Developmental Coordination Disorder in Preterm Children: A Systematic Review and Meta-Analysis

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Abstract

Aims: to systematically review the prevalence of DCD in individuals born preterm; explore this prevalence according to gestational age and different assessments cut-offs; and compare to full-term peers. Methods: The eligibility criteria was observational and experimental studies reporting the prevalence of DCD in preterm individuals. A systematic search was performed in databases from inception until March 2022. The selection was performed by two independent reviewers. Study quality assessment was performed using the checklists from Joanna Briggs Institute (JBI). Data analysis were performed on Excel and Review Manager Software 5.4. Results: Among the 1774 studies identified, 32 matched the eligibility criteria. The pooled estimates of DCD rate in preterm was 21% (95% CI 17.8–24.3). The estimate rates were higher as gestational age decreased, and preterm children are two times more likely to have DCD than their full-term peers RR 2.2 (95% IC 1.77–2.79). Interpretation: The limitation was high heterogeneity between studies: the assessment tools and cut-off points, as well as the age at assessment, were diverse. This study provided evidence that preterm children are at higher risk for DCD than full-term children, and the risks increased as gestational age decreased.

Introduction

Motor difficulties in preterm children may be observable at an early age,[1,2] and even in the absence of severe impairment, 30 to 50% of preterm and/or low-weight children have mild motor difficulties.[3] It is well known that cerebral palsy (CP) and other neurological sequelae due to prematurity are associated poor motor development.[1,4,5] However, many of preterm children do not have any neurological impairment and may demonstrate more subtle motor difficulties that can later be identified as Developmental Coordination Disorder (DCD).[6] Further, these mild difficulties may be overlooked by parents and clinicians, which may lead to a late diagnosis and a delayed necessary intervention such as physical therapy.

Developmental coordination disorder (DCD) is an impairment of motor skills that significantly interferes with the child's performance in their daily activities, academic performance, and leisure activities in otherwise healthy children.[7] A DCD diagnosis is based on the Diagnostic and Statistical Manual of Mental Disorders – 5th edition (DSM-5). [7] The DSM-5 establishes four criteria for diagnosis: 1) Learning and execution of coordinated motor skills are below the expected level for age, given opportunities for skill learning; 2) Motor skill difficulties significantly interfere with activities of daily living and impact academic/school productivity, pre-vocational and vocational activities, leisure and play; 3) Onset of delays is observed in the early developmental period; and 4) Motor skill difficulties are not better explained by intellectual delay, visual impairment or other neurological conditions that affect movement.[7]

It is estimated that around 6% of the world's school-age population is meet criteria for DCD.[8,9] However, in

the preterm population, the reported prevalence varies owing to different assessment tools, cut-off criteria, and the preterm population. There are two systematic reviews indicating that prematurity increases the risks of DCD.[10,11] The first one evaluated 11 studies and demonstrated that premature children are at risk three to four times higher than the general population. The pooled estimation for DCD was 19% and 40.5% depending on the cut-off point used for diagnosis.[10] The second one evaluated 16 studies and pointed out that preterm infants are six to eight times more likely to have DCD.[11]

However, the two systematic reviews[10,11] are from more than 10 years ago, and they did not assess the prevalence of DCD according to gestational age. Besides, none included studies from Low-Moderate Income Countries (LMIC), and none compared preterm children with different gestational ages. All these factors combined justify conducting a new study with more current articles and a more comprehensive global sample and expanding the previous group comparisons to include gestational age. Therefore, we established four aims for this systematic review and meta-analysis: 1) to investigate the prevalence of developmental coordination disorder in individuals born preterm; 2) to investigate the prevalence of developmental coordination disorder in individuals born preterm according to gestational age; 3) to investigate the prevalence of DCD in individuals born preterm according to different assessments cut-offs; 4) to investigate the prevalence of developmental coordination disorder in individuals born preterm compared to full terms. The hypothesis is that children born preterm will have higher prevalence of DCD than children born at term and this prevalence will be even higher in those born extremely preterm. Also, studies will present different criteria to identify DCD and varied prevalence rates.

Methods

This systematic review was performed following the recommendations proposed by Preferred Reporting Items for Systematic Review and Meta-analyses: The PRISMA Statement[12] and protocol were registered on PROSPERO International prospective register of systematic reviews (ID: XXXXX).

Eligibility Criteria

This review included observational (cohort, cross-sectional, or case-control studies) and experimental (data from the control group) studies that assessed the prevalence of DCD in preterm individuals. To be included in the review, studies must report the outcome as "developmental coordination disorder" or "clumsy"/"dyspraxia" for studies older than 1994, when the International Consensus Meeting in London endorsed the term "DCD".[8] The prevalence rate was considered as the number of participants with DCD who scored below the cut-off point established on a validated measure of DCD.

Articles were excluded from the review for any of the following reasons:

1. If reported the outcome as "developmental delays", "coordination difficulties", "coordination problems", or any other term rather than "developmental coordination disorder".
2. Studies with insufficient data to calculate the prevalence rate or effect sizes.
3. If reported DCD for preterm and full-term populations combined without specifying the rates for each group.
4. Studies with samples selection focused on children with DCD.
5. Review articles, single case studies, poster presentations, or other systematic reviews.

Information Sources and Search Strategy

A systematic search was performed in the following electronic databases: PubMed, Physiotherapy Evidence Database (PEDro), Register of Controlled Trials (Cochrane CENTRAL), EMBASE, Scopus, Web of Science, PsycInfo, and Lilacs, from inception until March 2022. The search strategy used in PubMed is shown in Table 1. There were no applied restrictions in terms of the publication date. Articles in Portuguese, Spanish, or English were included. A manual search was also performed and there was no need to contact the authors for further information.

INSERT Table 1

Selection Process and Data Extraction Process

The titles and abstracts of all the retrieved articles were independently analyzed by two reviewers, and a third reviewer solved instances of disagreement. Articles whose abstracts did not provide sufficient information were selected for full-text analysis. Following selection based on titles and abstracts, the same reviewers independently selected articles based on full-text analysis. Data extraction was performed in duplicate by the same two reviewers, and a third reviewer solved instances of disagreement, who used a standardized form for this purpose. The following data were extracted: authors, year of publication, country of the research, study design, sample size, prematurity categorization, assessment tool, DCD criteria cut-off point, and prevalence of DCD.

Study risk of bias assessment

Study quality assessment was performed using the checklists from Joanna Briggs Institute (JBI).[13] Critical Appraisal tools from JBI consist of checklists according to the study design (cohort, cross-sectional, case-control studies, and randomized clinical trials). The JBI critical appraisal tools were recognized as a reliable tool for investigating variations of study.[13] The questions for each checklist are presented in a supplementary table.

The same two reviewers independently performed studies quality assessment. The third reviewer resolved disagreements. The guidance to authors determining whether a study is low, moderate, or high quality, is that the systematic reviewers best decide these thresholds themselves.[14] For this review, when positive answers were [?]49%, the risk of bias was considered high risk; between 50% and 69%, the risk of bias was considered moderate; and when positive answers were above 70%, the risk of bias was low, according to other studies using the same tool.[15]

Effect measures and Synthesis methods

We used the extracted data to calculate the percentage of children with DCD in each sample, and this estimate's 95% confidence interval (CI). Random effects models were used due to the presumed variance in effect sizes extracted from each study. Data analysis for the prevalence of DCD in preterm, the prevalence considering categorization of prematurity, and considering assessment tools and different cut-off criteria for DCD, were performed on Excel, using a spreadsheet developed by Neyeloff, Funchs & Moreira (2012).[16] Categorization of prematurity was considered according to World Health Organization (WHO);[17] preterm children are those who were born alive before 37 weeks of gestation. The sub-categories based on gestational age: extremely preterm ($<$ 28 weeks), very preterm (28 to 32 weeks), and moderate to late preterm (32 to 37 weeks).[17]

Data analysis for comparison between preterm and full-term groups was conducted using Review Manager Software 5.4. Random effects models and risk ratio were used. Data analysis for comparison between preterm and full-term groups was also conducted considering categorization of prematurity, and considering assessment tools and different cut-off criteria for DCD. The full-term group was recruited from those studies that presented results for this population. Heterogeneity among studies was evaluated using the I^2 statistic with low, moderate, and high I^2 values of 25%, 50%, and 75% respectively.[18]

We analyzed the most restricted cut-off criteria from studies that considered more than one cut-off criteria. When there was more than one time point assessment, we considered the one with larger sample size.

Results

Description of the Studies

Among the 1774 studies identified in the database research, 32 matched the eligibility criteria (Figure 1). Of these studies, 27 had a cohort design, 2 had a cross-sectional design, 2 case-controls, and 1 was a randomized clinical trial.

18 studies had a full-term control group, 12 described the prevalence in the extremely preterm group, 17

described the prevalence in the very preterm group, and 8 described the prevalence in the moderate/late preterm group. Only 6 studies described more than one prematurity group according to gestational age, and 2 of them were classified by birth weight instead of gestational age, thus were excluded from the gestational age analysis.

INSERT Figure 1

The age of assessment ranged from 3 to 13 years old. The most used tool assessment was Movement Assessment Battery for Children (MABC); in a total of 22 studies, 12 of them used the 5th percentile cut-off, while 10 of them used the 15th percentile. The Developmental Coordination Disorder Questionnaire (DCDQ); was the second most used assessment tool in a total of 7 studies. Two studies used Touwen Infant Neurological Examination; 1 used Bruininks–Oseretsky Test of Motor Proficiency; and 1 study only referred to use the Diagnostic and Statistical Manual of Mental Disorders.

Most of the studies were from Western, Educated, Industrial, Rich, and Democratic (WEIRD) countries; Australia ranks first in the number of studies (8) followed by Sweden (4). Only three studies from LMIC were found in this review, 1 from India and 2 from China. All included studies were published in English. The characteristics of included studies without full-term control group are shown in Table 2, and studies with full-term control group are shown in Table 3.

INSERT Table 2

INSERT Table 3

Risk of bias

All the eligible studies had a low risk of bias – showing a high percentage of positive answers to the questions of the JBI tool. The few negative answers were related to how the measurement was conducted, if the evaluators were trained, and the description of the comparison between the study sample and dropouts. JBI quality appraisal criteria showed that the quality score of the included studies ranged between 81% and 100%, except one study had a score of 63%. Therefore, no studies with a high risk of bias were included in this review. The risk of bias assessment is presented in Table 4.

INSERT Table 4

Prevalence of DCD

The reported prevalence of DCD in preterm children ranged from 7% to 48%. With all 32 studies included, there were a total of 31184 preterm participants, 5962 of them were identified with DCD. The pooled estimates of DCD rates in preterm was 21% (95% CI 17.8 – 24.3), with high heterogeneity found between studies (I^2 = 93.83%). Figure 2 shows the metanalyses with all 32 studies.

INSERT Figure 2

Subgroup analysis

The following pooled estimate rates were found in the subgroup analysis: 25.8% (95% CI 19.3 – 32.3) in extremely preterm; 23% (95% CI 17.7 – 28.2) in very preterm, and 11.6% (95% CI 5.5 – 17.7) in moderate/late preterm. All these analyses presented high heterogeneity (I^2 = 87.7% to 98.8%) and are shown in Figure 3.

INSERT Figure 3

The analysis by assessment tools and different cut-off criteria for DCD showed the following pooled estimate rates: 18.7% (CI 95% 13.8 – 23.6) when the 5^{th} percentile on MABC was adopted, 31% (95% CI 20.9 – 41.2) when the 15^{th} percentile on MABC was adopted, and 20.3% (95% CI 12.3 – 28.3) when the DCDQ was used. There was also high heterogeneity between the studies (I^2 = 91.3% to 98.9%). The analyses are presented in Figure 4.

INSERT Figure 4

Comparison between preterm and full-term

The first analysis for comparison included all studies with a full-term control group (18 studies) and a preterm group. The sample size was 28557 preterm children and 183414 full-term children. The preterm group is more likely to have DCD with an overall risk ratio of 2.2 (95% CI 1.77 – 2.79) than full-term controls. High heterogeneity was observed between the studies (I^2 = 90%). The analyses are presented in Figure 5.

When comparing the groups by gestational age (extremely, very, and moderate/late preterm) with full-term, the results showed an increased risk as gestational age decreased. Extremely preterm children are at 3.78 (95% CI 2.38 – 6.02) more likely to have DCD compared to full-term; very preterm are at risk 2.72 (95% CI 1.90 – 3.91); and moderate/late preterm are at risk 1.58 (95% CI 1.27 – 1.96). The analyses are presented in Figure 6.

Analyses from comparison were also performed by assessment tool and different cut-off criteria for DCD; we still found that premature children are more likely to have DCD. Six studies had a control group and used 5^{th} percentile cut-off criteria with MABC; the risk ratio in the meta-analysis was 3.74 (95% CI 2.07 – 6.76). Four studies used 15^{th} percentile cut-off criteria with MABC, and the risk ratio was 2.67 (95% CI 1.64 – 4.37). Six studies with a control group used DCDQ, and the risk ratio was 1.58 (95% CI 1.16 – 2.15). Results are presented in Figure 7. Only one study with a control group used another cut-off criteria and then was excluded from this analysis.[47] Further, 4 studies used different tool assessments and were also excluded from this analysis.[22,25,30,43]

INSERT Figure 5

INSERT Figure 6

INSERT Figure 7

Discussion

This systematic review and meta-analysis summarized the currently available research related on the prevalence of DCD in preterm children, exploring subgroups by gestational age, assessment tools, and different cut-off scores on standardized assessments. Our results demonstrated that the overall prevalence of DCD among preterm children was 21% based on the 32 studies involving 31184 preterm participants. The analysis also showed that preterm children are two times more likely to have DCD than their full-term peers. The prevalence and risk of DCD vary according to gestational age and different assessments tools and cut-off criteria.

Up to our knowledge, this is the first systematic review and meta-analysis exploring DCD in different gestational age groups. The estimate rates were higher as gestational age decreased, aligned with previous studies.[9,48].The pooled prevalence of DCD in extremely, very, and moderate/late preterm children was 26%, 23%, and 12%, respectively. It is well known that extremely preterm children are at higher risk for several adverse outcomes, impacting their global neurodevelopment compared to other preterm groups.[2]Our results corroborate previous studies analyzing DCD or other motor impairments, showing a higher rate of delays in extremely preterm children.[2] However, these results could be more accurate if all studies in this review had reported prevalence according to gestational age. The studies that described only very preterm participants, moderate/late preterm, or even preterm below 37 weeks of gestational age, usually consider all preterm children below the specific cut-off point. That means that in a very preterm cohort, extremely preterm children may be included, as well in a moderate/late preterm cohort. We hypothesized that if all these data were broken down by gestational age, the differences between rates in extremely, very, and moderate/late preterm children would be higher.

We found similar results from previous systematic reviews when considering prevalence according to assessment tools and cut-off point criteria for DCD. The pooled estimate rate for DCD in studies using the 5^{th} percentile on MABC was 18.7% and 31.1% with the 15th percentile. Whereas Williams and colleagues (2010)[10] reported an overall pooled estimate of 19% of DCD in preterm children when the studies used the 5^{th} per-

centile, and 40% with the 15th percentile in the same assessment tool. There is a divergence in the literature about the percentile cut-off to be used; 12 studies used the 5th percentile while 10 studies used the 15^{th} percentile. The MABC seems to be the most used standard tool to detect DCD in children from 3 to 16 years old. However, in its manual, the categorization is described as: [?] 5^{th} percentile = significant motor difficulty; 6-15^{th} percentile = careful monitoring suggested; and > 15^{th} percentile = no significant motor difficulty.[49] Thus, the DCD condition criteria are unclear, giving scope to different interpretations. While some studies prefer to consider the most restricted criteria for DCD (5^{th}percentile),[6,21,23,24,26,27,29,35,39,42,44,46] others report the children "at risk for DCD" (6-15^{th}percentile) in the same group for analysis.[19,20,28,30-32,36,40,41,45] That said, there is a large range between the results and the need to establish standard cut-off criteria to compare the results of different studies, populations, and regions.

Further, the second most used tool presented in this systematic review was the DCDQ. The pooled estimate rate from studies using this instrument was 20% of DCD in preterm children. The DCDQ is a brief parent questionnaire designed to screen for coordination disorders in children aged 5- to 15-year-old, while LDCDQ assesses children from 3 to 4 years old.[50] As with all other self-reported questionnaires, its subject to biases as interpretations of the questions, honesty, memory, and others. In contrast, this could be the best tool to assess a large sample as a population-based cohort, which is the case in 4 of the 6 studies found in this review with this assessment tool.[9,35,38,48]

We also found 18 studies comparing DCD in a preterm and full-term group, the present analysis showed that preterm children are two times more likely to have DCD than their full-term peers. This result is different from two previous systematic reviews on this topic. The first one reported that premature children are at risk three to four times higher,[10] and the second one reported six to eight times higher[11] than the general population. This may be justified because one of these reviews, although had addressed the DCD throughout the article, included studies with "motor impairments, excluding cerebral palsy",[10] which may embrace other neurodevelopmental problems besides DCD. The other systematic review included studies only with very preterm or very low birth weight children, which does not consider the moderate/late preterm group that presented the lowest prevalence rate in our review.

Therefore, we advanced the previous systematic reviews[10,11] by comparing DCD prevalence across different classifications of prematurity and full-term children. It was observed that the risk of having DCD increases as gestational age decreases. Extremely preterm are at over 3 times higher risk than full-term children, while very preterm children are at over 2 times higher, and moderate/late preterm at 1.5 times higher risk. Two previous studies[34,42] that assessed full-term groups and different preterm groups according to gestational age have also found similar results.

Regarding cut-off criteria and assessment tools, comparing between preterm and full-term children demonstrates a similar quantity of studies using each criterion. There were also different results for each analysis. Preterm children are at over 3 times higher risk of DCD than full-term peers when using the MABC 5th percentile cut-off, and over 2 times when using the 15th percentile. Analyzing studies that used DCDQ, preterm children were 1.5 times at higher risk for DCD. It was observed that the stricter the criteria, the higher the risk, which may represent the sensibility and specificity of the instrument.

Interestingly, no studies were found with preterm adolescents or adults. This systematic review did not limit participants' age, but all studies ranged from 3 to 13 years old. Only one of the studies assessed the same children at three time points, 5, 7, and 13 years. The authors showed a decreased rate of DCD in very preterm children from 47.9% at 5 years of age, to 28.5% at 7 years and 27.8% at 13 years of age.[45] Considering that, future systematic reviews should analyze the DCD rates by age at assessment, and future original studies should focus on the older preterm population to comprehend the impact of prematurity late in life.

Furthermore, only two studies in this systematic review were from LMIC.[9,37] The lack of studies on LMIC may portray the difficulties that researchers face with the high-cost national studies. The follow-up care of preterm children is expensive as appropriate standardized assessment tools, making it difficult for researchers

and professionals in these countries to assess these children longitudinally for research or clinical practice. Besides, the lack of diversity in published research, especially from non-WEIRD countries, has been reported in the literature on children's development - around 10 % of study participants in research are from Asia, Africa, South / Central America, or the Middle East;[51] although in these regions lived the majority of the world population.

This review highlights the magnitude of DCD risks in preterm children. DCD is considered a subtle motor difficulty and may be undetected by parents and clinicians, requiring standardized assessments. Since this condition is not identified before 3 years old, attempting to detect early soft signs and longitudinal follow-up with children at risk is essential. Even before the DCD diagnoses, these children could benefit from early intervention as soon as a motor delay could be identified in the first years of life to take advance children's neuroplasticity. Further, the results demonstrated a higher risk for DCD in extremely preterm children; therefore, this population should have even more attentive care for motor difficulties in the first years of life until preschool and school age.

A limitation of this systematic review is the high heterogeneity between included studies. Some reasons may help in explaining this heterogeneity. First, the population was different in each study; we tried to minimize these differences by analyzing gestational age groups. Even so, some studies analyzed only one combined preterm group (born before 37 gestation weeks), and others categorized the groups by gestational age. Therefore, the isolation of this variable was challenging. Second, the assessment tools and cut-off points used were different, portraying different results. We also control the different cut-offs as much as possible. However, even then, some studies were excluded from the analyses lacking other studies with the same tool.

Moreover, third, the age at assessment may have some impact on prevalence outcomes. This variable was not analyzed in the present review for the high complexity of separating also the age groups, as we had separated the gestational age in the analysis. We suggest future research and reviews trying to control the age at assessment.

Conclusion

This systematic review and meta-analyses provided evidence that preterm children are at higher risk for DCD than full-term children, and the risks increased as gestational age decreased. In sum, our findings showed a DCD estimate pooled rate of 21% among preterm children, and they are at 2 times higher risk than full-term peers. There was variation in the prevalence of DCD in preterm according to prematurity classification, the assessment tool used, and the cut-off points adopted in each study. Limited available data on LMIC and for preterm adolescents and adults were observed, evidencing the need for additional primary research that would improve the estimated prevalence of DCD in these populations and the need for diversity and inclusion in research publication and support of researchers in LMIC countries. Clinical practice should focus on longitudinal motor assessment, early diagnosis, and early intervention for these children, while research should focus on standard cut-off criteria and older preterm populations.

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Figure lengends:

Figure 1. Flow chart diagram

Figure 2. Prevalence of DCD in preterm children

Figure 3. Prevalence of DCD in extremely, very, and moderate/late preterm children.

Figure 4. Prevalence of DCD according to assessment tool cut-off. (MABC: Movement Assessment Battery for Children; DCDQ: Development Coordination Disorder Questionnaire).

Figure 5. Comparison between preterm and full-term groups.

Figure 6. Comparison between preterm and full-term according to gestational age.

Figure 7. Comparison between preterm and full-term according to assessment tool cut-off. (MABC: Movement Assessment Battery for Children; DCDQ: Development Coordination Disorder Questionnaire).

Table 1 . The search strategy used for the PubMed database.

#1	"Premature Birth"[Mesh] OR "Premature Birth" OR "Birth, Premature" OR "Births, Premature" OR "Premature B
#2	"Developmental Coordination Disorder" OR "Coordination Disorder, Developmental" OR "Developmental Coordinati
#3	#1 AND #2

Table 2. Characteristics of the studies included without full-term control group.

Study	**Country**	**Design**	**Sample size**	**Age at assessment**	**Gestational age group classification**	**Exclusion criteria**	**Assessment tool**	**Cut-off criteria**	**DC pr pr le n**
Brown et al., 2015 [19]	Australia	Cohort study	50-preterm	50 months	Extremely preterm	IQ <70, congenital anomalies, CP, a visual or hearing impairment	MABC-2	[?]15th percentile	15

Study	Country	Design	Sample size	Age at assessment	Gestational age group classification	Exclusion criteria	Assessment tool	Cut-off criteria	DC pr pr le n
Dewey et al., 2019 [20]	Australia	Cohort study	162-preterm	7 years	Very preterm	CP	MABC-2	<16th percentile	53 (32
Doyley et al., 2014 [21]	Multicenter (Canada, Australia, Europe, Israel)	Randomized clinical trial	698-preterm (placebo group)	5 years	Classification by birth weight	IQ [?]69, CP, blindness	MABC	[?]5th percentile	10 (16
Garbi et al., 2022 [22]	France	Cross-Sectional	114-preterm	7 to 10 years	Extremely preterm	Autism, mental delay, CP	Touwen Infant Neurological Examination	Unclear	12
Hua et al., 2021 [9]	China	Cohort study	20676-preterm 115376-full-term	3 to 5 years	Very preterm, moderate/late preterm	Visual, hearing, or intellectual impairments or other severe developmental disorders	LDCDQ	[?]15th percentile	43 (20
Kwok et al., 2019 [23]	Canada	Cohort study	165-preterm	4.5 years	Very preterm	CP, global developmental delay, intellectual impairment, visual or hearing impairments	MABC-2	[?]5th percentile	29 (17

Study	Country	Design	Sample size	Age at assessment	Gestational age group classification	Exclusion criteria	Assessment tool	Cut-off criteria	DC pr pr le n
Lahti et al., 2020 [24]	Finland	Cohort study	37-preterm	11 years	Very preterm	Congenital anomalies or syndromes, CP, neuromuscular disorders	MABC-2	[?]5th percentile	8 (22
Losch, Dammann, 2004 [25]	Germany	Cohort study	298-preterm	6 years	Classification by birth weight	CP, ADHD	Touwen Infant Neurological Examination	Unclear	56 (18
Örtqvist, Einspieler, Ådén, 2021 [26]	Sweden	Cohort study	32-preterm	12 years	Extremely preterm	Malformations, chromosome aberrations, malignant disorders, CP, blindness, autism	MABC - 2	[?]5th percentile	15
Setänen et al., 2016 [27]	Finland	Cohort study	90-preterm	11 years	Very preterm	Intellectual disability, neurological disorder, CP	MABC-2 and DCDQ 07	[?]5th percentile	8 (
Sustersic, Sustar, Paro-Panjan, 2012 [28]	Slovenia	Cohort study	41-preterm	5 to 6 years	Preterm	CP	MABC	[?]15th percentile	7 (

Study	Country	Design	Sample size	Age at assessment	Gestational age group classification	Exclusion criteria	Assessment tool	Cut-off criteria	DC pr pr le n
Uusitalo et al., 2020 [29]	Finland	Cohort study	170-preterm	11 years	Very preterm	Congenital anomalies, syndrome affecting cognitive development, CP	MABC-2	[?]5th percentile	18 (11
Wocadlo, Rieger, 2008 [30]	Australia	Cohort study	323-preterm	8 yeays	Very preterm	CP, blindness, hearing impairment, IQ<76,	BOTMP	< 15th percentile	10 (31
Zamir et al., 2021 [31]	Sweden	Cohort study	345-preterm	6.5 years	Extremely preterm	Cerebral palsy	MABC-2	[?]5th percentile	76 (22
Zwicker et al., 2013 [32]	Canada	Cohort study	157-preterm	4 to 5 years	Extremely preterm	CP, IQ<70, blind	MABC	[?]15th percentile	65

IQ = intelligent quotient; CP = cerebral palsy; ADHD = Attention Deficit Hyperactivity Disorder DCDQ = Developmental Coordination Disorder Questionnaire; LDCDQ = Little Developmental Coordination Disorder Questionnaire; MABC = Movement Assessment Battery for Children; BOMPT = Bruininks–Oseretsky Test of Motor Proficiency; DSM = The Diagnostic and Statistical Manual of Mental Disorders.

Table 3. Characteristics of the studies included with full-term control group.

Study	Country	Design	Sample size	Age at assessment	Gestational age group classification	Exclusion criteria	Assessment tool	Cut-off criteria	DCD preterm prevalence n (%)
Bolk et al., 2018 [6]	Sweden	Cohort study	229-preterm 344-full-term	6.5 years	Extremely preterm	CP, cognitive impairment, visual or hearing impairment	MABC-2	[?]5th percentile	85 (37.1)
Cameron et al., 2021 [33]	Australia	Cohort study	48-preterm 96-full-term	4 to 5 years	Very preterm	Congenital abnormalities, IQ<70	L-DCDQ	Score below 68 for females and 67 for males	18 (38)
Caravale et al., 2019 [34]	Italy	Cohort study	608-preterm 362-full-term	9 years	Extremely and very preterm	CP, malformations, vision or hearing problems, cognitive disability	DCDQ	<15th percentile	185 (30.4)
Davis et al., 2007 [35]	Australia	Cohort study	210-preterm, 202-full-term	8 to 9 years	Extremely preterm	CP, IQ more than 2sds below the mean	MABC	[?]5th percentile	20 (9.5)
de Kieviet et al., 2013 [36]	Netherlands	Cohort study	58-preterm 64-full-term	7.5 years	Very preterm	Serious motor, hearing, or vision difficulties	MABC	<15th percentile	27 (46)

Study	Country	Design	Sample size	Age at assessment	Gestational age group classification	Exclusion criteria	Assessment tool	Cut-off criteria	DCD preterm prevalence n (%)
Deshmukh, Sahu, Deshpandec, 2021 [37]	India	Cross-sectional	88-preterm 628-full-term	5 to 10 years	Preterm	CP, muscular dystrophy, mental retardation, spinal fracture, visual, hearing and cognitive impairment	DCDQ 07	5-7years [?]46; 8-9years [?]54; 10-11years [?]56	26 (29.5)
Faebo Larsen et al., 2013 [38]	Denmark	Cohort study	143-preterm 29044-full-term	7 years	Very preterm and moderate preterm	Unclear	DCDC 07	5-7years [?]46; 8-9years [?]55; 10-11years [?]57	104 (7.3)
Foulder-Hughes, Cooke, 2003 [39]	England	Cohort study	280-preterm 210-full-term	7 to 8 years	Very preterm	CP	MABC	[?]5th percentile	86 (30.7)
Goyen, Lui, 2009 [40]	Australia	Case-control	50-preterm; 50-full-term	8 years	Extremely preterm and very preterm	Full-scale IQ<84, neurological abnormality, visual or hearing impairment	MABC	<15th percentile	21 (42)

Study	Country	Design	Sample size	Age at assessment	Gestational age group classification	Exclusion criteria	Assessment tool	Cut-off criteria	DCD preterm prevalence n (%)
Lingam et al., 2009 [41]	England	Cohort study	367-preterm, 6614-full-term	7.5 years	Preterm	Visual, developmental, or neurologic conditions, IQ<70	MABC	[?]15th percentile	27 (7.3)
Pierrat et al., 2021 [42]	France	Cohort study	2219-preterm 592-full-term	5.5 years	Extremely, very and moderate preterm	CP, sensory disability, IQ score less than 2 SD.	MABC - 2	[?]5th percentile	194 (8.7)
Pritchard et al., 2014 [43]	New Zealand	Cohort study	105-preterm 107-full-term	4 years	Very preterm	Congenital anomalies, fetal alcohol syndrome	DSM-4th	Unclear	7 (6.6)
Roberts et al., 2011 [44]	Australia	Cohort study	132-preterm 154-full-term	8 years	Extremely preterm	CP or an intellectual impairment.	MABC	[?]5th percentile	21 (16)
Spittle et al., 2021 [45]	Australia	Cohort study	165-preterm 65-full-term	5, 7 and 13 years (3 time points)	Very preterm	CP, IQ<80	MABC and MABC-2	[?]16th percentile	79 (47.9)
Tommiska et al., 2020 [46]	Finland	Cohort study,	60-preterm 30-full-term	11 years	Extremely preterm	Cognitive impairment, severe disability	MABC	[?]5th percentile	18 (30)
Yang et al., 2020 [47]	China	Case-control study	888-preterm 7698-full-term	3-6 years	Preterm	Unclear	MABC-2	Score [?]71 and pediatrician to confirm DCD	78 (8.7)

Study	Country	Design	Sample size	Age at assessment	Gestational age group classification	Exclusion criteria	Assessment tool	Cut-off criteria	DCD preterm prevalence n (%)
Zhu, Olsen, Olesen, 2012 [48]	Denmark	Cohort study	943-preterm 21955-full-term	7 years	Very and moderate preterm	DID NOT exclude children with diseases like CP and mental retardation,	DCDQ	Score of [?]46	71 (7.5)

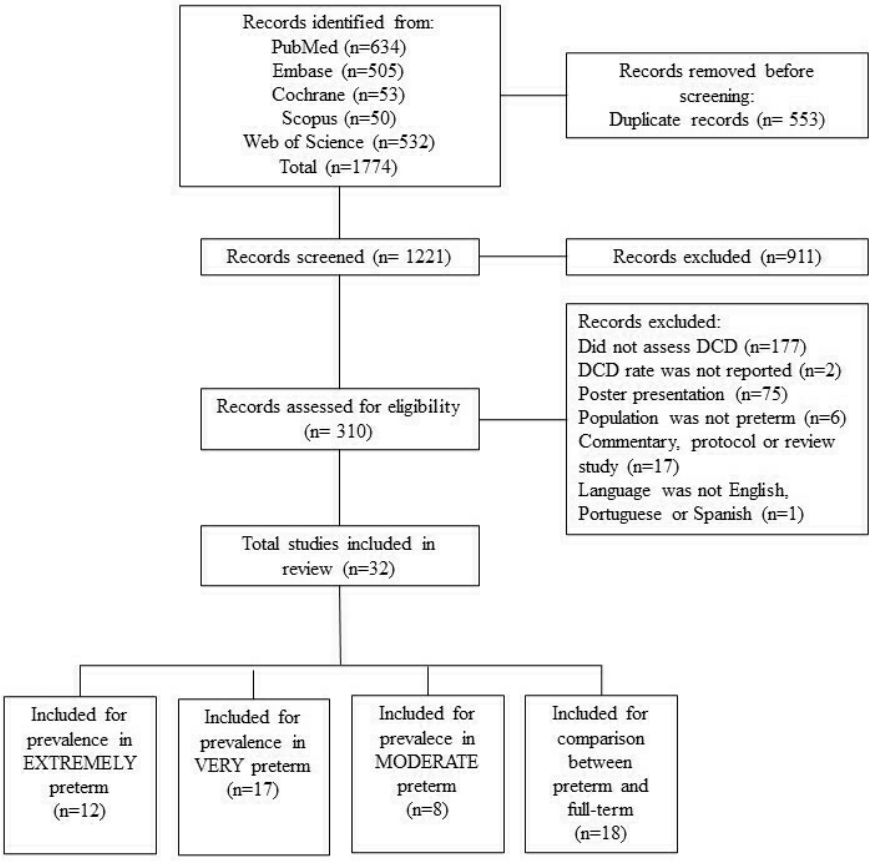
IQ = intelligent quotient; CP = cerebral palsy; ADHD = Attention Deficit Hyperactivity Disorder DCDQ = Developmental Coordination Disorder Questionnaire; LDCDQ = Little Developmental Coordination Disorder Questionnaire; MABC = Movement Assessment Battery for Children; BOMPT = Bruininks–Oseretsky Test of Motor Proficiency; DSM = The Diagnostic and Statistical Manual of Mental Disorders.

Table 4. JBI Clinical Appraisal Checklist to assess risk of bias in each study.

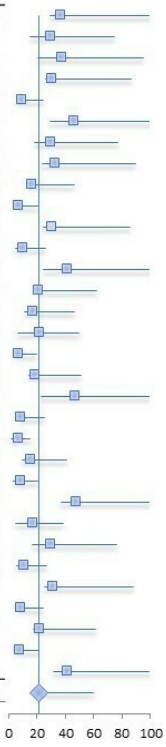
	Authors	Q.1	Q.2	Q.3	Q.4	Q.5	Q.6	Q.7	Q.8
Cohort Studies	**Cohort Studies**								
	Bolk et al., 2018	?	?	?	?	?	?	u	?
	Brown et al., 2015	?	?	?	u	u	?	?	?
	Cameron et al., 2021	?	?	?	?	?	?	?	?
	Caravale et al., 2019	?	?	?	?	?	?	?	?
	Davis et al., 2007	?	?	?	?	?	?	?	?
	de Kieviet et al., 2013	?	?	?	?	?	?	?	?
	Dewey et al., 2019	?	?	?	?	?	?	?	?
	Faebo Larsen et al., 2013	?	?	?	?	?	?	?	?
	Foulder-Hughes, Cooke, 2003	?	?	?	?	?	?	?	?
	Hua et al., 2021	?	?	?	?	?	?	?	?
	Kwok et al., 2019	?	?	?	?	?	?	?	?
	Lahti et al., 2020	?	?	?	?	?	?	u	?
	Lingam et al., 2009	?	?	?	?	?	?	?	?
	Losch, Dammann, 2004	?	?	?	u	u	?	u	?
	Örtqvist, Einspieler, Ådén, 2021	?	?	?	u	u	?	?	?
	Pierrat et al., 2021	?	?	?	?	?	?	?	?
	Pritchard et al., 2014	?	?	?	?	?	?	?	?
	Roberts et al., 2011	?	?	?	u	u	?	?	?
	Setänen et al., 2016	?	?	?	?	?	?	u	?
	Spittle et al., 2021	?	?	?	?	?	?	?	?
	Sustersic, Sustar, Paro-Panjan, 2012	?	?	?	u	u	?	?	?
	Tommiska et al., 2020	?	?	?	u	u	?	?	?

	Authors	Q.1	Q.2	Q.3	Q.4	Q.5	Q.6	Q.7	Q.8
	Uusitalo et al., 2020	?	?	?	?	?	?	?	?
	Wocadlo, Rieger, 2008	?	?	?	?	?	?	?	?
	Zamir et al., 2021	?	?	?	?	?	?	?	?
	Zhu, Olsen, Olesen, 2012	?	?	?	?	?	?	?	?
	Zwicker et al., 2013	?	?	?	?	?	?	?	?
Cross-sectional studies	**Cross-sectional studies**								
	Deshmukh, Sahu, Deshpandec, 2021	?	?	?	?	?	?	?	?
	Garbi et al., 2022	?	?	?	?	?	?	?	?
Randomized Clinical Trial	**Randomized Clinical Trial**								
	Doyley et al., 2014	?	?	?	?	?	?	?	?
Case-control studies	**Case-control studies**								
	Goyen, Lui, 2009	?	?	?	?	?	?	?	?
	Yang et al., 2020	?	?	?	?	?	?	?	?

Note: ?: yes; u: unclear; NA: not applicable.

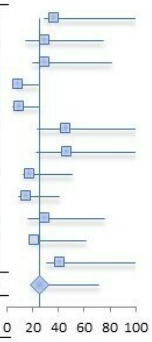


Study	Events	Sample Size	Outcome	CI lower	CI upper
Bolk et al., 2018	85	229	0,371179	0,292269	0,450089
Brown et al., 2015	15	50	0,3	0,148179	0,451821
Cameron et al., 2021	18	48	0,375	0,201759	0,548241
Caravale et al., 2019	185	608	0,304276	0,260429	0,348123
Davis et al., 2007	20	210	0,095238	0,053498	0,136978
de Kieviet et al., 2013	27	58	0,465517	0,289923	0,641111
Deshmukh, Sahu, Deshpandec, 2021	26	88	0,295455	0,181885	0,409024
Dewey et al., 2019	53	162	0,32716	0,23908	0,415241
Doyley et al., 2014	106	643	0,164852	0,133469	0,196236
Faebo Larsen et al., 2013	104	1431	0,072676	0,058708	0,086644
Foulder-Hughes, Cooke, 2003	86	280	0,307143	0,242228	0,372058
Garbi et al., 2022	12	114	0,105263	0,045705	0,164821
Goyen, Lui, 2009	21	50	0,42	0,240363	0,599637
Hua et al., 2021	4326	20676	0,209228	0,202993	0,215463
Kwok et al., 2019	29	165	0,175758	0,111788	0,239727
Lahti et al., 2020	8	37	0,216216	0,066386	0,366046
Lingam et al., 2009	27	367	0,073569	0,045819	0,10132
Losch, Dammann, 2004	56	298	0,187919	0,1387	0,237139
Örtqvist, Einspieler, Ådén, 2021	15	32	0,46875	0,23153	0,70597
Pierrat et al., 2021	194	2219	0,087427	0,075124	0,099729
Pritchard et al., 2014	7	105	0,066667	0,017279	0,116054
Roberts et al., 2011	21	132	0,159091	0,091047	0,227135
Setänen et al., 2016	8	90	0,088889	0,027292	0,150486
Spittle et al., 2021	79	165	0,478788	0,373207	0,584369
Sustersic, Sustar, Paro-Panjan, 2012	7	41	0,170732	0,044252	0,297212
Tommiska et al., 2020	18	60	0,3	0,161407	0,438593
Uusitalo et al., 2020	18	170	0,105882	0,056967	0,154798
Wocadlo, Rieger, 2008	101	323	0,312693	0,25171	0,373677
Yang et al., 2020	78	888	0,087838	0,068344	0,107331
Zamir et al., 2021	76	345	0,22029	0,170763	0,269817
Zhu, Olsen, Olesen, 2012	71	943	0,075292	0,057778	0,092805
Zwicker et al., 2013	65	157	0,414013	0,313363	0,514663
Summary			0,210867	0,178591	0,243143
		Q	977,94646		
		I^2	96,830092		



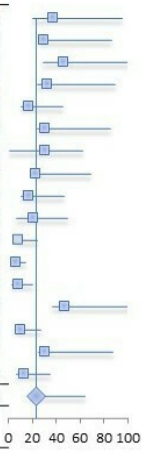
Extremely preterm

Study	Events	Sample Size	Outcome	CI lower	CI upper
Bolk et al., 2018	85	229	0,371179	0,292269	0,450089
Brown et al., 2015	15	50	0,3	0,148179	0,451821
Caravale et al., 2019	38	126	0,301587	0,205696	0,397478
Davis et al., 2007	20	210	0,095238	0,053498	0,136978
Garbi et al., 2022	12	114	0,105263	0,045705	0,164821
Goyen, Lui, 2009	17	37	0,459459	0,241046	0,677873
Örtqvist, Einspieler, Ådén, 2021	15	32	0,46875	0,23153	0,70597
Pierrat et al., 2021	47	252	0,186508	0,133186	0,23983
Roberts et al., 2011	21	132	0,159091	0,091047	0,227135
Tommiska et al., 2020	18	60	0,3	0,161407	0,438593
Zamir et al., 2021	76	345	0,22029	0,170763	0,269817
Zwicker et al., 2013	65	157	0,414013	0,313363	0,514663
Summary			0,258383	0,193145	0,323622
			Q	89,709556	
			I^2	87,738207	



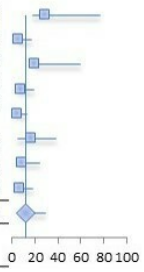
Very preterm

Study	Events	Sample Size	Outcome	CI lower	CI upper
Cameron et al., 2021	18	48	0,375	0,201759	0,548241
Caravale et al., 2019	147	482	0,304979	0,255677	0,354282
de Kieviet et al., 2013	27	58	0,465517	0,289923	0,641111
Dewey et al., 2019	53	162	0,32716	0,23908	0,415241
Faebo Larsen et al., 2013	25	141	0,177305	0,107801	0,246809
Foulder-Hughes, Cooke, 2003	86	280	0,307143	0,242228	0,372058
Goyen, Lui, 2009	4	13	0,307692	0,006154	0,609231
Hua et al., 2021	1268	5439	0,233131	0,220299	0,245963
Kwok et al., 2019	29	165	0,175758	0,111788	0,239727
Lahti et al., 2020	8	37	0,216216	0,066386	0,366046
Pierrat et al., 2021	117	1367	0,085589	0,07008	0,101098
Pritchard et al., 2014	7	105	0,066667	0,017279	0,116054
Setänen et al., 2016	8	90	0,088889	0,027292	0,150486
Spittle et al., 2021	79	165	0,478788	0,373207	0,584369
Uusitalo et al., 2020	18	170	0,105882	0,056967	0,154798
Wocadlo, Rieger, 2008	101	323	0,312693	0,25171	0,373677
Zhu, Olsen, Olesen, 2012	14	99	0,141414	0,067337	0,215491
Summary			0,230163	0,177619	0,282706
			Q	361,77856	
			I^2	95,577405	



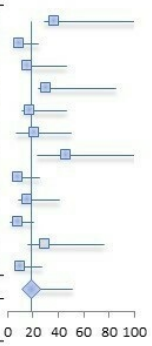
Moderate/late preterm

Study	Events	Sample Size	Rate	CI lower	CI upper
Deshmukh, Sahu, Deshpandec, 2021	26	88	0,295455	0,181885	0,409024
Faebo Larsen et al., 2013	79	1281	0,061671	0,048071	0,07527
Hua et al., 2021	3058	15237	0,200696	0,193582	0,207809
Lingam et al., 2009	27	367	0,073569	0,045819	0,10132
Pierrat et al., 2021	30	600	0,05	0,032108	0,067892
Sustersic, Sustar, Paro-Panjan, 2012	7	41	0,170732	0,044252	0,297212
Yang et al., 2020	78	888	0,087838	0,068344	0,107331
Zhu, Olsen, Olesen, 2012	57	844	0,067536	0,050003	0,085068
Summary			0,116563	0,055542	0,177584
			Q	626,63893	
			I^2	98,882929	



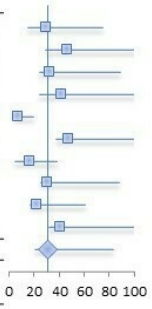
MABC 5th percentile

Study	Events	Sample Size	Outcome	CI lower	CI upper
Bolk et al., 2018	85	229	0,371179	0,292269	0,450089
Davis et al., 2007	20	210	0,095238	0,053498	0,136978
Doyley et al., 2014	106	643	0,164852	0,133469	0,196236
Foulder-Hughes, Cooke, 2003	86	280	0,307143	0,242228	0,372058
Kwok et al., 2019	29	165	0,175758	0,111788	0,239727
Lahti et al., 2020	8	37	0,216216	0,066386	0,366046
Örtqvist, Einspieler, Åden, 2021	15	32	0,46875	0,23153	0,70597
Pierrat et al., 2021	194	2219	0,087427	0,075124	0,099729
Roberts et al., 2011	21	132	0,159091	0,091047	0,227135
Setänen et al., 2016	8	90	0,088889	0,027292	0,150486
Tommiska et al., 2020	18	60	0,3	0,161407	0,438593
Uusitalo et al., 2020	18	170	0,105882	0,056967	0,154798
Summary			0,187483	0,138547	0,23642
			Q	126,85062	
			I^2	91,328383	



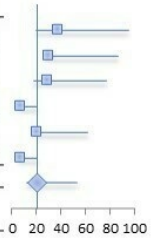
MABC 15th percentile

Study	Events	Sample Size	Outcome	CI lower	CI upper
Brown et al., 2015	15	50	0,3	0,148179	0,451821
de Kieviet et al., 2013	27	58	0,465517	0,289923	0,641111
Dewey et al., 2019	53	162	0,32716	0,23908	0,415241
Goyen, Lui, 2009	21	50	0,42	0,240363	0,599637
Lingam et al., 2009	27	367	0,073569	0,045819	0,10132
Spittle et al., 2021	79	165	0,478788	0,373207	0,584369
Sustersic, Sustar, Paro-Panjan, 2012	7	41	0,170732	0,044252	0,297212
Wocadlo, Rieger, 2008	101	323	0,312693	0,25171	0,373677
Zamir et al., 2021	76	345	0,22029	0,170763	0,269817
Zwicker et al., 2013	65	157	0,414013	0,313363	0,514663
Summary			0,311254	0,209821	0,412687
			Q	158,901111	
			I^2	94,3361	



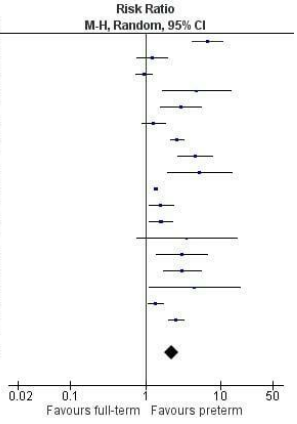
DCDQ

Study	Events	Sample Size	Outcome	CI lower	CI upper
Cameron et al., 2021	18	48	0,375	0,201759	0,548241
Caravale et al., 2019	185	608	0,304276	0,260429	0,348123
Deshmukh, Sahu, Deshpandec, 2021	26	88	0,295455	0,181885	0,409024
Faebo Larsen et al., 2013	104	1431	0,072676	0,058708	0,086644
Hua et al., 2021	4326	20676	0,209228	0,202993	0,215463
Zhu, Olsen, Olesen, 2012	71	943	0,075292	0,057778	0,092805
Summary			0,203468	0,123564	0,283372
			Q	487,84175	
			I^2	98,975077	



Study or Subgroup	Preterm Events	Preterm Total	Full-term Events	Full-term Total	Weight	Risk Ratio M-H, Random, 95% CI
Bolk et al., 2018	85	229	19	344	6.0%	6.72 [4.21, 10.74]
Cameron et al., 2021	18	48	29	96	6.0%	1.24 [0.77, 2.00]
Caravale et al., 2019	185	608	59	185	7.4%	0.95 [0.75, 1.22]
Davis et al., 2007	20	210	4	202	3.0%	4.81 [1.67, 13.83]
de Kieviet et al., 2013	27	58	10	64	5.0%	2.98 [1.58, 5.61]
Deshmukh et al., 2021	26	88	145	628	6.8%	1.28 [0.90, 1.82]
Faebo Larsen et al., 2003	104	1431	798	29044	7.6%	2.65 [2.17, 3.22]
Foulder-Hughes & Cooke, 2003	86	280	14	210	5.6%	4.61 [2.70, 7.87]
Goyen & Lui, 2009	21	50	4	50	3.2%	5.25 [1.94, 14.20]
Hua et al., 2021	4326	20676	17415	115376	8.1%	1.39 [1.35, 1.43]
Lingam et al., 2009	27	367	302	6614	6.6%	1.61 [1.10, 2.35]
Pierrat et al., 2021	194	2219	32	592	6.7%	1.62 [1.13, 2.32]
Prichard et al., 2014	7	105	2	107	1.7%	3.57 [0.76, 16.77]
Roberts et al., 2011	21	132	8	154	4.2%	3.06 [1.40, 6.68]
Spittle et al., 2021	79	165	10	65	5.2%	3.11 [1.72, 5.63]
Tommiska et al., 2020	18	60	2	30	2.0%	4.50 [1.12, 18.13]
Yang et al., 2020	78	888	493	7698	7.5%	1.37 [1.09, 1.72]
Zhu et al., 2012	71	943	643	21955	7.4%	2.57 [2.03, 3.26]
Total (95% CI)		**28557**		**183414**	**100.0%**	**2.22 [1.77, 2.79]**
Total events	5393		19989			

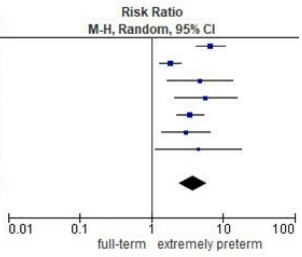
Heterogeneity: Tau² = 0.17; Chi² = 169.17, df = 17 (P < 0.00001); I² = 90%
Test for overall effect: Z = 6.83 (P < 0.00001)



Extremely Preterm

Study or Subgroup	Extremely Preterm Events	Total	Full-term Events	Total	Weight	Risk Ratio M-H, Random, 95% CI
Bolk et al., 2018	85	229	19	344	18.4%	6.72 [4.21, 10.74]
Caravale et al., 2019	38	126	59	362	20.0%	1.85 [1.30, 2.64]
Davis et al., 2007	20	210	4	202	10.4%	4.81 [1.67, 13.83]
Goyen & Lui, 2009	17	37	4	50	11.0%	5.74 [2.11, 15.66]
Pierrat et al., 2021	47	252	32	592	19.0%	3.45 [2.26, 5.27]
Roberts et al., 2011	21	132	8	154	13.8%	3.06 [1.40, 6.68]
Tommiska et al., 2020	18	60	2	30	7.4%	4.50 [1.12, 18.13]
Total (95% CI)		**1046**		**1734**	**100.0%**	**3.78 [2.38, 6.02]**
Total events	246		128			

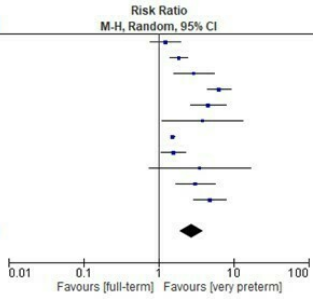
Heterogeneity: Tau² = 0.25; Chi² = 21.95, df = 6 (P = 0.001); I² = 73%
Test for overall effect: Z = 5.62 (P < 0.00001)



Very Preterm

Study or Subgroup	Very preterm Events	Total	Full-term Events	Total	Weight	Risk Ratio M-H, Random, 95% CI
Cameron et al., 2021	18	48	29	96	9.9%	1.24 [0.77, 2.00]
Caravale et al., 2019	147	482	59	362	11.2%	1.87 [1.43, 2.45]
de Kieviet et al., 2013	27	58	10	64	8.7%	2.98 [1.58, 5.61]
Faebo Larsen et al., 2003	25	141	798	29044	10.7%	6.45 [4.49, 9.27]
Foulder-Hughes & Cooke, 2003	86	280	14	210	9.5%	4.61 [2.70, 7.87]
Goyen & Lui, 2009	4	13	4	50	4.9%	3.85 [1.11, 13.35]
Hua et al., 2021	1268	5439	17415	115376	11.9%	1.54 [1.47, 1.62]
Pierrat et al., 2021	117	1367	32	592	10.6%	1.58 [1.08, 2.31]
Prichard et al., 2014	7	105	2	107	3.7%	3.57 [0.76, 16.77]
Spittle et al., 2021	79	165	10	65	9.1%	3.11 [1.72, 5.63]
Zhu et al., 2012	14	99	643	21955	9.8%	4.83 [2.95, 7.89]
Total (95% CI)		**8197**		**167921**	**100.0%**	**2.72 [1.90, 3.91]**
Total events	1792		19016			

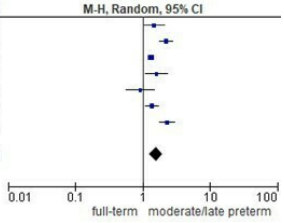
Heterogeneity: Tau² = 0.29; Chi² = 106.29, df = 10 (P < 0.00001); I² = 91%
Test for overall effect: Z = 5.43 (P < 0.00001)



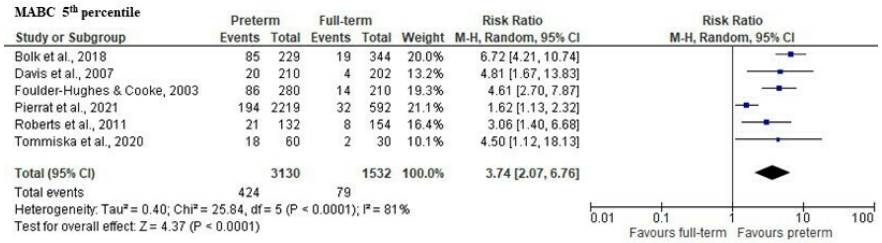
Moderate/late Preterm

Study or Subgroup	Moderate/late preterm Events	Total	Full-term Events	Total	Weight	Risk Ratio M-H, Random, 95% CI
Deshmukh et al., 2021	26	88	145	716	12.6%	1.46 [1.02, 2.08]
Faebo Larsen et al., 2003	79	1281	798	29044	15.9%	2.24 [1.79, 2.81]
Hua et al., 2021	3058	15237	17415	115376	19.0%	1.33 [1.28, 1.38]
Lingam et al., 2009	27	367	302	6614	12.0%	1.61 [1.10, 2.35]
Pierrat et al., 2021	30	600	32	592	9.7%	0.93 [0.57, 1.50]
Yang et al., 2020	78	888	493	7698	15.8%	1.37 [1.09, 1.72]
Zhu et al., 2012	57	844	643	21955	14.9%	2.31 [1.77, 3.00]
Total (95% CI)		**19305**		**181995**	**100.0%**	**1.58 [1.27, 1.96]**
Total events	3355		19828			

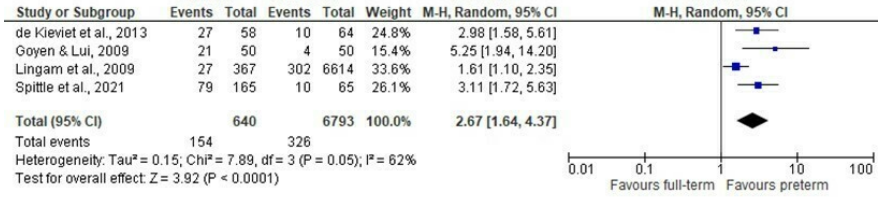
Heterogeneity: Tau² = 0.06; Chi² = 39.78, df = 6 (P < 0.00001); I² = 85%
Test for overall effect: Z = 4.12 (P < 0.0001)



MABC 5th percentile



MABC 15th percentile



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