	Higher cognitive maturity	Caruzzo et al. (2020)	1
Psychologic	1	Stimulating Maternal Interaction/Maternal practices/Environmental/precocious cognitive stimulation	Abreu et al. (2024); Fatori et al. (2021); Neves et al. (2016); Pereira et al. (2016); Ribeiro et al. (2014a); Saccani et al. (2013); Sánchez-Luquez et al. (2024); Weisleder et al. (2018)	8
Social	1	Variety of stimuli at the home environment	Abreu et al. (2024); Hass et al. (2023)	2
	2	Less rigorous social distance during the Covid-19 pandemic	Abreu et al. (2024)	1
	3	Adequate indoor physical environment	Saccani et al. (2013)	1
	4	Integration between nursery and the Family Health Strategy (FHS)	Silva, A. C. D. et al. (2015)	1
	5	Mother working out of the home	Ribeiro et al. (2014b).	1
	6	Greater number of toys at home	Pereira et al. (2016)	1
	7	Greater diversity in physical space	Pereira et al. (2016)	1
	8	Parental knowledge about child development	Hass et al. (2023)	1
	9	Home visits (adolescent mothers)	Fatori et al. (2021)	1

Note. N: Number of occurrences. *weight at birth < 1,500 g, 5-minute Apgar < 7, gestational age < 32 weeks and congenital malformations; † Scoring from 0 to 8 consisting of: Preterm birth, low weight at birth, 5-minute Apgar score < 7, Breastfeeding < 3 months, fewer than 6 prenatal consultations and more than three hospitalizations due to health complications; Composite score ranging from 0 to 8, consisting of: Low economic class, Low maternity schooling, Maternity during adolescence, Single/divorced marital status and high levels of parental stress.

Biological risk factors

Preterm birth (PTB) and/or low birth weight (LBW)

The PTB has been associated with delay in neuropsychomotor development (Fink et al., 2018), especially in cognitive domains (Orioli et al., 2024;), gross and fine motor skills (Panceri et al., 2020; Saccani et al., 2013; Zago et al., 2023) and sensory processing (Machado et al., 2019). It was possible to observe a reduction in the development scores for PTB children and children with LBW [< 2500g] (Caldas et al., 2014; Fernandes et al., 2012). The LBW also demonstrated strong association with low neuropsychomotor scores (Araujo et al., 2017; Panceri et al., 2020; Zago et al., 2023) and risk of delay in development (Kofke et al., 2022).

Prolonged mechanical ventilation, periventricular hemorrhage, low Apgar scores, and periventricular leukomalacia were negatively associated with global developmental outcomes in preterm infants (Panceri et al., 2020). Bronchopulmonary dysplasia and periventricular leukomalacia emerged as predictors of motor, cognitive, and adaptive behavior deficits (Fernandes et al., 2012). Prolonged time in the Neonatal ICU was the most relevant negative predictor of PTB motor and cognitive development (Hass et al., 2023). Clinical neonatal sepsis increased the risk for neuromotor alterations at the age of twelve months for premature infants with very low weight (Ferreira et al., 2014). The Neonatal Near Miss events was associated to all domains of development (Aristizábal et al., 2023).

Male sex

The male sex was a major predictor of low Intelligence Quotient (IQ) at the age of six years, even after controlling for confounding factors (Camargo-Figuera et al., 2014). Boys born small for gestational age demonstrated poorer physical and neuropsychological performance (Fink et al., 2018). Yamaguchi et al. (2019) found that boys were 1.65 times more likely to present questionable development, even after controlling for contextual variables. Correia et al. (2019) observed a higher risk of developmental delay among boys, particularly in the domains of motor skills, problem-solving, and social skills, especially after 36 months of age. Boys showed motor (Fernandes et al., 2012; Góes et al., 2015; Pereira et al., 2016), language (Fernandes et al., 2012; Góes et al., 2015; Pereira et al., 2016), and socio-emotional deficits (Fernandes et al., 2012), as well as impairments in perceptual-motor skills (Santos et al., 2020) and in the personal-social domain among those exposed to SARS-CoV-2 at 12 months of age (Santos, C. A. D. et al., 2024).

Type of delivery

While Caldas et al. (2014), Pinheiro et al. (2024) and Zago et al. (2023) pointed at the cesarean section as a variable associated to lower results in development, Silva, A. C. D. et al. (2015) observed a higher risk among children born via vaginal delivery.

Height Deficits

Low height in the first year of life was associated with IQ deficits (Camargo-Figuera et al., 2014). Height deficits were linked to below-average scores in the cognitive and language domains (Neves et al., 2016). Birth length was significantly associated with poor motor performance in twelve-month-old preterm infants (Panceri et al., 2020).

Intrauterine exposure to SARS-CoV-2

Children whose mothers were infected during the first trimester of pregnancy were 2.15 times more likely to be classified as having possible developmental delays at 12 months of age, compared to those whose mothers were infected during the third trimester (Pinheiro et al., 2024). Similarly, researchers identified a threefold increased risk of neurodevelopmental delays in children with intrauterine exposure to the virus, with statistically significant associations even after controlling for prematurity, sex, and maternal depression (Santos, C. A. D. et al., 2024). Alterations observed in brain imaging exams were also associated with lower developmental scores (Santos, C. A. D. et al., 2024). The highest prevalence of motor and socio-emotional delays, as well as inflexibility, was observed in the group exposed to SARS-CoV-2 (Silva et al., 2023).

Adverse neonatal and perinatal clinical conditions

A study with a sample of children born to adolescent or young adult mothers identified prolonged neonatal ICU hospitalization as an independent risk factor for global developmental delay

(Kofke et al., 2022). In another study, conducted with full-term and preterm children in vulnerable contexts, researchers found an association between periventricular hemorrhage and developmental deficits (Caldas et al., 2014). Neonatal pneumonia was also shown to negatively affect language development (Góes et al., 2015), and the presence of clinical pathologies in childhood was associated with lower motor performance (Silva, J. et al., 2015). The use of phototherapy increased the likelihood of developmental alterations in children older than 12 months (Silva, A. C. D. et al., 2015). While investigating twin-twin transfusion syndrome (TTTS), Campos et al. (2016) identified that cardiopulmonary diseases and donor twin status were associated with delays in fine motor skills and expressive language. Deficits in head circumference during the first year of life were associated with an increased risk of low IQ (Camargo-Figuera et al., 2014).

Simultaneous exposure to alcohol and tobacco during pregnancy increased the risk of children being classified as emerging/at risk by 2.81 times (Negrão et al., 2020), and parental tobacco use was associated with lower IQ scores (Camargo-Figuera et al., 2014). Finally, Santos, J. A. T. et al. (2024) found that children with a high Biopsychosocial Risk Index (BRI) presented lower developmental scores, particularly in fine motor skills.

Psychological risk factors

The presence of maternal mental disorders, including depression, anxiety, and psychological distress, was associated with delays in children's cognitive, motor, emotional, and social development (Pinheiro et al., 2024; Ribeiro et al., 2014a; Rocha et al., 2021; Shephard et al., 2019). Children exposed to multiple adverse childhood experiences (ACEs), and whose mothers were victims of intimate partner violence, showed delays across all developmental domains (Rocha et al., 2021). In a study involving adolescent mothers living in poverty, maternal symptoms of ADHD were associated with altered brain connectivity in their children, negatively impacting cognitive and self-regulatory skills (Shephard et al., 2019). A negative maternal perception of the child's health was also associated with lower IQ scores (Camargo-Figuera et al., 2014).

Social risk factors

Socioeconomic vulnerability and food insecurity

Studies have pointed to a strong association between economically disadvantaged contexts and delays in neuropsychomotor development (Araujo et al., 2017), particularly in the cognitive (Fernandes et al., 2012; Hass et al., 2023; Neves et al., 2016; Panceri et al., 2020), language (Caldas et al., 2014; Hass et al., 2023; Neves et al., 2016; Panceri et al., 2020; Tella et al., 2018), and motor domains (Panceri et al., 2020; Pereira et al., 2016; Saccani et al., 2013; Tella et al., 2018), as well as in perceptual-motor skills (Santos et al., 2020). Low household income was associated with an increased risk of delays in expressive communication among infants with twin-twin transfusion syndrome (Campos et al., 2016). In addition, low family income emerged as a significant predictor of low IQ (Camargo-Figuera et al., 2014). Children from families with low monthly income, lower socioeconomic status, and food insecurity were at greater risk for delays across multiple developmental domains, with chronic poverty identified as a more detrimental risk factor than temporary exposure to economic vulnerability (Correia et al., 2019).

Low parental education

Low maternal education was associated with deficits in cognition (Camargo-Figuera et al., 2014; Panceri et al., 2020; Shephard et al., 2019; Tella et al., 2018), language (Lima & Cáceres-Assenço, 2022; Panceri et al., 2020; Tella et al., 2018), and motor skills (Panceri et al., 2020). Higher maternal education was linked to greater engagement in home-based stimulation, especially among children with biological risk factors (Abreu et al., 2024). Silva et al. (2024) found that maternal education was the most important variable in predicting CD, followed by paternal education.

Unfavorable family, environmental and institutional conditions

Situations such as single-parent families (Araujo et al., 2017; Góes et al., 2015), multiparity (Kofke et al., 2022), overcrowding at home (Camargo-Figuera et al., 2014) and precarious habitations (McCoy et al., 2024; Neves et al., 2016) and poor-quality neighborhoods (Neves et al., 2016) were linked to low development scores. Racial and social inequalities were also highlighted: children whose both parents were not white (Camargo-Figuera et al., 2014) belonged children identified as Black or

ethnic/racial groups (Sánchez-Luquez et al., 2024) presented greater risk for delay. Recent exposure to community violence was associated to lower scores for self-regulation, externalizing problems and deficits in global development (McCoy et al., 2024). Attendance to nurseries after the first year of life was negatively associated with motor development (Saccani et al., 2013) whereas children who attended the CEI part-time presented a significantly increased risk for developmental concerns in comparison to children who attended the institution full-time (Yamaguchi et al., 2019). Not going to school was a significant predictor of low perception-motor skills in children aged 4 to 5 years (Santos et al., 2020). The unemployment of a child's parents was linked to lower IQ scores (Camargo-Figuera et al., 2014). The high in risk factors to form the Social Risk Index (SRI), was related to loss especially in the language and social behavior domains (Santos, J. A. T. et al., 2024). Finally, the precocious use of digital media with non-educational content, without adult mediation and with multiple screens was significantly associated with low cognitive scores for children after their 12th month of life (Pedrotti et al., 2024).

Biological protective factors

Breastfeeding, especially when it is exclusive (at hospital release) or prolonged, was presented as a protective factor for cognitive and language development (Camargo-Figuera et al., 2014; Hass et al., 2023; Kofke et al., 2022; Orioli et al.,2024). Child cognitive maturity presented itself as a predictor for motor cognition (Caruzzo et al., 2020). The practice of physical activities during pregnancy, provided evidence that physically active women were more likely to have children with better scores in neuropsychomotor development at twelve months of age (Domingues et al., 2014). Advanced maternal age also emerged as a protective factor that was associated to improved gross motor skills (Abreu et al., 2024).

Psychological protective factors

Stimulating parental practices, including home interaction (Abreu et al., 2024; Neves et al., 2016; Ribeiro et al., 2014b), playing that involves movement for the baby (Saccani et al., 2013), encouragement to take on challenging postures (Pereira et al., 2016) and better emotional/verbal responses (Fatori et al., 2021) were positively associated with motor and cognitive development. Cognitive stimulation was positively associated with IQ at the age of 6 years, regardless of genetic predisposition (Sánchez-Luquez et al., 2024). Interventions based on the reading of materials out loud by parents and their children promoted significant gains in receptive language and enhanced the quality of mother–child interactions in the home context (Weisleder et al., 2018).

Social protective factors

The variety of stimuli in the home environment, such as the presence of objects, significantly benefits cognitive and motor development in small children, including premature infants (Abreu et al., 2024; Hass et al., 2023). The larger quantity of toys and diversity of home physical space were significantly associated with higher cognitive scores (Pereira et al., 2016). The participation of nurseries in the first year of life and access to health services, such as the Family Health Strategy (FHS) [Estratégia Saúde da Família (ESF)], are important support networks for monitoring and for precocious stimulation (Silva, A. C. D. et al., 2015). In the family realm, having a mother that worked outside the home was associated with better CD results (Ribeiro et al., 2014b). Parents' knowledge of CD also stood out as a protective factor for development, even though it was partial (Hass et al., 2023). In the context of the Covid-19 pandemic, it was possible to observe that children who were submitted to less rigorous social distance presented better performance in gross motor activities (Abreu et al., 2024). Structured interventions focusing on family support, such as home visit programs for adolescent mothers, demonstrated positive effects in the development of expressive language as well as in the indicators of home environment quality (Fatori et al., 2021).

Discussion

This study aimed to analyze the relationship between biopsychosocial risk and protective factors and CD during early childhood, using a sample of Brazilian children.

There is a notable predominance of social and biological risk factors—such as socioeconomic vulnerability, preterm birth, and male sex—and their association with neuropsychomotor developmental delays. It is possible to verify that, although biological factors are strongly associated to

risk of developmental delay, social risk factors such as low parental income and education stand out as the most consistent determinants across the analyzed studies. Moreover, the negative impact of these risks is amplified when combined with psychosocial factors such as maternal mental disorders, exposure to violence, low levels of stimulation at home and, more recently, the direct and indirect effects of the Covid-19 pandemic. On the other hand, the review also verified that responsive parental practices, stimulating home environments, prolonged breastfeeding, early interventions based on the family, and integrated public policies (such as home visits and conditional cash transfers) serve as robust and protective factors capable of promoting positive developmental trajectories even in contexts marked by multiple risk factors.

The systematization of these findings makes an original contribution to the field by compiling recent national evidence. It reinforces the importance of intersectoral public policies that not only address clinical and perinatal conditions but also act directly to reduce social inequalities and to strengthen families as key environments for promoting development in early childhood.

Furthermore, the results in this systematic review support existing evidence that biopsychosocial factors might generate a negative or a positive impact in the development of Brazilian children, thus being classified as risk factors or protective factors for CD, respectively. These results are also consistent with the findings of studies conducted by Formiga (2009), Caldas et al. (2014) and Araujo et al. (2020) when it comes to the multifactorial characteristic of the development process and of the cumulative concept of risk and protective. It is important to emphasize that the analyzed variables do not inherently constitute risk or protective factors. Rather, their classification depends on the multifactorial context in which they occur, and they may acquire different valences depending on the specific context and established combinations (Pérez-López & Sánchez-Caravaca, 2008). To illustrate this, the review data indicate that variables such as maternal education and socioeconomic level are associated with CD, where lower levels were identified as risk factors, while higher levels were described as protective factors during early childhood.

Socioeconomic vulnerability emerged as one of the most frequently examined variables in the studies included in this systematic review, highlighting its central role in the multiplicity of risks CD. It reinforces the additive and intensifying nature of social risks when combined with biological vulnerabilities. Studies have shown that children who were exposed to multiple layers of social disadvantages presented higher risk of developmental delays, even when born at term and without clinical complications (Camargo-Figuera et al., 2014; Correia et al., 2019). Chronical poverty, in particular, was considered an impact factor that was more persistent and detrimental factor to cognitive and motor development than temporary exposure to economic hardship (Araujo et al., 2017; Santos et al., 2020; Tella et al., 2018). Children at lower socioeconomic backgrounds often have reduced access to high-quality schools and stimulating environments. Poverty, low maternal education, precarious housing conditions and family environment with low-stimulation are adversities that negatively affect CD. These disparities might contribute to the perpetuation of the poverty cycle into adulthood (Camargo-Figuera et al., 2014; Correia et al., 2019; Lu et al., 2020; Sania et al., 2019; Venancio et al., 2022; Walker et al, 2007, Walker et al., 2011). According to Walker et al. (2011), there is a significant inequality in the development of programs and public policies for early childhood in underdeveloped and emerging countries. The authors also emphasize the importance of such initiatives in supporting children living in social vulnerability across the globe, with the aim of mitigating global disparities.

The male sex variable was frequently associated with poorer developmental outcomes. Studies such as the ones by Ferreira et al. (2014), Fink et al. (2018) and Zago et al. (2023) demonstrated that preterm boys or those small for gestational age exhibited lower neuropsychomotor results when compared to girls under the same conditions. Similarly, boys living in poverty presented a higher risk of developmental delays, supporting the hypothesis that the male sex functions as an indicator of greater sensitivity to adverse contexts rather than as an isolated causal determinant. Explanations based on cultural expectations and different standards for caretaking according to gender have been proposed to account for these findings (Correia et al., 2019; Santos et al., 2020). Yamaguchi et al. (2019) suggest that the differences in the personal-social and language domains among boys and girls might be under the influence of the way parents or caregivers interact with and stimulate their children, indicating that boys may receive less verbal and emotional stimulation in certain cultural contexts. Therefore, although the male sex was widely cited as being associated with developmental delay risks, its interpretation must not be based on direct causality, but rather viewed as a marker of population-level vulnerability

(Camargo-Figuera et al., 2014). Its significance must be regarded in relation to environmental and social contexts. This finding reinforces the importance of developing gender-sensitive approaches in CD promotion policies, viewing gender not as an inherent difference but as an indicator of specific needs.

According to the classification by the World Health Organization [WHO] (2015), preterm infants are those born before 37 weeks of gestation, while those born between 37 and 42 weeks are considered full-term. The high number of studies on preterm birth (PTB) in Brazil, compared to other identified risk factors, may be related to the fact that the country ranks among the ten nations with the highest number of preterm births worldwide (WHO, 2018). Between 2012 and 2022, a total of 3,530,568 preterm births were recorded in Brazil (Ministério da Saúde, 2024). It is also important to highlight that the cost of PTB for the Brazilian public health system exceeds R$ 8 billion per year (Campos et al., 2020). It is well known that children born preterm may exhibit subtle developmental disturbances, even in the absence of severe neurological disorders (Ballot et al., 2012; Brown et al., 2014; Guerra et al., 2014). These findings justify and reinforce the need for studies that promote preventive measures against PTB, as well as sustained attention and continued advances in mitigating its impact.

Factors such as PTB, low parental education, and LBW were associated with lower CD scores in early childhood. These findings corroborate the meta-analysis conducted by Sania et al. (2019), which aimed to assess the magnitude of the relationship between risk factors and cognitive, motor, and language development in children under seven years of age living in low- and middle-income countries. This study was among the first to report statistically significant associations between lack of access to clean drinking water and basic sanitation and poorer cognitive development in children. It also identified additional risk variables, such as short maternal stature and childhood anemia. Despite the relevance of these findings, our review did not identify these specific risk factors; instead, they appeared broadly categorized under socioeconomic vulnerability and inadequate infrastructure. This discrepancy may be related to differences in eligibility criteria, as the study by Sania et al. (2019) included a global sample. However, these data point to a lack of studies using Brazilian samples that examine the association between these variables and early childhood development—an alarming gap for a developing country. Therefore, future research should investigate the relationship between lack of access to clean water and basic sanitation and CD. According to the Sanitation Ranking published by Instituto Trata Brasil in partnership with GO Associados (2022), based on data from SNIS 2020, more than 35 million Brazilians lack access to treated water, 100 million are not served by sewage collection systems, and only 50% of sewage is treated in the country.

According to the 2023 report by the Food and Agriculture Organization of the United Nations (FAO), there has been an increase in hunger indicators and limited access to adequate food in Brazil. According to 2022 data, approximately 70.3 million individuals experienced moderate situations of food insecurity, meaning they faced difficulties in accessing sufficient food (FAO, 2023). In addition, it was identified that 21.1 million Brazilian people suffered from serious food insecurity between 2020 and 2022 (FAO, 2023). These findings also reflect the period of the COVID-19 pandemic, which marked a critical scenario of risk to CD, exacerbating preexisting inequalities and vulnerabilities across all Brazilian regions. Social distance measures directly affected the routines of families by reducing access to healthcare, education, and psychosocial support services. The studies indicated that for children whose mothers were infected by the SARS-CoV-2 virus during their intrauterine period, exhibited greater developmental delays (Pinheiro et al., 2024; Santos, C. A. D. et al., 2024; Silva et al., 2023). The results by Orioli et al. (2024), with a sample of newborns who were exposed to SARS-CoV-2 in the perinatal period, show that COVID-19 was not a risk factor for intrauterine growth restriction, but it was possible to verify that the rate of premature births on the sample was 46.3 %, which, according to the authors, is possibly the result of the impact of COVID-19 on maternal health. Additionally, it was verified that PTB (gestational age < 36 weeks) was the greatest risk for cognitive development.

Studies such as those by Silva et al. (2023) and Pedrotti et al. (2024) demonstrated that the deprivation of social interaction, increased parental stress, and the replacement of family engagement with excessive screen time negatively affected the motor and cognitive development of young children. These findings are corroborated by Murray et al. (2023), who reported psychosocial and economic risks resulting from the COVID-19 pandemic, with a direct effect on the mental health of caregivers and children, and the intensification of pre-existing inequalities. There is a clear need for further research in this area to better understand the biological, social, and psychological impacts of the COVID-19 pandemic, considering the characteristics of the different regions of Brazil, on the development of

Brazilian children and on their families' quality of life, especially during early childhood, which is a period when children build the foundations for subsequent phases of development. It is also a period in which children are particularly sensitive and responsive to interventions.

Regarding protective factors, the data show a significant decline across all domains when compared to risk factors, highlighting a scarcity of studies that emphasize the perspective of fostering development rather than merely avoiding risks. Notably, in the context of protective factors, the social domain appears to surpass the biological domain. Overall, the studies included in this systematic review highlight a range of strategies to promote CD. Among these, the orientation of families toward early stimulation practices, including responsive interactions, enriched environments, and structured parental support interventions, all of which emerged as important factors in mitigating the negative effects of biopsychosocial risks (Abreu et al., 2024; Fatori et al., 2021; Hass et al., 2023; Neves et al., 2016; Ribeiro et al., 2014a; Weisleder et al., 2018). However, there remains a shortage of studies focusing on protective factors, particularly longitudinal cohort studies aimed at early interventions that promote resilience, as supported by previous national reviews (Maia & Williams, 2005; Morais et al., 2016).

A divergence was observed regarding the type of delivery. Some studies indicated that birth by cesarean section was associated with lower developmental scores (Caldas et al., 2014; Pinheiro et al., 2024; Zago et al., 2023). However, Silva C. D. (2015) identified vaginal delivery as a contradictory risk factor. These discrepancies suggest that the type of delivery alone does not determine developmental outcomes; rather, that the associated clinical and perinatal contexts must be taken into account. Thus, future studies should control for confounding variables, such as the quality of obstetric care and neonatal complications, in order to clarify the relationship between delivery type and neuropsychomotor developmental delays.

Among the limitations of the present study, it is worth mentioning the absence of a registered review protocol and the lack of quantitative analyses. In addition, the included studies exhibited substantial heterogeneity, with most adopting a cross-sectional design and statistical approaches that did not allow for the assessment of causal relationships between the studied variables. It is important to highlight the need for future research with the following characteristics: expanded measurement of the impact of COVID-19 on the development of Brazilian children in early childhood; investigations into how risk factors—such as inadequate sanitation and screen time—affect development; studies focused on protective factors for early childhood development and the effectiveness of intervention models as mechanisms to promote human developmental potential; and meta-analyses aimed at measuring the relative weight (valence) of risk and protective factors, in order to provide guidance for inter-, multi-, and transdisciplinary teams in designing and implementing early intervention strategies for CD.

Risk and protective factors are understood through the analysis of multiple variables, such as the social context, and socioeconomic, environmental, cultural, family, and genetic factors. As a consequence, they are not studied in isolation. Therefore, it is essential that risk and protective factors be examined by multidisciplinary and interdisciplinary teams, while considering the diverse conditions that are involved and the impact of these relationships in the lives of individuals. In addition, the promotion of research aiming at the understanding of protective factors for the development of biopsychosocial dimensions would lead to early interventions designed to create opportunities for mitigating the negative effects of risk factors, and consequently, significantly altering the quality of life of individuals and their families, as well as promote preventive health policies.

Conclusion

In conclusion, the evidence gathered in this systematic review indicates that a range of biopsychosocial risk factors contributes to disparities in the development of Brazilian children. Although research on protective factors for child development remains limited in comparison to studies on risk factors, the findings highlight key variables that function as enhancers, promoters, and protectors during early childhood.

Comprehensive care for Brazilian children is structured under the aegis of health, education, and social action, which aim to promote the conditions necessary for achieving their full developmental potential. Thus, ongoing assessment and monitoring of CD by different fields of knowledge is considered an important mechanism for management, especially during the period of greatest neural plasticity: early childhood. Through such efforts, it is possible to identify developmental adversities at an early

stage and promote actions that prevent, minimize, or eradicate negative effects (Walker et al., 2011). In this context, it is necessary to recognize the complexity of human relations from childhood onward, from biological, psychological, and social perspectives. Therefore, interventions that focus on the reduction of risk factors might enhance the realization of human potential when it comes to CD in early childhood, which extends into adult life and the next generation (Walker et al., 2011). Thus, investment in public policies for family, education, healthcare, and community environments might alter the trajectory of social inequalities that continue to cause suffering in the lives of Brazilian children and their families, ultimately contributing to improved quality of life.

References

Abreu, R. W. F. D., Lima, C. R. G., Verdério, B. N., Santos, M. M. D., dos Santos, A. N., Brugnaro, B. H., & Rocha, N. A. C. F. (2024). Association between environmental factors during the COVID-19 pandemic and functioning of infants with biological risk in the first year of life: Cross-sectional exploratory study. *Early Human Development*, *191*. https://doi.org/10.1016/j.earlhumdev.2024.105987

Amorim, R. C. A., Laurentino, G. E. C., Barros, K. M. F. T., Ferreira, A. L. P. R., Moura Filho, A. G., & Raposo, M. C. F. (2009). Family health program: proposal for identification of risk factors for neuropsychomotor development. *Brazilian Journal of Physical Therapy, 13*(6), 506-513. https://doi.org/10.1590/S1413-35552009005000065

Araujo, D. M., Cabrera Santos, D. C., & Marconi Pinheiro Lima, M. C. (2020). Cognitive, language and motor development of infants exposed to risk and protective factors. *International Journal of Pediatric Otorhinolaryngology, 138*, 110353. https://doi.org/10.1016/j.ijporl.2020.110353

Araujo, L. B., Mélo, T. R., & Israel, V. L. (2017). Low birth weight, family income and paternal absence as risk factors in neuropsychomotor development. *Journal of Human Growth and Development*, *27*(3), 272. https://doi.org/10.7322/jhgd.124072

Aristizábal, L. Y. G, Rocha, P. R. H, Confortin, S. C., Simões, V. M. F., Bettiol, H., Barbieri, M. A., & Silva, A. A. M. (2023). Association between neonatal near miss and infant development: The Ribeirão Preto and São Luís birth cohorts (BRISA). *BMC Pediatrics*, *23*(1), 125. https://doi.org/10.1186/s12887-023-03897-3

Aromataris, E., & Munn, Z. (2020). *JBI Manual for Evidence Synthesis*. JBI. https://synthesismanual.jbi.global

Ballot, D. E., Potterton, J., Chirwa, T., Hilburn, N., & Cooper, P. A. (2012). Developmental outcome of very low birth weight infants in a developing country. *BMC Pediatrics, 12*(11), 1-10. https://doi.org/10.1186/1471-2431-12-11

Black, M. M., Walker, S. P., Fernald, L., Andersen, C. T., DiGirolamo, A. M., Lu, C., McCoy, D. C., Fink, G., Shawar, Y. R., Shiffman, J., Devercelli, A. E., Wodon, Q. T., Vargas-Barón, E., & Grantham-McGregor, S.. (2017). Early childhood development coming of age: science through the life course. *The Lancet*, *389*(10064), 77-90. https://doi.org/10.1016/S0140-6736(16)31389-7

Brasil. (1990, July 13). Lei nº 8.069/90, de 13 de julho de 1990. Dispõe sobre o Estatuto da Criança e do Adolescente. https://www.planalto.gov.br/ccivil_03/leis/l8069.htm

Brasil. (2016, March 8). Lei nº 13.257, de 8 de março de 2016. Dispõe sobre as políticas públicas para a primeira infância e altera as Leis nºs 8.069/1990, 8.742/1993, 12.662/2012 e 11.494/2007. *Diário Oficial da União*. https://www.planalto.gov.br/ccivil_03/_ato2015-2018/2016/lei/l13257.htm

Brasil. (2016, October 5). Decreto nº 8.869, de 5 de outubro de 2016. Institui o Programa Criança Feliz. *Diário Oficial da União.* https://www.in.gov.br/materia/-/asset_publisher/Kujrw0TZC2Mb/content/id/21292775/do1-2016-10-06-decreto-n-8-869-de-5-de-outubro-de-2016-21292718

Brasil. (2018, November 22). Decreto nº 9.579, de 22 de novembro de 2018. Consolida atos normativos editados pelo Poder Executivo federal que dispõem sobre a temática do lactente, da criança, do adolescente e do jovem. *Diário Oficial da União.* https://www.planalto.gov.br/ccivil_03/_ato2015-2018/2018/decreto/d9579.htm

Brown, H. K., Speechley, K. N., Macnab, J., & Natale, R. (2014). Mild prematurity, proximal social processes, and development. *Pediatrics, 134*(3). https://doi.org/10.1542/peds.2013-4092d

Caldas, C. S. O., Takano, O. A., Mello, P. R. B., Souza, S. C., & Zavala, A. A. Z. (2014). Language abilities performance of children born preterm and low birth weight and associated factors. *Audiology - Communication Research, 19*(2), 158-166. https://doi.org/10.1590/S2317-64312014000200010

Camargo-Figuera, F. A., Barros, A. J., Santos, I. S., Matijasevich, A., & Barros, F. C. (2014). Early life determinants of low IQ at age 6 in children from the 2004 Pelotas Birth Cohort: a predictive approach. *BMC Pediatrics*, *14*, 308. https://doi.org/10.1186/s12887-014-0308-1

Campos, D., Arias, A. V., Campos-Zanelli, T. M., Souza, D. S., dos Santos Neto, O. G., Peralta, C. F. A., & Guerreiro, M. M. (2016). Twin-twin transfusion syndrome: Neurodevelopment of infants treated with laser surgery. *Arquivos de Neuro-Psiquiatria*, *74*(4), 307-313. https://doi.org/10.1590/0004-282X20160032

Campos, J. O., Silva, A. M., Santana, M. S., Oliveira, T. L. P. S., Rocha, C. S. A., Silva, A. R., Silva, G., M., Silva, J., S., Pereira, C., S., S., P., A. & Carvalho, M., F. (2020). Avaliação do estado nutricional de recém-nascidos pré-termo em unidade de terapia intensiva neonatal. *Brazilian Journal of Development*, *8*(10), 80007-80028. https://doi.org/10.34117/bjdv6n10-432

Caruzzo, N. M., Belem, I. C., Santos, V. A. P., Contreira, A. R., Fiorese, L., & Vieira, J. L. L. (2020). Association between motor performance, cognitive maturity and socio-demographic aspects in preschooler children. *Journal of Physical, 31*, 2-11. https://doi.org/10.4025/jphyseduc.v31i1.3174

Cohen, J. A. (1960). Coefficient of agreement for nominal scales. *Journal of Educational and Measurement, 20*(1), 37-46. https://doi.org/10.1177/001316446002000104

Correia, L. L., Rocha, H. A. L., Sudfeld, C. R., Rocha, S. G. M. O., Leite, Á. J. M., Campos, J. S., & Silva, A. C. E. (2019). Prevalence and socioeconomic determinants of development delay among children in Ceará, Brazil: A population-based study. *PLoS ONE*, *14*(11). https://doi.org/10.1371/journal.pone.0215343

Costa, E. F., Cavalcante, L. I. C., & Dell'Aglio, D. D. (2015). Language development profile of children in Belem, according to Denver developmental screening test. *Revista CEFAC*, *17*(4), 1090-1102. https://doi.org/10.1590/1982-0216201517418514

Domingues, M. R., Matijasevich, A., Barros, A. J. D., Santos, I. S., Horta, B. L., & Hallal, P. C. (2014). Physical activity during pregnancy and offspring neurodevelopment and iq in the first 4 years of life. *PLoS ONE*, *9*(10). https://doi.org/10.1371/journal.pone.0110050

Fatori, D., Zuccolo, P., Shephard, E., Brentani, H., Matijasevich, A., Ferraro, A., Fracolli, L., Chiesa, A., Leckman, J., Miguel, E., & Polanczyk, G. (2021). A randomized controlled trial testing the efficacy of a nurse home visiting program for pregnant adolescents. *Scientific Reports*, *11*(1). https://doi.org/10.1038/s41598-021-93938-7

Fernandes, L. V., Goulart, A. L., Santos, A. M. N., Barros, M. C. M., Guerra, C. C., & Kopelman, B. I. (2012). Avaliação do neurodesenvolvimento de prematuros de muito baixo peso ao nascer entre 18 e 24 meses de idade corrigida pelas escalas Bayley III. *Jornal de Pediatria, 88*(6), 471-478. https://doi.org/10.1590/S0021-75572012000600005

Ferreira, R. C., Mello, R. R., & Silva, K. S. (2014). Neonatal sepsis as a risk factor for neurodevelopmental changes in preterm infants with very low birth weight. *Jornal de Pediatria*, *90*(3), 293-299. https://doi.org/10.1016/j.jped.2013.09.006

Fink, G., Andrews, K. G., Brentani, H., Grisi, S., Ferrer, A. P. S., & Brentani, A. (2018). Overall and sex-specific associations between fetal adversity and child development at age 1 year: Evidence from Brazil. *American Journal of Epidemiology*, *187*(11), 2324-2331. https://doi.org/10.1093/aje/kwy141

Food and Agriculture Organization of the United Nations. (2023). *The state of food security and nutrition in the world 2023*. https://www.fao.org/3/CC3017EN/online/CC3017EN.html

Formiga, K. M. R. (2009). *Detecção de Risco para Problemas no Desenvolvimento de Bebês Nascidos Pré-termo no Primeiro Ano* [Doctoral dissertation, Universidade de São Paulo). Biblioteca Digital de Teses e Dissertações da USP. https://teses.usp.br/teses/disponiveis/17/17148/tde-23042009-131422/pt-br.php

Gazzaniga, M., Heatherton, T., & Halpern, D. (2018). *Ciência psicológica* (5th ed.). Artmed.

Góes, F. V., Méio, M. D. B. B., Mello, R. R., & Morsch, D. (2015). Evaluation of neurodevelopment of preterm infants using Bayley III scale. *Revista Brasileira de Saúde Materno Infantil, 15*(1), 47-55. https://doi.org/10.1590/S1519-38292015000100004

Grantham-McGregor, S., Cheung, Y. B., Cueto, S., Glewwe, P., Richter, L., & Strupp, B. (2007). Developmental potential in the first 5 years for children in developing countries. *The Lancet, 369*(9555), 60-70. https://doi.org/10.1016/S0140-6736(07)60032-4

Guerra, C. C., Barros, M. C. D. M., Goulart, A. L., Fernandes, L. V, & Kopelman, B. I. (2014). Premature infants with birth weights of 1500–1999 g exhibit considerable delays in several developmental areas. *Acta Pediátrica*, *103*(1), 1-6. https://doi.org/10.1111/apa.12430

Haggerty, R. J., Sherrod, L. R., Gamezy, N., & Rutter, M. (1996). *Stress, risk and resilience in children and adolescents: process, mechanisms and interventions*. Cambridge University Press.

Hass, J. V., Panceri, C., Procianoy, R. S., Silveira, R. de C., & Valentini, N. C. (2023). Risk Factors for cognitive, motor and language development of preterm children in the first year of life. *Revista Paulista de Pediatria*, *41*, e2021165–e2021165. https://doi.org/10.1590/1984-0462/2023/41/2021165

Hassano, A. Y. (2011). Desenvolvimento neuropsicomotor no primeiro ano de vida. *Revista de Pediatria SOPERJ, 12*(Supl. 1), 9-14.

Instituto Brasileiro de Geografia e Estatística. (1992). *Divisão do Brasil em Mesorregiões e Microrregiões Geográficas* (Vol. II). Fundação Instituto Brasileiro de Geografia e Estatística, Departamento de Geografia.

Instituto Brasileiro de Geografia e Estatística. (2022). *Projeções da População do Brasil e Unidades da Federação por sexo e idade: 2010-2060*. https://www.ibge.gov.br/estatisticas/sociais/populacao/9109-projecao-da-populacao.html?=&t=resultados

Instituto Trata Brasil & GO associados. (2022). *Ranking do Saneamento Instituto Trata Brasil 2022 (SNIS 2020)*. GO associados. https://tratabrasil.org.br/wp-content/uploads/2022/09/Relatorio_do_RS_2022.pdf

Kofke, L., Pérez-Escamilla, R., Gubert, M. B., & Buccini, G. (2022). Socio-demographic, maternal, and infant characteristics associated with early childhood development delays among children of young mothers in Brasília, Brazil. *PLoS ONE*, *17*(3). https://doi.org/10.1371/journal.pone.0266018

Kraemer, H. C, Lowe, K. K., & Kupfer, D. J. (2005). *To your health*. Oxford University Press.

Landis, J. R., & Koch, G. G. (1977). The measurement of observer agreement for categorical data. *Biometrics, 33*(1), 159-174. https://doi.org/10.2307/2529310

Lima, A. M. O., & Cáceres-Assenço, A. M. (2022). What factors interfere with the performance of preschool children in the language subtest of Bayley-III? *CoDAS, 34*(1), 1-6. https://doi.org/10.1590/2317-1782/20212020200

Lu, C., Cuartas, J., Fink, G., McCoy, D., Liu, K., Li, Z., Daelmans, B., & Richter, L. (2020). Inequalities in early childhood care and development in low/middle-income countries: 2010-2018. *BMJ Global Health*, *5*(2), e002314. https://doi.org/10.1136/bmjgh-2020-002314

Machado, A. C. C. P., de Castro Magalhães, L., de Oliveira, S. R., & Bouzada, M. C. F. (2019). Is sensory processing associated with prematurity, motor and cognitive development at 12 months of age? *Early Human Development*, *139*. https://doi.org/10.1016/j.earlhumdev.2019.104852

Maia, J. M. D., & Williams, L. C. de A. (2005). Fatores de risco e fatores de proteção ao Desenvolvimento Infantil: uma revisão da área. *Temas em Psicologia*, *13*(2), 91-103.

Mancini, M. C., Megale, L., Brandão, M. B., Melo, A. P. P., & Sampaio, R. F. (2004). Efeito moderador do risco social na relação entre risco biológico e desempenho funcional infantil. *Revista Brasileira de Saúde Materno Infantil*, *4*(1), 25-34. https://doi.org/10.1590/s1519-38292004000100003

McCoy, D. C., Dormal, M., Cuartas, J., Carreira dos Santos, A., Fink, G., & Brentani, A. (2024). The acute effects of community violence on young children's regulatory, behavioral, and developmental outcomes in a low-income urban sample in Brazil. *Journal of Child Psychology and Psychiatry and Allied Disciplines*, *65*(5), 620-630. https://doi.org/10.1111/jcpp.13799

McCoy, D. C., Peet, E. D., Ezzati, M., Danaei, G., Black, M. M., Sudfeld, C. R., Fawzi, W., & Fink, G. (2016). Early childhood developmental status in low- and middle-income countries: National, regional, and global prevalence estimates using predictive modeling. *PLoS Medicine*, *13*(6), e1002034. https://doi.org/10.1371/journal.pmed.1002034

Ministério da Saúde. (2024). Perfil epidemiológico dos nascimentos prematuros no Brasil, 2012 a 2022. *Boletim epidemiológico,* 55(13). https://www.gov.br/saude/pt-br/centrais-de-conteudo/publicacoes/boletins/epidemiologicos/edicoes/2024/boletim-epidemiologico-volume-55-no-13.pdf

Miranda, D. M., & Malloy-Diniz, L. F. (2018). *O Pré Escolar.* Hografe.

Morais, R. L. S., Carvalho, A. M., & Magalhães, L. C. (2016). The environmental context and the child development: brazilian studies. *Journal of Physical Education*, *27*(1), 2714. https://doi.org/10.4025/jphyseduc.v27i1.2714

Murray, J., Bauer, A., Loret de Mola, C., Martins, R. C., Blumenberg, C., Esposti, M. D., Stein, A., Barros, F. C., Hallal, P. C., Silveira, M. F., Bertoldi, A. D., & Domingues, M. R. (2023). Child and Maternal Mental Health Before and During the COVID-19 Pandemic: Longitudinal Social Inequalities in a Brazilian Birth Cohort. *Journal of the American Academy of Child and Adolescent Psychiatry, 62*(3), 344-357. https://doi.org/10.1016/j.jaac.2022.07.832

Negrão, M. E. A., Rocha, P. R. H., Saraiva, M. C. P., Barbieri, M. A., Simões, V. M. F., Batista, R. F. L., Ferraro, A. A., & Bettiol, H. (2020). Association between tobacco and/or alcohol consumption during pregnancy and infant development: Brisa cohort. *Brazilian Journal of Medical and Biological Research*, *54*(1), 1-9. https://doi.org/10.1590/1414-431x202010252

Neves, K. R., Morais, R. L. S., Teixeira, R. A. & Pinto, P. A. F. (2016). Growth and development and their environmental and biological determinants. *Jornal de Pediatria, 92*(3), 241-250. https://doi.org/10.1016/j.jped.2015.08.007

Orioli, P. A., Johnston, C., Del Bigio, J. Z., Krebs, V. L. J., Pissolato, M., Gibelli, M. A. B. C., De Araujo, O. R., Francisco, R. P. V., & De Carvalho, W. B. (2024). Assessment of newborn neuropsychomotor development born with exposure to SARS-CoV-2 in the perinatal period using the Bayley III scale at 6 months of age. *Clinics*, *79*. https://doi.org/10.1016/j.clinsp.2024.100460

Page, M. J., McKenzie, J. E., Bossuyt, P. M., Boutron, I., Hoffmann, T. C., Mulrow, C. D., Shamseer, L., Tetzlaff, J. M., Akl, E. A., Brennan, S. E., Chou, R., Glanville, J., Grimshaw, J. M., Hróbjartsson, A., Lalu, M. M., Li, T., Loder, E. W., Mayo-Wilson, E., McDonald, S., & McGuinness, L. A. (2021). The PRISMA 2020 statement: An updated guideline for reporting systematic reviews. *British Medical Journal, 372*(71). https://doi.org/10.1136/bmj.n71

Panceri, C., Valentini, N. C., Silveira, R. C., Smith, B. A., & Procianoy, R. S. (2020). Neonatal adverse outcomes, neonatal birth risks, and socioeconomic status: Combined influence on preterm infants' cognitive, language, and motor development in Brazil. *Journal of Child Neurology*, *35*(14), 989-998. https://doi.org/10.1177/0883073820946206

Papalia, D. E., Olds, S. W., & Feldman, R. D. (2013). *Desenvolvimento Humano* (12th ed.). AMGH.

Pedrotti, B. G., Bandeira, D. R., & Frizzo, G. B. (2024). Context of digital media use in early childhood: Factors associated with cognitive development up to 36 months of age. *Infant Behavior and Development*, *76*. https://doi.org/10.1016/j.infbeh.2024.101963

Pereira, K. R. G., Valentini, N. C., & Saccani, R. (2016). Brazilian infant motor and cognitive development: Longitudinal influence of risk factors. *Pediatrics International*, *58*(12), 1297-1306. https://doi.org/10.1111/ped.13021

Pérez-López, J., & Sánchez-Caravaca, J. (2008). Riegos y tratamiento como factores responsables del progreso en los niños prematuros. In González-Pienda, J. A., & Nuñes-Pérez, J. C. (Orgs.). *Psicología y Educación: Un lugar de encuentro* (pp. 1631-1640). Ediciones de la Universidad de Oviedo.

Pilz, E. M., & Schermann, L. B. (2007). Determinantes biológicos e ambientais no desenvolvimento neuropsicomotor em uma amostra de crianças de Canoas/RS. *Ciencia & Saude Coletiva*, *12*(1), 181-190. https://doi.org/10.1590/s1413-81232007000100021

Pinheiro, G. S. M. A., Lemos, S. M. A., Martins, I. de A., Januário, G. C., Cintra, M. L., Farias, A. V. S. R., Oliveira, R. M. D. S., Januário, J. N., Azevedo, V. M. G. de O., Bentes, A. A., & Alves, C. R. L. (2024). Effects of SARS-CoV-2 gestational exposure and risk factors on neurodevelopment until 12 months: A prospective cohort study in Brazil. *Early Human Development*, *188*, 105918-105918. https://doi.org/10.1016/j.earlhumdev.2023.105918

Ribeiro, A. M., Silva, R. R. F., & Puccini, R. F. (2010). Conhecimentos e práticas de profissionais sobre desenvolvimento da criança na atenção básica à saúde. *Revista Paulista de Pediatria, 28*(2), 208-214. https://doi.org/10.1590/S0103-05822010000200013

Ribeiro, D. G., Perosa, G. B., & Padovani, F. H. P. (2014a). Fatores de risco para o desenvolvimento de crianças atendidas em Unidades de Saúde da Família, ao final do primeiro ano de vida. *Ciência & Saúde Coletiva, 19*(1), 215-226. https://doi.org/10.1590/1413-81232014191.1904

Ribeiro, D. G., Perosa, G. B., & Padovani, F. H. P. (2014b). Mental health, mother-child interaction and development at the end of the first year of life. *Paidéia (Ribeirão Preto), 24*(59), 331-339. https://doi.org/10.1590/1982-43272459201407

Rocha, H. A. L., Sudfeld, C. R., Leite, Á. J. M., Rocha, S. G. M. O., Machado, M. M. T., Campos, J. S., E Silva, A. C., & Correia, L. L. (2021). Adverse Childhood Experiences and Child Development Outcomes in Ceará, Brazil: A Population-based Study. *American journal of preventive medicine*, *60*(4), 579–586. https://doi.org/10.1016/j.amepre.2020.08.012

Rutter, M. (1981). Stress, coping and development: Some issues and some questions. *Journal of Child Psychology and Psychiatry*, *22*(4), 323-356. https://doi.org/10.1111/j.1469-7610.1981.tb00560.x

Rutter, M. (2006). Implications of resilience concepts for scientific understanding. *Annals of the New York Academy of Sciences*, *1094*(1), 1-12. https://doi.org/10.1196/annals.1376.002

Saccani, R., Valentini, N., Pereira, K., Müller, A., & Gabbard, C. (2013). Associations of biological factors and affordances in the home with infant motor development. *Pediatrics International*, *55*(2), 197-203. https://doi.org/10.1111/ped.12042

Sameroff, A. J., & Rosenblum, K. L. (2006). Psychosocial constraints on the development of resilience. *Annals of the New York Academy of Sciences*, *1094*(1), 116-124. https://doi.org/10.1196/annals.1376.010

Sánchez-Luquez, K. Y., Carpena, M. X., Karam, S. M., Martins-Silva, T., Barros, F. C., de Oliveira, I. O., Santos, I. S., Barros, A. J. D., Matijasevich, A., & Tovo-Rodrigues, L. (2024). Evaluation of genomic factors and early childhood stimulation on intelligence in children from a Brazilian birth cohort: The primary role of independent factors. *Progress in Neuro-Psychopharmacology and Biological Psychiatry*, *131*. https://doi.org/10.1016/j.pnpbp.2023.110932

Sania, A., Sudfeld, C. R., Danaei, G., Fink, G., McCoy, D. C., Zhu, Z., Fawzi, M. C. S., Akman, M., Arifeen, S. E., Barros, A. J. D., Bellinger, D., Black, M. M., Bogale, A., Braun, J. M., van den Broek, N., Carrara, V., Duazo, P., Duggan, C., Fernald, L. C. H., & Gladstone, M. (2019). Early life risk factors of motor, cognitive and language development: a pooled analysis of studies from low/middle-income countries. *BMJ Open, 9*(10), e026449. https://doi.org/10.1136/bmjopen-2018-026449

Santa Maria-Mengel, M. R. S., & Linhares, M. B. M. (2007). Risk factors for infant developmental problems. *Revista Latino-Americana de Enfermagem, 15*, 837-842. https://doi.org/10.1590/S0104-11692007000700019

Santos, C. A. D., Paula, A. P., Filho, G. G. F., Alves, M. M., Nery, A. F., Pontes, M. G. A., Macedo, E. Y. L., Oliveira, R. M., Freitas, S. M., Lima, S., Varela, F. V. C., Viana, A. L. S., Silva, A. L. P., Silva, É. G. C., & D'Souza-Li, L. (2024). Developmental impairment in children exposed during pregnancy to maternal SARS-COV2: A Brazilian cohort study. *International Journal of Infectious Diseases*, *139*, 146–152. https://doi.org/10.1016/j.ijid.2023.12.001

Santos, E. M. M., Constantino, B., Rocha, M. M., & Mastroeni, M. F. (2020). Predictors of low perceptual-motor skills in children at 4-5 years of age. *Revista Brasileira de Saúde Materno Infantil, 20*(3), 759-767. https://doi.org/10.1590/1806-93042020000300006

Santos, J. A. T., Ayupe, K. M. A., Camargos, A. C. R., Medeiros, N. L., & Gutierres Filho, P. J. B. (2024). Moderating effect of social risk on the relationship between biological risk and child development. *Ciência & Saúde Coletiva*, *29*(8), e18432022-e18432022. https://doi.org/10.1590/1413-81232024298.18432022

Semrud-Clikeman, M., & Ellison, P. A. T. (2011). *Neuropsicología Infantil: Evaluacion e Intervencion en los Trastornos Neuroevolutivos.* Pearson Educación.

Shephard, E., Fatori, D., Mauro, L. R., de Medeiros Filho, M. V., Hoexter, M. Q., Chiesa, A. M., Fracolli, L. A., Brentani, H., Ferraro, A. A., Nelson, C. A., Miguel, E. C., & Polanczyk, G. V. (2019). Effects of maternal psychopathology and education level on neurocognitive development in infants of adolescent mothers living in poverty in Brazil. *Biological Psychiatry: Cognitive Neuroscience and Neuroimaging*, *4*(10), 925-934. https://doi.org/10.1016/j.bpsc.2019.05.009

Shonkoff, J. P., Richter, L., Van Der Gaag, J., & Bhutta, Z. A. (2012). An integrated scientific framework for child survival and early childhood development. *Pediatrics*, *129*(2). https://doi.org/10.1542/peds.2011-0366

Silva, A. C. D., Engstron, E. M., & Miranda, C. T. (2015). Fatores associados ao desenvolvimento neuropsicomotor em crianças de 6-18 meses de vida inseridas em creches públicas do Município de João Pessoa, Paraíba, Brasil. *Cadernos de Saúde Pública, 31*(9), 1881-1893. https://doi.org/10.1590/0102-311X00104814

Silva, E. V, Hartwig, F. P., Santos, T. M., Yousafzai, A., Santos, I. S., Barros, A. J. D., Bertoldi, A. D., Freitas da Silveira, M., Matijasevich, A., Domingues, M. R., & Murray, J. (2024). Predictors of early child development for screening pregnant women most in need of support in Brazil. *Journal of Global Health*, *14*, 04143-04143. https://doi.org/10.7189/jogh.14.04143

Silva, J., Fronio, J. S., Lemos, R. A., Ribeiro, L. C., Aguiar, T. S., Silva, D. T., Vieira, M. T. & Neves, L. A. T. (2015). Pacing opportunities at home and skill of children with potential changes in functional development. *Journal of Human Growth and Development, 25*(1), 19-26 https://doi.org/10.7322/JHGD.96763

Silva, P. Y. F., da Cruz, M. C. L., Azevedo, I. G., Moreira, R. S., Sousa, K. G., & Pereira, S. A. (2023). Risk of global developmental delay in infants born from mothers with COVID-19: A cross-sectional study. *International Journal of Women's Health*, *15*, 467-474. https://doi.org/10.2147/IJWH.S389291

Slopen, N., McLaughlin, K. A., & Shonkoff, J. P. (2014). Interventions to improve cortisol regulation in children: A systematic review. *Pediatrics*, *133*(2), 312-326. https://doi.org/10.1542/peds.2013-1632

Tella, P., Piccolo, L. R., Rangel, M. L., Rohde, L. A., Polanczyk, G. V., Miguel, E. C., Grisi, S. J. F. E., Fleitlich-Bilyk, B., & Ferraro, A. A. (2018). Socioeconomic diversities and infant development at 6 to 9 months in a poverty area of São Paulo, Brazil. *Trends in Psychiatry and Psychotherapy, 40*(3), 232-240. https://doi.org/10.1590/2237-6089-2017-0008

United Nations. (2023). *Objetivos de Desenvolvimento Sustentável | As Nações Unidas no Brasil*. https://brasil.un.org/pt-br/sdgs

Valiati, M. R. M. S., Bromberg, M. C., Antoniuk, S. A., & Riechi, T. I. J. S. (Orgs.). (2011). *Desenvolvimento da criança e do adolescente: avaliação e intervenção*. Íthala.

Venancio, S. I., Teixeira, J. A., de Bortoli, M. C., & Bernal, R. T. I. (2022). Factors associated with early childhood development in municipalities of Ceará, Brazil: A hierarchical model of contexts, environments, and nurturing care domains in a cross-sectional study. *The Lancet Regional Health-Americas*, *5*, 100139. https://doi.org/10.1016/j.lana.2021.100139

Walker, S. P., Wachs, T. D., Gardner, J. M., Lozoff, B., Wasserman, G. A., Pollitt, E., Carter, J. A., & International Child Development Steering Group (2007). Child development: Risk factors for adverse outcomes in developing countries. *The Lancet*, *369*(9556), 145-157. https://doi.org/10.1016/S0140-6736(07)60076-2

Walker, S. P., Wachs, T. D., Grantham-Mcgregor, S., Black, M. M., Nelson, C. A., Huffman, S. L., Baker-Henningham, H., Chang, S. M., Hamadani, J. D., Lozoff, B., Gardner, J. M. M., Powell, C. A., Rahman, A., & Richter, L. (2011). Inequality in early childhood: Risk and protective factors for early child development. *The Lancet*, *378*(9799), 1325-1338. https://doi.org/10.1016/S0140-6736(11)60555-2

Weisleder, A., Mazzuchelli, D. S. R., Lopez, A. S., Neto, W. D., Cates, C. B., Gonçalves, H. A., Fonseca, R. P., Oliveira, J., & Mendelsohn, A. L. (2018). Reading Aloud and Child Development: A Cluster-Randomized Trial in Brazil. *Pediatrics, 141*(1), 1-12. https://doi.org/10.1542/peds.2017-0723

Word Health Organization. (2015). *WHO recommendations on interventions to improve preterm birth outcomes*. https://www.who.int/publications/i/item/9789241508988

Word Health Organization. (2018). *Preterm Birth*. http://www.who.int/news-room/fact-sheets/detail/pretermBirth

Yamaguchi, B., Silva, A., Araujo, L., Guimaraes, A., & Israel, V. (2019). Psychomotor evaluation of children attending Child Education Centers in the south of Brazil. *Early Child Development and Care*, *191*(11), 1707-1714. https://doi.org/10.1080/03004430.2019.1672165

Zago, A. C., Trettim, J. P., Rubin, B. B., Scholl, C. C., Coelho, F. T., Ulguim, F., Pinheiro, L. M. de S., Matos, M. B. de, Pinheiro, R. T., & Quevedo, L. de A. (2023). Early motor development: Risk factors for delay in a population study in Southern Brazil. *Revista Saúde Pública (Online)*, *57*, 59-59. https://doi.org/10.11606/s1518-8787.2023057004991

Authors' contribution (CRediT Taxonomy): 1. Conceptualization; 2. Data curation; 3. Formal Analysis; 4. Funding acquisition; 5. Investigation; 6. Methodology; 7. Project administration; 8. Resources; 9. Software; 10. Supervision; 11. Validation; 12. Visualization; 13. Writing: original draft; 14. Writing: review & editing.

T. da G. M. has contributed in 1, 2, 3, 4, 5, 6, 7, 9, 11, 12, 13, 14; K. J. K. in 2, 3, 5, 6, 9, 11, 14; L. F. F. in 2, 5, 6, 12, 13; T. I. J. de Sá R. in 1, 7, 10, 11, 14.

Scientific editor in charge: Dra. Cecilia Cracco.

Appendix A

Table A1

Search Strategies in Scientific Databases for Studies on Risk and Protective Factors for Child Development

Source of data	Search strategies
LILACS (Title, Abstract and Topic)	("risk factors" OR "protective factors" OR "biopsychosocial factors") AND (psychological OR social OR biological OR cognition OR emotional OR intelligence OR "language development" OR language OR "motor development") AND ("preschool child" OR "child development" OR "child behavior" OR "infant behavior")
PubMed	("risk factor*"[Title/Abstract] OR "protective factor*"[Title/Abstract] OR "biopsychosocial factor*"[Title/Abstract]) AND ("psychological"[Title/Abstract] OR "social"[Title/Abstract] OR "biological"[Title/Abstract] OR "cognition"[Title/Abstract] OR "emotional"[Title/Abstract] OR "intelligence"[Title/Abstract] OR "language development"[Title/Abstract] OR "language"[Title/Abstract] OR "motor development"[Title/Abstract]) AND ("preschool child"[Title/Abstract] OR "child development"[Title/Abstract] OR "child behavior"[Title/Abstract] OR "infant behavior"[Title/Abstract]) (Keywords: "risk factor*" OR Keywords: "protective factor*" OR Keywords: "biopsychosocial factor*") AND (Keywords: "psychological" OR Keywords: "social" OR Keywords: "biological" OR Keywords: "cognition" OR Keywords: "emotional" OR Keywords: "intelligence" OR Keywords: "language development" OR Keywords: "language" OR Keywords: "motor development") AND (Keywords: "child development" OR Keywords: "preschool child" OR Keywords: "child behavior" OR Keywords: "infant behavior")
PsycINFO	(Keywords: "risk factor*" OR Keywords: "protective factor*" OR Keywords: "biopsychosocial factor*") AND (Keywords: "psychological" OR Keywords: "social" OR Keywords: "biological" OR Keywords: "cognition" OR Keywords: "emotional" OR Keywords: "intelligence" OR Keywords: "language development" OR Keywords: "language" OR Keywords: "motor development") AND (Keywords: "child development" OR Keywords: "preschool child" OR Keywords: "child behavior" OR Keywords: "infant behavior") (Abstract: "risk factor*" OR Abstract: "protective factor*" OR Abstract: "biopsychosocial factor*") AND (Abstract: "psychological" OR Abstract: "social" OR Abstract: "biological" OR Abstract: "cognition" OR Abstract: "emotional" OR Abstract: "intelligence" OR Abstract: "language development" OR Abstract: "language" OR Abstract: "motor development") AND (Abstract: "child development" OR Abstract: "preschool child" OR Abstract: "child behavior" OR Abstract: "infant behavior")
SciElo	("risk factor*" OR "protective factor*" OR "biopsychosocial factor*") AND (psychological OR social OR biological OR cognition OR emotional OR intelligence OR "language development" OR "language" OR "motor development") AND ("preschool child" OR "child development" OR "child behavior" OR "infant behavior")
Web of Science	TS=("risk factor*" OR "protective factor*" OR "biopsychosocial factor*") AND TS=("psychological" OR "social" OR "biological" OR "cognition" OR "emotional" OR "intelligence" OR "language development" OR "language" OR "motor development") AND TS=("preschool child" OR "child development" OR "child behavior" OR "infant behavior")
Scopus	(TITLE-ABS-KEY ("risk factor*" OR "protective factor*" OR "biopsychosocial factor*") AND TITLE-ABS-KEY (psychological OR social OR biological OR cognition OR emotional OR intelligence OR "language development" OR language OR "motor development") AND TITLE-ABS-KEY ("preschool child" OR "child development" OR "child behavior" OR "infant behavior"))AND PUBYEAR > 2013 AND PUBYEAR < 2025 AND (LIMIT-TO (DOCTYPE , "ar")) AND (LIMIT-TO (SRCTYPE , "j")) AND (LIMIT-TO (LANGUAGE , "English") OR LIMIT-TO (LANGUAGE ,"Spanish") OR LIMIT-TO (LANGUAGE, "Portuguese")) AND (LIMIT-TO (AFFILCOUNTRY , "Brazil")) (TITLE-ABS-KEY ("risk factor*" OR "protective factor*" OR "biopsychosocial factor*") AND TITLE-ABS-KEY (psychological OR social OR biological OR cognition OR emotional OR intelligence OR "language development" OR language OR "motor development") AND TITLE-ABS-KEY ("preschool child" OR "child development" OR "child behavior" OR "infant behavior")) AND PUBYEAR > 2011 AND PUBYEAR < 2014 AND (LIMIT-TO (AFFILCOUNTRY , "Brazil"))

Note. The last search was conducted on March 20, 2024, and was limited to the title, abstract, and/or keywords of the articles. Filters were used in order to restrict results to only scientific articles reviewed by peers, in accordance with inclusion criteria such as publication year (2014-2024), language (English, Spanish, or Portuguese), and studies involving human subjects.

***Table** A2*

Presentation of Bias Analysis

Study	Study design and scores per item*									
	Cross-sectional									
	1	2	3	4	5	6	7	8	Total	Final Decision
Araujo et al. (2020)	1	0	1	1	1	0	1	1	6	Excluded
Delgado et al. (2020)	1	1	1	1	1	0	1	1	7	Excluded
Fernandes et al. (2012)	1	1	1	1	1	1	1	1	8	Included
Araujo et al. (2017)	1	0	1	1	1	1	1	1	7	Included
Lamônica et al. (2015)	1	0	1	1	1	0	0	1	5	Excluded
Formiga et al. (2013)	1	1	1	1	1	0	0	1	6	Excluded
Caldas et al. (2014)	1	1	1	1	1	1	0	1	7	Included
Rodovalho et al. (2012)	1	1	1	1	1	0	0	1	6	Excluded
Schiavo et al. (2020)	0	0	1	1	1	1	0	1	5	Excluded
Formiga et al. (2015)	1	1	1	1	1	0	1	1	7	Excluded
Neves et al. (2016)	1	1	1	1	1	1	1	1	8	Included
Herrero et al. (2012)	1	0	1	1	0	0	0	0	3	Excluded
Paula et al. (2020)	1	1	1	1	1	0	1	1	7	Excluded
Ribeiro et al. (2014)	1	0	1	1	1	1	1	1	7	Included
Costa et al. (2015)	1	1	1	1	1	0	1	1	7	Excluded
Santos et al. (2020)	1	1	1	1	1	1	1	1	8	Included
Santos et al., (2016)	0	1	1	1	1	1	0	1	6	Excluded
Eickmann et al. (2012)	1	1	1	1	1	0	1	1	7	Excluded
Lima & Cáceres-Assenço (2022)	1	0	1	1	1	1	0	1	6	Included
Saur et al. (2018)	1	0	1	1	1	0	0	0	4	Excluded
Rocha et al. (2021)	1	1	1	1	1	1	1	1	8	Included
Tella et al. (2018)	1	0	1	1	1	1	1	1	7	Included
Chaves et al. (2021)	1	1	1	1	1	0	1	1	7	Excluded
Silva et al. (2015)	1	0	1	1	1	1	1	1	7	Included
Panceri et al. (2012)	0	0	1	1	1	1	1	0	5	Excluded
Zago et al. (2017)	1	0	1	1	1	0	1	1	6	Excluded
Boo et al. (2018)	1	1	1	1	1	0	0	0	5	Excluded
Caruzzo et al. (2020)	1	0	1	1	1	1	1	1	7	Included
Góes et al. (2015)	1	1	1	1	1	1	1	1	8	Included
Silva et al. (2015)	1	1	1	1	1	1	1	1	8	Included
Ribeiro et al. (2014)	1	0	1	1	1	1	0	1	6	Included
Abreu et al. (2024)	1	1	1	1	1	1	0	1	7	Included
Cavalheiro et al. (2019)	1	0	1	1	0	0	1	1	5	Excluded
Correa et al. (2019)	1	1	1	1	1	1	1	1	8	Included
Machado et al. (2019)	1	1	1	1	1	1	1	1	8	Included
Souza et al. (2023)	1	0	1	1	0	0	0	1	4	Excluded
Caetano et al. (2021)	0	1	1	1	1	1	1	1	7	Excluded
Kofke et al. (2022)	1	1	1	1	1	1	1	1	8	Included
Marques et al. (2023)	1	1	1	1	1	0	1	1	7	Excluded
Mezzari et al. (2019)	0	0	1	1	1	0	0	1	4	Excluded
Monteiro-Luperi et al. (2016)	1	0	1	1	0	0	1	0	4	Excluded
Novakoski et al. (2023)	1	0	1	1	1	0	1	1	6	Excluded
Orioli et al. (2024)	1	1	1	1	1	1	1	1	8	Included
Pedrotti et al. (2024)	1	1	1	1	1	1	0	1	7	Included
Saccani et al. (2013)	1	0	1	1	1	1	1	1	7	Included
Saccani & Valentini (2015)	1	1	1	1	1	0	1	1	7	Excluded
Santos et al. (2024)	1	1	1	1	1	1	1	1	8	Included
Santos et al. (2022)	1	1	1	1	1	0	1	1	7	Excluded
Shephard et al. (2019)	1	0	1	1	1	1	1	1	7	Included
Silva et al. (2023)	1	1	1	1	1	1	0	1	7	Included
Silveira et al. (2012)	1	1	1	1	1	0	1	1	7	Excluded
Tabaquim et al. (2013)	0	0	1	1	0	0	0	1	3	Excluded
Venturella et al. (2013)	1	0	1	1	1	0	1	1	6	Excluded
Yamaguchi et al. (2019)	1	1	1	1	1	1	1	1	8	Included
Zago et al. (2023)	1	1	1	1	1	1	1	1	8	Included
Panceri et al. (2020)	1	0	1	1	1	1	1	1	7	Included

Cohort															
	1	2	3	4	5	6	7	8	9	10	11			Total	Final Decision
Almeida et al. (2021)	1	1	1	1	0	1	0	1	1	0	1			8	Excluded
Reis et al. (2012)	1	1	1	1	1	1	0	1	1	0	1			9	Excluded
Souza & Magalhães (2012)	1	1	1	1	1	1	1	1	1	0	1			10	Excluded
Nascimento et al. (2020)	1	0	1	1	1	1	0	1	0	0	1			7	Excluded
Sá et al. (2017)	1	0	1	1	0	1	1	1	0	0	1			7	Excluded
Bortagarai et al. (2021)	1	1	1	1	1	1	0	1	0	0	1			8	Excluded
Ticona et al. (2021)	0	1	1	1	1	0	0	1	1	1	1			8	Excluded
Borba e Valentini (2015)	1	1	1	1	0	1	1	1	1	1	1			10	Excluded
Camargo-Figuera et al. (2014)	1	1	1	1	1	1	0	1	1	1	1			10	Included
Campos et al. (2016)	1	1	1	1	1	1	1	1	1	1	1			11	Included
Oliveira et al. (2016)	0	1	1	1	0	1	1	1	1	1	0			8	Excluded
Domingues et al. (2014)	1	1	1	1	1	1	1	1	1	1	1			11	Included
Ferreira et al. (2014)	1	1	1	1	1	1	1	1	1	1	1			11	Included
Fink et al. (2018)	1	1	1	1	1	1	0	1	1	1	1			10	Included
Hass et al. (2023)	1	1	1	1	1	1	1	1	1	1	1			11	Included
Aristizábal et al. (2023)	1	1	1	1	1	1	1	1	1	1	1			11	Included
Marques et al. (2019)	0	1	1	0	0	1	1	1	0	0	0			5	Excluded
Mattos et al. (2023)	0	1	1	1	1	1	1	1	1	1	1			10	Excluded
Negrão et al. (2020)	1	1	1	1	1	1	1	1	1	1	1			11	Included
Nunes et al. (2020)	1	1	1	1	0	1	1	1	1	0	0			8	Excluded
Pamplona et al. (2019)	1	1	1	1	0	1	0	1	1	0	1			8	Excluded
Pereira et al. (2016)	1	1	1	1	1	1	1	1	1	1	1			11	Included
Rocha et al. (2020)	1	1	1	1	1	1	0	1	0	0	1			8	Excluded
Sanchez-Luquez et al. (2024)	1	1	1	1	1	1	1	1	1	1	1			11	Included
Santos et al. (2024)	1	1	1	1	1	1	1	1	1	1	1			11	Included
Valentini et al. (2021)	0	1	1	1	1	1	1	1	0	0	1			8	Excluded
Silva et al. (2024)	1	1	1	1	1	1	0	1	1	1	1			10	Included
Pinheiro et al. (2024)	1	1	1	1	1	1	1	1	1	1	1			11	Included
Fattore et al. (2017)	1	1	1	1	0	1	1	1	0	0	0			7	Excluded
Freitas et al. (2022)	0	1	1	1	0	1	1	1	1	1	0			8	Excluded
Randomized															
	1	2	3	4	5	6	7	8	9	**10**	11	12	13	Total	Final Decision
Weisleder et al. (2018)	1	1	1	1	0	1	1	1	1	1	1	1	1	12	Included
Fatori et al. (2021)	1	1	1	0	0	1	1	1	1	1	1	1	1	11	Included
Quasi-experimental															
	1	2	3	4	5	6	7	8	9					Total	Final Decision
Panceri et al. (2017)	1	1	1	1	1	1	1	0	1					8	Excluded
McCoy et al. (2024)	1	1	1	1	0	1	1	1	1					8	Included

Note. *The items correspond to the checklist, according to each delineation, available in Critical Appraisal Tools on the JBI page, which can be accessed at https://jbi.global/critical-appraisal-tools

Complement to the analysis assessment of the methodological quality of the included studies

Items regarded as critical

Cross-sectional studies: minimal score of 6 out of 8 items, without absence in the critical items 1 (clear definition of the inclusion criteria), 3 (valid measurement of the exposure), 5 (identification of confounders) and 6 (strategies for confounder control)

Longitudinal studies (cohort): minimal score of 8 out of 11 items, with obligation for critical items 1 (similar groups), 3 (validly measured exposure), 4 (identification of confounders), 5 (confounder control), 9 (description and analysis of losses that were over 20 %) and 10 (strategies to handle significant loss).

Quasi-experimental studies: minimal scores of 7 out of 9 items, with a demand for the full presence of critical items 1 (clear time precedence between cause and effect), 2 (presence of control group), 3 (initial comparability of the groups) and 8 (complete follow-up period or duly treated loss).

Randomized Control Studies (RCT): minimal score of 10 out of 13 items, the researchers adopted a specific, more flexible criterion, and kept as critical items 1 (true randomization), 2 (concealment of the allocation), 7 (blinding of the assessors of results), 10 (description and treatment of follow-up loss) and 11 (analysis for intention to treat), permission to make items referring to the blinding of the

participants and appliers flexible (items 4 and 5). Thus, the included randomized studies present an absence of failures in the other critical aforementioned items.

Table A3

Instruments for assessing child development and/or adopted behavior in the studies

Instrument's name	Assessment domain	Neuropsychological Constructs
AIMS ALBERTA - Alberta Infant Motor Scale	**Motor Development**	Motor Development Sequence and control of antigravitational muscles in prone, supine, sitting, and standing positions
ASQ-3 - Ages and Stages Questionnaire	**Global Behavior**	Communication, gross motor skills, fine motor skills, problem-solving and personal-social
BAYLEY II-EM - Bayley Scales of Infant and Toddler Development II	**Global development**	Memory, habituation, problem-solving, primitive concepts of numbers, generalizations, classification, vocalization, language and social skills
BAYLEY III - Bayley Scales of Infant and Toddler Development III	**Global Development**	Cognition, motor, language, socioemotional and adaptive behavior
BNT - Boston Naming Test	**Language Development**	Naming
BDI – Batelle's Development Inventory (screening version)	**Global Development**	Motor skills, communication, cognition, social interaction, attention, memory, and school preparedness.
CBCL - Child Behavior Checklist	**Socioemotional behavior**	Socioemotional
DENVER II - Denver developmental screening test	**Global Development**	Personal-social, adaptive fine motor skills, gross motor skills and language
ECBQ - Early Childhood Behavior Questionnaire	**Self-regulation**	Caretaker's report that measures behavior and emotional regulation.
ELM - Early Language Milestone Scale	**Language Development**	Expressive and receptive auditory language, visual processing, and speech intelligibility
EMMC - Columbia Mental Maturity Scale	**Intelligence Development**	General reasoning (intelligence)
IDADI – Dimensional Inventory of Child Development Assessment	**Global Development**	Cognitive, Communication, Expressive and receptive language, gross and fine motor skills, Socioemotional and Adaptive behavior
IBQ-R - Infant Behavior Questionnaire – Revised	**Child Temper**	Negative behavior, Orientation/Regulation and Extroversion/Surgence
IMCI - Integrated Management of Childhood Illness)	**Cognitive and motor development**	Motor and cognitive development
ITSEA - Competence Domain of the Infant-Toddler Social and Emotional Assessment-Revised	**Emotional Behavior**	Internalization, Externalization, Regulation and competence
MABC-2 - Movement Assessment Battery for Children – 2	**Motor Development**	Manual dexterity, aiming and grabbing, balance (dynamic and static)

Instrument's name	Assessment domain	Neuropsychological Constructs
PEDI - Pediatric Evaluation of Disability Inventory	**Global Development**	Daily life activities, behavior, cognition, communication, food, functional mobility, language, occupational, reasoning, problem-solving, and social relations
PRIDI - Regional Project on Child Development Indicators	**Global Development**	Cognitive, Language, Motor Skills
SDQ - Strengths and Difficulties Questionnaire	**Child Behavior**	Externalization and Internalization (conduct problems, emotional problems, hyperactivity and lack of attention)
SWYC-BR - Survey of Wellbeing of Young Children (Brazilian version)	**Global Development**	Development (motor, cognitive, language), emotional and behavioral symptoms, and family context.
SON-R - Snijders-Oomen Nonverbal Intelligence Test	**Intelligence Development**	Non-verbal intelligence
THCP – Test of Pre-Literacy Skills and Knowledge	**Global Development**	Perception skills, Language, Quantitative reasoning, Memory and concentrated attention
TIMT – Infant Working Memory Test	**Development of executive functions**	Working memory
TSFI - Test of Sensory Functions in Infants	**Sensorial Development**	Assesses sensorial processing and reactivity in babies in five domains: deep tactile pressure, adaptative motor function, visual-tactile integration, motor-eye control and vestibular stimulation.
TVIP - Test de Vocabulario en Imágenes Peabody	**Language development**	Auditory receptive vocabulary
WISC-III – Wechsler Intelligence Scale for Children	**Cognitiva Assessment**	Standardized Instrument for measuring the Intelligence Quotient (IQ) of children aged from 6 to 16 years, composed by subtests that assess skills such as logical reasoning, memory, attention, language, verbal comprehension and processing speed.
WPPSI – Wechsler Preschool and Primary Scale of Intelligence	**Cognitive Development**	Standardized assessment of the Intelligence Quotient (IQ), including verbal reasoning and general cognitive skills.

Table A4

Instruments for assessing the risk/protective factors adopted in the studies

Assessment Instrument for the adopted risk/protective factors
ABEP – Brazilian Economic Classification Criteria
ACcA – Clinical assessment with Anamneses
ACIRI – Inventory of Adult/children interactive reading
ADHD Self-report Scale – Self-report scale for ADHD
AHEMD-IS - Affordances in the Home Environment for Motor Development - Infant Scale

Assessment Instrument for the adopted risk/protective factors
Alexander - Alexander Intrauterine Growth Curve
ASRS - Adult ADHD Self-Report Scale
BAI - Beck's anxiety inventory
BD – Digital scale (BD)
BDI - Beck's depression inventory
CES-D - Center for Epidemiologic Studies Depression Scale
CSSAS-USP – socioeconomic classification of the social assistance department of the university of São Paulo
CTQ - Childhood Trauma Questionnaire
QCV-19 – COVID-19 questionnaire
DAIS - Daily Activities of Infants Scale
DIAP - Dyadic Interaction Assessment Protocol
Escala Ballard – estimate gestational age at birth
EPDS - Brazilian adaptation of the Edinburgh Postnatal Depression Scale
EBIA – Brazilian scale for food insecurity
EEG – Electroencephalogram
EL – Laboratory Exams
ENB - New Ballard Scale
EP – Parental Interview
SWYC-BR - Family Questions
GAD-7 - Generalized Anxiety Disorder
HITSQ - Hurt, Insult, Threaten, Scream questionnaire
HOME - The Home Observation for Measurement of the Environment Inventory
IPF – Physical punishment scale
IEV – Chronic exposure to violence
ISD – Development support index
IRB – Biological risk index
IRS – Social risk index
IIRBRLHC - Interview for the Identification of Risk and Biopsychosocial Resources in the Life History of the Child
IMC – Body mass index
IMNP – Poverty Level Measuring Instrument
ITERS-R - Infant/Toddler Environment Rating Scale – Revised
KIDI - Knowledge of Infant Development Inventory
MacArthur - MacArthur Development Inventory on Communicative Skills

Assessment Instrument for the adopted risk/protective factors
MUQ- Media Use Questionnaire
NCHS – Growth curves from the National Center for Health Statistics
PA – Custom-developed questionnaire by the authors to assess physical activity
IQ-PGS – Polygenic Score for intelligence
PM – Medical report
PPSDS - Physical Punishment subscale of the Socolar Discipline Survey
PREAUT - Child Development Risk Indicators and PREAUT protocols
QC – Clinical situation
QCBC – Child's biopsychosocial characteristics questionnaire
QEMP - Maternal and Paternal Style Questionnaire
QSUS – Structured questionnaire for the use of substances
QSP – Study-Specific Sociodemographic Questionnaire
SES – Socioeconomic status index
SDQ- Sociodemographic Data Questionnaire
SRQ-20 - Self-Reporting Questionnaire
STIMQ - StimQ cognitive home-environment questionnaire
SWYC - Family Questions
(PCR and/or serology) - for SARS-CoV-2.
UTIN – time of hospitalization at the neonatal intensive care unit
Cranial Ultrasound – image exam
YC-PEM - Young Children's Participation and Environment Measure
WHO Anthro Software – Calculate indicators for physical growth (height and weight)

References

Abreu, R. W. F. D., Lima, C. R. G., Verdério, B. N., Santos, M. M. D., dos Santos, A. N., Brugnaro, B. H., & Rocha, N. A. C. F. (2024). Association between environmental factors during the COVID-19 pandemic and functioning of infants with biological risk in the first year of life: Cross-sectional exploratory study. *Early Human Development*, *191*. https://doi.org/10.1016/j.earlhumdev.2024.105987

Almeida, N., da Silva, D. A., da Silva, L. R. V., Vojciechowski, A. S., Motter, A. A., & Zotz, T. G. G. (2021). Analysis of neuropsychomotor development of preterm in multidisciplinary ambulatory: A view of physiotherapy. *Revista Pesquisa em Fisioterapia*, *11*(1), 1-10. https://doi.org/10.17267/2238-2704rpf.v11i1.3378

Araujo, D. M., Cabrera Santos, D. C., & Marconi Pinheiro Lima, M. C. (2020). Cognitive, language and motor development of infants exposed to risk and protective factors. *International Journal of Pediatric Otorhinolaryngology, 138*, 110353. https://doi.org/10.1016/j.ijporl.2020.110353

Araujo, L. B., Mélo, T. R., & Israel, V. L. (2017). Low birth weight, family income and paternal absence as risk factors in neuropsychomotor development. *Journal of Human Growth and Development*, *27*(3), 272. https://doi.org/10.7322/jhgd.124072

Aristizábal, L. Y. G, Rocha, P. R. H, Confortin, S. C., Simões, V. M. F., Bettiol, H., Barbieri, M. A., & Silva, A. A. M. (2023). Association between neonatal near miss and infant development: The Ribeirão Preto and São Luís birth cohorts (BRISA). *BMC Pediatrics*, *23*(1), 125. https://doi.org/10.1186/s12887-023-03897-3

Boo, F. L., Mateus, M. C., & Duryea, S. (2018). Analysis of socioeconomic gradients in the development of children aged 0–3 years in Fortaleza, Northeastern Brazil. *Revista de Saúde Pública*, *52*, 84-84. https://doi.org/10.11606/s1518-8787.2018052000525

Borba, L. S. de, & Valentini, N. C. (2015). Motor and cognitive development of infants of adolescent and adult mothers: Longitudinal study X1—Desenvolvimento motor e cognitivo de bebês de mães adolescentes e adultas: Estudo longitudinal. *Revista Brasileira de Cineantropometria & Desempenho Humano*, *17*(4), 438-449. https://doi.org/10.5007/1980-0037.2015v17n4p438

Bortagarai, F. M., Moraes, A. B. de, Pichini, F. dos S., & Souza, A. P. R. de. (2021). Risk factors for fine and gross motor development in preterm and term infants. *CoDAS*, *33*(6), e20200254–e20200254. https://doi.org/10.1590/2317-1782/20202020254

Caetano, S. C., Ribeiro, M. V. V., Askari, M. S., Sanchez, Z. M., do Rosário, M. C., Perissinoto, J., Resegue, R., Felix, E., Mariano, M., Fidalgo, T. M., Caetano, M., Mari, J. J., Surkan, P. J., & Martins, S. S. (2021). An epidemiological study of childhood development in an urban setting in Brazil. *Brazilian Journal of Psychiatry*, *43*(1), 43-54. https://doi.org/10.1590/1516-4446-2020-0934

Caldas, C. S. O., Takano, O. A., Mello, P. R. B., Souza, S. C., & Zavala, A. A. Z. (2014). Language abilities performance of children born preterm and low birth weight and associated factors. *Audiology - Communication Research, 19*(2), 158-166. https://doi.org/10.1590/S2317-64312014000200010

Camargo-Figuera, F. A., Barros1, A. J. D., Santos, I. S., Matijasevich, A., & Barros, F. C. (2014). Early life determinants of low IQ at age 6 in children from the 2004 Pelotas Birth Cohort: A predictive approach. *BMC Pediatrics*, *14*(1). https://doi.org/10.1186/s12887-014-0308-1

Campos, D., Arias, A. V., Campos-Zanelli, T. M., Souza, D. S., dos Santos Neto, O. G., Peralta, C. F. A., & Guerreiro, M. M. (2016). Twin-twin transfusion syndrome: Neurodevelopment of infants treated with laser surgery. *Arquivos de Neuro-Psiquiatria*, *74*(4), 307-313. https://doi.org/10.1590/0004-282X20160032

Caruzzo, N. M., Pereira dos Santos, V. A., Belem, I. C., Contreira, A. R., Fiorese, L., & Lopes Vieira, J. L. (2020). Association between motor performance, cognitive maturity and socio-demographic aspects in preschooler children. *Journal of Physical Education (Maringa)*, *31*(1). https://doi.org/10.4025/JPHYSEDUC.V31I1.3174

Cavalheiro, M., Lamônica, D., Hage, S., & Maximino, L. (2019). Child development skills and language in toddlers with cleft lip and palate. *International Journal of Pediatric Otorhinolaryngology*, *116*, 18-21. https://doi.org/10.1016/j.ijporl.2018.10.011

Chaves, K. Y. S., Campos, M. M. M. S., & Nobre, R. A. (2021). Mother-child bonding, environment, and motor development of babies at risk accompanied by a follow-up. *Revista Brasileira de Saude Materno Infantil*, *21*(4), 1015-1023. https://doi.org/10.1590/1806-93042021000400004

Correia, L. L., Rocha, H. A. L., Sudfeld, C. R., Rocha, S. G. M. O., Leite, Á. J. M., Campos, J. S., & Silva, A. C. E. (2019). Prevalence and socioeconomic determinants of development delay among children in Ceará, Brazil: A population-based study. *PLoS ONE*, *14*(11). https://doi.org/10.1371/journal.pone.0215343

Costa, E. F., Cavalcante, L. I. C., & Dell'Aglio, D. D. (2015). Language development profile of children in Belem, according to Denver developmental screening test. *Revista CEFAC*, 17(4), 1090-1102. https://doi.org/10.1590/1982-0216201517418514

Delgado, D. A., Michelon, R. C., Gerzson, L. R., Almeida, C. S. de, & Alexandre, M. da G. (2020). Evaluation of child motor development and its association with social vulnerability. *Fisioterapia e Pesquisa*, *27*(1), 48-56. https://doi.org/10.1590/1809-2950/18047027012020

Domingues, M. R., Matijasevich, A., Barros, A. J. D., Santos, I. S., Horta, B. L., & Hallal, P. C. (2014). Physical activity during pregnancy and offspring neurodevelopment and IQ in the first 4 years of life. *PLoS ONE*, *9*(10). https://doi.org/10.1371/journal.pone.0110050

Eickmann, S. H., Malkes, N. F. de A., & Lima, M. de C. (2012). Psychomotor development of preterm infants aged 6 to 12 months. *Sao Paulo Medical Journal*, *130*(5), 299-306.

Fatori, D., Zuccolo, P., Shephard, E., Brentani, H., Matijasevich, A., Ferraro, A., Fracolli, L., Chiesa, A., Leckman, J., Miguel, E., & Polanczyk, G. (2021). A randomized controlled trial testing the efficacy of a Nurse Home Visiting Program for Pregnant Adolescents. *Scientific reports*, *11*(1). https://doi.org/10.1038/s41598-021-93938-7

Fattore, I. de M., Uhde, R. M., Oliveira, L. D., Roth, A. M., & Souza, A. P. R. de. (2017). Análise comparativa das vocalizações iniciais de bebês prematuros e a termo, com e sem risco ao desenvolvimento. *CoDAS*, *29*(4), e20160075-e20160075. https://doi.org/10.1590/2317-1782/20172016075

Fernandes, L. V., Goulart, A. L., Santos, A. M. N., Barros, M. C. M., Guerra, C. C., & Kopelman, B. I. (2012). Avaliação do neurodesenvolvimento de prematuros de muito baixo peso ao nascer entre 18 e 24 meses de idade corrigida pelas escalas Bayley III. *Jornal de Pediatria, 88*(6), 471-478. https://doi.org/10.1590/S0021-75572012000600005

Ferreira, R. C., Mello, R. R., & Silva, K. S. (2014). Neonatal sepsis as a risk factor for neurodevelopmental changes in preterm infants with very low birth weight. *Jornal de Pediatria (Rio J.)*, *90*(3), 293-299. https://doi.org/10.1016/j.jped.2013.09.006

Fink, G., Andrews, K. G., Brentani, H., Grisi, S., Ferrer, A. P. S., & Brentani, A. (2018). Overall and sex-specific associations between fetal adversity and child development at age 1 year: Evidence from Brazil. *American Journal of Epidemiology*, *187*(11), 2324-2331. https://doi.org/10.1093/aje/kwy141

Formiga, C. K. M. R., Nonato, J. C. R., Amaral, L. E. F. do, Fagundes, R. R., & Linhares, M. B. M. (2013). Comparação do desenvolvimento motor de lactentes pré-termo de duas amostras regionais brasileiras. *Revista Brasileira de Crescimento e Desenvolvimento Humano*, *23*(3), 352-357.

Formiga, C. K. M. R., Vieira, M. E. B., & Linhares, M. B. M. (2015). Developmental assessment of infants born preterm: comparison between the chronological and corrected ages. *Journal of Human Growth and Development*, *25*(2), 230. https://doi.org/10.7322/jhgd.103020

Freitas, N. F. de, Nunes, C. R. do N., Rodrigues, T. M., Valadares, G. C., Alves, F. L., Leal, C. R. V., Luz, N. M. C. da, Rabello, M. de O., Machado, M. G. P., & Bouzada, M. C. F. (2022). Neuropsychomotor development in children born preterm at 6 and 12 months of corrected gestational age. *Revista Paulista de Pediatria*, *40*, e2020199-e2020199. https://doi.org/10.1590/1984-0462/2022/40/2020199

Góes, F. V. D., Méio, M. D. B. B., Mello, R. R. D., & Morsch, D. (2015). Evaluation of neurodevelopment of preterm infants using Bayley III scale. *Revista Brasileira de Saúde Materno Infantil*, *15*(1), 47-55. https://doi.org/10.1590/S1519-38292015000100004

Hass, J. V., Panceri, C., Procianoy, R. S., Silveira, R. de C., & Valentini, N. C. (2023). Risk Factors for cognitive, motor and language development of preterm children in the first year of life. *Revista Paulista de Pediatria*, *41*, e2021165-e2021165. https://doi.org/10.1590/1984-0462/2023/41/2021165

Herrero, D., Monteiro, C. B. de M., Massetti, T., Silva, T. D. da, Barros, A. R. de, Valenti, V. E., & Abreu, L. C. de. (2012). Characterization of the motor performance in infants with a diagnosis of Cerebral Palsy in process of rehabilitation: the importance of the proactivity of caregivers. *HealthMED Journal of Society for development in new net environment in B&H*, *6*(11), 3558-3564.

Kofke, L., Pérez-Escamilla, R., Gubert, M. B., & Buccini, G. (2022). Socio-demographic, maternal, and infant characteristics associated with early childhood development delays among children of young mothers in Brasília, Brazil. *PLoS ONE*, *17*(3). https://doi.org/10.1371/journal.pone.0266018

Lamônica, D. A. C., Paiva, C. S. T., Abramides, D. V. M., & Biazon, J. L. (2015). Communication skills in individuals with spastic diplegia. *CoDAS, 27*(2), 135–141. https://doi.org/10.1590/2317-1782/20152013060

Lima, A. M. O., & Cáceres-Assenço, A. M. (2022). What factors interfere with the performance of preschool children in the language subtest of Bayley-III? *CoDAS, 34*(1), 1-6. https://doi.org/10.1590/2317-1782/20212020200

Machado, A. C. C. P., de Castro Magalhães, L., de Oliveira, S. R., & Bouzada, M. C. F. (2019). Is sensory processing associated with prematurity, motor and cognitive development at 12 months of age? *Early Human Development*, *139*. https://doi.org/10.1016/j.earlhumdev.2019.104852

Marques, F. J. P., Amarante, C., Elias, M. A. C., Klein, R., Nascimento, O. J. M., & Leyser, M. (2023). Neurodevelopmental outcomes in a cohort of children with congenital Zika syndrome at 12 and 24 months of age. *Child: Care, Health and Development*, *49*(2), 304-310. https://doi.org/10.1111/cch.13044

Marques, F. J. P., Teixeira, M. C. S., Barra, R. R., de Lima, F. M., Dias, B. L. S., Pupe, C., Nascimento, O. J. M., & Leyser, M. (2019). Children born with congenital Zika syndrome display atypical gross motor development and a higher risk for cerebral palsy. *Journal of Child Neurology*, *34*(2), 81-85. https://doi.org/10.1177/0883073818811234

Mattos, A. M., Rastely-Junior, V. N., Pires, M. M., Aguilar, J. P., Lessa, M. S. A., Regis, C., Wanderley, M., Leony, J., Bouzon, J., Ballalai, V., Vieira, C., Carvalho, G. B. S., Almeida, J. R. M., Nery, N., Leal, R., Costa, F., Ko, A. I., Reis, M. G., & Oliveira-Filho, J. (2023). Predictors of Neurodevelopment in Microcephaly Associated with Congenital Zika Syndrome: A Prospective Study. *Children*, *10*(12). https://doi.org/10.3390/children10121831

McCoy, D. C., Dormal, M., Cuartas, J., Carreira dos Santos, A., Fink, G., & Brentani, A. (2024). The acute effects of community violence on young children's regulatory, behavioral, and developmental outcomes in a low-income urban sample in Brazil. *Journal of Child Psychology and Psychiatry and Allied Disciplines*, *65*(5), 620-630. https://doi.org/10.1111/jcpp.13799

Mezzari, S. S., Donadio, M. V. F., Gerzson, L. R., & De Almeida, C. S. (2019). Motor development and malnutrition in a risk population of a neighborhood in Porto Alegre. *Medicina (Brazil)*, *52*(2), 80-90. https://doi.org/10.11606/issn.2176-7262.v52i2p80-90

Monteiro-Luperi, T. I., Befi-Lopes, D. M., Diniz, E. M. A., Krebs, V. L., & Carvalho, W. B. de. (2016). Linguistic performance in 2 years old preterm, considering chronological age and corrected age. *Codas*, *28*(2), 118-122. https://doi.org/10.1590/2317-1782/20162015075

Nascimento, G., Kessler, T., de Souza, A., Costa, I., & de Moraes, A. (2020). Risk indicators for hearing loss and language acquisition and their relationship with socioeconomic, demographic and obstetric variables in preterm and term babies. *CODAS*, *32*(1). https://doi.org/10.1590/2317-1782/20192018278

Negrão, M. E. A., Rocha, P. R. H., Saraiva, M. C. P., Barbieri, M. A., Simões, V. M. F., Batista, R. F. L., Ferraro, A. A., & Bettiol, H. (2020). Association between tobacco and/or alcohol consumption during pregnancy and infant development: Brisa cohort. *Brazilian Journal of Medical and Biological Research*, *54*(1), 1-9. https://doi.org/10.1590/1414-431x202010252

Neves, K. R., Morais, R. L. S., Teixeira, R. A. & Pinto, P. A. F. (2016). Growth and development and their environmental and biological determinants. *Jornal de Pediatria, 92*(3), 241-250. https://doi.org/10.1016/j.jped.2015.08.007

Novakoski, K. R. M., de Araujo, L. B., Mélo, T. R., & Israel, V. L. (2023). Mom Didn't Go to School, Dad Is Out of Work: Associations between Maternal Educational Attainment, Family Socioeconomic Status, and Infant Development. *Health services insights*, *16*, 11786329231163009. https://doi.org/10.1177/11786329231163009

Nunes, S. F., Chiquetti, E. M. dos S., Moraes, A. B. de, & Souza, A. P. R. de. (2020). Prechtl's General Movements Assessment (GMA) in early detection for child development risk. *Fisioterapia e Pesquisa*, *27*(4), 347-355. https://doi.org/10.1590/1809-2950/19008427042020

Oliveira Alves, C., De Castro, L., Silva, R., Freitas, I., Gomes, M., & Cândida, M. (2016). Factors associated with the development of preterm children at four and eight months of corrected gestational age. *Journal of Human Growth and Development*, *26*(1), 41-47. https://doi.org/10.7322/jhgd.110024

Orioli, P. A., Johnston, C., Del Bigio, J. Z., Krebs, V. L. J., Pissolato, M., Gibelli, M. A. B. C., De Araujo, O. R., Francisco, R. P. V., & De Carvalho, W. B. (2024). Assessment of newborn neuropsychomotor development born with exposure to SARS-CoV-2 in the perinatal period using the Bayley III scale at 6 months of age. *Clinics*, *79*. https://doi.org/10.1016/j.clinsp.2024.100460

Pamplona, M. C. C. A., Chaves, E. C., Carvalho, A. C., Pamplona, R. C. A., Vallinoto, A. C. R., Queiroz, M. A. F., Lima, S. S., & Ishak, R. (2019). Influence of exposure and vertical transmission of HIV-1 othe neuropsychomotor development in children. *Revista da Sociedade Brasileira de Medicina Tropical*, *52*. https://doi.org/10.1590/0037-8682-0263-2018

Panceri, C., Pereira, K., & Valentini, N. (2017). The motor intervention as delays prevention factor in motor and cognitive development of infants during the hospital stay. *Cadernos Brasileiros de Terapia Ocupacional*, *25*(3), 469-479. https://doi.org/10.4322/2526-8910.ctoAO0977

Panceri, C., Pereira, K., Valentini, N, & Sikilero, R. (2012). A influência da hospitalização no desenvolvimento motor de bebês internados no Hospital de Clínicas de Porto Alegre. *Clinical and Biomedical Research, 32*(2).

Panceri, C., Valentini, N. C., Silveira, R. C., Smith, B. A., & Procianoy, R. S. (2020). Neonatal adverse outcomes, neonatal birth risks, and socioeconomic status: combined influence on preterm infants' cognitive, language, and motor development in Brazil. *Journal of Child Neurology*, *35*(14), 989-998. https://doi.org/10.1177/0883073820946206

Paula, Í. R., Oliveira, J. C. S., Batista, A. C. F., Nascimento, L. C. S., Araújo, L. B. de, Ferreira, M. B., Gomes, M. B., & Azevedo, V. M. G. de O. (2020). Influência da cardiopatia congênita no desenvolvimento neuropsicomotor de lactentes. *Fisioterapia e Pesquisa*, *27*(1), 41-47. https://doi.org/10.1590/1809-2950/18039627012020

Pedrotti, B. G., Bandeira, D. R., & Frizzo, G. B. (2024). Context of digital media use in early childhood: Factors associated with cognitive development up to 36 months of age. *Infant Behavior and Development*, *76*. https://doi.org/10.1016/j.infbeh.2024.101963

Pereira, K. R. G., Valentini, N. C., & Saccani, R. (2016). Brazilian infant motor and cognitive development: Longitudinal influence of risk factors. *Pediatrics International*, *58*(12), 1297-1306. https://doi.org/10.1111/ped.13021

Pinheiro, G. S. M. A., Lemos, S. M. A., Martins, I. de A., Januário, G. C., Cintra, M. L., Farias, A. V. S. R., Oliveira, R. M. D. S., Januário, J. N., Azevedo, V. M. G. de O., Bentes, A. A., & Alves, C. R. L. (2024). Effects of SARS-CoV-2 gestational exposure and risk factors on neurodevelopment until 12 months: A prospective cohort study in Brazil. *Early Human Development*, *188*, 105918-105918. https://doi.org/10.1016/j.earlhumdev.2023.105918

Reis, A. B. R., Mello, R. R. de, Morsch, D. S., Meio, M. D. B. B., & Silva, K. S. da. (2012). Desempenho mental de bebês pré-termo de muito baixo peso ao nascer: Avaliação da estabilidade nos dois primeiros anos de vida e fatores associados ao desempenho mental. *Revista Brasileira de Epidemiologia*, *15*(1), 13-24. https://doi.org/10.1590/s1415-790x2012000100002

Ribeiro, D. G., Perosa, G. B., & Padovani, F. H. P. (2014a). Fatores de risco para o desenvolvimento de crianças atendidas em Unidades de Saúde da Família, ao final do primeiro ano de vida. *Ciência & Saúde Coletiva, 19*(1), 215-226. https://doi.org/10.1590/1413-81232014191.1904

Ribeiro, D. G., Perosa, G. B., & Padovani, F. H. P. (2014b). Mental health, mother-child interaction and development at the end of the first year of life. *Paidéia (Ribeirão Preto), 24*(59), 331-339. https://doi.org/10.1590/1982-43272459201407

Rocha, H. A. L., Sudfeld, C. R., Leite, Á. J. M., Rocha, S. G. M. O., Machado, M. M. T., Campos, J. S., E Silva, A. C., & Correia, L. L. (2021). Adverse Childhood Experiences and Child Development Outcomes in Ceará, Brazil: A Population-based Study. *American Journal of Preventive Medicine*, *60*(4), 579-586. https://doi.org/10.1016/j.amepre.2020.08.012

Rocha, P. R. H., Saraiva, M. D. C. P., Barbieri, M. A., Ferraro, A. A., & Bettiol, H. (2020). Association of preterm birth and intrauterine growth restriction with childhood motor development: Brisa cohort, Brazil. *Infant Behavior and Development*, *58*. https://doi.org/10.1016/j.infbeh.2020.101429

Rodovalho, J. C., Karolina, A., & Formiga, R. (2012). Diferenças no crescimento e desenvolvimento neuropsicomotor de crianças em centros de educação infantil de Goiânia/GO. *Revista Eletrônica de Enfermagem*, *14*(1). https://doi.org/10.5216/ree.v14i1.10382

Sá, F. E. de, Nunes, N. P., Gondim, E. J. L., Almeida, A. K. F. de, Alencar, A. J. C. de, & Cardoso, K. V. V. (2017). Intervenção parental melhora o desenvolvimento motor de lactentes de risco: Série de casos. *Fisioterapia e Pesquisa*, *24*(1), 15-21. https://doi.org/10.1590/1809-2950/15828624012017

Saccani, R., & Valentini, N. C. (2015). Postural control in children born at term according to the alberta infant motor scale: Comparison between sexes. *Journal of Human Growth and Development*, *25*(3), 364-370. https://doi.org/10.7322/jhgd.106014

Saccani, R., Valentini, N., Pereira, K., Müller, A., & Gabbard, C. (2013). Associations of biological factors and affordances in the home with infant motor development. *Pediatrics International*, *55*(2), 197-203. https://doi.org/10.1111/ped.12042

Sánchez-Luquez, K. Y., Carpena, M. X., Karam, S. M., Martins-Silva, T., Barros, F. C., de Oliveira, I. O., Santos, I. S., Barros, A. J. D., Matijasevich, A., & Tovo-Rodrigues, L. (2024). Evaluation of genomic factors and early childhood stimulation on intelligence in children from a Brazilian birth cohort: The primary role of independent factors. *Progress in Neuro-Psychopharmacology and Biological Psychiatry*, *131*. https://doi.org/10.1016/j.pnpbp.2023.110932

Santos, C. A. D., Paula, A. P., Filho, G. G. F., Alves, M. M., Nery, A. F., Pontes, M. G. A., Macedo, E. Y. L., Oliveira, R. M., Freitas, S. M., Lima, S., Varela, F. V. C., Viana, A. L. S., Silva, A. L. P., Silva, É. G. C., & D'Souza-Li, L. (2024). Developmental impairment in children exposed during pregnancy to maternal SARS-COV2: A Brazilian cohort study. *International Journal of Infectious Diseases*, *139*, 146–152. https://doi.org/10.1016/j.ijid.2023.12.001

Santos, E. M. M., Constantino, B., Rocha, M. M., & Mastroeni, M. F. (2020). Predictors of low perceptual-motor skills in children at 4-5 years of age. *Revista Brasileira de Saúde Materno Infantil, 20*(3), 759-767. https://doi.org/10.1590/1806-93042020000300006

Santos, J. A. T., Ayupe, K. M. A., Camargos, A. C. R., Medeiros, N. L., & Gutierres Filho, P. J. B. (2024). Moderating effect of social risk on the relationship between biological risk and child development. *Ciência & Saúde Coletiva*, *29*(8), e18432022-e18432022. https://doi.org/10.1590/1413-81232024298.18432022

Santos, J. C., Barreto, N. M. P. V., & Silva, L. R. (2022). Neuropsychomotor development and functional skills in preschool children with liver diseases. *Fisioterapia em Movimento*, *35*, e35138-e35138. https://doi.org/10.1590/fm.2022.35138

Santos, L. M., Queirós, F. C., Barreto, M. L., & dos Santos, D. N. (2016). Prevalence of behavior problems and associated factors in preschool children from the city of Salvador, state of Bahia, Brazil. *Revista Brasileira de Psiquiatria*, *38*(1), 46-52. https://doi.org/10.1590/1516-4446-2014-1596

Saur, B., Bruck, I., Antoniuk, S. A., & de Sá Riechi, T. I. J. (2018). Relação entre vínculo de apego e desenvolvimento cognitivo, linguístico e motor. *PSICO*, *49*(3), 257-265. https://doi.org/10.15448/1980-8623.2018.3.27248

Schiavo, R. A., Rodrigues, O. M. P. R., Santos, J. S., Antonucci, J. M., Mormanno, C., & Pereira, V. A. (2020). Fatores materno-infantis associados ao desenvolvimento de bebês prematuros e a termo. *Revista Psicologia e Saúde*. https://doi.org/10.20435/pssa.vi.1031

Shephard, E., Fatori, D., Mauro, L. R., de Medeiros Filho, M. V., Hoexter, M. Q., Chiesa, A. M., Fracolli, L. A., Brentani, H., Ferraro, A. A., Nelson, C. A., Miguel, E. C., & Polanczyk, G. V. (2019). Effects of maternal psychopathology and education level on neurocognitive development in infants of adolescent mothers living in poverty in Brazil. *Biological Psychiatry: Cognitive Neuroscience and Neuroimaging*, *4*(10), 925-934. https://doi.org/10.1016/j.bpsc.2019.05.009

Silva, A. C. D., Engstron, E. M., & Miranda, C. T. (2015). Fatores associados ao desenvolvimento neuropsicomotor em crianças de 6-18 meses de vida inseridas em creches públicas do Município de João Pessoa, Paraíba, Brasil. *Cadernos de Saúde Pública, 31*(9), 1881-1893. https://doi.org/10.1590/0102-311X00104814

Silva, E. V, Hartwig, F. P., Santos, T. M., Yousafzai, A., Santos, I. S., Barros, A. J. D., Bertoldi, A. D., Freitas da Silveira, M., Matijasevich, A., Domingues, M. R., & Murray, J. (2024). Predictors of early child development for screening pregnant women most in need of support in Brazil. *Journal of Global Health*, *14*, 04143-04143. https://doi.org/10.7189/jogh.14.04143

Silva, J., Fronio, J. S., Lemos, R. A., Ribeiro, L. C., Aguiar, T. S., Silva, D. T., Vieira, M. T. & Neves, L. A. T. (2015). Pacing opportunities at home and skill of children with potential changes in functional development. *Journal of Human Growth and Development, 25*(1), 19-26 https://doi.org/10.7322/JHGD.96763

Silva, P. Y. F., da Cruz, M. C. L., Azevedo, I. G., Moreira, R. S., Sousa, K. G., & Pereira, S. A. (2023). Risk of global developmental delay in infants born from mothers with COVID-19: A cross-sectional study. *International Journal of Women's Health*, *15*, 467-474. https://doi.org/10.2147/IJWH.S389291

Silveira, K. A., & Enumo, S. R. F. (2012). Riscos biopsicossociais para o desenvolvimento de crianças prematuras e com baixo peso. *Paidéia (Ribeirão Preto)*, *22*(53), 335-345.

Souza, C. D. R., Padovani, L. F., Ferreira-Donati, G. C., Moraes, M. C. A. F., Corrêa, C. D. C., & Maximino, L. P. (2023). Babies With Pierre Robin Sequence: Neuropsychomotor Development. *Pediatric Neurology*, *141*, 72-76. https://doi.org/10.1016/j.pediatrneurol.2023.01.010

Souza, E. S., & de Castro Magalhães, L. (2012). Motor and functional development in infants born preterm and full term: Influence of biological and environmental risk factors. *Revista Paulista de Pediatria*, *30*(4), 462-470. https://doi.org/10.1590/S0103-05822012000400002

Tabaquim, M. de L. M., Nardi, C. G. A., Ferrari, J. B., Moretti, C. N., Yamada, M. O., & Bevilacqua, M. C. (2013). Avaliação do desenvolvimento cognitivo e afetivo-social de crianças com perda auditiva. *Revista CEFAC*, *15*(6), 1475-1481.

Tella, P., Piccolo, L. R., Rangel, M. L., Rohde, L. A., Polanczyk, G. V., Miguel, E. C., Grisi, S. J. F. E., Fleitlich-Bilyk, B., & Ferraro, A. A. (2018). Socioeconomic diversities and infant development at 6 to 9 months in a poverty area of São Paulo, Brazil. *Trends in Psychiatry and Psychotherapy, 40*(3), 232-240. https://doi.org/10.1590/2237-6089-2017-0008

Ticona, J. P. A., Nery, N., Doss-Gollin, S., Gambrah, C., Lessa, M., Rastely-Júnior, V., Matos, A., de Paula Freitas, B., Borja, A., Wunder, E. A., Ballalai, V., Vieira, C., Cruz, J. S., de Oliveira, D., Araujo, D. B., Oliveira, D. B., Maeda, D. L. N. F., Mendes, E. A., Soares, C. P., … Costa, F. (2021). Heterogeneous development of children with Congenital Zika Syndrome-associated microcephaly. *PLoS ONE*, *16*(9). https://doi.org/10.1371/journal.pone.0256444

Valentini, N. C., de Borba, L. S., Panceri, C., Smith, B. A., Procianoy, R. S., & Silveira, R. C. (2021). Early Detection of Cognitive, Language, and Motor Delays for Low-Income Preterm Infants: A Brazilian Cohort Longitudinal Study on Infant Neurodevelopment and Maternal Practice. *Frontiers in Psychology*, *12*. https://doi.org/10.3389/fpsyg.2021.753551

Venturella, C. B., Zanandrea, G., Saccani, R., & Valentini, N. C. (2013). Motor development of children between 0 and 18 months of age: Differences between sexes. *Motricidade*, *9*(2), 3-12. https://doi.org/10.6063/motricidade.9(2).617

Weisleder, A., Mazzuchelli, D. S. R., Lopez, A. S., Neto, W. D., Cates, C. B., Gonçalves, H. A., Fonseca, R. P., Oliveira, J., & Mendelsohn, A. L. (2018). Reading Aloud and Child Development: A Cluster-Randomized Trial in Brazil. *Pediatrics, 141*(1), 1-12. https://doi.org/10.1542/peds.2017-0723

Yamaguchi, B., Silva, A., Araujo, L., Guimaraes, A., & Israel, V. (2019). Psychomotor evaluation of children attending Child Education Centers in the south of Brazil. *Early Child Development and Care*, *191*(11), 1707-1714. https://doi.org/10.1080/03004430.2019.1672165

Zago, A. C., Trettim, J. P., Rubin, B. B., Scholl, C. C., Coelho, F. T., Ulguim, F., Pinheiro, L. M. de S., Matos, M. B. de, Pinheiro, R. T., & Quevedo, L. de A. (2023). Early motor development: Risk factors for delay in a population study in Southern Brazil. *Revista de Saúde Pública (Online)*, *57*, 59-59. https://doi.org/10.11606/s1518-8787.2023057004991

Zago, J. T. de C., Pinto, P. A. F., Leite, H. R., Santos, J. N., & Morais, R. L. de S. (2017). Associação entre o desenvolvimento neuropsicomotor e fatores de risco biológico e ambientais em crianças na primeira infância. *Revista CEFAC*, *19*(3), 320-329. https://doi.org/10.1590/1982-0216201719314416