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Birthweight of babies born to migrant mothers - What role do integration policies play?

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ABSTRACT

Birthweights of babies born to migrant women are generally lower than those of babies born to native-born women. Favourable integration policies may improve migrants’ living conditions and contribute to higher birthweights. We aimed to explore associations between integration policies, captured by the Migrant Integration Policy Index (MIPEX), with offspring birthweight among migrants from various world regions. In this cross-country study we pooled 31 million term birth records between 1998 and 2014 from ten high-income countries: Australia, Belgium, Canada, Denmark, Finland, Japan, Norway, Spain, Sweden and United Kingdom (Scotland). Birthweight differences in grams (g) were analysed with regression analysis for aggregate data and random effects models.

Proportion of births to migrant women varied from 2% in Japan to 28% in Australia. The MIPEX score was not associated with birthweight in most migrant groups, but was positively associated among native-born (mean birthweight difference associated with a 10-unit increase in MIPEX: 105 g; 95% CI: 24, 186). Birthweight among migrants was highest in the Nordic countries and lowest in Japan and Belgium. Migrants from a given origin had heavier newborns in countries where the mean birthweight of native-born was higher and vice versa. Mean birthweight differences between migrants from the same origin and the native-born varied substantially across destinations (70 g – 285 g).

Birthweight among migrants does not correlate with MIPEX scores. However, birthweight of migrant groups aligned better with that of the native-born in destination counties. Further studies may clarify which broader social policies support migrant women and have impacts on perinatal outcomes.

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1. Introduction

Newborn size at term varies widely between and within countries (Urquia, Serbye, & Wanigaratne, 2016; Wilcox, 2001). At the population level, birthweight differences even within the “normal” range may reflect environmental disparities in health and living conditions (Weightman et al., 2012). Settings characterised by optimal maternal living conditions, fetal growth, and thus newborn size show only small variations across populations (Villard et al., 2014; Wehby, Gill, Pawluk, Castillo, & Lopez-Camejo, 2015). However, in prospective studies of fetal growth curves substantial variation by maternal origin is found, even in low-risk populations (Gardosi, Francis, Turner, & Williams, 2018). With conflicting data, how can we explore population birthweight differences further? Human migration creates a natural experiment in terms of a change in maternal living conditions. An increasing proportion of births in high-income countries are to migrant women (Indicators of Immig, 2015, pp. 37–51). Among migrants from low-resource countries living in a high-resource country, we find elevated rates of low birthweight and perinatal death in several groups (Gogon, Zimbeck, & Zeitlin, 2009; Gisler et al., 2009; Vangen et al., 2002). For example, South Asian women tend to give birth to smaller babies than non-migrant mothers (Ray et al., 2012; Seaton, Yadav, Field, Khunti, & Manktelow, 2011). However, high-income countries differ in their efforts and success in integrating migrants. Integration is difficult to measure, although policies indicate the degree of effort made by a government to reduce obstacles to migrant participation and acceptance, something likely to affect health (Juarez et al., 2019). The Migrant Integration Policy Index (MIPEX) has been developed to capture policies and laws of EU and OECD countries that promote integration of migrants (Migrant Integration Policy Index, 2018). The MIPEX score covers eight policy areas: health, education, labour market mobility, family reunion, political participation, permanent residence, access to nationality and anti-discrimination. The index facilitates comparisons as to what governments are doing to promote integration, but has not been validated in terms of population health outcomes, such as birthweight.

Assuming no selection bias, if newborn birthweight varies depending on which high-income country migrant mothers from the same geographic origin move to, that may reflect potential differences in environmental factors in the destination countries. Poor living conditions, encompassing poor access to optimal maternity care, education and income-generating activities could contribute to smaller term babies. Stressors such as austerity measures or deportation raids have been associated with low birthweight among migrant groups (Kana, Correia, Peleteiro, Severo, & Barros, 2017; Novak, Geronimus, & Martinez-Cadoso, 2017) whereas beneficial integration policies have been linked to reduced risk of adverse birth outcomes (Bollini, Pampallona, Wanner, & Kupelnick, 2009). Overall migrants in countries with exclusionist policies experience worse health compared to countries with multicultural policies (Malmusi, 2015).

On the other hand, native-born and migrant population groups share environmental influences. The risk of diabetes, obesity and maternal smoking in migrants has been shown to rise with increasing length of residence (Goel, McCarthy, Phillips, & Wee, 2004; Hawkins, Lamb, Cole, & Law, 2008; Oza-Frank, Stephenson, & Narayan, 2011). Furthermore, migration is not a random event. Migration to particular countries often occurs based on shared language and historical attachments or particular admission criteria. Healthier and/or wealthier women may choose to migrate to richer countries where they can have better outcomes compared with those whose circumstances meant they only made it to less optimal destinations (Urquia, Vang, & Bolumur, 2015).

Comparing birthweight among migrants in several destination countries is challenging, as the acquisition and sharing of multi-country data publicly across borders is increasingly difficult due to confidentiality concerns. Birthweight represents a suitable outcome to investigate variations among well-defined population subgroups across jurisdictions due to being measured with high accuracy and reliability across settings and for being sensitive to environmental influences (Wilcox, 2001). We restricted to term births due to variations in registration of births at the extremes of the gestational age distribution (Delnord et al., 2017; Joseph et al., 2012). For this study, we took advantage of the Reproductive Outcomes And Migration (ROAM) network (Reproductive Outcomes and, 2018) to access and pool cross-national birth and migration data. Our objective was twofold. First, we explored the association between integration policies in destination countries, as measured by the MIPEX score, and birthweight at term among migrants originating in the same world region. Assuming that MIPEX is an indicator of integration and higher scores are higher integration, we hypothesised that a higher MIPEX score would be associated with higher birthweights among migrants from the same geographic region, meaning that the distribution of BW at term would be shifted (boosted) to the right (Wilcox, 2001). Second, we explored how birthweight of migrants relates to the birthweight of the native-born population across destination countries.

2. Materials and methods

This was a cross-country comparative study. We used population-based national and regional data from ten high-income OECD countries/regions. The study protocol was specified prior to data collection. Participating centres had to meet the following inclusion criteria: (a) categorisation of maternal region of origin according to pre-specified groups; (b) categorisation of data by maternal age, parity and year of birth within maternal regions of birth; (c) provision of the number of births and mean birthweight with standard deviation (SD) in each subgroup.

2.1. Data sources and study population

The study population included births from Australia (the state of Victoria), Belgium, Canada, Denmark, Finland, Japan, Norway, United Kingdom (Scotland), Spain and Sweden. Population health data were obtained from medical birth registries and perinatal data collections. Inclusion criteria were singleton livebirths and stillbirths between 37 and 41 completed gestational weeks among migrants and non-migrants occurring between 1998 and 2014. Pre- and post-term births (<37 + 0 or ≥42 + 0 gestational weeks) and births with birthweight <1000 g or >6999 were excluded. We used the best obstetric estimate for gestational age. Women could have contributed more than one birth to the cohort. Data from the most recent 10–12 year period were included with at least three years before 2008 and at least one year after 2008. Not all centres contributed data for all the years. Each participating centre assessed the internal consistency and quality of data, and obtained ethical approval to share the results. The study was approved by the Norwegian Regional Committee for Medical and Health Research Ethics, reference 2016/417.

2.2. Outcome measures and predictors

The main outcome was mean birthweight in grams (g) with standard deviation reported in strata for the following categorical predictors: maternal region of birth, calendar year of birth, maternal age and parity. Information on maternal country of birth was used for classification into one of eight maternal regions of birth based on a modification of the United Nations sub-regions (Supplemental Table A) (United Nations Geographic, 2016): “Eastern Europe”, “Rest of Europe”, “Latin America/Caribbean”, “North Africa/Middle East”, “Sub-Saharan Africa”, “South Asia”, “Rest of Asia” and “North America/Oceania”. For Japan, maternal region of origin could only be classified into four of the nine categories. Women born in the destination country (“native-born”) were used as the reference category, where applicable. We reported data by each calendar year to account for time trends. Maternal age was categorised as <35 years or 35 years and above, and parity as...
influenced by a wider range of policies beyond the health sector. A score (based on only one policy area) as birthweight is likely to be

Table 2

<table>
<thead>
<tr>
<th>Destination country</th>
<th>MIPEX score</th>
<th>All births</th>
<th>Migrants</th>
<th>Native-born</th>
<th>Maternal age&lt;35</th>
<th>Para 0</th>
<th>Year of birth</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Australia</td>
<td>66</td>
<td>987.742</td>
<td>3.1</td>
<td>275.660</td>
<td>7.9</td>
<td>712.082</td>
<td>2.6</td>
<td>76.7</td>
</tr>
<tr>
<td>Belgium</td>
<td>68</td>
<td>1.00792</td>
<td>4.5</td>
<td>372.108</td>
<td>10.7</td>
<td>1.028.684</td>
<td>3.7</td>
<td>86.1</td>
</tr>
<tr>
<td>Canada</td>
<td>71</td>
<td>4.689.40</td>
<td>14.9</td>
<td>1.195.375</td>
<td>34.3</td>
<td>3.473.565</td>
<td>12.4</td>
<td>82.9</td>
</tr>
<tr>
<td>Denmark</td>
<td>49</td>
<td>585.542</td>
<td>1.9</td>
<td>82.747</td>
<td>2.4</td>
<td>502.795</td>
<td>1.8</td>
<td>82.7</td>
</tr>
<tr>
<td>Finland</td>
<td>69</td>
<td>717.066</td>
<td>2.3</td>
<td>48.773</td>
<td>1.4</td>
<td>668.293</td>
<td>2.4</td>
<td>81.2</td>
</tr>
<tr>
<td>Japan</td>
<td>62</td>
<td>14.673.357</td>
<td>46.7</td>
<td>288.539</td>
<td>8.3</td>
<td>14.858.018</td>
<td>51.5</td>
<td>83.9</td>
</tr>
<tr>
<td>Norway</td>
<td>70</td>
<td>894.272</td>
<td>2.7</td>
<td>163.558</td>
<td>4.7</td>
<td>678.714</td>
<td>2.4</td>
<td>82.7</td>
</tr>
<tr>
<td>Scotland</td>
<td>62</td>
<td>803.077</td>
<td>2.6</td>
<td>83.976</td>
<td>2.4</td>
<td>719.101</td>
<td>2.6</td>
<td>81.5</td>
</tr>
<tr>
<td>Spain</td>
<td>61</td>
<td>5.458.880</td>
<td>17.4</td>
<td>716.054</td>
<td>20.5</td>
<td>4.742.826</td>
<td>17.0</td>
<td>74.3</td>
</tr>
<tr>
<td>Sweden</td>
<td>80</td>
<td>1.269.620</td>
<td>4.0</td>
<td>258.941</td>
<td>7.4</td>
<td>1.010.679</td>
<td>3.6</td>
<td>80.1</td>
</tr>
<tr>
<td>TOTAL</td>
<td></td>
<td>31.407.288</td>
<td>100</td>
<td>3.485.531</td>
<td>100</td>
<td>27.921.757</td>
<td>100</td>
<td>81.6</td>
</tr>
</tbody>
</table>

* Migrant Integration Policy Index for 2010.

0 (nulliparous) or 1 or more (multiparous). The 2010 MIPEX overall country score was used to indicate the level of policies conducive to migrants’ integration in destination countries, on a scale from 0 to 100 (Migrant Integration Polic, 2018). We chose the overall MIPEX score for 2010 given the data reporting period. Furthermore, the overall score based on eight policy areas was chosen over the MIPEX Health-specific score (based on only one policy area) as birthweight is likely to be influenced by a wider range of policies beyond the health sector. However, we performed sensitivity analyses with the MIPEX 2014 Health-specific score as well as the MIPEX overall scores for 2014.

2.3. Statistical analyses

Data were reported as the mean term birthweight estimate with standard deviation (SD) and number of observations within strata of the covariates. These estimates were then combined and analysed using regression techniques for aggregate data to obtain unadjusted and adjusted mean birthweight differences (Moineddin & Urquia, 2014). Regression analysis of continuous aggregate data produces point estimates as well as 95% confidence intervals (CI), similar to those obtained using individual-level data (Moineddin & Urquia, 2014). First, to assess the association between MIPEX score and birthweight across the ten destination countries, we calculated unadjusted and adjusted birthweight differences in grams associated with a 10-unit increase in MIPEX score for each maternal region of origin. Analyses were adjusted for year of birth, parity and maternal age group. We further modelled country of origin as a random intercept and calculated the proportion of country-level variance explained by the MIPEX. Second, to explore how the birthweight of different migrant groups relates to the birthweight of the native-born population, we plotted the birthweight difference between migrants and the native-born. By doing this, we defined four quadrants (Q1-Q4) that classify destination countries. Q1: higher than average birthweight among native-born and migrants; Q2: lower than average birthweight among native-born and higher than average among migrants; Q3: higher than average birthweight among native-born and lower than average among migrants; and Q4: lower than average BW among native-born and migrants. We used the mean of the country means, as this gives equal weight to all destination countries irrespective of the number of births. Furthermore, to quantify variability in birthweight between destination countries we compared the birthweight of migrants of the same origin in different countries, using the country with the highest MIPEX score as the reference (Sweden), and adjusting for year of birth, parity and maternal age group. Analyses were performed in SAS (SAS Institute, Cary, NC) version 9.4.

3. Results

We included 31 407 288 births across the ten destination countries with complete information on maternal origin, age, parity and year of birth. The cohort is presented in Table 1. Maternal age was less than 35 years in 81.6% of all women, whilst 47.7% were nulliparous. The mean year of birth ranged from 2003 to 2007 in destination countries. Japan contributed the largest proportion of total births (46.7%), followed by Spain (17.4%) and Canada (14.9%). Of all births, 3 485 531 births (11.1%) were to migrant women. Canada (34.3%), Spain (20.5%) and Belgium (10.7%) contributed the most births among migrant women. MIPEX overall scores for the year 2010 were available for all countries. Median score was 67; ranging from 42 for Japan to 80 for Sweden. Table 2 shows the distribution of maternal age groups, parity groups, median year of birth and mean birthweight in offspring to migrant and native-born women according to destination country. Table 3 shows the
Table 3
Births by maternal region of origin and country of destination.

<table>
<thead>
<tr>
<th>Maternal region of birth</th>
<th>Destination</th>
<th>Native-born</th>
<th>%</th>
<th>Migrant-born</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Eastern Europe</td>
<td>Rest of Europe</td>
<td>North Africa/Middle East</td>
<td>Sub-Saharan Africa</td>
<td>South Asia</td>
</tr>
<tr>
<td>Australia</td>
<td>7529</td>
<td>28382</td>
<td>2.4</td>
<td>102864</td>
<td>3.7</td>
</tr>
<tr>
<td>Belgium</td>
<td>39153</td>
<td>120822</td>
<td>3.2</td>
<td>516210</td>
<td>14.3</td>
</tr>
<tr>
<td>Denmark</td>
<td>54184</td>
<td>159515</td>
<td>2.7</td>
<td>374880</td>
<td>10.7</td>
</tr>
<tr>
<td>Finland</td>
<td>13078</td>
<td>32232</td>
<td>5.1</td>
<td>42386</td>
<td>1.2</td>
</tr>
<tr>
<td>Norway</td>
<td>12838</td>
<td>23883</td>
<td>5.5</td>
<td>21383</td>
<td>0.6</td>
</tr>
<tr>
<td>Spain</td>
<td>126790</td>
<td>397093</td>
<td>2.5</td>
<td>62491</td>
<td>1.9</td>
</tr>
<tr>
<td>Sweden</td>
<td>206670</td>
<td>657122</td>
<td>6.5</td>
<td>71705</td>
<td>11.0</td>
</tr>
<tr>
<td>TOTAL</td>
<td>316634</td>
<td>1035233</td>
<td>100</td>
<td>386754</td>
<td>100</td>
</tr>
</tbody>
</table>

*Note: Values shown are in thousands.*

4. Discussion

Using multi-country data for more than 31 million births in ten OECD countries, we found that birthweight of babies born to migrant mothers from different regions of the world varies according to the country of destination. However, the MIPEX score, designed to measure favourable integration policies in destination countries, was not significantly
The MIPEX score was associated with birthweight among non-migrants, suggesting that the index may capture broader characteristics of the local policy and social environment and may not necessarily be migrant-specific. A clearer pattern emerged when comparing migrants’ birthweight with that of non-migrants. For all eight regional groups of migrants, offspring mean birthweight was highest in the Nordic countries, followed by Belgium and Spain. Thus, women from a given origin tended to have heavier newborns in countries where the mean birthweight among those of the native-born women was higher, and have lighter newborns in destination countries where the mean birthweight among the native-born was lower. These findings suggest that unmeasured environmental characteristics of the destination countries may be “pulling” migrants’ birthweight towards the level experienced by their non-migrant counterparts.

4.1. Strengths and limitations

The strength of this study is the use of a large multi-country population-based data set from ten countries, including more than three million births among migrant women and 27 million births among native-born women. We were able to use individual-level data, but at a high level of aggregation. Birthweight is measured with high accuracy and reliability. Maternal regional origin and covariates were standardised across participating countries.

There are several limitations to this study. We could not include covariates such as maternal body mass index (BMI), maternal smoking, mode of birth, father’s region of origin, refugee status or duration of residence, due to absence of such information in many participating countries or small cell size disclosure restrictions. Furthermore, in this study we classified migrant women according to their region of origin, disregarding the heterogeneity within such large geographical units (see Supplementary Table C). In addition, migration patterns are shaped by historical events and may have differed in time and place for each destination country.

4.2. Interpretation

To our knowledge, this is the first multi-country population-based study assessing term birthweight differences between destination countries for migrants originating in different world regions. Our main discovery, comparing birthweight in the native-born population to different migrant groups across destination countries, was that migrants’ birthweights were higher in countries with high birthweights in the local population and lower in countries with lower birthweights in the local population. This was a consistent magnet-effect where the birthweight among native-born seems to “pull” the birthweight of migrant groups, no matter in which world region the mother was born. This pattern may partially reflect migrant integration policies, but also other unmeasured features of the social and policy environment of the destination countries. However, such an effect might not be confirmed in countries where selective migration and health care influences are less of an issue (Juarez & Hjern, 2017). Further investigation is needed as to which specific policy elements that protect societal/financial benefits for women also promote health and well-being.

We did not find a consistent association between the MIPEX score and mean term birthweight. All the Nordic countries came out on top in terms of birthweight in every regional migrant group. Nordic countries have traditionally had similar state welfare policies and women-friendly policies. However, Denmark’s MIPEX scores were considerably lower; yet the country produces birthweights among migrants almost as high as those observed in other Nordic countries. Similarly, migrants in Belgium produced disproportionately low birthweights for a MIPEX score near the average. This finding is not entirely paradoxical given that some countries have high-quality maternity care systems even if they have poor or average integration policies.

Contrary to previous reports that have shown MIPEX to be useful in predicting migrant health outcomes such as self-reported health and long-standing illness (Giannoni, Franzini, & Masiero, 2016; Malmusi, 2015) this is not the case for birthweight. In addition to differential selection of migrants to countries, another potential explanation for the poor predictive ability of MIPEX is that the score exhibited insufficient variability between our included countries to be able to detect an association with the complex health outcome of birthweight. The fact that the MIPEX score predicted mean birthweight in the native population warrants further studies to explore if the base indicators grasp central societal aspects of the destination country that are associated with generally progressive social and economic policies (Migrant Integration Policy, 2018).

Our purpose was to explore birthweight differences as a measure of population health and not as a clinically relevant end-point or in terms of optimal birthweights. However, the mean absolute difference in offspring birthweight for women from the same geographic region of origin across the ten destination countries was around 200 g. This magnitude is comparable to that of maternal smoking, high BMI or gestational weight gain (Juarez & Merlo, 2013). The mean absolute
Fig. 1. (a-h) Birthweight differences in migrants compared to native-born by destination country and according to maternal origin.

Dashed blue horizontal line: Mean of the birthweight (BW) means of migrants across destination countries.
Dashed blue vertical line: Mean of the mean BW differences between migrants and the native-born across destination countries.
Countries in Q1 are those with both higher than average BW among native-born and migrants. Countries in Q2 are those with lower than average BW among native-born and higher than average among migrants. Countries in Q3 are those with higher than average BW among native-born and lower than average among migrants. Countries in Q4 are those with both lower than average BW among native-born and migrants.
difference in offspring birthweight across the ten destination countries varied by maternal region of origin, from 285 g for women from Latin America/Caribbean to 70 g among women from North Africa/Middle East. The resulting mean birthweight differences in our study are likely to be a minimum estimate, and the real differences could be higher if migrant groups were further disaggregated. Our findings differ somewhat from the findings of a binational study showing that Spanish-speaking Latin American migrants in Canada had newborns 100 g heavier than their same-country counterparts giving birth in Spain (Urquia et al., 2015). This difference is likely due to pooling Latin Americans/Caribbean as a single group in our study. Caribbeans are more common in some countries (e.g., Canada) but not in others (Nordic countries). As Caribbean-born women are known to have poorer pregnancy outcomes, such as preterm birth, they are expected to lower the mean in the destination countries where they are more prevalent (Park, Urquin, & Ray, 2015). The strikingly low variability of birthweight among the North African/Middle East group points to homogeneity in this group. Migrants to Japan had the lowest offspring birthweight compared to migrants of the same origin arriving in any other destination country, which could be related to the low levels of obesity and gestational weight gain in the native-born population (Morisaki, Kawachi, Oken, & Fujiwara, 2016).

If selective migration was the driving factor we would expect the highest birthweights in Australia and Canada, countries that limit the number of humanitarian admissions in favour of migrants who can contribute to the economy. However, countries with the highest birthweights in our study, the Nordic countries, do not have specific admission policies and accept a fair proportion of refugees and asylum seekers. Thus, our results are not likely to be primarily driven by countries “skimming the cream” in regards to picking the socioeconomically well-off migrants. Although Denmark was an outlier in terms of having a low MIPEX, but producing high birthweights, we did not find any indication that our findings were heavily influenced by selective migration of healthier women to richer countries. At the lower end of the birthweight scale, Spain has a high proportion of illegal migrants, who might be vulnerable with regards to access to pregnancy care and unstable living conditions. Belgium also has a disproportionately high proportion of asylum seekers in relation to other EU countries, and a high proportion of undocumented migrants (Indicators of Immig, 2015, pp. 37–51). All in all, the pattern of the birthweight of migrants being pulled to that of the native-born population is not consistent with selective migration as the major explanation.

5. Conclusion

Using multi-country data for more than 31 million births in ten OECD countries, the MIPEX score does not explain the variations seen in birthweight of migrants across destination countries. However, migrant women from a given origin tended to have heavier babies in countries where birthweight of the native-born was higher, and vice versa. We need further investigation into which broader social policies as well as specific components of maternity care support women and have impact on perinatal outcomes like birthweight.

Contribution to authorship

IS, MU and SV conceived the study. IS and MU analysed the data and led the writing process. FB, NM, MG, SJ, AMNA, JR, RS, RW, MU and IS contributed data and results for analysis. All authors contributed to the study design, writing of the manuscript and approved the final version.

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Declaration of competing interest

None.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.ssmph.2019.100503.

References


