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# Birth outcomes for African and Caribbean babies in England and Wales: retrospective analysis of routinely collected data

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## ABSTRACT

**Objectives:** To compare mean birth weights, gestational ages and odds of preterm birth and low birth weight of live singleton babies of black African or Caribbean ethnicity born in 2005 or 2006 by mother's country of birth.

**Design:** Secondary analysis of data from linked birth registration and NHS Numbers for Babies data set.

**Setting:** Births to women in England and Wales in 2005 and 2006.

**Participants:** Babies of African and Caribbean ethnicity born in England and Wales in 2005–2006, whose mothers were born in African and Caribbean countries or the UK. Birth outcomes for 51 599 singleton births were analysed.

**Main outcome measures:** Gestational age and birth weight.

**Results:** Mothers born in Eastern or Northern Africa had babies at higher mean gestational ages (39.38 and 39.41 weeks, respectively) and lower odds of preterm birth (OR=0.80 and 0.65, respectively) compared with 39.00 weeks for babies with mothers born in the UK. Babies of African ethnicity whose mothers were born in Middle or Western Africa had mean birth weights of 3327 and 3311 g, respectively. These were significantly higher than the mean birth weight of 3257 g for babies of the UK-born mothers. Their odds of low birth weight (OR=0.75 and 0.72, respectively) were significantly lower. Babies of Caribbean ethnicity whose mothers were born in the Caribbean had higher mean birth weight and lower odds of low birth weight than those whose mothers were born in the UK.

**Conclusions:** The study shows that in babies of African and Caribbean ethnicity, rates of low birth weight and preterm birth varied by mothers' countries of birth. Ethnicity and country of birth are important factors associated with perinatal health, but assessing them singly can mask important heterogeneity in birth outcomes within categories particularly in relation to African ethnicity. These differences should be explored further.

The most complete source of national perinatal data for England and Wales is derived from the civil registration of births and

## ARTICLE SUMMARY

### Article focus

- To analyse birth weight and gestational age for babies of African ethnicity born in England and Wales by grouping mothers' countries of birth to see if these differed between groups of African countries.
- To compare the mean birth weight and gestational age and the odds of preterm birth and low birth weight of live singleton babies of black African or Caribbean ethnicity whose mothers were born in the UK with those whose mothers were born in Caribbean countries or in groups of African countries.

### Key messages

- Using linked national data on live singleton births in England and Wales enabled African country groups to be subdivided into regions to assess heterogeneity within the African ethnic group. This showed differences between birth weights and gestational ages for babies of women born in Africa or the Caribbean compared with babies of women of the same ethnicities born in the UK.

### Strengths and limitations of this study

- Using routinely collected national data enabled analyses of large numbers of births.
- Data linkage of birth registration to the NHS Numbers for Babies data set made it possible to analyse birth weight and gestational age by mother's country of birth and baby's ethnicity.
- Some potential confounders such as parity, smoking, length of residence were not available in the data set as this information is not routinely collected at birth registration or notification.

deaths, with data recorded at the registration of deaths of people born from 1993 onwards being routinely linked to data recorded when their births were registered.<sup>1</sup> The data items include socio-demographic data about the parents, including their ages, occupations and countries of birth and their babies' sex and birth weight but not gestational age and ethnicity.

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The opportunity to obtain data about gestational age came about when the system for allocating babies' NHS numbers, a unique identifier, was changed. As part of this new birth notification process, a small set of data, the NHS Numbers for Babies (NN4B) data set, is recorded, and this includes gestational age and the baby's ethnicity.<sup>2</sup> This provided the opportunity to acquire these additional variables for use at a national level via linkage to the birth registration data set. This linkage was successfully piloted using data for 2005 and has now become a routine component in the processing of birth data by the Office for National Statistics (ONS).<sup>3</sup>

The baby's ethnicity in the NN4B data set is coded according to a classification devised for use in the Census of Population and other official records from 1991 onwards and updated for subsequent censuses. Although parents' countries of birth are recorded at birth registration and show that the proportion of live births to women born outside the UK rose from 13.6% in 1998 to 25.1% in 2010,<sup>4</sup> neither the parents' nor their babies' ethnicity are recorded. Preliminary analysis of gestational age data for 2005 showed that the distributions of gestational age and birth weight varied by ethnic group in England and Wales with babies of white British ethnicity being heavier and more likely to be born at term.<sup>5</sup> In particular, it showed high rates of preterm birth among babies of Caribbean ethnicity but apparently not among those of black African ethnicity.

This was surprising, as a study of live births from 1983 to 2001 in England and Wales by mother's country of birth found that mothers born in East Africa, India, Pakistan and Bangladesh had the highest proportion of low birth weight babies, while mothers born in the Caribbean and West Africa had the highest proportion of very low birth weight babies.<sup>6</sup> This suggested that these groups of women might have high rates of preterm and very preterm birth seen in data from the USA and elsewhere.<sup>7-10</sup>

As many women of African ethnicity giving birth in England and Wales were born outside the UK, the linked data set offered the possibility of more detailed analyses of gestational age and birth weight of babies of African ethnicity according to their mother's countries of birth. The first aim of this study was to analyse birth weight and gestational age data of babies of African ethnicity by groups of mothers' countries of birth to see if these differed between groups of African countries.

Questions have also been raised as to whether babies whose mothers were born in the UK have better or worse outcomes than babies of the same ethnicity whose mothers were born outside the UK. To explore this question, birth weights of babies of South Asian ethnicity born in 2005 and 2006 were subsequently analysed in greater detail. This showed that the mean birth weight of babies of South Asian ethnicities whose mothers were born in England and Wales was no higher than that of babies whose mothers were born in the Indian subcon-

tinents.<sup>11</sup> There was no corresponding analysis for babies of black African and Caribbean ethnicity, however.

The second aim of this study was therefore to fill this gap by doing a similar analysis for these babies. It compared the mean birth weight and gestational age and the odds of preterm birth and low birth weight of live singleton babies of black African or Caribbean ethnicity whose mothers were born in the UK with those whose mothers were born in Caribbean countries or in groups of African countries. An overall comparison was made with white British babies whose mothers were born in the UK.

## METHODS

### Data

The analysis used national data about births in England and Wales from two sources. The first source was civil birth registration, which records social and demographic information, such as the mother's country of birth. Birth weight is collected through notification of births and provided to the local registrar of births and deaths to be added to data recorded at birth registration. The second is the NN4B data set, which is generated when the NHS Number, a national unique patient identifier, is issued. Since 2002, an electronic notification of each birth has been sent to the Central Issuing System so that the NHS number for the baby can be generated and a small set of data recorded about the birth. This includes the gestational age at birth and the baby's ethnicity. Gestational age in the NN4B data is recorded in weeks, calculated from relevant menstrual data held within the maternity system.<sup>2</sup> In 2005, the ONS started receiving a subset of the variables from this data set so that linkage with birth registration could be piloted.<sup>3</sup>

As described in detail elsewhere, birth registration and NN4B data sets were first linked for the year 2005.<sup>3 12</sup> From 2006 onwards, ONS has linked these data routinely.

Data for 2005 and 2006 were combined to give a larger data set for the analysis.

### Variables used in the analysis

Birth status (live or stillbirth), multiplicity (singleton or multiple birth), mother's age at delivery and country of birth, and baby's sex and birth weight were taken from birth registration data. Gestational age and baby's ethnicity were taken from the NN4B data set.

Mothers' countries of birth were grouped according to the United Nations Statistics Division-Standard Country and Area Codes Classification.<sup>13</sup> The country groups were Eastern Africa, Northern Africa, Southern Africa, Western Africa, Middle Africa, Caribbean and the UK and are defined in [table 1](#). For mothers born in the UK, the ONS country group classification was used.<sup>14</sup>

### Statistical analysis

The analyses were based on live singleton births only. Means, 95% CIs of mean birth weight and gestational

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**Table 1** Number of singleton live births by ethnicity and mother's country of birth and data completeness on birth weight and gestational age, England and Wales (2005–2006)

Ethnicity	Mother's country of birth	Number of babies	% of babies	Completeness per cent	
				Birth weight	Gestational age
Black African	Eastern Africa	14 493	36.6	98.6	99.6
	Middle Africa	3578	9.0	97.2	99.4
	Northern Africa	944	2.4	99.4	99.5
	Southern Africa	838	2.1	98.9	99.4
	Western Africa	15 163	38.3	97.5	99.8
	UK	3176	8.0	97.5	99.6
	Other	1396	3.5	95.7	99.6
	All	39 588	100.0		
Caribbean	Caribbean	4672	32.4	97.3	99.8
	UK	8735	60.6	97.9	99.8
	Other	1004	7.0	98.2	99.7
	All	14 411	100.0		

The mother's country of birth groups includes the following countries—Eastern Africa: Burundi, Comoros, Djibouti, Eritrea, Ethiopia, Kenya, Madagascar, Malawi, Mauritius, Mayotte, Mozambique, Reunion, Rwanda, Seychelles, Somalia, Uganda, United Republic of Tanzania, Zambia and Zimbabwe; Middle Africa: Angola, Cameroon, Central African Republic, Chad, Congo, Democratic Republic of the Congo, Equatorial Guinea, Gabon, Sao Tome and Principe; Northern Africa: Algeria, Egypt, Libyan Arab Jamahiriya, Morocco, Sudan and Tunisia; Southern Africa: Botswana, Lesotho, Namibia, South Africa and Swaziland; Western Africa: Benin, Burkina Faso, Cape Verde, Cote D'Ivoire, Gambia, Ghana, Guinea-Bissau, Liberia, Mali, Mauritania, Niger, Nigeria, Saint Helena, Senegal, Sierra Leone and Togo. Caribbean: Anguilla, Antigua and Barbuda, Bahamas, Barbados, British Virgin Islands, Cayman Islands, Cuba, Dominica, Dominican Republic, Grenada, Guadeloupe, Haiti, Jamaica, Montserrat, Puerto Rico, Saint Kitts and Nevis, Saint Lucia, Saint Vincent and the Grenadines, Trinidad and Tobago, Turks and Caicos Islands, US Virgin Islands. UK: Guernsey, Jersey, Isle of Man, England, Northern Ireland, Scotland, Wales.

age were calculated for each of the ethnic groups, crosstabulated by mother's country of birth. Multiple regression was used to adjust for mothers' age at delivery, babies' sex and gestational age in the birth weight analysis and for babies' sex and mothers' age at delivery in the gestational age analysis. The assumptions of multiple regression, that is, lack of multicollinearity among the independent variables and normality and linearity of residuals were assessed.

Percentages of low birth weight and preterm births were calculated. Logistic regression was performed to look at odds of preterm birth and low birth weight adjusted for the available confounders. The Hosmer and Lemeshow test was used to assess the goodness of fit of the models.

Analyses of both mean gestational age and rates of preterm birth were carried out twice. The first analysis excluded births occurring before 22 weeks of gestation with birth weights over 1000 g. This was based on earlier work that had found that in this instance either gestational age or birth weight or both were wrongly recorded.<sup>15</sup> The second analysis was based on all births. Analyses were carried out using SPSS V.17.

## RESULTS

### Completeness and data quality

A total of 1 315 352 live births occurred in England and Wales in 2005 and 2006, of which 1 276 198 were singletons. Among babies of black African ethnicity, 96.5% had mothers who were born in one of the African country groups or in the UK and 93% of babies of black Caribbean ethnicity had mothers who were born in the Caribbean or the UK. Birth weight and gestational age

data were recorded for between 97.2% and 99.8% of babies (table 1). Around 95.8% of live singleton babies of white British ethnicity had mothers born in the UK.

The results of the analysis that excluded births reported as occurring before 22 weeks of gestation with birth weights over 1000 g are shown here, but both analyses showed very similar results.

### Overall differences between ethnic groups

Caribbean babies had the lowest mean birth weight and gestational age and the highest percentages of preterm births and low birth weights, whereas white British babies had the highest mean birth weight and gestational age and the lowest percentages of low birth weight and preterm birth (table 2).

### Differences in babies with mothers born in Africa

Babies of mothers born in Middle Africa had the highest mean birth weight among babies of mothers born in Africa. Mothers who were born in Middle and Western Africa had babies of significantly higher mean birth weight than babies of mothers born in Eastern, Northern and Southern Africa.

Babies of mothers born in Eastern Africa had significantly higher mean gestational age than those born in Middle, Southern or Western Africa.

### Ethnicity and mother's country of birth

White British babies with UK-born mothers had significantly higher mean birth weights and gestational ages and lower percentages of low birth weights than babies of African and Caribbean ethnicities whose mothers were born in the UK, Africa or the Caribbean (table 3).

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**Table 2** Birth weight and gestational age distributions of singleton live births by ethnicity, England and Wales (2005–2006)

	<b>Black African Mean (95% CI)</b>	<b>Black Caribbean Mean (95% CI)</b>	<b>White British Mean (95% CI)</b>
Mean birth weight, g	3285 (3279 to 3291)	3166 (3156 to 3177)	3393 (3392 to 3395)
Mean gestational age, completed weeks	39.11 (39.08 to 39.13)	38.80 (38.75 to 38.84)	39.31 (39.30 to 39.31)
	Number of babies (%)	Number of babies (%)	Number of babies (%)
Birth weight, g			
Under 1500	701 (1.8)	310 (2.2)	6947 (0.8)
1500–2499	2107 (5.4)	1121 (8.0)	38 226 (4.7)
2500–4499	35 436 (91.5)	12 519 (88.9)	756 588 (92.5)
4500 and over	505 (1.3)	133 (0.9)	15 983 (2.0)
Total stated	38 749 (100.0)	14 083 (100.0)	817 744 (100.0)
Gestational age groups, completed weeks			
Under 32	785 (2.0)	350 (2.4)	8207 (1.0)
32–36	2035 (5.2)	1006 (7.0)	41 170 (5.1)
37–41	34 207 (86.7)	12 529 (87.1)	728 501 (89.4)
42 and over	2426 (6.1)	495 (3.4)	36 708 (4.5)
Total stated	39 453 (100.0)	14 380 (100.0)	814 586 (100.0)
Mother's age at delivery, years			
Under 19	1548 (3.9)	1376 (9.5)	64 953 (7.9)
20–24	6208 (15.7)	3292 (22.8)	156 381 (19.1)
25–29	12 181 (30.8)	3275 (22.7)	197 748 (24.1)
30 and over	19 651 (49.6)	6468 (44.9)	401 403 (48.9)
Total stated	39 588 (100.0)	14 411 (100.0)	820 485 (100.0)

### Babies of Caribbean ethnicity

Babies of Caribbean ethnicity with Caribbean-born mothers had a higher mean birth weight and a lower percentage of low birth weight than Caribbean babies with the UK-born mothers (table 3). This remained significant after adjustment (figure 1A). The odds of having a low birth weight baby were higher among UK-born mothers compared with Caribbean-born mothers (table 4).

No significant differences were observed between the two groups in mean gestational age and odds of preterm birth.

### Babies of African ethnicity

Mean birth weight was significantly lower for babies whose mothers were born in the UK than for those born in Eastern, Northern or Western Africa (table 3). After adjustment, however, mean birth weights of African babies whose mothers were born in Middle or Western Africa were found to be significantly higher than those born in the UK. The odds of having a low birth weight baby were lower for babies with mothers born in these two regions compared with those with the UK-born mothers.

Babies of African ethnicity with mothers born in Eastern and Northern Africa had significantly higher mean gestational age and the mother had lower odds of preterm birth compared with babies of mothers born in the UK both before (table 3) and after adjusting for confounders (figure 1B, table 4). Mothers born in Western Africa had the highest percentage of preterm births, but mothers born in Middle Africa had the highest percentage of very preterm births (table 3).

### DISCUSSION

This is the first time that birth weights and gestational ages of babies of African and Caribbean ethnicity born in England and Wales have been analysed at a national level by their mother's country of birth.

In the Millennium Cohort Study, singleton black Caribbean and black African babies were more likely than white British babies to be of low birth weight. As these data were recorded at interviews with parents when their children were around 9–10 months old, babies who were stillborn or died in the early months after live birth were not included.<sup>16</sup> Another study using the linked data showed that white British babies had better birth outcomes compared with other ethnic groups.<sup>5</sup>

A study based on the ONS Longitudinal Study, a representative sample of the population of England and Wales, found no significant differences in mean birth weights between the UK-born babies of black Caribbean and black African origin and corresponding migrant mothers.<sup>17</sup> The ONS Longitudinal Study is based on a 1% sample so numbers of births to mothers born in Africa were too small to subdivide to look at births by specific regions of Africa. Our study, in which we subdivided Africa into regions using a classification based on some common factors such as historical and cultural ancestry,<sup>6</sup> showed how aggregation can mask heterogeneity within African ethnicity. However, it was not possible to classify mothers born in the UK by their parents' country of origin in order to identify those originating from different parts of Africa and the Caribbean, as information about their own parents was not available.

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**Table 3** Characteristics of live singleton births by ethnicity and mother's country of birth, England and Wales (2005–2006)

Birth weight					
Ethnicity	Mother's country of birth	Number of babies with birth weight data	Mean (95% CI)	Percentage	
				Under 2500 g	Under 1500 g
African	Eastern Africa	14 288	3299* † (3290 to 3309)	6.5	1.3
	Middle Africa	3478	3281† (3259 to 3302)	8.0	2.4
	Northern Africa	938	3316* † (3281 to 3351)	6.2	1.2
	Southern Africa	829	3234† (3193 to 3274)	8.1	2.1
	Western Africa	14 783	3284* † (3274 to 3294)	7.6	2.1
	UK	3097	3247† (3226 to 3269)	8.3	2.0
Caribbean	Caribbean	4548	3229* † (3211 to 3247)	8.9	1.8
	UK	8549	3124† (3111 to 3137)	11.2	2.4
White British	UK	783 171	3392 (3391 to 3393)	5.6	0.9

Gestational age					
Ethnicity	Mother's country of birth	Number‡ of babies with gestational age data	Mean (95% CI)	Percentage	
				Before 37 weeks	Before 32 weeks
African	Eastern Africa	14 431	39.40* (39.36 to 39.43)	5.7	1.4
	Middle Africa	3558	38.87† (38.78 to 38.95)	8.0	2.7
	Northern Africa	939	39.40* (39.27 to 39.52)	4.9	1.0
	Southern Africa	833	39.03† (38.88 to 39.18)	7.2	1.3
	Western Africa	15 132	38.93† (38.89 to 38.97)	8.1	2.3
	UK	3164	38.96† (38.87 to 39.04)	7.5	2.2
Caribbean	Caribbean	4661	38.84† (38.77 to 38.92)	9.2	2.4
	UK	8717	38.77† (38.71 to 38.82)	9.5	2.4
White British	UK	779 778	39.31 (39.30 to 39.31)	6.1	1.0

\*Significantly higher ( $p < 0.05$ ) than mothers born in the UK.†Significantly lower ( $p < 0.05$ ) than babies of white British ethnicity born to mothers born in the UK.

‡Excludes births occurring before 22 weeks of gestation with birth weight over 1000 g.

There is some uncertainty about the recording of the ethnic group in the NN4B data set as the system requests information on the ethnic category of the baby as defined by the mother using the 2001 Census categories.<sup>2</sup> It is unclear whether mothers or health professionals define the ethnic category. In addition, although the ethnic group of the baby is requested in NN4B, there might be occasions when the mother's ethnic group is actually recorded. Subsequent linkage with Maternity Hospital Episode Statistics data set, which contained data about mother's ethnicity, suggests that ethnicity recorded in the NN4B data is of the mother's rather than the baby.<sup>18</sup> Furthermore, people's identification with an ethnic group is not always straightforward and individual responses, whether self-reported or not, may vary according to circumstances and over time.

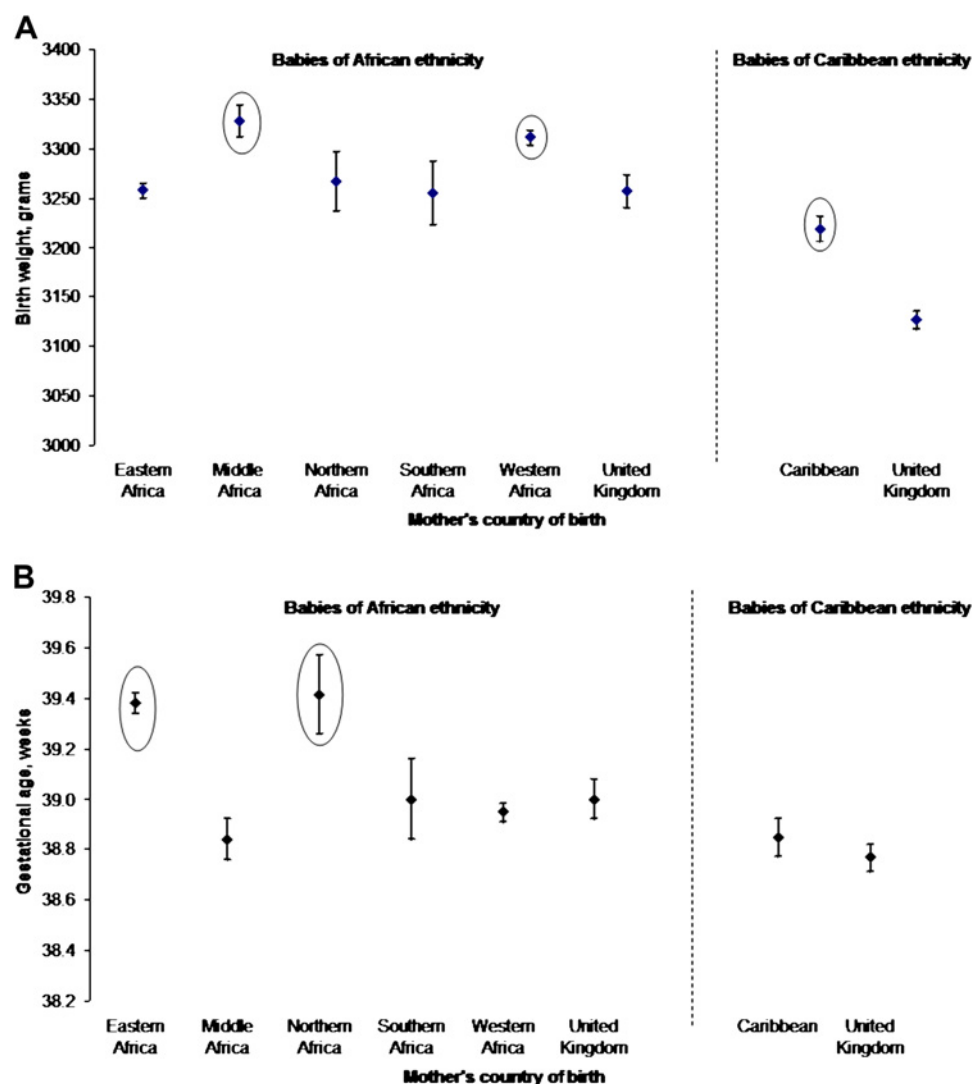
Gestational age is not recorded at registration of live births but is available from the NN4B data. Accuracy of recording of gestational age is important.<sup>19</sup> Information on the exact method of assessment of gestational age is not recorded on NN4B records. It could be based on time from the first day of the last menstrual period (LMP)<sup>20</sup> or assessed by ultrasound because second trimester scans are now a routine part of antenatal assessment in Britain. Linkage of birth registration and NN4B linked data to Maternity HES shows good agreement between gestational age from NN4B and Maternity

HES, with only 7% of linked records differing by 1 week. This suggests the method used by Maternity HES, which is time from first day of LMP, is used in NN4B. Gestational age distributions have been shown to differ depending on the method used to assess gestational age, and it has been shown that if second trimester ultrasound is used rather than LMP, then the mean gestational age is around 1 week less, the percentage of preterm births slightly higher and that of post-term births lower.<sup>21–23</sup>

Routine analysis of the data collected at birth registration shows that birth weight distributions vary by gestational age, maternal age, sex of the baby, marital status and father's socioeconomic status.<sup>14</sup> The father's occupation is recorded only for births inside marriage or births outside marriage registered by both parents. It is coded for analysis on a 10% sample of all live births in England and Wales. Parity is recorded only for births inside marriage, but in 2005, around 40% of births of babies of African ethnicity and 70% of births of babies of Caribbean ethnicity occurred outside marriage.<sup>5</sup> The percentage of babies registered by the mother alone was 20.5% in the Caribbean group and 13% in the African group compared with 7% in the white British group. Therefore, marital status, father's socioeconomic status and parity could not be used in our analyses.

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**Figure 1** (A) Adjusted mean birth weight by ethnicity and mother's country of birth for live singleton births, England and Wales (2005–2006). (B) Adjusted mean gestational age by ethnicity and mother's country of birth for live singleton births, England and Wales (2005–2006).



Studies in the USA have shown lower rates of preterm birth in babies of foreign-born black women compared with those born in the USA.<sup>24–26</sup> This is concordant with the findings in these analyses, but the migration histories of black African women to the USA and UK differ. Furthermore, grouping all black African and Caribbean women together could mask any diversity in birth outcomes.

In an analysis of babies in Canada, a higher risk of preterm birth was associated with time since migration with the most recent migrants having a lower risk than non-migrants, whereas a higher risk was observed for those with longer than 15 years of residence.<sup>27</sup> Length of residency in a receiving country can impact on health behaviours. There is evidence that, for example, Caribbeans born in the UK are more likely to smoke than Caribbeans who have recently migrated.<sup>28</sup> Data from the Millennium Cohort showed that after migration, mothers' health behaviours worsened with their length of stay in the UK. For every additional 5 years spent in the UK, the likelihood of mothers smoking during pregnancy increased by 31%.<sup>29</sup> On the other hand,

another analysis of data from the same source pointed to complex inter-relationships and found both positive and negative association with health status, health behaviour and use of healthcare.<sup>30</sup> It could have been that the duration of residence in the UK may have been associated with differences in the rates of low birth weight or preterm birth in some groups of mothers in our analysis, but no data are available at national level to test this.

The favourable results observed in migrant mothers in some analyses have been attributed to a 'Healthy migrant effect'. It has been suggested that there is a selection process in which the healthiest women are most likely to migrate and are less likely to engage in negative health behaviours than the host population. For example, since the 1960s, there has been an increase in the number of Africans travelling to Britain for higher education and technical training.<sup>31</sup> This ties in with selective migration where later migrants could have better socioeconomic circumstances and better health resulting in selection bias compared with the UK-born mothers of the same ethnicity. Nevertheless, information on length of stay/time since migration and maternal



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**Table 4** Odds ratio of low birth weight and preterm birth by ethnicity and mother's country of birth for live singleton births, England and Wales (2005–2006)

Low birth weight			
Ethnicity	Mother's country of birth	Unadjusted OR (95% CI)	Adjusted* OR (95% CI)
African	UK	1.00	1.00
	Eastern Africa	0.76† (0.66 to 0.88)	0.90 (0.74 to 1.08)
	Middle Africa	0.96 (0.80 to 1.14)	0.75† (0.59 to 0.95)
	Northern Africa	0.73† (0.54 to 0.98)	0.96 (0.67 to 1.39)
	Southern Africa	0.97 (0.73 to 1.29)	0.89 (0.62 to 1.28)
	Western Africa	0.90 (0.79 to 1.04)	0.72† (0.60 to 0.87)
Caribbean	UK	1.00	1.00
	Caribbean	0.78† (0.69 to 0.88)	0.68† (0.57 to 0.80)
Preterm birth			
Ethnicity	Mother's country of birth	Unadjusted‡ OR (95% CI)	Adjusted‡ § OR (95% CI)
African	UK	1.00	1.00
	Eastern Africa	0.76† (0.65 to 0.88)	0.80† (0.69 to 0.93)
	Middle Africa	1.08 (0.90 to 1.29)	1.15 (0.96 to 1.37)
	Northern Africa	0.64† (0.46 to 0.88)	0.65† (0.47 to 0.90)
	Southern Africa	0.96 (0.71 to 1.29)	1.02 (0.76 to 1.38)
	Western Africa	1.09 (0.95 to 1.27)	1.15 (0.97 to 1.30)
Caribbean	UK	1.00	1.00
	Caribbean	0.96 (0.85 to 1.08)	0.96 (0.85 to 1.08)

\*Adjusted for baby's sex, gestational age and mother's age at delivery.

†Significantly lower ( $p < 0.05$ ) than mothers born in the UK.

‡Excludes births occurring before 22 weeks of gestation with birth weight over 1000 g.

§Adjusted for baby's sex and mother's age at delivery.

health behaviours such as smoking and alcohol intake in relation to pregnancy are not routinely available at a national level. This means that any possible associations between these factors and birth outcomes cannot be assessed.

Substantive conclusions could not be reached for very preterm births and very low birth weight babies due to the small number of babies in these groups for some regions. Data should be combined for larger number of years. In a feasibility study of fetal and infant death in East London, West African women were found to have three times the rate of extremely preterm birth compared with white women.<sup>32</sup> These relatively high rates of very preterm births to West African and Caribbean women contributed to the high rates of infant mortality in the boroughs where they lived.<sup>33</sup>

This analysis was restricted to singleton births, as earlier analyses showed that multiple maternity rates varied by mothers' countries of birth, with women born in West Africa and the Caribbean having the highest rates.<sup>6</sup>

In conclusion, variations by country of birth were observed in rates of low birth weight and preterm birth within the African and Caribbean ethnic groups. Ethnicity and nativity are important factors associated with perinatal health, but when assessed in isolation can hide important heterogeneity in birth outcomes. The reasons for these differences should be explored further, along with the potential for subdividing the 'African'

group. Further work is also needed to assess possible associations between mothers' countries of birth by ethnicity and infant mortality since low birth weight and preterm birth are important factors associated with infant deaths.

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**Contributors** PD-N was involved in the design of the study, analysed the data, interpreted the results, drafted the article and made relevant amendments to it according to the other authors' comments. ND made significant contribution to the design, acquisition of data and commented on the various drafts. AM had the original idea for the analysis, made substantial contribution to the design of the study and made significant amendments to the final draft. All the authors approved the final version to be published.

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**Data sharing statement** As the data are personal protected data, access was restricted to ONS secure research data centre, the Virtual Microdata Laboratory (VML). The original data are to be archived at the VML and will be accessible for research purposes (including verification of statistical outputs) subject to the approval of the National Information Governance Board, the Office for National Statistics and the NHS Numbers for Babies Management Board, and to the standard operating procedures of the VML.

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