National, regional, and global estimates of preterm birth in 2020, with trends from 2010: a systematic analysis

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Summary

Background Preterm birth is the leading cause of neonatal mortality and is associated with long-term physical, neurodevelopmental, and socioeconomic effects. This study updated national preterm birth rates and trends, plus novel estimates by gestational age subgroups, to inform progress towards global health goals and targets, and aimed to update country, regional, and global estimates of preterm birth for 2020 in addition to trends between 2010 and 2020.

Methods We systematically searched population-based, nationally representative data on preterm birth from Jan 1, 2010, to Dec 31, 2020 and study data (26 March–14 April, 2021) for countries and areas with no national-level data. The analysis included 679 data points (86% nationally representative administrative data [582 of 679 data points]) from 103 countries and areas (62% of countries and areas having nationally representative administrative data [64 of 103 data points]). A Bayesian hierarchical regression was used for estimating country-level preterm rates, which incoporated country-specific intercepts, low birthweight as a covariate, non-linear time trends, and bias adjustments based on a data quality categorisation, and other indicators such as method of gestational age estimation.

Findings An estimated 13·4 million (95% credible interval [CrI] 12·3–15·2 million) newborn babies were born preterm (<37 weeks) in 2020 (9·9% of all births [95% CrI 9·1–11·2]) compared with 13·8 million (12·7–15·5 million) in 2010 (9·8% of all births [9·0–11·0]) worldwide. The global annual rate of reduction was estimated at –0·14% from 2010 to 2020. In total, 55·6% of total livebirths are in southern Asia (26·8% [36 099 000 of 134 767 000]) and sub-Saharan Africa (28·7% [38 819 300 of 134 767 000]), yet these two regions accounted for approximately 65% (8 692 000 of 13 376 200) of all preterm births globally in 2020. Of the 33 countries and areas in the highest data quality category, none were in southern Asia or sub-Saharan Africa compared with 94% (30 of 32 countries) in high-income countries and areas. Worldwide from 2010 to 2020, approximately 15% of all preterm births occurred at less than 32 weeks of gestation, requiring more neonatal care (<28 weeks: 4·2%, 95% CI 3·1–5·0, 567 800 [410 200–663 200 newborn babies]); 28–32 weeks: 10·4% [9·5–10·6], 1 392 500 [1 274 800–1 422 600 newborn babies]).

Interpretation There has been no measurable change in preterm birth rates over the last decade at global level. Despite increasing facility birth rates and substantial focus on routine health data systems, there remain many missed opportunities to improve preterm birth data. Gaps in national routine data for preterm birth are most marked in regions of southern Asia and sub-Saharan Africa, which also have the highest estimated burden of preterm births. Countries need to prioritise programmatic investments to prevent preterm birth and to ensure evidence-based quality care when preterm birth occurs. Investments in improving data quality are crucial so that preterm birth data can be improved and used for action and accountability processes.

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Introduction

Preterm birth (<37 weeks of gestation) is a global burden considered to be one of the main risk factors for neonatal mortality (aged under 5 years) and is associated with short-term and long-term effects, such as poor health and growth, intellectual and mental disabilities, and early onset of chronic diseases, among others.[1–3] Previous estimates showed that 10·6% (uncertainty interval: 9·0–12·0%, 14·84 million [12·65 million–16·73 million]) of all livebirths worldwide were preterm births in 2014.[4]

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Research in context

Evidence before this study

In 2015, WHO published global, regional, and national preterm birth rates based on systematic data searches and analysis of administrative routine data from 1990 to 2014. These previous estimates showed that approximately 10·6% (14·84 million [12·65 million–16·73 million live births], uncertainty interval 9·0–12·0%) of all livebirths worldwide in 2014 were preterm births. Around 91% of these preterm births occurred in low-income and middle-income countries, with more than half in south Asia (52·9% [7 847 643 of 14 835 606]) and more than a quarter in sub-Saharan Africa (28·2% [4 182 440 of 14 835 606]). No comparable preterm birth estimates have been published since then. Updated global, regional, and national estimates are needed to assess progress and inform acceleration towards the Sustainable Development Goal targets and other important global frameworks. This new set of estimates supersedes the previous estimates published in 2015. WHO has the mandate for updating global estimates for preterm birth and has not published new preterm estimates since 2015; therefore, there was no systematic review needed. This study was done in collaboration with WHO and UNICEF.

Added value of this study

We estimated preterm birth rate for all 194 WHO member states and the occupied Palestinian territory, including east Jerusalem (subsequently, throughout the paper, we refer to them as countries and areas). We expanded the previous preterm birth database for all countries and areas with data from Jan 1, 2010, to Dec 31, 2020 (679 data points from 103 countries and areas) and included new data for 18 additional countries and areas, seven of which are administrative data and 11 data from studies. Covariates were selected using a priori criteria involving identifying potential covariates through a conceptual framework, evaluating data availability and quality of potential covariates time-series, and finally analysing between covariate clusters and correlation of covariates with preterm birth rate. Using data available from 103 countries and areas, we estimated preterm birth rate for all 195 countries and areas, using a Bayesian framework approach incorporating hierarchical country and region intercepts, covariates, and non-linear time trends with bias adjustments based on the quality of the data. For countries and areas without input data, predictions were obtained using within-region country intercepts, country-level low birthweight prevalence as a covariate, and time trends from estimates within the region. Additionally, we estimated the distribution of preterm newborn babies by detailed subgroups based on gestational age (<28 weeks, 28 to <32 weeks, and 32 to <37 weeks). This preterm subset information enables programme planning for neonatal care, and also informs data quality assessment. Our analyses found selective data missingness for very preterm babies less than 28 weeks.

Implications of all the available evidence

Little change is observed in the global preterm birth rate in the last decade, and indeed reductions in numbers could be more related to the falling number of births in most regions. Action is needed to address the underlying causes of preterm births, and to improve the use of real-time data for policies, programmes, and clinical management to develop effective prevention and treatment programmes. However, data gaps persist (only 53% [103 of 195] of countries and areas provided data for estimation of the preterm birth rates). Preterm birth data are not routinely collected nor reported in many countries and areas and reliance on study data continues, especially in south Asia and sub-Saharan Africa. Investments are needed to improve country health information systems, including increased coverage of preterm data availability at national level and quality so that countries can monitor trends in preterm birth and coverage of recommended interventions for preterm birth, and by providing services for 13·4 million newborn babies born too soon.

Newborn babies born preterm have substantially higher risks of adverse outcomes compared with babies born at term. Risks of mortality and morbidity increase according to degree of prematurity, with babies born extremely preterm (<28 weeks of gestation) at the highest risk, followed by babies born very preterm (28 weeks to <32 weeks), then babies born moderate to late preterm (32 weeks to <37 weeks).[5–7]

Addressing the global burden of preterm birth is essential for reducing preterm-related neonatal and child mortality and achieving the Sustainable Development Goal target 3·2 (committing to reduce neonatal mortality to 12 or fewer neonatal deaths per 1000 livebirths in every country).[8] Estimates of preterm birth at global, regional, and national levels are essential to improve understanding of its epidemiology and where action should be focused. Although data are available for preterm birth in high-income countries, information from low-income and middle-income countries (LMICs) remains scarce even when facility delivery rates now exceed 80% of all births worldwide.[9]

Systematic collation of available data, and periodic estimates of the prevalence of preterm birth using comparable methods are needed to assess the burden at global, regional, and national levels, and to understand how the burden is changing over time. Regular estimates are also needed to help raise awareness of preterm birth as an important global public health problem, inform the need for implementation or redesign of health policies and programmes, and guide resource allocation in health systems. These can also be used to monitor the effect of such interventions.

Three papers[4,10,11] have been previously published with the latest preterm birth estimates for 2014 published in 2019. Those preterm birth estimates required updating by virtue of new data availability and to reflect changes in the last decade. This review presents a systematic analysis of preterm birth prevalence data, and aimed to update new country, regional, and global estimates of preterm birth for 2020 in addition to trends between 2010 and 2020. Recommendations are provided for further improvements in the data cycle to monitor this pertinent health outcome.

Methods

Study design

For this study, the detailed process, methods, and statistical framework used for modelling the preterm birth estimates were defined a priori and published as part of a study protocol.[12]

The data inputs for preterm births were all livebirths obtained from a systematic review of national civil registration and vital statistics databases, and published literature. Modelling was done according to a minor adaptation of the Sustainable Development Goal regions (revision 1), for all 194 WHO member states and the occupied Palestinian territory, including east Jerusalem (subsequently, throughout the paper, we refer to them as "countries and areas").[13] Specifically, Iran, the Maldives, and Sri Lanka were moved from Southern Asia to the Western Asia and Northern Africa region, as they are closer epidemiologically to this region. All other countries and areas remain in their original Sustainable Development Goal region grouping (appendix pp 6–7).[13] Using national-level or study data meeting our inclusion criteria from 103 countries and areas, we estimated national rates for all 195 countries and areas, and regional and global preterm birth rates using a hierarchical Bayesian framework. This statistical framework compiled available data from all countries and areas, including a priori selected covariates, and accounted for data quality differences according to data source by incorporating different weighting and bias shifts in the model. In addition, a more detailed distribution of preterm subgroups based on gestational age at the time of birth (<28 weeks, 28 to <32 weeks, and 32 to <37 weeks) was estimated. National-level data are presented only for countries and areas that provided preterm input data. These estimates follow the Guidelines for Accurate and Transparent Health Estimates Reporting checklist (appendix pp 3–4).[12,14] This work was guided and reviewed periodically by a group of global experts who formed the Expert Consultative Group.

Preterm birth is defined as a livebirth with gestational age of <37 weeks. The denominator used to calculate preterm birth rate was determined by the availability of the reported information (ie, number of livebirths with a gestational age or number of livebirths overall [with or without a gestational age], or number of total births [livebirths and stillbirths], or the reported preterm birth rate if either the numerator or the denominator were not available; appendix p 18).

Data collection and assessment

Data inputs were compiled from two sources: national administrative data, defined as data from national systems, including civil registration and vital statistics systems, national health management systems, and birth registries, and published studies obtained through a systematic online search.

Data sources assessed were administrative sources and research studies. For administrative data, a systematic search of Ministry of Health and National Statistical Office publications and datasets available in the public domain was conducted for countries and areas that had a population facility birth of at least 80% of births between 2010 and 2020.[9] Data sources used for the last round of estimates were searched first to identify more recent data.[4] For research studies, a systematic review of published studies was conducted for countries and areas that did not meet the threshold for searching administrative data sources and where coverage of institutional deliveries was less than 80%. Databases searched were MEDLINE, Embase, POPline, WHO Global Health Library, the Cumulative Index to Nursing and Allied Health Literature, PsycINFO, and the Cochrane Central Register for Controlled Trials, with no language restrictions. The search was restricted to studies published after the last round of preterm estimates in 2014 (ie, from Jan 1, 2015) to 2020. Search terms are shown in the appendix (pp 8–16).

See Online for appendix

For administrative data, extraction was conducted by a single reviewer (YBO). A second reviewer (A–BM) extracted 10% of data points independently and performed rigorous consistency checks and quality control techniques to ascertain accuracy. Any discrepancies on the inclusion of the data were discussed and resolved within the team. For the research studies, double abstraction was performed, and any conflicts were resolved by a third reviewer (HB; appendix p 17).

For the exclusion criteria, all data sources with an estimated preterm rate of less than 3% in a given year were considered implausible based on findings from the international newborn standards[15] and from the INTERGROWTH-21st project[16] and were therefore excluded. All data sources with no metadata were also excluded. In addition, administrative data for country-years reporting preterm birth for less than 80% of UN Population Division World Population Prospects 2022 estimated livebirths were excluded (appendix pp 17–19).[17]

Country consultation

A WHO and UNICEF country consultation on the preterm birth estimates was conducted between Sept 29 and Nov 15, 2022. This consultation provided countries and areas the opportunity to review and comment on the modelling methods used to generate the estimates, including data sources, and the preliminary modelled preterm estimates for their country. During the consultation, new data from 203 country-years (from

18 countries and areas) were received and reviewed, and those that met the inclusion criteria were included in the final estimates.

Accounting for data quality differences in the input data

A priori, several potential sources of bias in the preterm input data[12] were identified (appendix pp 29–30). Data quality categories were developed through an iterative process to produce the final Data Quality Category (appendix pp 30–32) based on the following indicators: reporting coverage of facility births combined with percentage of births occurring in facilities (eg, countries and areas with 90% or higher of births occurring in facilities with 90% or higher coverage of preterm birth data across 80% of the time-series between 2010 and 2020 considered as the highest quality [Data Quality Category A]); data source type (eg, administrative or study, subnational or national); denominator used to calculate preterm births (eg, livebirths with gestational age or livebirths only or total births); and subgroup proportions (eg, proportion of preterm births that are <28 weeks or <32 weeks if no data available for <28 weeks, between 28 weeks and <32 weeks, and between 32 weeks and <37 weeks). The administrative data were categorised by country-year to account for changes in data quality within countries and areas over time (appendix pp 30–32).

Covariate selection

The selection of covariates was done a priori in four steps:[12] (1) identification of plausible covariates using a conceptual framework; (2) a search for covariate time-series data from UN and other databases; (3) assessment of the quality of the time-series data for all potential covariates, and imputing any missing years of data using linear interpolation and constant extrapolation; and (4) statistical analysis to identify the smallest set of covariates with the best quality time-series that were most highly correlated with the preterm birth rate. The fourth step was the following: a cluster analysis to identify covariates belonging to the same cluster based on correlation, a correlation of each covariate with the preterm birth rate and, within each cluster, identifying the covariate with the highest correlation with the preterm birth rate. The covariates selected were low birthweight, gross national income, prevalence of modern contraceptive rate, prevalence of being underweight among female adults, and percentage of the population that reside in urban areas (appendix pp 19–28). However, to avoid circularity, we only included the modelled low birthweight estimates for 2020[18] in the preterm model because the modelled low birthweight estimates already included gross national income, prevalence of modern contraceptive rate, prevalence of being underweight among female adults, and percentage of the population that reside in urban areas as covariates.

For more on **rjags** see https://cran.r-project.org/web/packages/rjags/index.html

For more on **R2jags** see https://cran.r-project.org/web/packages/R2jags/index.html

For more on **distortr** see https://github.com/MJAlexander/distortr

Statistical analysis

Estimates of preterm birth rate (2010–20) at national levels were predicted from all included input data using a Bayesian hierarchical regression model.[19] The model was fit on the logit scale to ensure that the estimates (ie, proportions) were bounded between zero and one, and are then back-transformed to the original scale for prevalence. The model included hierarchical random country-specific intercepts, non-linear time trends,[20,21] covariate data, and additional bias shift and standard deviation terms based on the country's input Data Quality Category, singleton or all livebirth capture, method of gestational age assessment, and data source type.

The country-specific intercepts were estimated for the six Sustainable Development Goal regions using a within-region and between-region variance (appendix pp 33–36). At the country level, alongside the random intercepts, penalised splines were used as temporal smoothing across the time-series.

For model validation, a cross-validation approach was used by leaving out 20% of the country-years data for countries and areas with more than 10 country-years, and estimates were compared with the estimates from all data by quantifying the percentage of points that fell within expected credible intervals (CrI; appendix pp 37–39). Sensitivity analyses were performed by checking that the direction of low birthweight covariate was biologically plausible and by comparing a model with and without low birthweight as a covariate.

The Markov Chain Monte Carlo sampling method was used for the estimation and generation of CrIs, combining the country-level regression terms with the additional data quality terms to generate preterm estimates from 2010 to 2020.

For countries and areas with no data or data not meeting the inclusion criteria, preterm birth estimates were predicted from country-level low birthweight, regional intercepts, and time trends from data inputs within the region to predict their preterm birth estimates in the final model.

The absolute numbers of preterm births for each country were estimated by multiplying the estimated preterm birth rate by the UN World Population Prospects 2022 livebirths estimates.[17] To obtain the absolute numbers for the regional estimates of preterm birth, we summed the estimates of the preterm birth numbers for the countries and areas within each of the corresponding regions. For the absolute numbers for the global estimates, we summed the estimates of the preterm birth numbers for all regions. All models were fitted in R statistical software (version 4.1.2) using the following packages: rjags, R2jags, distortr.

For countries and areas reporting preterm birth rates from administrative data by gestational age subgroups (<28 weeks, 28 to <32 weeks, and 32 to <37 weeks), the proportion that these subgroups contributed to the estimated preterm birth rate for each country-year with available data was calculated. Due to inconsistent and non-standardised reporting of the preterm subgroups and the small amount of disaggregated data especially in southern Asia and sub-Saharan Africa, the preterm subgroups across regions and globally were estimated using a random effects meta-analysis of a single proportion with a logit transformation using the meta-prop function in R.[22–24] Due to paucity of data across regions, we applied the global estimates for each preterm subgroup from the meta-analysis to all regions. The numbers of preterm births within the subgroup were calculated by multiplying the estimated subgroup proportion of the preterm birth estimates by the estimated number of preterm births (appendix pp 52–58).

	Total number of countries and areas in the region*	Administrative data (number of countries and areas [number of country/area-years])	Published studies (number of countries and areas [number of studies])	Total (number of countries and areas [number of country/area-years or studies])
Latin America and the Caribbean	33	13 (105)	4 (5)	16 (110)
Eastern Asia, south-eastern Asia, and Oceania (excluding Australia and New Zealand)	30	4 (43)	8 (19)	12 (62)
Northern America, Australia and New Zealand, central Asia, and Europe	51	41 (398)	0 (0)	41 (398)
Southern Asia	6	0 (0)	4 (24)	4 (24)
Sub-Saharan Africa	48	0 (0)	17 (37)	17 (37)
Western Asia and northern Africa	27	6 (36)	7 (12)	13 (48)
Total†	195	64 (582)	40 (97)	103 (679)

*A minor adaptation of the Sustainable Development Goal regions (revision 1) grouping was used in the modelling with Iran, Sri Lanka, and the Maldives moved from southern Asia into western Asia and northern Africa regions. All other countries and areas remain in their original Sustainable Development Goal region grouping; the countries and areas included in each regional group can be seen in the appendix (pp 6–7). †Some countries have both administrative and survey data.

Table 1: **Input data by type and region included in the modelling in the Bayesian hierarchical regression model used to generate the preterm estimates**

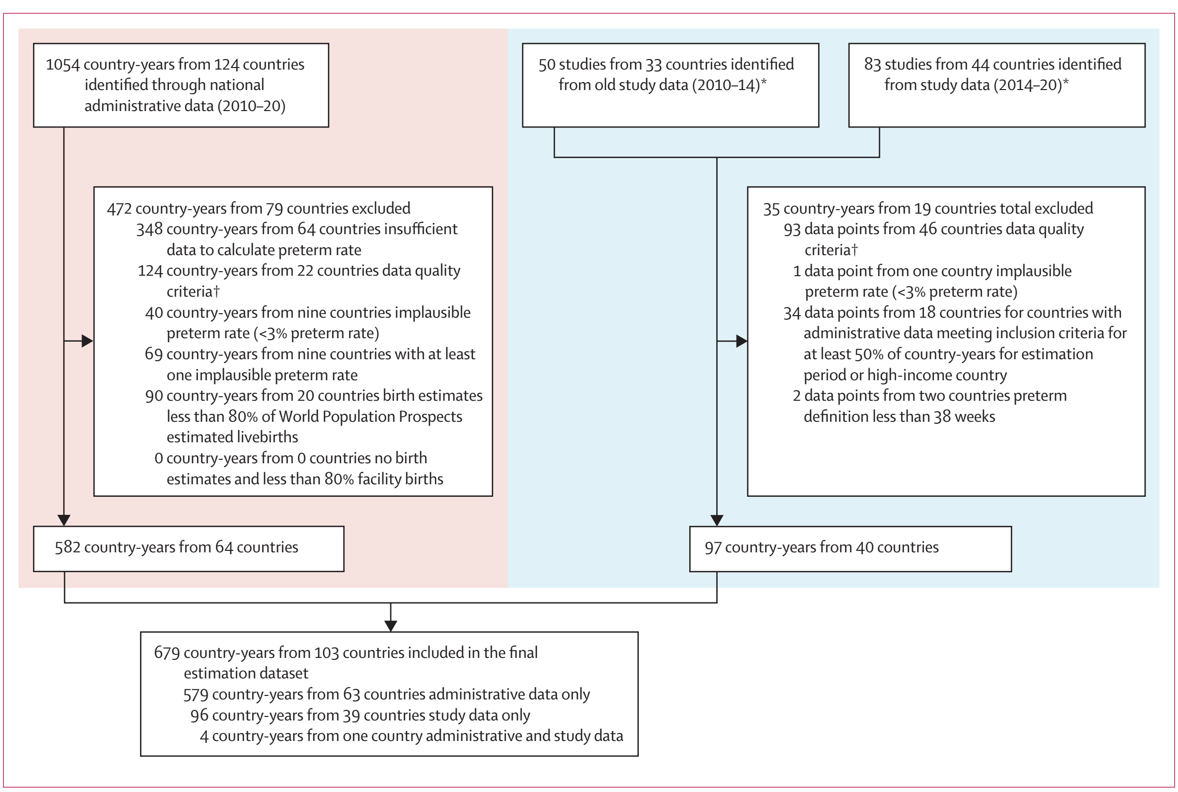

Figure 1: **Study selection**
*Year of publication. †Some meet more than one exclusion criteria.

	2010		2020		Average annual rate of reduction in preterm birth prevalence 2010–20
	Preterm birth rate per 100 livebirths (95% CrI)	Number of preterm births (95% CrI)	Preterm birth rate per 100 livebirths (95% CrI)	Number of preterm births (95% CrI)	
Latin America and the Caribbean	8·9 (8·4–9·5)	955 900 (909 500–1 021 400)	8·9 (8·4–9·5)	870 000 (827 000–930 500)	–0·05%
Eastern Asia, south-astern Asia, and Oceania*	6·6 (5·8–8·0)	2 113 600 (1 842 300–2 532 800)	6·8 (5·9–8·3)	1 717 600 (1 485 700–2 092 800)	–0·20%
Northern America, Australia and New Zealand, central Asia, and Europe	7·8 (7·6–8·0)	1 130 900 (1 106 100–1 161 700)	7·9 (7·7–8·1)	1 038 900 (1 013 600–1 070 500)	–0·17%
Southern Asia	13·3 (10·8–16·5)	5 250 400 (4 278 300–6 502 400)	13·2 (10·8–16·6)	4 778 900 (3 895 900–6 003 400)	0·05%
Sub-Saharan Africa	10·1 (8·5–12·7)	3 350 100 (2 843 400–4 218 500)	10·1 (8·6–12·7)	3 913 200 (3 319 300–4 916 900)	–0·03%
Western Asia and northern Africa	8·8 (6·1–12·9)	994 500 (691 100–1 453 200)	9·1 (6·3–13·3)	1 057 600 (731 600–1 549 600)	–0·30%
Worldwide	9·8 (9·0–11·0)	13 795 300 (12 715 800–15 535 900)	9·9 (9·1–11·2)	13 376 200 (12 316 700–15 156 400)	–0·14%

CrI=credible interval. *Excluding Australia and New Zealand.

Table 2: **Estimated preterm birth rate and number of preterm babies in 2010 and 2020 by Sustainable Development Goal region**

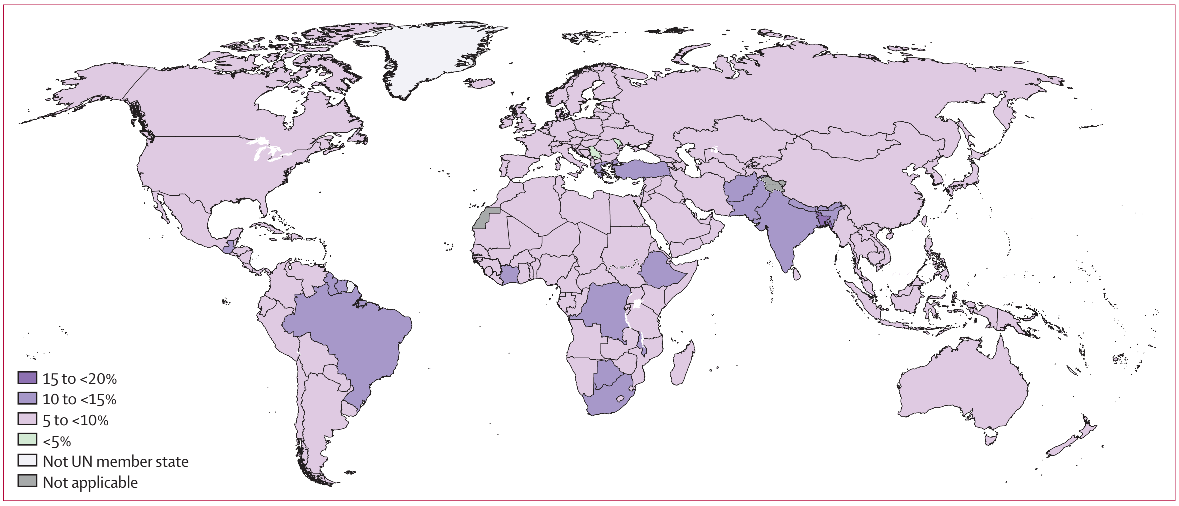

Figure 2: **Estimated national preterm birth rates in 2020**
The boundaries shown on this map do not signify any official endorsement of borders, or the legal status of any country or area. Produced by WHO.

Role of the funding source

The funders of the study had no role in the study design, data collection, data analysis, data interpretation, or writing of the report.

Results

The final dataset was comprised of 679 data points of input data (222 million births) from Jan 1, 2010, to Dec 31, 2020 from 103 countries and areas (table 1). Data meeting inclusion criteria were available for 53% (103 of all 195) of countries and areas. Most data, 86% (582 of 679 data points), were from national administrative data with 71% (412 of 582 data points) from high-income settings and 26% (150 of 582 data points) from upper-middle-income settings (table 1, figure 1).

The estimated global preterm prevalence in 2020 was 9·9% (95% CrI 9·1–11·2) translating to 13·4 million preterm livebirths (12·3–15·2 million; table 2, figures 2, 3). The highest preterm birth rate was in southern Asia (13·2% [95% CrI 10·8–16·6]), and is almost double the rate for the lowest preterm birth rate reported in the Sustainable Development Goal region of eastern Asia, south-east Asia, and Oceania (excluding Australia and New Zealand; 6·8% [95% CrI 5·9–8·3]; figure 2). However, within regions, large national variations persisted in 2020. For instance, in southern Asia, Bangladesh had the highest rate of preterm births in 2020 (16·2% [95% CrI 11·8–21·7]), followed by Pakistan (14·4% [8·6–23·1]) and India (13·0% [9·7–17·3]; table 3). In Latin America, country-level preterm birth rates ranged from 5·8% (95% CrI 5·4–6·2) in Nicaragua to 12·8% (8·0–20·4) in Suriname.

Over 50% of all preterm births in 2020 occurred in just eight countries and areas (table 3). India had the highest number of preterm births in 2020 (3·02 million, accounting for over 20% of all preterm births worldwide) followed by Pakistan, Nigeria, China, Ethiopia, Bangladesh, Democratic Republic of the Congo, and the USA. Although most of the high preterm birth rates occur in low-income and middle-income countries and areas (table 3), rates of 10% or higher were also observed in high-income countries such as Greece (11·6% [95% CrI 10·9–12·3]) and the USA (10·0% [9·6–10·4]; appendix pp 60–61).

Globally in 2020, approximately 15% (2 million of 13·4 million) of all preterm births were before 32 weeks (before 28 weeks: 4·2% [95% CI 3·1–5·0], 567 800 [410 200–663 200] newborn babies) and between 28 weeks and 32 weeks (10·4% [9·5–10·6], 1 392 500 [1 274 800–1 422 600 newborn babies]; figure 4).

Discussion

Preterm birth rates for 2020 and time trends from 2010 to 2020 were estimated using, to our knowledge, the largest dataset developed using a Bayesian-based modelling approach, which is more robust than previous models. The process for updating the preterm estimates was led by WHO and UNICEF and included a country consultation with designated national nominated focal points.

At global level, there has not been a measurable change in preterm birth rate between 2010 (9·8% [95% CrI 9·0–11·0%] of livebirths) and 2020 (9·9% [9·1–11·2%] of livebirths). In terms of numbers, there were 13·8 million (95% CrI 12·7–15·5 million) preterm births in 2010 compared with 13·4 million (12·3–15·2 million) in 2020 (table 2). Similarly, across regions, very little or no change occurred in preterm birth rates in the last decade, including in southern Asia (13·3% [95% CrI 10·8–16·5%]) in 2010 compared with 13·2% (10·8–16·6%) in 2020, and sub-Saharan Africa (10·1% [8·5–12·7%]) in 2010 and 10·1% (8·6–12·7%) in 2020, the highest burden regions. However, in sub-Saharan Africa, despite no reduction in the prevalence of preterm birth between 2010 and 2020 (remained constant at 10·1%), the total number of babies born preterm increased by 563 100 babies between 2010 and 2020. In 2020, 3 913 200 babies were born preterm (95% CrI 3 319 300–4 916 900 preterm babies), compared with 3 350 100 preterm babies (2 843 400–4 218 500 preterm babies) in 2010. This increase is related to continued high fertility in the region and consequent increases in the size of the birth cohort.

The region with the highest preterm birth rate is southern Asia where 13·2% (95% CrI 10·8–16·6%; table 2) of babies were preterm in 2020 (highest in Bangladesh 16·2% [11·8–21·7%]; table 3), followed by Malawi (14·5% [9·5–21·6%]; appendix p 61–66) compared with fewer than 8% of preterm births in the regions of eastern Asia, south-eastern Asia, and Oceania (excluding Australia and New Zealand), and northern America, Australia, New Zealand, central Asia, and Europe. With preterm birth prevalence of 10% or higher persisting in some high-income countries and areas including Greece (11·6% [95% CrI 10·9–12·3%]) and the USA (10·0% [9·6–10·4%]; appendix pp 60–61), targeted efforts to identify the most affected groups and determine and implement the most effective strategies to reduce preterm birth in those populations are needed.

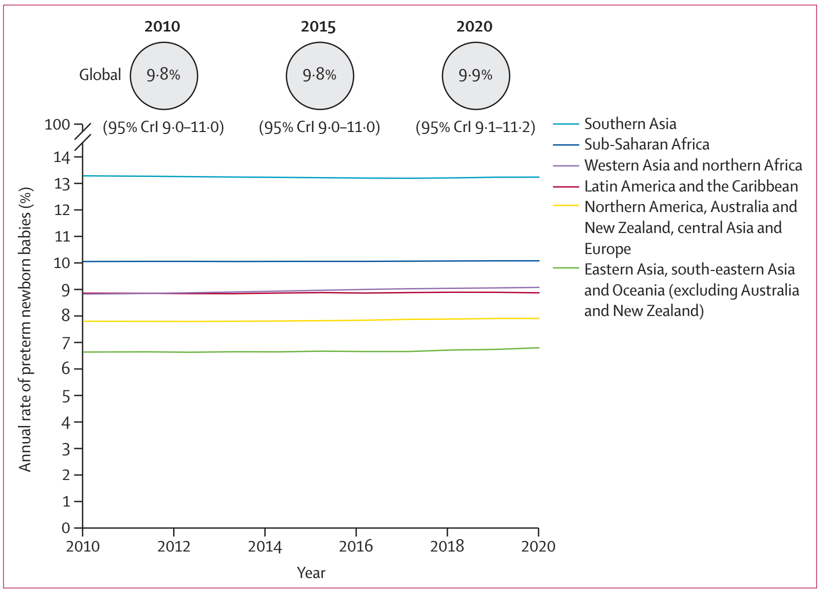

Figure 3: **Regional and worldwide trends in preterm birth between 2010 and 2020**
CrI=credible interval.

	2010			2020		
	Country	Preterm birth rate per 100 livebirths (95% CrI)	Number of preterm births (95% CrI)	Country	Preterm birth rate per 100 livebirths (95% CrI)	Number of preterm births (95% CrI)
1	India	13·1 (9·9–17·2)	3 496 500 (2 627 500–4 568 200)	India	13·0 (9·7–17·3)	3 016 700 (2 247 900–3 992 500)
2	China	6·1 (5·1–7·4)	1 096 300 (907 100–1 321 800)	Pakistan	14·4 (8·6–23·1)	914 000 (549 900–1 469 100)
3	Pakistan	14·3 (8·6–22·9)	892 200 (539 200–1 432 000)	Nigeria	9·9 (5·5–17·5)	774 100 (426 300–1 366 200)
4	Nigeria	9·9 (5·5–17·4)	672 600 (371 900–1 177 200)	China	6·1 (5·1–7·4)	752 900 (624 500–904 100)
5	Bangladesh	16·4 (12·1–21·8)	520 200 (385 100–691 700)	Ethiopia	12·9 (7·9–20·7)	495 900 (302 400–796 900)
6	Ethiopia	12·9 (7·8–20·9)	419 500 (254 100–680 500)	Bangladesh	16·2 (11·8–21·7)	488 600 (355 600–657 100)
7	USA	9·7 (9·4–10·1)	392 200 (377 900–406 900)	Democratic Republic of the Congo	12·4 (7·8–19·5)	487 500 (305 100–767 000)
8	Democratic Republic of the Congo	12·4 (7·7–19·4)	366 000 (228 300–574 300)	USA	10·0 (9·6–10·4)	366 200 (351 300–381 400)

CrI=credible interval.

Table 3: **Top eight countries and areas for numbers of preterm births in 2010 and 2020**

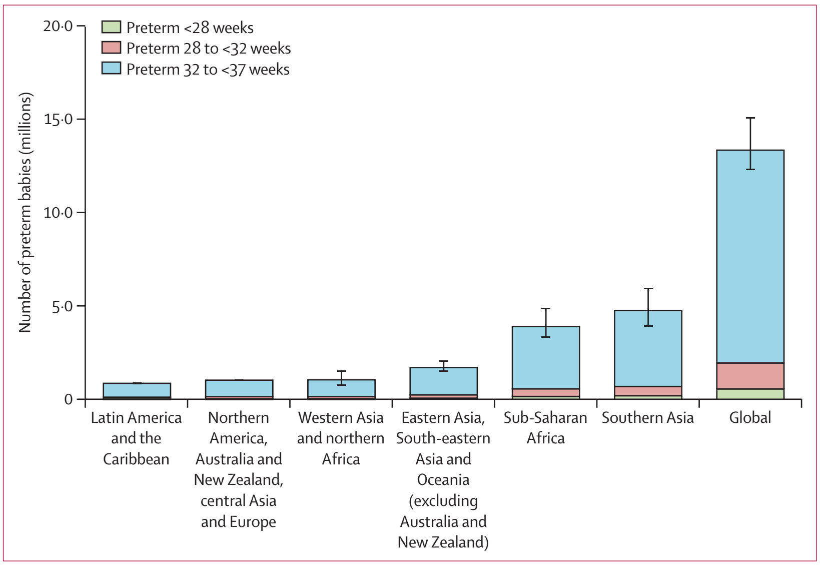

***Figure 4:* Regional and worldwide subgroups of preterm births in 2020**
Interval bars are the 95% CIs.

Over 50% of all preterm births in 2020 occurred in just eight countries and areas, the same top eight countries and areas as in 2010 with slight variations in the ranking of each country at the two timepoints. India had the highest total number of preterm births in 2020 (3·02 million) and accounted for over 20% of all preterm births worldwide followed by Pakistan, Nigeria, China, Ethiopia, Bangladesh, Democratic Republic of the Congo, and the USA. The high numbers of preterm births in these countries and areas are, in part, a reflection of their large population sizes, high numbers of total births, and weaker health systems that are unable to deliver high-quality family planning, antenatal care, and childbirth services to all individuals who need them.

Our time-series for the last decade shows little progress in reducing preterm births. Despite minimal progress at the global and regional level on reduction of preterm birth, some apparent progress has been seen in a few settings. Overall, 13 countries experienced a decline of 0·5% or more average annual rate of reduction in their preterm birth rates between 2010 and 2020 (Austria, Brazil, Brunei, Czechia, Denmark, Germany, Hungary, Latvia, the Netherlands, Singapore, Spain, Sweden, and Switzerland). In this period, the largest changes (decline of ≥1% average annual rate of reduction in their preterm birth rates) were seen in Czechia (preterm birth rates reduced from 8·4% to 6·9%), Austria (8·4% to 7·3%), Brunei (6·7% to 5·9%), Singapore (9·2% to 8·2%), and Spain (7·9% to 7·1%; appendix pp 61–66). However, some progress occurred in countries with the highest preterm birth rates, with six of the top ten highest burden countries experiencing some declines in estimated preterm birth rates over the decade. Given that direct complications due to preterm birth were the leading cause of child mortality in 2019, more research and advocacy is urgently needed to address the stagnation in reducing preterm births worldwide and more country focus on management of preterm birth and its complications to reduce mortality and morbidity among children.[1] Although there are large variations in the survival of preterm babies, neonates born at 26 weeks of gestation in resource-rich settings are more likely to survive than those born in contexts with poor access to care regardless of gestational age. The large toll of preterm birth has not shifted much over the last decade and should remain high on the global public health agenda.

Analyses of preterm data by subgroups of gestational age (ie, <28 weeks, 28 to <32 weeks, and 32 to <37 weeks) is crucial for stratifying individual risk at a population level for programme planning and to assess data quality, especially for the extremely preterm category (<28 weeks). The analyses by subgroups of preterm babies showed clear data gaps for the younger age categories, especially in southern Asia and sub-Saharan Africa. The pooled global estimate of the proportional distributions by preterm subgroups could differ across regions and is probably an underestimate for these regions, especially for extremely preterm infants (<28 weeks category).

Data are needed to identify gaps, track progress, and inform action. Gaps in routine data availability, low coverage, low quality, and low reporting in many LMICs and areas impede the evidence available on preterm births. However, remarkable progress in the availability of data has occurred over the past decade, with increasing preterm data availability in all regions, and substantial improvements in the national data systems of some LMICs and areas. These preterm birth estimates include preterm data for 18 additional countries and areas, seven countries with administrative data, and 11 countries with study data. The highest capture of nationally representative administrative preterm birth data from 2010 to 2020 was in northern America, Australia, New Zealand, central Asia, and Europe where nearly 77·4% (119 861 900 of 154 951 500) of estimated World Population Prospects livebirths were reported. In comparison, only study data were available in sub-Saharan Africa and southern Asia. In these regions, substantial progress in availability of preterm birth data is expected to be achieved quickly by virtue of increasing percentage of births occurring in facilities worldwide, the availability of adequate ultrasound, which allows gestational age to be estimated, and with more countries integrating advanced information technologies. This progress will rely upon continued investments in health information systems.

Our estimates have strengths, notably the larger dataset from past estimation processes, with 679 data points from 103 countries and areas. The application of a Bayesian framework allowed all data to be incorporated into one model, accounting for regional differences and data quality biases. This approach has adequately generated country-specific estimates for all 195 countries and areas including regional and global estimates, using data inputs from corresponding regions and time-series in which countries and areas had no input data. An additional strength is the a priori selection of covariates based on a conceptual framework as opposed to a model-driven selection of covariates.[12]

Despite these advances, there are considerable limitations. First, for countries and areas with no preterm birth data, predicted preterm birth rate might be lower or higher than the true preterm birth rate, as noted with wider CrIs. Countries and areas without data are systematically different to those with data and, as the model is trained on countries with data (mostly high-income countries), estimates generated for countries without data inputs should be interpreted with caution and, for this reason, these estimates are not reported. Secondly, data quality categories pose several limitations especially countries that were not grouped into data quality category A and might be missing important information about their administrative data, including how gestational age was estimated and whether this was ascertained in the first trimester as recommended. Thirdly, we defined gestational age as per International Classification of Diseases (ICD-11) and usual practice as starting from the first day of the last menstrual period (or post-conception age plus 2 weeks). Although the ICD recommends that all livebirths are included in livebirth figures regardless of gestational age, in 1993 before the publication of ICD-10,[25] there was substantial between-country variation in the legal gestational age thresholds for reporting livebirths, and now, despite most countries adopting ICD recommendations to report all livebirths regardless of gestational age, there remains substantial variation in the application of these recommendations. This variation is often based on perceptions of viability. As such, there remains substantial variation in the capture of livebirths less than 28 weeks across settings globally. We did consider this variation as a source of bias (appendix pp 29–30) but after assessment, the variation was not accounted for in the model for two reasons: (1) most countries (77 of 103 [75%]) did not report or provide information on whether a lower threshold of gestational age for reporting was used; and (2) where countries reported a lower threshold than 28 weeks, in most cases this reporting only excluded livebirths before 22 weeks. After examining the distribution of preterm births by gestational age, we concluded that as very few livebirths occur before 22 weeks excluding those less than 22 weeks would have minimal or no effect on the overall preterm birth rate. Fourthly, there remains some uncertainty of the effect of the COVID-19 pandemic on the estimates for 2020. Some studies, predominately in high-income countries, have found that the COVID-19 pandemic did not effect preterm birth rates.[26,27] New evidence using harmonised data from 26 countries, 18 of which had representative population-based data, seem to indicate small reductions in preterm birth of around 4%, in the first three months following lockdown.[28] Finally, these estimates are likely to be underestimates of preterm births as the denominator only includes livebirths and excludes stillbirths.[29] Most stillbirths are likely to be preterm with a great variation in risk. However, due to a shortage of a full time-series of stillbirth data, it was not possible to account for stillbirths (appendix pp 19–23). In addition, differences in the practices of obstetric monitoring during pregnancy and provision of resulting interventions, including preterm induction of labour and caesarean section, are likely to effect the rates of preterm births across countries.

Unfortunately, we do not have routine aggregate data from all countries on provider initiated versus spontaneous preterm birth and, therefore, we are unable to account for these two types of preterm delivery in the preterm birth estimations.

We observed some progress in preterm data availability in the past decade. Although data are available for preterm birth, issues in data availability and data quality still exist especially in sub-Saharan Africa and southern Asia. Furthermore, 92 countries and areas had either no or insufficient data to generate a national estimate, all being from LMICs. Information from LMICs remains limited even as facility delivery rates now exceed 80% of all births worldwide. Gaps in country reporting on preterm births point towards the need for greater investments in country health information systems in settings where routine information systems are weak or unavailable, and subnational studies continue to be an important source for preterm data albeit associated challenges, especially on representativeness.

The accelerated efforts by the UN Institute for Training and Research and implementing partners to improve data availability, data literacy, and data use for the 2030 agenda should also be continued with greater emphasis on strengthening country, civil, and vital registration, and administrative data systems. Unlike low birthweight, for which there is the Global Nutrition Target of 30% reduction of low birthweight by 2025 from a 2012 baseline,[30] there is no specific global goal or target for preterm birth. The development of such a goal could help spur greater attention to the issue.

Countries need reliable and timely national data to tailor interventions and monitor progress towards Sustainable Development Goals and other global and national targets related to newborn and child mortality and morbidity. Assessment of gestational age is a commonly cited barrier to obtaining data for preterm birth. However, substantial advancements in the measurement of gestational age have been achieved over the last decade through a large scale-up of the availability of ultrasound in antenatal clinics globally. These advancements in assessments of gestational age mean that all countries should strive towards accurate determination of gestational age in the first trimester and reporting of this data. In addition, the WHO antenatal care guideline for a positive pregnancy experience includes key interventions that aim to prevent preterm birth and other adverse outcomes. The recommendations emphasise a minimum of eight contacts with health professionals throughout pregnancy, starting before 12 weeks' gestation. Important aspects of antenatal care are counselling families and pregnant people on healthy lifestyle, such as optimal nutrition, cessation of tobacco, and alcohol and substance use, as well as physical activity. Early ultrasound should be accessible to help determine gestational age and detect multiple pregnancies. Health-care providers should be trained to identify and manage risk factors such as infections, pregnancy-associated conditions (eg, pre-eclampsia), and clinical enquiry about the possibility of intimate partner violence. Also, ending unnecessary inductions and caesarean sections will further reduce preterm birth.[31,32]

Improving data on preterm birth will require counting every baby everywhere, whether live or stillborn, and recording their gestational age. The collection of the WHO minimum perinatal dataset for every baby (including gestational age, sex, and birthweight) will ensure data are of good quality and appropriate for reporting. Continued strengthening of national routine health information systems and civil registration and vital statistics will limit burdens on health-care workers and help monitor data that trigger timely action. In settings with robust data collection systems, databases including individual-level data with unique identifiers can enable tracking of short-term and long-term health and development outcomes of preterm birth across populations.[33]

This study is primarily descriptive of the status and trends in the preterm birth rate at global, regional, and national levels. Further research is needed at a regional and country level to explore health systems, policy, financial, and contextual factors that can help explain variations in preterm birth rates across countries and why progress has been so slow.

Minimal progress has been made in the reduction of preterm births in the last decade. Despite substantial investment in routine health information systems over the last decade and increasing facility birth rates, many missed opportunities to improve preterm birth data collection and reporting remain. Only 33% of countries and areas (64 of 195 countries and areas) had national routine preterm birth data of sufficient quality to be included in these estimates. Gaps in routine data for preterm birth are most marked in southern Asia and sub-Saharan Africa where all input data were from subnational studies. These are also the two regions with the highest burdens of preterm births. Countries need to prioritise programme investments and the implementation or redesign of public policies to reduce preterm birth, notably babies experiencing intrauterine growth restriction and preterm delivery, and investments in data systems so that they are able to generate and use high-quality data for monitoring and action.

Contributors

ACM, JR, HB, EOO, A-BM and JEL conceptualised the study and contributed to the overall coordination of the process. HB, JEL, and EOO contributed to the overall coordination, collating of data sources, and verified and analysed the data. EOO and EB led the overall statistical analysis, in coordination with AL, LH-A, HB, and JEL. YBO coordinated the administrative database, co-variates database, and data quality assessment. EWJ, A-BM, and TL coordinated and conducted the systematic review. A-BM, DEF, JK, EOO, EB, GGD, WRM, SC, and LH-A contributed to the coordination and implementation of the country consultation. All authors reviewed and helped revise the manuscript and agreed the final version. The authors alone are responsible for the views expressed in this article and they do not necessarily represent the views, decisions, or policies of the institutions with which they are affiliated.

Declaration of interests

We declare no competing interests.

Data sharing

Data sharing and transfer agreements were jointly developed and signed by all collaborating partners. Pooled summary tables generated are deposited online at https://github.com/WorldHealthOrganization/mca-pretermbirths-analysis with data access subject to approval by collaborating parties.

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