The impact of ethnicity and migration on pregnancy and birth outcomes: A secondary analysis of the Born in Bradford cohort

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Running Title

Migrant populations and perinatal outcomes: Born in Bradford

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Abstract

Objective: To investigate the relationship between maternal ethnicity and migration status on perinatal outcomes.

Design: Population-based cohort

Setting: Maternity department of a large hospital in Northern England

Population: Women delivering at Bradford Royal Infirmary between March 2007 and December 2010

Methods: Impact of maternal migration status and ethnicity were assessed using multiple logistic regression for categorical outcomes and multiple linear regression for continuous outcomes.

Main outcome measures: Maternal and neonatal outcomes

Results: First-and-second-generation Pakistani migrants had higher odds of low birthweight (aOR 1.63, CI 1.35-1.97 and aOR 2.01, CI 1.66-2.42 respectively) and gestational diabetes (aOR 2.68, CI 2.20-3.27 and aOR1.79, CI 1.43-2.23) and lower odds of macrosomia (aOR 0.30, CI 0.24-0.37 and aOR 0.30, CI 0.24-0.39) compared to white British natives. First-generation Pakistani migrants also had higher odds of stillbirth (aOR 2.01, CI 1.00-4.01) and lower odds of preterm birth (aOR 0.80, CI 0.64-0.98) and APGAR score<7 at 1 minute (aOR 0.80, CI 0.68-0.94), which was not the case for other groups with either shared ethnicity or migration status.

Conclusion: This study highlights higher odds of both low birthweight and lower odds of macrosomia among migrant Pakistani mothers compared to native women, despite having higher rates of gestational diabetes. Lower odds of preterm birth in first-generation migrants compared to native and second-generation women is of interest, however other poorer neonatal outcomes are concerning. The observed intergenerational differences in particular merit further explorations.

Key words: Perinatal; Pregnancy; Ethnicity; Migration; Born in Bradford.

Tweetable abstract: Analysis of Born in Bradford shows differences in neonatal outcomes by maternal migration status and ethnicity

Introduction

Bradford is an ethnically diverse and relatively economically deprived city in the north of England. The population of the city was influenced by large numbers of Pakistani migrants arriving in the 1950's, having been actively recruited to take up employment in the city's wool mills. The majority of migrants initially were working age men; subsequently family reconstitution migration has meant that Bradford is now home to a three-generational population of Pakistani origin (1).

It has been established that perinatal outcomes are influenced by maternal ethnicity; women of South Asian origin tend to be more at risk of delivering babies who are of a low birthweight and less at risk of macrosomia despite higher prevalence of gestational diabetes. The interplay between maternal ethnicity and migration status is less clear in the existing literature. A narrative review of available evidence relating to perinatal outcomes in migrant women highlighted the need for research which attempts to explore the interplay between ethnicity and migration to examine whether migration status influences the established additional risks associated with ethnicity (2).

While the impact of ethnicity on health has been relatively well documented, the majority of studies of this type are conducted in Western countries and do not examine the role of place of birth or length of stay in host countries for first generation migrants. Particularly in the UK, analysis of health outcomes related to migration is often based on self-reported ethnicity due to a lack of data relating to migration in health datasets. According to mortality rates in the 2011 census, a slight advantage in terms of life expectancy at birth among first generation migrants was observed (3), however further research has highlighted that ethnic minority groups may have lower disability free life expectancy compared to the white British population (4). Improving recording of ethnicity and migration history in health records is of paramount importance in studying the patterns of health and disease in these populations (5).

The Born in Bradford cohort has collected data relating to the personal and family history of migration of all participants. Assessing pregnancy and birth outcomes, particularly with the inclusion of more objective variables such as migration status and country of origin, in addition to self-reported ethnicity, could provide substantive information on health inequalities.

For these reasons, the objective of this study is to investigate the impact of maternal migration status and ethnicity on perinatal outcomes.

Methods

Born in Bradford cohort

Born in Bradford (BiB) is a prospective cohort study for which participants were recruited during pregnancy. The cohort was established in the Northern English city of Bradford in response to the observation of very high rates of infant mortality in the city. Women were invited to participate in the Born in Bradford study when attending an oral glucose tolerance test appointment at 26–28 weeks' gestation (which is offered universally to pregnant women in Bradford) or when attending other antenatal appointments. Informed consent was obtained, and women were asked to complete a baseline questionnaire providing data on maternal characteristics including their personal and family migration background. Recruitment took place between March 2007 and December 2010, and over 80% of women eligible in this period agreed to take part, which represents approximately 64% of the births occurring in Bradford during this period. Data from the baseline questionnaire has been linked with routine maternity data which enables the examination of perinatal outcomes by maternal characteristics. Details of the cohort profile have been published elsewhere (6).

Outcome variables

The neonatal outcome variables studied were low birthweight (below 2500 g), macrosomia (birth weight over 4000 g), preterm birth (<37 completed weeks gestation), outcome of birth (live birth or stillbirth) and Apgar score at 1 min and 5 min (analysed as two groups: <7 and 7–10). Low birthweight and macrosomic infants were compared with infants born weighing 2500–4000 g, and those born preterm to those born ≥37 completed weeks' gestation. Birth weight and gestational age at delivery were also considered as continuous variables. The maternal outcome variables included in this analysis were diagnosis of pre-eclampsia (diagnosis in this cohort was made when proteinuria is >0.3 mg and blood pressure is ≥140/90mmHg on more than one occasion), diagnosis of gestational diabetes (defined as a 2-hour post-glucose load plasma glucose level of 7.8 mmol/L or a fasting plasma glucose level of 6.1 mmol/L) (7) and mode of birth (vaginal or caesarean section). Distinction between elective and emergency caesarean sections was not available. The outcome variables were collected in the process of routine maternity care and were made available for this analysis via data linkage to questionnaire data.

Migration status

Migration status groups were calculated using questionnaire responses to questions about the mother's own country of birth and that of her parents and grandparents. First generation migrants are therefore those women who were themselves born outside of the UK; second generation migrants those women who were themselves born in the UK but have at least one parent who was born abroad. Due to small numbers, those with a higher order migrant background (i.e. grandparents born abroad) were combined with second generation migrants. In order to account for the

impact of ethnicity in differences between groups each migrant group was stratified based on self-reported ethnicity, White British, Pakistani or Other Ethnicity.

Statistical analysis

Characteristics of the sample and perinatal outcomes in all other groups were compared with those for white British native women who were considered as the reference group. Characteristics of the sample were described, presenting categorical variables as percentages and continuous variables as means and standard deviations (SD). Differences between groups were explored using χ2 for categorical data and Student's t-test for continuous data.

Logistic regression analyses were used to compare the rate of each of the binary outcome variables by migration status with white British native women considered as the reference group and differences between groups estimated using odds ratios (ORs). The adjusted regression model included maternal characteristics which may influence the outcome variables. These were informed by the literature and refined by the assessment of multicollinearity. Index of multiple deprivation (IMD) score, maternal age, and parity were therefore included as covariates in the adjusted analysis. Crude and adjusted ORs (OR and aOR) are therefore presented with 95% CIs. IMD is the official measure of relative deprivation for small areas in England and combines information from seven domains of deprivation (income, employment, education, health, crime, housing and environment) to give a deprivation score. In the multivariate logistic regression model for this study, there is no clear logical or theoretical basis for assuming any variable to be prior to any other, either in terms of its relevance to the research goal of explaining phenomena or in terms of a hypothetical causal structure of the data. For this reason, a simultaneous model of including independent variables in the multivariate logistic regression model was most appropriate.

Where significant associations between first generation migrant status and outcome variables were observed, multiple linear regression was employed to explore the extent to which maternal length of stay in the UK was associated with changes in outcomes. Statistical analysis was undertaken using SPSS V.24.

Results

Characteristics of the sample

There were a significantly higher proportion of adolescent mothers in all native groups compared to migrant groups except for second generation white British migrants (majority Irish immigrants). Approximately, 23.5 % of first-generation Pakistani migrants had parity of three or more compared to 17.1% among second generation Pakistani migrants and 7.2% of white British natives. Migrant women of both Pakistani and other ethnicities were significantly more likely to be married compared to native women in the same ethnic groups. Both mothers and fathers in

migrant groups were more likely to have educational qualifications equivalent to A level or higher; first generation Pakistani migrants were twice as likely than any other group to have never been employed and the highest levels of unemployment among fathers were in the native Pakistani men and native men of other ethnicities. Characteristics of the sample are shown in Table 1.

Exploratory analysis of differences in perinatal outcomes between migrant groups is shown in Table 2. The results suggest a higher prevalence of gestational diabetes among migrant groups with the highest rate being among first generation Pakistani migrants. There was also a higher incidence of low birthweight and a lower rate of macrosomia among these groups. The rate of low birthweight was highest among second generation migrants of Pakistani or other ethnicities.

Perinatal outcomes by Ethnicity and Migration Status

Table 3 presents a comparison of perinatal outcomes by ethnicity and migration status. First and second generation migrant Pakistani women and second-generation migrant women of other ethnicities had higher odds of delivering low birthweight babies in the adjusted analysis while; lower odds of macrosomia were also observed among these groups. First generation Pakistani migrants had increased odds of stillbirth, but it did not reach statistical significance. However decreased odds of preterm delivery, APGAR score below 7 at 1 minute and caesarean section were observed in this group of migrant women compare to native mothers.

Given the differing observations relating to preterm delivery and birthweight categories between migrant groups multiple linear regression analyses were conducted to examine the relationship between both birthweight and gestational age at delivery and length of stay in the UK for first generation migrants.

The multiple linear regression calculated to predict birthweight based on length of stay in the UK and adjusted for maternal age, maternal BMI, Index of Multiple Deprivation score, parity and gestational age at delivery found a significant regression equation ($F(6,3625)=418.1$, $p<0.001$), with an R^2 of 0.409. Predicted birthweight decreased 4.4 grams for each additional year of residence in the UK amongst first generation migrants. The multiple linear regression calculated to predict gestational age at delivery based on length of stay in the UK and adjusted for maternal age, maternal BMI, Index of Multiple Deprivation score and parity found a significant regression equation ($F(5,3626)=8.67$, $p<0.001$), with an R^2 of 0.012. Predicted gestational age at delivery decreased by 0.014 days for each additional year of residence in the UK amongst first generation migrants.

Discussion

Main findings

The results show some important differences in outcomes both by ethnicity and migration status. The results of this study support the previous literature suggesting higher odds of low birthweight and gestational diabetes in Pakistani women and lower odds of macrosomia (2,8). However, the results show that first generation Pakistani migrants had decreased odds of preterm delivery and APGAR score below 7 at 1 minute which were not apparent in other groups.

Examination of gestational age at delivery and birthweight for first generation migrants using multivariate linear regression suggested a statistically significant association between both variables and length of stay in the UK. This said the predicted change in outcomes in real terms was very small; a decrease of 4.4g in birthweight and 0.014 days gestation for each additional year of residence calls the clinical importance of this finding into question.

While the odds of gestational diabetes in both first- and second-generation Pakistani women in the present study were significantly higher compared to white British native women there were also differences between these two groups. Odds of gestational diabetes in first generation Pakistani migrants were 2.68 (CI 2.20 - 3.27) compared to 1.79 (CI 1.43 - 2.23) for second generation Pakistani migrants, meaning the odds for first generation migrants were almost double those for second generation migrants in the same ethnic group.

Strengths and limitations

The size and diversity of the Born in Bradford cohort is a significant strength of this study, particularly the availability of detailed information regarding migration histories. This analysis utilises this data in a way that is unique and adds important insights to the patterns of ethnic inequalities established in the existing knowledge base. This said, the analysis is limited for some outcomes by small numbers, particularly in relation to rare outcomes such as stillbirth, meaning robust conclusions are difficult to draw.

Interpretation

Previous studies examining the relationship between ethnicity and preterm birth have reported mixed results regarding Pakistani populations (9-11), suggesting that factors other than ethnicity may be stronger predictors of preterm birth risk. A previous retrospective study examining the relationships between ethnicity, maternal country of birth and preterm birth in over 4.5 million births in England and Wales found an increased risk of preterm birth in Pakistani mothers, however this risk was lower in mothers born outside the UK compared to UK born Pakistanis (12). This

suggests that the low clinical importance of the findings relating time since migration and preterm birth in the present study may, in part, be due to lower numbers of participants.

Associations between ethnicity, hyperglycaemia and perinatal outcomes have been previously investigated in the Born in Bradford cohort (13). In addition to examining birthweight this study also examined infant adiposity measured using skinfold thickness and cord blood leptin levels. The study found that while babies born to South Asian women were lighter, on average they had a higher body fat percentage when adjusted for birthweight compared to white British infants. These findings suggest that any attempts to address disparities in low birthweight babies must be mindful of the tendency for greater adiposity in South Asian infants and that the classification of low birthweight thresholds may need to be revisited to take account of ethnic variations in the determinants of adverse outcomes. To this end, ethnicity-specific birthweight distributions have been investigated with significant results. A study assessing birthweight distribution of babies with European, Chinese and South Asian heritage reported that on average infants born at 40 weeks gestation of European descent weighed 254.6g more than those of South Asian origin (14). The use of the proposed ethnicity-specific vs. general population based birthweight distributions in a further study found the former to be significantly better at identifying infants at increased risk of short-term neonatal morbidity (Apgar score <7 at 5 minutes, admission to the neonatal intensive care unit, ventilation, extended length of stay in hospital, hypothermia, hypoglycaemia, and infection) (15). Previous work in this programme of research has found lower rates of physical activity in Asian women (16). Due to the known benefit of physical activity perinatally in reducing the risk of gestational diabetes (17) these findings provide an evidence base for targeted implementation research.

The observed higher odds of stillbirth among first-generation Pakistani migrants and also the higher odds of preeclampsia in the Pakistani second generation were of a borderline statistical significance, which could be indicative of the need for a larger sample size for these outcomes. Similar patterns by ethnicity have been seen previously, (18) however the higher risk of pre-eclampsia in second-generation Pakistani mothers' merits further attention to investigate the potential interplay between ethnicity and acculturation.

The positive trend for the increased risk of stillbirth is in line with previous reports in which Pakistani ethnicity was identified as one of the significant risk factors for stillbirth alongside factors such as maternal obesity, smoking, pre-existing diabetes, socioeconomic inequalities and foetal growth restriction (19). Gardosi et.al. (20) identified unrecognised foetal growth restriction as the single largest risk factor and along with our findings this provides a solid evidence for the need for targeted preventive strategies.

Stillbirth may also be associated with higher prevalence of congenital abnormalities particularly considering that consanguineous marriages are also more common in this group (21). Previous study of the Born in Bradford cohort showed the risk of congenital abnormalities in infants of Pakistani origin was almost twice that of white British infants and that 37% of babies born in Pakistani families had parents in first-cousin unions (21). The current study potentially adds a further level of detail to these associations by highlighting the increased odds of stillbirth in first generation Pakistani migrants, however further investigation into these associations is needed.

There is a significant lack of evidence in the existing literature regarding the relationship between migration status of UK residents and perinatal health, and there is a tendency to focus on refugees and asylum seekers. It is possible that this highlights problems in grouping of 'migrants' vs. 'non-migrants' without consideration of the reasons for migration. Economic and family restoration migrants are likely to have very different characteristics compared to refugees and asylum seekers, for example, meaning the grouping of migrants as a homogenous group may be problematic. A recent systematic review evaluating maternal and perinatal outcomes of asylum seekers and undocumented migrants in Europe found evidence of increased risk of adverse outcomes in these groups, largely attributed to lack of access to health care and quality of services (22). This said the study only reviewed eleven eligible papers, highlighting the dearth of research in this area. Data regarding the reason for migration was not available in the Born in Bradford cohort; however, this is an important consideration for further research.

Conclusion

At the time of writing this is the first UK based study to examine the interplay between ethnicity and migration status and has uncovered some important differences, particularly between groups of women with shared ethnicity but different migration status. Further work is needed to examine the nuances of these associations, particularly regarding reasons for migration among first generation migrants. Work to develop appropriate interventions to address the identified inequalities is also needed.

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