

2023

Global Prevalence of Bronchopulmonary Dysplasia in Very Low Birth Weight Neonates: A Systematic Review and Meta-Analysis

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Recommended Citation

Joy, Jooby; Noronha, Michelle; Tarriela, Aina; Naqvi, Altha; Zoretic, Sarah; Jones, Maxwell; Marotta, Ali; Valarie, Taylor; Lee, Grace; Ahuja, Sunil K.; and Moreira, Alvaro, "Global Prevalence of Bronchopulmonary Dysplasia in Very Low Birth Weight Neonates: A Systematic Review and Meta-Analysis" (2023). *MEDI 9331 Scholarly Activities Clinical Years*. 69.

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Introduction

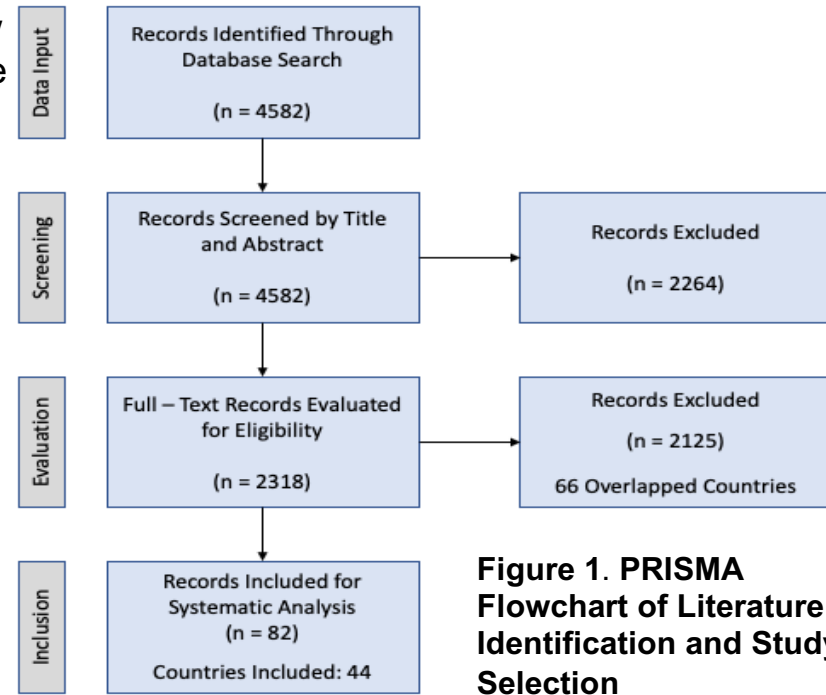
- Bronchopulmonary dysplasia (BPD) is a chronic lung disease that is characterized by arrest of lung growth and development in preterm neonates exposed to long periods of supplemental oxygen and positive pressure ventilation.
- Evolving interventions have led to survival of smaller and younger infants, however treatments for BPD are still limited.
- Early preventive measures and treatment are warranted to attenuate disease progression.
- To accomplish this endeavor, a global understanding of the disease and its impact over time is necessary.
- Valid and consistent estimates of the prevalence of BPD around the globe are largely lacking.

Objectives

- To estimate global trends in the prevalence of BPD, to examine temporal changes of BPD rates, and to stratify BPD rates according to definition, birth weight, gestational age, setting, continent, and gross domestic product.

Materials and Methods

- We conducted a systematic review and meta-analysis according to the Cochrane Handbook for Systematic Reviews of Interventions and adhered to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) criteria.
- Two investigators systematically searched MEDLINE from January 1990 to September 30th, 2019. Search terms included (bronchopulmonary dysplasia OR chronic lung disease) AND a list of each country.



- Articles were filtered to include children between the age range of birth and 1 month, limited to articles written in English and Spanish, and refined to remove review articles.
- Two groups of investigators independently reviewed the titles and abstracts of all citations to determine suitability.
- Male and female neonates with a birth weight of less than or equal to 1,500 grams or a gestational age of less than 32 weeks were included in this study. Case report, editorials, and commentaries were excluded.
- Study specifics included country, BPD definition, BPD rates, total number of neonates in the study, years of observation, inclusion criteria, and study design.
- BPD was defined by three categories: (i) BPD28- supplemental oxygen or positive pressure ventilation at 28 days, (ii) BPD36- supplemental oxygen or positive pressure ventilation at 36 weeks postmenstrual age, (iii) AnyBPD- combination of studies that defined BPD as either BPD28 or BPD36.
- If the study used both definitions, we inserted BPD28 as the prevalence.
- Prespecified subgroup analyses included birth weight categories, gestational age (GA), years, setting, continent, and gross domestic product (GDP).
 - GA: extremely low gestational age (ELGA) (≤ 28 weeks) vs. very low gestational age (VLGA) (< 32 weeks)
- Study setting: international, national, regional, or community
- Study years: 1990-1999, 2000-2009, 2010-2019
- Birth weight: extremely low birth weight ($< 1,000$ grams), very low birth weight ($\leq 1,500$ grams), and modifications of these terms (e.g., 501-750 grams, 751-1000 grams, 1001-1250 grams, and 1251-1500 grams).

Results

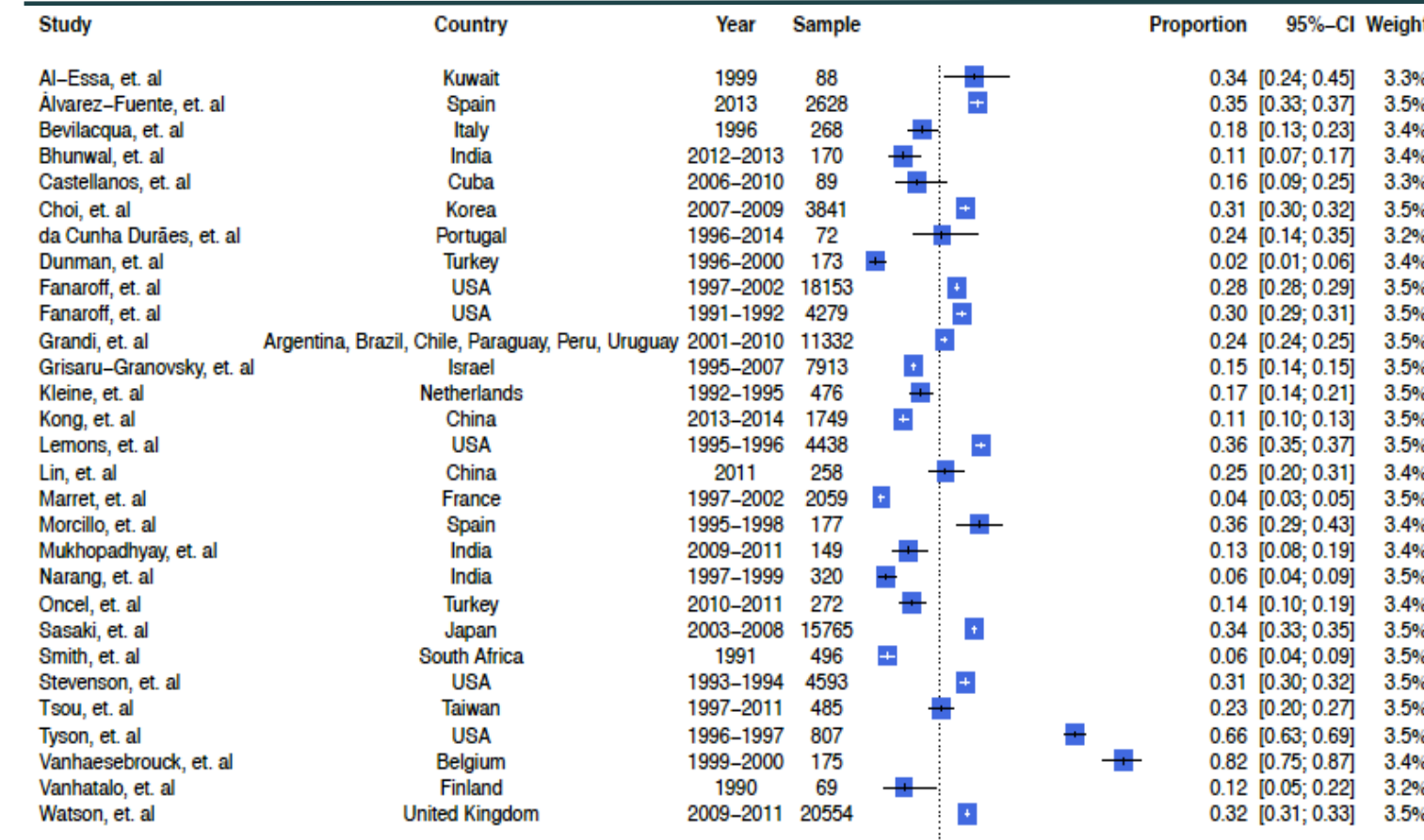


Figure 2. Pooled Prevalence for BPD28. Forest plot demonstrating pooled prevalence for BPD28 and 95% CI with a random-effects meta-analysis model. The pooled prevalence for BPD28 with 29 studies and 101,848 neonates was 23% (95% CI, 0.17-0.30).

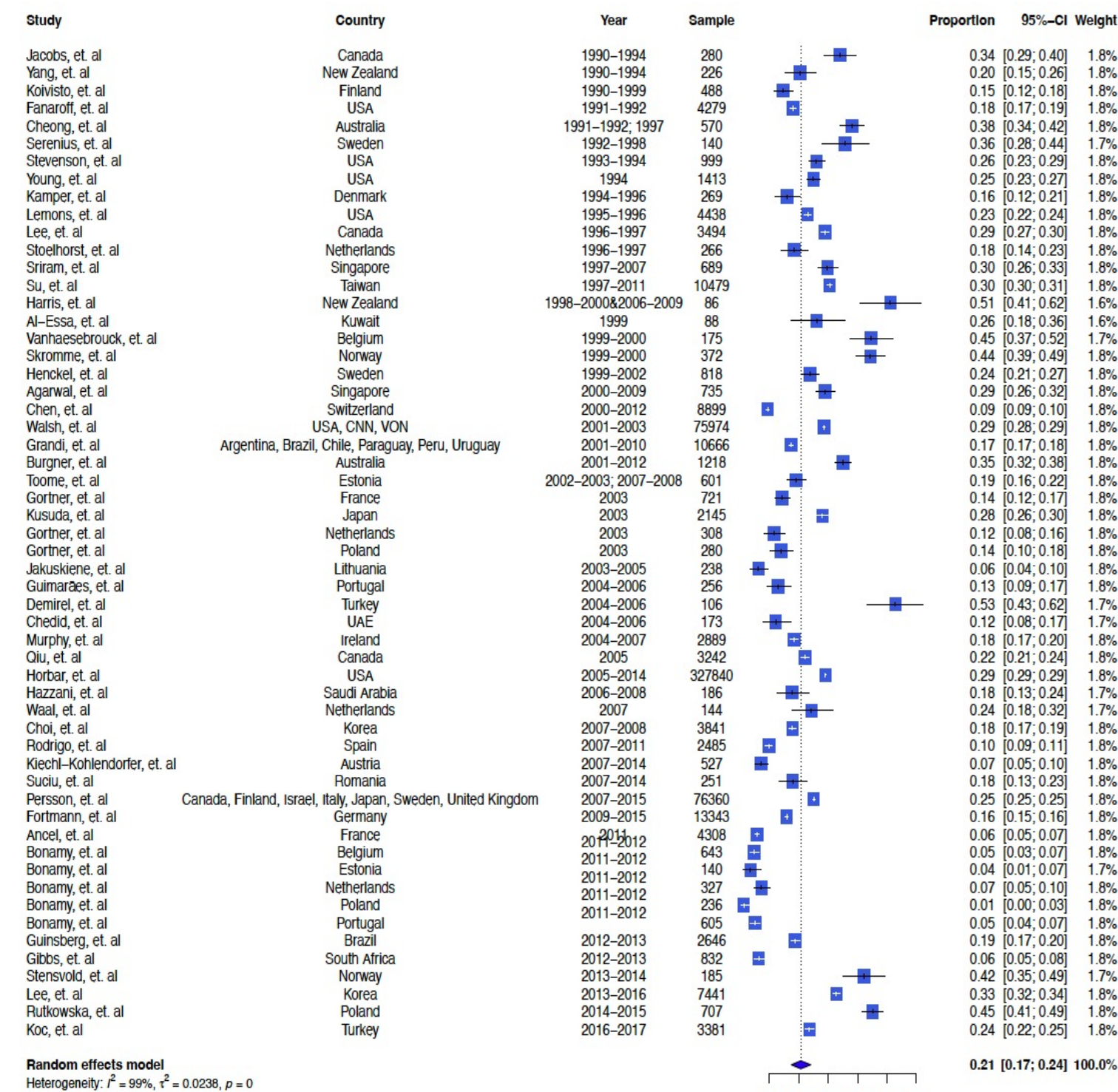


Figure 3. Pooled Prevalence for BPD36. Forest plot demonstrating pooled prevalence for BPD36 and 95% CI with a random-effects meta-analysis model. The pooled prevalence for BPD36 with 56 studies and 584,448 neonates was 21% (95% CI, 0.17-0.24).

Table 1. Global Prevalence of BPD28 and BPD36 Using Subgroup Meta-Analysis.

Variable	No. of Articles	No. of Cases	No. of Participants	Prevalence (95% CI)	I ²	P Value
Subgroup Analysis for BPD28						
<i>Birthweight</i>						
501-750 grams	4	4327	6916	0.60 (0.42-0.77)	0.99	<0.01
751-1000 grams	4	3263	7379	0.50 (0.41-0.59)	0.99	<0.01
1001-1250 grams	4	1449	7893	0.21 (0.16-0.28)	0.98	<0.01
1251-1500 grams	4	570	9275	0.07 (0.05-0.08)	0.90	<0.01
<1000 grams	5	784	1481	0.40 (0.13-0.71)	0.99	<0.01
<1500 grams	6	10229	37795	0.25 (0.17-0.34)	1.00	<0.01
Overall	27	20622	70739	0.13 (0.11-0.14)	1.00	<0.01
<i>Gestational age</i>						
ELGA	2	160	247	0.53 (0.04-0.98)	0.99	<0.01
VLGA	10	13469	47484	0.18 (0.12-0.24)	1.00	<0.001
Overall	12	13629	47731	0.18 (0.13-0.25)	0.99	0.22
<i>Year</i>						
1990-1999	11	5118	16011	0.25 (0.15-0.36)	0.99	<0.01
2000-2009	3	6564	19776	0.25 (0.12-0.41)	0.97	<0.01
2010-2019	4	1291	4907	0.21 (0.11-0.32)	0.99	<0.01
Overall	18	12919	40694	0.23 (0.17-0.30)	0.99	0.83
<i>Setting</i>						
Community	10	198	1898	0.12 (0.07-0.18)	0.90	<0.01
Regional	2	145	734	0.21 (0.14-0.29)	0.84	0.01
National	16	25811	87884	0.31 (0.22-0.41)	1.00	<0.001
International	1	2768	11332	0.24 (0.24-0.25)	NA	NA
Overall	29	28922	101848	0.24 (0.23-0.25)	0.99	<0.01
<i>Continent</i>						
Africa	1	30	496	0.06 (0.04-0.09)	NA	NA
Asia	11	7,051	23,270	0.17 (0.11-0.25)	0.99	<0.01
Europe	10	9,068	34,391	0.26 (0.14-0.40)	1.00	<0.001
North America	6	10,005	32,359	0.34 (0.22-0.48)	0.99	<0.01
South America	1	2,768	11,332	0.24 (0.24-0.25)	NA	NA
Overall	29	28,922	101,848	0.23 (0.23-0.24)	0.99	<0.01
<i>GDP</i>						
1st quartile	2	99	814	0.17 (0.08-0.28)	0.93	<0.01
2nd quartile	5	1,295	8,088	0.47 (0.00-0.99)	1.00	<0.01
3rd quartile	4	1,149	3,861	0.22 (0.14-0.32)	0.98	<0.01
4th quartile	8	18,602	62,709	0.19 (0.11-0.29)	1.00	<0.001
Overall	19	21,145	75,472	0.20 (0.15-0.25)	0.99	0.74
Subgroup Analysis for BPD36						
<i>Birthweight</i>						
501-750 grams	5	1,406	3,549	0.45 (0.28-0.64)	0.99	<0.01
751-1000 grams	5	1,395	4,360	0.32 (0.28-0.36)	0.87	<0.01
1001-1250 grams	5	797	4,958	0.16 (0.14-0.18)	0.64	0.03
1251-1500 grams	5	468	5,879	0.08 (0.07-0.09)	0.22	0.28
<1000 grams	3	703	1,887	0.38 (0.30-0.47)	0.93	<0.01
<1500 grams	14	145,669	526,356	0.19 (0.15-0.23)	1.00	<0.01
Overall	37	150,438	546,989	0.12 (0.11-0.13)	0.99	<0.01
<i>Gestational age</i>						
ELGA	16	401	338,497	0.06 (0.04-0.09)		