International migration and adverse birth outcomes: role of ethnicity, region of origin and destination

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ABSTRACT

Background The literature on international migration and birth outcomes shows mixed results. This study examined whether low birth weight (LBW) and preterm birth differed between non-migrants and migrant subgroups, defined by race/ethnicity and world region of origin and destination.

Methods A systematic review and meta-regression analyses were conducted using three-level logistic models to account for the heterogeneity between studies and between subgroups within studies.

Results Twenty-four studies, involving more than 30 million singleton births, met the inclusion criteria. Compared with US-born black women, black migrant women were at lower odds of delivering LBW and preterm birth babies. Hispanic migrants also exhibited lower odds for these outcomes, but Asian and white migrants did not. Sub-Saharan African and Latin-American and Caribbean women were at higher odds of delivering LBW babies in Europe but not in the USA and south-central Asians were at higher odds in both continents, compared with the native-born populations.

Conclusions The association between migration and adverse birth outcomes varies by migrant subgroup and it is sensitive to the definition of the migrant and reference groups.

Approximately 95 million women are international migrants worldwide and female immigrants have recently outnumbered men in most industrialised countries.[1] Immigrant women currently contribute more than one fifth of all live births in the USA[2] and several European countries.[3] Despite a substantial body of literature focussing on the reproductive health of migrants to western industrialised countries, there is no obvious pattern describing the relation between migrant status and perinatal outcomes. The literature shows positive, negative and null associations between migration and perinatal health, suggesting that different sources of heterogeneity may play a role. It is uncertain to what extent the association between foreign-born status and birth outcomes is a function of the characteristics of the migrant populations, of the baseline risk of the native-born reference groups, or of some combination of both. For example, foreign-born black women in the USA compare favourably with US-born black women but not with US-born white women.[4] Such comparisons suggest that the influence of migration may be modified by ethnicity.[5] Ethnic disparities in birth outcomes are well documented, particularly in the USA, but the contribution of migration to these disparities is not well understood. In studies comparing native-born compared with migrant groups defined by their regions of origin, there is uncertainty over whether the so-called healthy migrant effect[6] applies to migrants from all or only some regions of the world, and what these regions are.

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In addition, the vast majority of the studies on migration and birth outcomes grouped women according to their ethnicity or their country of origin, but comparisons according to their country of destination have largely been neglected, with one recent European exception.[7] Moreover, the interaction between sending and receiving countries has not previously been explored. International migration patterns may generate the selection of particular migrants from and to certain countries, thus leading to differential health outcomes among migrants from one particular world region settling in different receiving countries. Health differences may also arise as a result of exposure to contrasting receiving environments.

Most studies devoted to migration and perinatal health have focused on birth outcomes defined by birth weight or gestational age or both. Our purpose was to conduct a systematic review to clarify the relation between migration and these birth outcomes by determining the differences in low birth weight (LBW) and preterm birth (PTB) between migrants and non-migrants by migrant subgroups, defined according to race/ethnicity, world region of origin and actual destination.

METHODS

This review was prepared following the MOOSE guidelines[8] and draws on the material identified by the Reproductive Outcome And Migration (ROAM) collaboration for a series of systematic reviews on migration and reproductive health.

Study population

This study was restricted to published reports on any outcome requiring gestational age or infant birth weight to define it. The exposure was maternal international migration to western industrialised countries, assessed by evidence of cross-border movement. This definition thus excludes internal migration, 'protectorates' such as Puerto Rico and second-generation populations. Referent groups were the native-born women of the receiving countries and white women when comparisons were made between ethnic groups. We excluded case studies, clinical reports, reports without a comparison group and reports in which the results of the migrant group(s) were not presented separately from the comparison group.

Search and study selection criteria

Studies were identified through electronic literature databases from 1995 to October 2007 using Ovid (V.10.5.1) in the following order: Medline, Health Star, Embase and PsychInfo. Searches were supplemented with bibliographic citation hand searches of included articles published from 2004 onwards and relevant articles referred to the authors. No language exclusions were routinely applied. Articles in French, Italian and Spanish were reviewed by the authors. Two ROAM members independently assessed included studies for quality using the US Preventive Services Task Force criteria for cohort and case–control studies[9] and no discrepancies were found in the overall score between raters.

All articles for the meta-analyses were selected by applying the following criteria:

1. Definitions of the outcomes: LBW was restricted to a birth weight less than 2500 g and PTB to a gestational age of less than 37 completed weeks. Due to the small number of studies it was not possible to choose a uniform definition of small for gestational age (SGA), and therefore SGA was dropped from further analysis. Varying definitions included SGA based on different percentiles of the birth weight distribution of native-born populations[6 10–13] or standard deviations,[14 15] full-term LBW infants[16 17] and revealed SGA, based on the fetuses at-risk approach.[18]
2. Restriction to singleton births.
3. Information on race/ethnicity and foreign-born status or country of birth or nationality.
4. Descriptive tables including summary data on the outcomes with at least one native-born and one foreign-born group.

Meta-analyses

Studies differed substantially in the way migrant groups were categorised. Unlike the USA, where birth certificates include fields for parental race/ethnic origin and birthplace,[19] the EU legislation discourages the collection and reporting of individual information on race/ethnicity.[20] In the UK, ethnic origin is not collected in birth records but some studies linked them to the census, in which such information is recorded.[21] European studies thus relied on country of birth or nationality to assess minority groups. These continental differences in the measurement of migrant groups prevented us from combining all selected studies into one single meta-analysis, and therefore we conducted two meta-analyses based on the two main approaches that have been used to study the influences of international migration on birth outcomes.

In the first approach, studies conducted in the USA used self-reported race/ethnicity and foreign-born status,[19] but not necessarily maternal birthplace. These studies allowed the comparison of foreign-born versus native-born women of the same race/ethnicity. One UK study[21] also reported these data for LBW but was excluded to restrict our analysis to the US context. We also excluded Hispanic women from one US study[5] to avoid data duplication with another study.[6]

In the second approach, several studies conducted in Europe compared all migrants or migrants from particular regions of the world with the native-born population without reference to ethnic group (table 1). This second meta-analysis excluded some US studies that did not provide information at the country level. In one study that stratified the outcomes by Asian countries of origin but not by foreign-born status, we considered as foreign-born those national-origin groups with at least 90% of foreign-born women and therefore excluded Japanese and Filipino women.[22] One UK study[21] was removed to avoid data duplication with another national study.[23]

Our searches identified 82 studies. Of these, we excluded 11 studies that did not include LBW or PTB or used different definitions,[10 24–33] 31 studies that did not discriminate between singleton and multiple births,[2 34–63] four that did not ascertain migration appropriately[64–67] and seven that did not have appropriate tables for the extraction of the data.[68–74] Finally, five studies reporting PTB by world region of birth were not used due to the small number of studies available for this outcome using the second approach.[14 15 75–77] Therefore, 24 studies were included in the meta-analyses: 16 by race/ethnicity (table 2),[4–6 12 13 16–18 78–85] 16 by world region (table 1)[4 6 11–13 16 17 22 23 81 83 85–89] and nine by both.[4 6 12 13 16 17 81 83 85] None of the selected studies had poor internal validity.[9]

Data extraction

For each outcome, we extracted summary birth data consisting of at least two records per study: one for the migrant and one for the native-born group, although many studies included several subgroups including maternal ethnic groups, world regions or countries of origin or infants' year of birth. Each record contained a numerator and a denominator for the outcome and indicators of migrant status (foreign-born, native-born), race/ethnicity as categorised in US studies (Asians, blacks, Hispanics and whites),[19] migrants' country of birth or origin or nationality, place of destination (US or European countries) and infants' year of birth. If the birth data aggregated more than one year, the midpoint was recorded, and for articles reporting numerators and denominators for different periods, one record was assigned to each period. We grouped countries of birth into world regions, following the classification of the United Nations in most cases.[90] Asia was subdivided into south-central Asia (mainly India, Pakistan and Bangladesh) and east/south-east Asia, because women from the Indian subcontinent may differ in the risk of adverse birth outcomes compared with the rest of Asia.[91] In the same vein, north Africans were separated from the rest of Africa (ie, sub-Saharan Africa) because of their particularly good birth outcomes,[87] and were grouped with Middle Eastern

Table 1 Characteristics of the studies included in the meta-analysis of LBW by world regions

Study	Country, state/region	Type of database	Year of data	Migrants' world regions	No of subgroups	Births	% Migrants
Buekens/1998	Belgium, national	PBR	1981—8	North Africa	2	838972	4.1
Collinwood-Bakeo/2004	UK, national	PBR	1983—2001	Caribbean, East Africa, West Africa, south-central Asia, east Europe, western Europe	55	11401247	8.0
Crump/1999	USA, Washington State	PBR	1989—94	Latin America (Mexico)	2	9572	50.0
David/1997	USA, Illinois State	PBR	1980—95	Sub-Saharan Africa	3	90503	3.5
Fang/1999	USA, New York City	PBR	1988—94	Caribbean, South America, Africa (excl North)	5	269863	35.9
Fuentes-Afflick/1997	USA, California State	PBR	1992	Cambodia, China, India, Korea, Laos, Thailand, Vietnam	8	253592	12.5
Gissler/2003	Sweden, national	PBR	1987—8	Finland	6	140390	23.8
Gould/2003	USA, California State	PBR	1995—7	India, Mexico	4	1057977	42.2
Guendelman/1999	Belgium, national	PBR	1992	North Africa	2	107968	4.3
	France, national	PBS	1995	North Africa	2	11802	5.4
	USA, national	PBR	1995	Latin America (Mexico)	2	3417003	8.4
Johnson/2005	USA, Washington State	PBR	1993—2001	Somalia	3	5398	10.7
Landale/1999	USA, national	PBR	1989—91	Latin America, China, Philippines, Japan	16	2390430	47.8
Madan/2006	USA, national	PBR	1995—2000	India, Latin America (Mexico)	5	6424172	23.1
Rasmussen/1995	Sweden, national	PBR	1978—90	West Europe/north America, east Europe, north Africa/Middle East, sub-Saharan Africa, Latin America	8	1258021	11.3
Rosenberg/2005	USA, New York City	PBR	1996—7	Latin America	12	78042	58.8
Vangen/2002	Norway, national	PBR	1980—95	Pakistan, Vietnam, north Africa	4	820256	1.4
Wingate/2006	USA, national	PBR	1995—9	Latin America (Mexico)	4	2446253	61.5
Total					143	31021461	19.9

HR, hospital record; LBW, low birth weight; PB, population-based; PBR, population-based registry; PBS, population-based survey.

countries, because some studies[15 88] have grouped these regions together. Sensitivity analyses performed without these two studies did not affect the results regarding north Africans and therefore we did not exclude them.

Statistical analyses

In order to account for the potential heterogeneity between studies and subgroups within studies, we employed random effects meta-regression analysis, which involves the application of multilevel methods to meta-analysis.[92–94] We used three-level models, with births at level 1, subgroups at level 2 and studies at level 3. The inclusion of random effects at the subgroup level assumes that each subgroup represents a different population with its own distribution. Ignoring the hierarchical structure of these data would produce over-precise confidence intervals.[95 96] Analyses were conducted using Proc GLIMMIX in SAS version 9.1 to fit multilevel logistic regression models for summary data.

In the first meta-analysis (migration and race/ethnicity) we fitted two models for each outcome: the first model had migrant status as the only predictor and a more complex model added race/ethnicity and a product term between race/ethnicity and migrant status to obtain odds ratios (OR) simultaneously comparing minority groups with whites, by migrant status, and foreign-born with native-born within ethnic groups. All models were adjusted for infants' year of birth. We quantified the percentage of variance explained for logistic models by comparing the more complex model relative to the model including migrant status as the only predictor.[97]

The second meta-analysis (migration and world regions) was based on studies that analysed LBW in Europe or the USA, categorising migrants and non-migrants by their countries of birth, irrespective of their race/ethnicity. We could not analyse PTB due to the small number of studies and migrant groups. The LBW model included a product term between world region of origin and place of destination (Europe vs USA) in order to test the hypothesis that the odds of LBW differ both according to the region of origin and destination, adjusted for infants' year of birth. p Values less than 0.10 were considered statistically significant for product terms.

RESULTS

Migration and race/ethnicity

We first fitted a three-level model with migrant status as the independent variable, adjusted for infant's year of birth, but ignoring race/ethnicity. The OR (95% CI) for the comparisons between migrants and non-migrants were 0.81 (0.70 to 094) for LBW and 0.85 (0.74 to 0.98) for PTB, respectively. These are inappropriate models that assume that the effect of migrant status can be averaged across racial/ethnic groups. Instead, table 3 shows the results of the three-level models including race/ethnicity and a product term between race/ethnicity and migrant status for the two outcomes, adjusted for year of birth. The p values of the product term for the models of LBW and PTB were 0.0611 and 0.0018, respectively. The percentage of total variance explained by the introduction of race/ethnicity and the product term 'migrant status×race/ethnicity' relative to a model including only migrant status, adjusted for year of birth, was 57% and 24% for LBW and PTB, respectively, suggesting that race/ethnicity and its interplay with migrant status explain substantial variability in the outcomes not accounted for by migrant status alone.

The first, second and third columns of OR in table 3 present ethnic disparities within first-generation migrants, within US-born, and disparities between foreign-born and US-born of the same ethnic group, respectively.

Among foreign-born migrants, all minority groups were more likely to have adverse birth outcomes than white women, with the exception of Hispanic migrants for LBW. Black women were the group at the highest odds for the two outcomes both among foreign-born and US-born women. Despite baseline LBW

Table 2 Characteristics of the US studies included in the meta-analysis by race/ethnicity

Study (author, year, reference)	Country, state/region	Type of database	Year of data	Outcome	Migrants	US-born	No of subgroups	Births*	% Migrants
Acevedo-Garcia *et al* 2005	USA, national	PBR	1998	LBW	Asians, Blacks, Whites	Asians, Blacks, Whites	6	2102393	9.3
Alexander *et al* 1996	USA, regional NE	PBR	1983–7	LBW	Asians	Asians	2	37941	45.3
Cervantes *et al* 1999	USA, Chicago City	PBR	1994	LBW, PTB	Blacks, Hispanics, Whites	Blacks, Hispanics, Whites	8	52033	27.0
Crump *et al* 1999	USA, Washington State	PBR	1989–94	LBW, PTB	Hispanics	Hispanics	2	9572	50.0
David *et al* 1997	USA, Illinois State	PBR	1980–95	LBW	Blacks	Blacks, Whites	3	90503	3.5
English *et al* 1997	USA, California	PBR + quest	1992	LBW, PTB	Hispanics	Hispanics	6	4404	55.3
Fang *et al* 1999	USA, New York City	PBR	1988–94	LBW, PTB	Blacks	Blacks	5	269863	35.9
Fuentes-Afflick *et al* 1998	USA, California State	PBR	1992	LBW, PTB	Asians, Blacks, Hispanics, Whites	Asians, Blacks, Hispanics, Whites	8	573233	44.5
Gould *et al* 2003	USA, California State	PBR	1995–7	LBW, PTB	Asians, Hispanics	Blacks, Whites	4	1057977	42.2
Johnson *et al* 2005	USA, Washington State	PBR	1993–2001	LBW, PTB	Blacks	Blacks, Whites	3	5398	10.7
Kramer *et al* 2006	USA, national	PBR	1998–2000	PTB	Blacks	Blacks	2	1754777	11.4
Landale *et al* 1999	USA, national	PBR	1989–91	LBW	Asians, Blacks, Hispanics, Whites	Asians, Blacks, Hispanics, Whites	36	4856798	48.6
Madan *et al* 2006	11 States	PBR		LBW, PTB	Asians, Hispanics,	Asians, Hispanics, Whites	5	6424172	23.1
	California, Hawaii, Illinois, New Jersey, New York, Texas, Washington		1995–7						
	Minnesota		1997						
	Virginia		1998						
	Missouri, West Virginia		1999–2000						
Palotto *et al* 2000	USA, Illinois State	PBR	1985–90	LBW	Blacks	Blacks, Whites	3	103 746	2.2
Rosenberg *et al* 2005	USA, New York City	PBR	1996–7	LBW	Hispanics	Hispanics	14	156 084	63.1
Wingate *et al* 2006	USA, national	PBR	1995–9	LBW, PTB	Hispanics	Hispanics	4	2 446 253	61.5
Total							111	19 945 147	33.5

HR, hospital record; LBW, low birth weight; PB, population-based; PBR, population-based registry; PBS, population-based survey; PTB, preterm birth; Quest, questionnaire.
*When the sample size varies by outcome, the denominator for LBW was reported, followed by PTB if LBW was not reported.

and PTB rates that were higher for native-born white women compared with white migrants, the black–white gap was wider among the US-born than among international migrants. Conversely, the Asian–white gap narrowed among the US-born compared with first-generation migrants, and there was no evidence that foreign-born Asian women were protected for these outcomes compared with US-born Asian women. Black women presented the strongest protective effect of being foreign born for the two outcomes, followed by Hispanic women (last column). The Hispanic–white gap was wider among the native-born than among the foreign-born women in LBW but not in PTB.

Table 3 Percentage and OR (and 95% CI)* for adverse birth outcomes for ethnic minority women compared with white women, by migrant status; and OR of migrants compared with US-born women, by ethnic group

Outcome	Ethnic group	Migrants		US-born		Migrants versus US-born†
LBW			N=6 487 938		N=11 702 432	
		LBW %	OR (95% CI)	LBW %	OR (95% CI)*	OR (95% CI)*
	Whites	4.0	1.00	4.6	1.00	0.87 (0.66 to 1.16)
	Asians	5.4	1.37 (1.05 to 1.79)	5.8	1.28 (1.02 to 1.60)	0.94 (0.76 to 1.14)
	Blacks	8.2	2.14 (1.61 to 2.41)	12.3	2.94 (2.36 to 3.67)	0.64 (0.51 to 0.79)
	Hispanics	4.4	1.10 (0.85 to 1.43)	5.6	1.26 (1.02 to 1.55)	0.76 (0.65 to 0.89)
PTB			N=4 009 158		N=8 587 564	
		PTB %	OR (95% CI)	PTB %	OR (95% CI)	OR (95% CI)
	Whites	7.9	1.00	9.5	1.00	0.82 (0.66 to 1.01)
	Asians	11.1	1.44 (1.15 to 1.81)	10.2	1.08 (0.88 to 1.33)	1.09 (0.88 to 1.35)
	Blacks	12.3	1.62 (1.30 to 2.03)	16.6	1.89 (1.64 to 2.19)	0.70 (0.62 to 0.80)
	Hispanics	10.5	1.35 (1.10 to 1.66)	11.6	1.24 (1.07 to 1.44)	0.89 (0.79 to 1.00)

LBW, low birth weight; OR, odds ratio; PTB, preterm birth.
*Obtained with the full three-level model including random effects (subgroup and studies), and fixed effects (migrant status, race/ethnicity, migrant status × race/ethnicity and infant's year of birth).
†US-born is the reference group.

Table 4 Infants and percentage of LBW infants born in Europe and the USA, by migrant group

Migrant group	Infants born in Europe		Infants born in the USA	
	Births	LBW %*	Births	LBW %*
Native-born women	13439223	4.3	11 395 215	6.9
Migrants from				
Western Europe and north America	284372	3.9	–	–
East Europe	40224	4.3	–	–
North Africa/Middle East	62622	3.4	–	–
Sub-Saharan Africa	172936	7.3	13 076	5.3
South-central Asia	508208	7.7	92 761	9.0
East/south-east Asia	3283	5.1	328 713	6.2
Latin America/Caribbean	67788	6.2	4 613 040	5.0

LBW, low birth weight.
*Obtained with a three-level model including random effects (subgroup and studies) and fixed effects (migrant status, maternal region of origin, place of destination, maternal region of origin × place of destination and infant's year of birth).

Migration and world regions

This meta-analysis is based on 16 studies that measured foreign-born status and country or region of birth, irrespective of their ethnicity (Table 1). Tables 4 and 5 present the results of a three-level model of LBW assessing the interaction between world region of origin and destination, which was highly significant ($p<0.0001$). A few comparisons were not possible because some subgroups migrating to the USA were not represented in the selected studies. Table 4 shows the LBW percentage as predicted by the model, by migrant subgroup.

Table 5 presents OR for LBW according to maternal region of origin and destination. Women from western countries and north Africa compared favourably with European-born women but there were no data available for the USA. Women from sub-Saharan Africa and Latin America and the Caribbean were at higher odds of LBW if migrating to European countries but at lower odds if migrating to the USA, compared with the respective native-born women. Unlike other groups, south-central Asian women were at higher odds in both contexts but the association was stronger in Europe. The direction and strength of these associations are affected by the different baseline risk of the European and US reference groups, with European-born women less likely to deliver LBW infants compared with US-born women (OR 0.61, 95% CI 0.47 to 0.79). Despite this, sub-Saharan African and Latin-American and Caribbean women migrating to Europe seemed to be more likely to deliver LBW babies compared with those from the same region who migrated to the USA, although these trends did not reach statistical significance in the three-level model (table 5, third column).

DISCUSSION

Main findings

One of the main findings of this systematic review is that the association between foreign-born status and birth outcomes is not uniform but depends on the migrant subgroup, either defined by a combination of maternal race/ethnicity and migrant status or by the world region of origin and actual destination. We found that infants born to first-generation black and Hispanic migrant women were at lower risk of adverse birth outcomes than their US-born counterparts, but did not find evidence of such protective effect among Asian and white women. Migrants from these ethnicities were at higher risk than white migrants overall. Regarding subgroups defined by region of origin, sub-Saharan African and Latin-American and Caribbean migrants were at higher odds of LBW in Europe but not in the USA, and south-central Asians were at higher odds in both continents.

Strengths and limitations

Unlike most meta-analyses of observational studies, instead of combining adjusted OR we used summary data stratified by key predictors. This approach made it possible to examine comparisons not explored in previous studies, such as the assessment of ethnic disparities by migrant status and comparisons within

Table 5 OR (and 95% CI)* for LBW for migrant women compared with European-born and US-born women, and for various world regions according to their place of destination (Europe vs USA)

Migrant group	Infants born in Europe OR (95% CI)	Infants born in USA OR (95% CI)	Infants born take over in Europe take over versus in USA† OR (95% CI)
Native-born women	1.00	1.00	0.61 (0.47 to 0.79)
Migrants from			
Western Europe and north America	0.91 (0.77 to 1.07)	–	–
East Europe	0.99 (0.79 to 1.25)	–	–
North Africa and Middle East	0.78 (0.60 to 1.01)	–	–
Sub-Saharan Africa	1.75 (1.44 to 2.12)	0.75 (0.55 to 1.02)	1.42 (0.95 to 2.14)
South-central Asia	1.84 (1.54 to 2.20)	1.33 (1.01 to 1.77)	0.84 (0.57 to 1.23)
East and south-east Asia	1.20 (0.72 to 2.02)	0.89 (0.73 to 1.09)	0.82 (0.46 to 1.46)
Latin America and Caribbean	1.46 (1.17 to 1.83)	0.72 (0.62 to 0.82)	1.24 (0.90 to 1.72)

LBW, low birth weight; OR, odds ratio.
*Obtained with a three-level model including random effects (subgroup and studies) and fixed effects (migrant status, maternal region of origin, place of destination, maternal region of origin × place of destination and infant's year of birth).
†Infants born in the USA are the reference group.

migrant subgroups according to their place of destination. Another advantage is that our analyses used the same set of covariates and definitions for each study, thus making interpretation of results less problematical than in meta-analyses based on effect estimates adjusted for a varying number of covariates with heterogeneous definitions. However, the limitation of our approach was the inability to extract birth data stratified by potential confounders.

Immigration policies in the receiving countries and social class dynamics in the source countries may favour the selection of women or couples for migration, based on certain characteristics for which distributions may differ both from those of the source and the receiving population (eg, maternal age, maternal and paternal social class, marital status, overall health) and that are also associated with birth outcomes. For example, differences in maternal age may explain part of the foreign-born advantage of Hispanic women in the USA, as they have lower teenage pregnancy rates than their US-born counterparts.[79 82] Foreign-born Hispanic and black women had lower proportions of single mothers.[5 79 82] Despite these favourable characteristics foreign-born Mexican women but not foreign-born black women in the USA had lower education, less prenatal care and lower income compared with US-born mothers.[5 13 16] This phenomenon makes up part of the so-called ‘Latino paradox’,[17 64 69 85] which can also be extended to the birth weight advantage of north African women in France and Belgium.[25 76] It is clear that any adjusting for risk factors should be undertaken with caution because the same factors cannot be assumed to have the same effects in different populations or different contexts.

As the social and historical complexity involved in each migrant population could not be adequately explored in a meta-analysis searching for overarching trends, our findings should be regarded as global tendencies that may not apply to particular migrant subgroups settling in particular countries, regions, or cities. Part of such complexity involves heterogeneity of source countries within ethnic and migrant subgroups. In addition, ethnic groups differ according to generational status, with US-born Hispanic and Asian women more likely to be first or second generation than US-born black or white women, who are mostly fourth or higher generation.[98] Even first-generation migrants may differ in their risk of adverse birth outcomes according to their length of residence in the receiving country, information that was rarely collected.[16 65 88]

Another potential source of bias is measurement error, mainly resulting from self-reported race/ethnicity and country of birth and nationality in birth certificates. Validation studies suggest that the misclassification is less than 10% for any ethnic group.[99 100] The meaning and limitations of the racial/ethnic classification for epidemiological research had been extensively discussed.[101 102] The reviewed literature on birth outcomes tended to consider the racial/ethnic categories as markers for a social process external to individual physiology rather than indicators of biological types.

Migration and ethnic disparities

The protective effect in the immigrant generation has a clear gradient: It is stronger for black migrants, still present among Hispanic migrants, but virtually absent among Asian and white migrants. This gradient mirrors the ethnic group hierarchy in the USA, which places people of African descent at the bottom, Hispanic individuals in the middle, and gives (east) Asian individuals a favourable treatment close to that of white individuals.[103 104] These findings are at odds with the classic assimilation theory that predicts a convergence of the outcomes of migrant groups towards the level observed in the mainstream white society.[105] Instead, the observed pattern is more consistent with the segmented assimilation theory that suggests that migrants are selectively incorporated into the system of stratification of the American society based on their ethnic affiliation.[104]

The better birth outcomes of foreign-born black women compared with their US-born counterparts cannot be explained by the ‘genetic hypothesis’, which would predict that US-born black women be an intermediate risk group between foreign-born black and US-born white women because of intermarriage and genetic mixing over previous generations.[4 18] Among the environmental explanations, assimilation theories cannot fully account for US—black disadvantage, because these theories focus on how migrants and their offspring are incorporated into the host society[104 105] and approximately 97% of US-born black individuals were fourth or higher generation in 1990.[98] A few studies have proposed a sociohistorical hypothesis, pointing to continuous exposure to socioeconomic and structural discrimination,[58 84 106] from past historical periods to the urban underclass. Such explanation is consistent with a substantial sociological literature indicating that racial segregation concentrates deprivation in black neighbourhoods by concentrating people who fit negative racial stereotypes and by restricting the poverty created by economic downturns into a small number of visible minority neighbourhoods, mainly through discrimination in the housing market.[107 108] Residential racial segregation has been positively associated with infant mortality among black individuals but negatively among white individuals,[109] and the black—white gap in PTB was found to be higher in hyper-segregated areas.[110]

Because international migration barely contributes to the number of black people in the USA, the relative advantage of foreign-born black individuals has little impact on the birth outcomes of black individuals as a whole. In contrast, migrant women contributed to nearly 60% of births among Hispanic individuals, thus shaping the birth outcomes of this ethnic group.

Migration and region of origin and destination

Regarding subgroups defined by region of origin and destination, sub-Saharan African and Latin-American and Caribbean migrants were at higher odds of LBW in Europe but not in the USA, and south-central Asian individuals were at higher odds in both continents, although their disadvantage was somewhat attenuated in the USA. Part of these differences can be explained by the ethnic composition of the native-born populations in these analyses, defined by their place of birth but not by their ethnic groups and by the patterns of emigration. Therefore, US-born individuals compare unfavourably with European-born individuals partly due to the heavier weight of their ethnic minorities. In the same vein, the Latin-American advantage in the USA may be driven by the disproportionate representation of Mexican people in the USA, but not in Europe. LBW rates of Mexican individuals were among the lowest among Latin-American immigrants.[85] It is believed that Mexican individuals in the USA are protected because of their residential proximity with co-ethnics, social support systems and cultural orientation,[16 17 79 111] all of which is facilitated by the spatial contiguity with the home country. The safeguarding of such protective traits may be more difficult to achieve in transatlantic Europe.

The reasons for the higher odds of LBW of sub-Saharan African women in Europe compared with those settling in the USA are not clear. Differential migration could not be assessed because, with one exception,[83] studies did not provide

What is already known on this subject

- Immigrant women contribute more than one fifth of all live births in several industrialised countries.
- Studies comparing birth outcomes of migrants with those of native-born women show mixed results.

What this study adds

- The use of foreign-born status as a single category is not informative.
- Compared with native-born women, sub-Saharan African and Latin-American and Caribbean migrants were at higher odds of LBW in Europe but not in the USA, and south-central Asian women were at higher odds in both continents.
- The direction and strength of the associations between foreign-born status and birth outcomes depend on the choice of the reference group and on the definition of the migrant subgroup, either defined by maternal race/ethnicity, world region of origin and place of destination.

information at the country level. It is unlikely that the distribution of reported risk factors accounts for the difference, because the rates of anaemia, tobacco smoking, marital status, maternal education and low income were comparable in both continents.[4 15 25 81 83] Unmeasured factors or a differential effect of the receiving environments probably plays a role. The same receiving environment may also affect some migrant groups favourably and others unfavourably, as suggested in a Swedish study.[88]

Further research

It remains to be determined whether and to what extent the risk of adverse birth outcomes differs for particular migrant groups according to their actual destination and whether such an effect, if existent, is due to selective migration or to differential exposures in the receiving environment. The existence of differences in the risk of adverse birth outcomes within migrant groups according to place of migration remains a plausible hypothesis to be investigated further.

Our analyses imply that the definition of the migrant groups and the choice of the reference groups have a decisive impact on the direction and strength of the effect estimates for the migrant groups. Although the comparison between migrants and majority populations may be of interest in itself for highlighting disparities by migrant status as a single category, summary statistics representing the effect of foreign-born status may result in misleading conclusions regarding particular migrant groups. Future research should thus strive to distinguish subgroups defined by their regions and, when feasible, by their countries of origin because there may be heterogeneity between countries within the same world region.[22 85] Distinguishing appropriate comparison subgroups within the receiving-country population is also recommended, especially in countries highly stratified by race/ethnicity such as the USA.[101]

Further research on migration and adverse birth outcomes may advance knowledge by examining why some migrant groups experience poor outcomes and why others do not and what are the dynamics leading to worse outcomes among the offspring of some migrant groups but not of others. Future studies will benefit from obtaining longitudinal measurements on migrants, including premigration characteristics and circumstances of immigration, and social environment, medical care and health behaviour after arrival.

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