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Naturalization of immigrants and perinatal mortality

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Background: Differences in neonatal mortality among immigrants have been documented in Belgium and elsewhere, and these disparities are poorly understood. Our objective was to compare perinatal mortality rates in immigrant mothers according to citizenship status. **Methods:** This was a population-based study using 2008 data from the Belgian birth register data pertaining to regions of Brussels and Wallonia. Odds ratio (OR) and 95% confidence intervals (95% CIs) for perinatal mortality according to naturalization status were calculated by logistic regression analyses adjusting for parents' medical and social characteristics. **Results:** Four hundred and thirty-seven perinatal deaths were registered among 60 881 births (7.2‰). Perinatal mortality rate varied according to the origin of the mother and her naturalization status: among immigrants, non-naturalized immigrants had a higher incidence of perinatal mortality (10.3‰) than their naturalized counterparts (6.1‰) with an adjusted OR of 2.2, 95% CI (1.1–4.5). **Conclusion:** In a country with a high frequency of naturalization, and universal access to health care, naturalized immigrant mothers experience less perinatal mortality than their not naturalized counterparts.

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Introduction

The decrease in perinatal mortality during the last decades has been attributed to socio-economic improvements and to better antenatal and neonatal care.¹ However, we face new socio-demographic changes such as advanced maternal age, multiple births and frequency of immigration. Immigrant women have contributed approximately one-third of all deliveries in Belgium in 2008.² Differences in obstetric outcome and neonatal mortality in

immigrants have been documented in Belgium and elsewhere, but these disparities are poorly understood.³

Studies have successively shown either positive¹ or negative⁴ associations between immigration and perinatal mortality. The effects of immigration on perinatal mortality differ according to geographical origin and destination. Discrepancies in study results may also reflect heterogeneity within immigrant subgroups in terms of socio-economic status, health behaviours and circumstances of immigration.⁵

Adjustment for background factors is not sufficient to explain differences of mortality rates among immigrants. This may be explained by the limitations in the available data on potentially important risk factors. However, adverse socio-economic factors explain more of the excess mortality risk among certain groups of immigrants than do parity and maternal age.⁶

In Europe 'integration' is a term often used to qualify a successful immigration process, and in regard to Belgian law naturalization and integration are tightly connected with naturalization being an important step towards integration. A recent review has suggested that perinatal outcome might vary by receiving country by means of integration policies, and risk of perinatal mortality was significantly reduced in countries with a strong integration policy.⁷ A high naturalization rate might be seen in societies with high levels of sensitivity to the needs of immigrant communities, and Belgium was then considered as having a strong integration policy.⁷ Accession to naturalization is granted according to several circumstances: principal residence in Belgium or genuine attachments to the country such as a job, friends or family, investments or debts, family reunification, work, studies, marriage or more recently, at birth if parents were born in Belgium. Minimum residence or attachment requirements for naturalization range from 2 years in the particular case of refugees to 3 years for others. Naturalization attainment does not depend on receiving country language or cultural knowledge, and no medical examination is required. The process for attribution of Belgian citizenship takes between 1 and 18 months, and successive liberalizations of access to citizenship in Belgium were introduced and have resulted in a very liberal naturalization policy.^{8,9}

Scarce literature thus exists regarding changes in birth outcomes among first-generation immigrants, and few studies have concentrated on perinatal mortality.^{5,7} As we could not find any study that investigates the impact of naturalization on obstetric outcome, we sought to evaluate the relationship between naturalization and perinatal outcome by comparing perinatal mortality rates in immigrant mothers according to citizenship status.

Methods

The objective is to examine differences in the occurrence of perinatal mortality according to the naturalization status of the mother.

Study design

This is a population-based study using birth certificates from the birth registry of 2008. Data pertain to all births in the regions of Brussels and Walloon, including the German Community of Belgium. The Brussels-Capital Region is one of the three Regions of Belgium. The Walloon Region is the southern region of Belgium. The small German-speaking minority is located in the east of Wallonia and forms the German-speaking community of Belgium.

Databases

The birth registry legally includes birth certificates of all live births and stillbirths from 500 grams or 22 weeks' gestation. The registry also includes births by women staying in Belgium illegally, asylum seekers and planned and unplanned home births.

No linkage is necessary as neonatal, maternal, socio-economic and medical forms are automatically linked with an identical file number. Medical data are filled by gynaecologists and midwives, and socio-economic data are filled with the parents at the civil registration service within 15 days of the birth. Data are checked monthly by the first author, and seemingly incorrect information (with the likelihood of being data errors) is sent back to the hospitals or city civil registration services for correction.

Data

Mothers and fathers were defined as immigrants or non-immigrants based on their nationality at birth, and immigrants were defined as naturalized or not naturalized based on their present nationality.

A particular subgroup includes the border countries: Germany, Luxembourg, France and the Netherlands. Inhabitants of the border zone are likely to cross the border to deliver in Belgian maternity units near the border and share common features with the Belgian nationals. Belgian citizens along with border-country natives were categorized as non-immigrants and comprise all women who were born with the Belgian or a border-country nationality and who did not abandon their original nationality. Immigrants were categorized as naturalized if their present nationality was Belgian or one of the four border-country nationalities.

In total, 61 562 births were registered in 2008. Nationality at birth was missing in only 640 births (1%) and present nationality in <0.1%. Forty-one women were Belgian or border-country natives at birth and had opted for another nationality at the time of delivery and were excluded. In total, 60 881 births were thus included in the analysis, from which 4.2% were border-country natives. No further exclusion of data was necessary.

We included all stillbirths and early neonatal deaths (<7 days after birth), expressed per 1000 live and stillbirths in the same year, according to the Euro-Peristat definition.¹⁰

Age was categorized as follows: <20 years; 20–34 years; ≥35 years. Previous stillbirth was noted if one or more previous stillbirths had occurred before the present birth. Parity was measured as primiparous (first birth) or multipara. Hypertension and diabetes (either gestational or permanent) were simply coded as present or absent. Education was categorized as follows (diploma completed): no education; sixth grade completed; ninth grade completed; high school completed; or college completed. Marital status was dichotomized into married or not. The father's employment status was dichotomized into active or non-active. If the mother was living alone, the father's employment status was categorized as non-active.

Analysis

We first calculated the perinatal mortality rate of immigrant and national women. Differences in percentages between the three groups were compared by chi-square analyses. Next, we calculated the distribution of socio-demographic and medical factors in each subgroup.

We conducted bivariate and multivariate analyses, and perinatal mortality was used as the dependent variable and naturalization status as an independent variable. Several multivariate logistic regression models were built: first, by including parity and maternal age, which are common confounders used in most studies assessing perinatal mortality and migration⁶; secondly, in an explicative view by adding gestational age, hypertension, diabetes and previous stillbirth to the first model; and thirdly, by building a model including the second model and parents' socio-economic characteristics. As education level was missing in 18% of cases and is difficult to assess in women <25 years, we built a fourth model with education restricted to women aged ≥25 years. Although multiple births were equally prevalent in immigrant subgroups, we repeated the logistic regression analyses for singletons to validate our results. Adjusted odds ratio (OR) and 95% confidence interval (95% CI) were derived from the model and likelihood-ratio test *P*-values are presented in the result tables. Goodness of fit for the final model was evaluated with the Hosmer–Lemeshow test. Models were tested for the presence of interactions and the graphic of residues against predicted values of losses was used for checking the hypothesis of non-correlation among errors. Statistical calculations were undertaken using the STATA software (version 10.0, College Station, TX, USA).

Results

Immigrant mothers accounted for 20 894 of 60 881 births (34.3%). In total, 39.8% of immigrant mothers had obtained Belgian or border-country citizenship. The largest nationality groups were from North Africa: Morocco, Tunisia and Algeria (11.2%), Europe (10.7%), former Belgian–African colonies or protectorates: Rwanda, Burundi and the Democratic Republic of the Congo (DRC) (2.9%) and Turkey (1.6%).

Four hundred and thirty-seven perinatal deaths were registered (437/60 881, 7.2‰). Stillbirths accounted for 76.9% of all perinatal deaths. These rates varied according to the origin of the mother and her naturalization status (Table 1). Differences in perinatal mortality rates were statistically significant between natives and immigrants, and among immigrants between naturalized and non-naturalized mothers. When observations were restricted to the most prevalent subgroups, perinatal mortality rates varied according to the specific origin, but were higher in non-naturalized mothers and fathers.

The malformation rate was 1.3% for both naturalized and non-naturalized mothers ($P=0.95$), and 1.2% for non-immigrants (P -value for non-immigrants vs. immigrants = 0.09).

Table 2 summarizes the distribution of medical and socio-demographic differences according to naturalization status. Non-naturalized immigrants had lower parity and were more likely to be <20-year old than their naturalized counterparts. They also had substantially less education and the fathers were seen to work less. Besides these comparisons among immigrants, risk factors such as diabetes, primiparity, previous stillbirth, age <20 years, less education, unemployed father were significantly less prevalent in non-immigrant compared with immigrant mothers, but rates of preterm birth and low birthweight were significantly higher (data not shown).

Table 1 Perinatal deaths according to parents' immigrant and naturalization status and region of origin

Immigration and naturalisation status	n (%)	P-value
Mother (n = 60881)		
Non-immigrants (n = 39987)	257 (6.4)	<0.01 ^a
All immigrants (n = 20894)	180 (8.6)	
Naturalized (n = 8376)	51 (6.1)	
Not naturalized (n = 12518)	129 (10.3)	<0.001 ^b
Specific subgroups (n = 17637) ^c		
Maghreb (Morocco, Algeria, Tunisia) (n = 6789)		
Naturalized (n = 3636)	25 (6.9)	<0.05 ^b
Not naturalized (n = 3153)	36 (12.4)	
Ex-colonies (Rwanda, Burundi, Congo DRC) (n = 1794)		
Naturalized (n = 750)	7 (9.3)	0.05 ^b
Not naturalized (n = 1044)	22 (21.1)	
Turkey (n = 1674)		
Naturalized (n = 981)	2 (2.0)	0.21 ^b
Not naturalized (n = 693)	4 (5.8)	
Former European Union-15 member states ^d (n = 3812)		
Naturalized (n = 1471)	6 (4.1)	0.17 ^b
Not naturalized (n = 2341)	18 (7.7)	
Europe others (n = 2673)		
Naturalized (n = 426)	3 (7.0)	0.37 ^b
Not naturalized (n = 2247)	27 (12.0)	
South-East Asia (n = 895)		
Naturalized (n = 308)	1 (3.2)	1.0 ^b
Not naturalized (n = 587)	3 (5.1)	
Father (n = 54 950)		
Non-immigrants (n = 36 371)	182 (5.0)	<0.05 ^a
All immigrants (n = 18 579)	123 (6.6)	
Naturalized (n = 9737)	45 (5.1)	<0.05 ^b
Not naturalized (n = 8842)	78 (8.0)	

a: non-immigrants compared to immigrants.
 b: naturalized compared to non-naturalized immigrants.
 c: restricted to the most prevalent subgroups.
 d: Austria, Denmark, Spain, Finland, Greece, Ireland, Italy, Portugal, United Kingdom, Sweden.

Table 2 Medical and social characteristics according to mothers' immigrant and naturalization status

Naturalisation status	Primipara	Maternal age <20 years	Previous stillbirth	Birthweight <2500 g	Gestational age <37 weeks	HT	Diabetes	Multiple birth	No education	Married	Father employed	Immigrant father
Naturalized immigrant (N = 8376), n (%)	n (%) or mean ± standard deviation 2933 (35.3)	130 (1.6)	104 (1.3)	555 (6.7)	642 (7.7)	250 (3.0)	375 (4.5)	288 (3.4)	182 (2.6)	6112 (72.8)	5889 (71.5)	6379 (79.4)
(missing)	48	2	48	19	18	11	11	0	1308	7	130	336
Not naturalized immigrant (N = 12 518), n (%)	5589 (45.0) ^a	403 (3.2) ^a	158 (1.3)	846 (6.8)	945 (7.6)	383 (3.1)	465 (3.7) ^a	407 (3.3)	479 (4.9) ^a	8922 (72.0)	8036 (66.2) ^a	9165 (80.7)
(missing)	92	3	92	13	27	19	18	0	2816	127	378	1163

a: difference statistically significant between naturalized and non-naturalized immigrants with a $P < 0.01$.
 HT: hypertension.

Table 3 Crude and adjusted ORs of perinatal mortality according to medical and social characteristics in naturalized and non-naturalized mothers

Non-naturalized mother vs. naturalized mother	Crude OR (95% CI)	aOR (95% CI)			
		Model 1 ^a	Model 2 ^b	Model 3 ^c	Model 4 ^d
Total population (<i>n</i> = 20 894)	1.7 (1.2–2.4)	1.5 (1.1–2.1)	1.7 (1.2–2.5)	1.5 (1.0–2.3)	2.2 (1.1–4.5)
Number of observations		20 749	20 686	19 271	14 276
Model (χ^2)		10.8	468.1	366.5	162.9
<i>P</i> (χ^2)		<0.05	<0.001	<0.001	<0.001
Pseudo <i>R</i> ² (%)		0.6	28.9	28.1	30.3
Maghreb (Morocco, Algeria, Tunisia) (<i>n</i> = 6789)	1.7 (1.0–2.8)	1.7 (1.0–2.8)	1.8 (1.0–3.3)		
Ex-colonies (Rwanda, Burundi, Congo DRC) (<i>n</i> = 1794)	2.3 (1.0–5.4)	1.8 (0.7–4.4)	1.5 (0.6–4.3)		
Former European Union-15 member states (<i>n</i> = 3812)	1.9 (0.7–4.8)	1.8 (0.7–4.6)	8.2 (1.4–49.1)		
Europe others (<i>n</i> = 2673)	1.7 (0.5–5.7)	1.9 (0.6–6.2)	2.6 (0.6–12.0)		
Turkey (<i>n</i> = 1674)	2.8 (0.5–15.6)	1.3 (0.2–9.6)	NC		
South-East Asia (<i>n</i> = 895)	1.6 (0.2–15.2)	1.6 (0.2–15.1)	NC		

a: aOR, adjusted OR from a multivariate logistic regression model including maternal naturalization status, maternal age and parity.

b: aOR, adjusted OR from a multivariate logistic regression model including Model 1 and gestational age, hypertension, diabetes, previous stillbirth.

c: aOR, adjusted OR from a multivariate logistic regression model including Model 2 and marital status, father occupation and father citizenship status.

d: aOR, adjusted OR from a multivariate logistic regression model including Model 3 and maternal education in women aged ≥ 25 years (*n* = 18 982).

NC: not calculable.

Results of bivariate and multivariate analyses are presented in Table 3. Model 1 uses adjustment for parity and maternal age. This model explains <1% of the excess mortality risk. Model 2 uses adjustment for all maternal characteristics and Model 3 adds father characteristics. These models, including a large set of covariates, explain up to 28% of the excess perinatal mortality. Adding education level in Model 4 raises this proportion to 30%. Adjusted odds for perinatal mortality were similar or greater than crude odds. Even after adjustment, differences in perinatal mortality rates remain statistically significant, and the odds adjusted for confounders were higher for non-naturalized immigrants by 50–70% in Models 1–3 and by 120% in Model 4. We found similar OR after repeating analyses for single births only, with a crude OR for perinatal mortality in non-naturalized immigrants compared with naturalized immigrants of 1.6 (95% CI: 1.1–2.2). ORs and 95% CI for the four different logistic models were 1.4 (1.0–2.0) for Model 1, 1.6 (1.0–2.3) for Model 2, 1.4 (0.9–2.2) for Model 3 and 1.9 (0.9–4.2) for Model 4, respectively.

Adjusted odds for perinatal mortality in the most prevalent subgroups tended towards higher perinatal mortality in non-naturalized mothers.

Discussion

The naturalization status of immigrants was associated with a decreased risk of perinatal mortality in multivariate analyses. Although mortality rates varied according to the region or country of origin, when analysing specifically the most prevalent subgroups mortality rates were higher in non-naturalized mothers.

We cannot exclude that residual confounding might explain our results, even though we did adjust for medical and social characteristics. Also, the relationship between naturalization and perinatal mortality is most likely not direct, but hinges on a large and complex social process of integration facilitation including special forms of services.⁹ It is important to keep in mind that both naturalized and non-naturalized immigrants are heterogeneous groups: they do not constitute a common cohort from which some individuals have attained receiving country citizenship. The immigrants for whom better outcomes are observed might have been already better integrated prior to naturalization. However, a recent review has shown longitudinal data from the USA and Europe

that compare immigrants' labour market outcomes before and after naturalization. The evidence points to an immediate positive effect on the wages and the employment rate after controlling for factors as education, occupation, prior experience, age, length of stay and country of origin. This improvement seems to be attributable to a mix of factors involving immigrants' self-investment, the removal of institutional barriers and employer behaviour.⁹ Similarly, a study based on Belgium census data has shown a better occupation rate in naturalized men and women even after controlling for education.¹¹ Such data are not available for health outcomes and several characteristics should be discussed. First, mothers in illegal residency are integrated in the non-naturalized group, as well as diplomat women or diplomats' wives. However, refugees accounted for 175 births, and did not experience any death (data not shown), contrary to recent data showing higher mortality rates,⁶ but the group is too small to make any conclusions. Secondly, accession to naturalization is granted according to several circumstances, and most immigrants take up the nationality between 25 and 40 years of age.⁸ These factors may have an impact on length of residence before naturalization and may in turn affect perinatal outcome. A recent study has observed a higher stillbirth rate in newcomers with an OR of 1.2 (1.1–1.4) compared with mothers who had been in Sweden for at least 5 years, but this result was only adjusted for parity and might not be generalizable.¹² Thirdly, background characteristics of non-naturalized mothers are somewhat different: they tend to be <20 years, primiparous and less educated than their naturalized counterparts. We have tried to preclude the impact of these differences by adjusting for all these potential confounders.

It would be of interest in future studies to concentrate on circumstances of immigration. There is scarce data on the reasons for immigration, and no reliable data about illegal residence in Belgium. Most legal immigrants have asked a visa for family reunification, followed by students, asylum seekers and workers.⁸ The naturalization rate in Belgium ranges from 30% for the former 15 European Union member countries to 70% for Turkish immigrants.⁸ In our study, naturalization rates range from 15.9% for Central and Oriental Europe immigrants to 58.6% for Turkish immigrants (Table 1). The trend in our cohort is similar but lower than the national trend. These lower rates might indicate that the proportion of newcomers is higher in immigrant mothers than in

the total immigrant population; however, immigrant mothers are younger than the total immigrant population.⁸

Besides differences between naturalized and non-naturalized mothers, the perinatal mortality rates varied according to the region of origin. The association between migration and birth outcome is not uniform but depends on the combination of maternal origin and actual destination, some immigrant mothers being at higher risk if migrating to some regions but at lower risk in other regions.⁵ Turkish women have low perinatal mortality rates in this series, which contrasts with data from a Dutch and a Danish study but our Turkish subgroup is small and makes any explanation speculative.^{6,13,14} Higher mortality has been reported for North Africans in France but not in Norway.⁶ It has also been suggested that women from a former colony had a higher mortality risk in the European receiving country than in other receiving countries without a colonial history.⁶ Moreover, we cannot exclude that socio-economic and medical characteristics may have different impacts within specific subgroups of the population.¹⁵ We were unable to address this issue with the multivariate models because of too small categories and this is a limitation of this study. However, we have adjusted for medical characteristics in multivariate models for the most prevalent subgroups and OR still tended towards higher perinatal mortality in non-naturalized mothers. Despite this limitation, and even if variability exists among immigrants, accession to receiving country citizenship is related with a decreased risk of perinatal mortality within the same generation in the most prevalent subgroups.

Other limitations of this study are the lack of data on smoking and body mass index and the high rate of missing data on education levels that make these observations less reliable. Cultural assimilation that could be related with naturalization is associated with fostering bad dietary habits and lifestyles such as smoking and increased maternal weight, which in turn should affect perinatal mortality rates.^{16,17} If a bias exists regarding these factors, adjusting would result in increasing the beneficial effect of naturalization on the perinatal mortality rate in our study.

The strength of our study is that it is population based, with a low rate of missing data and a large set of covariates. Only a minority of the studies reporting higher stillbirth and neonatal mortality rates for immigrants have utilized statistical methods to adjust for medical, demographic and socio-economic variables.⁶ Moreover, we have included father's background characteristics in our analysis, which to our knowledge has only been done earlier in a study comparing mortality rates in Mexican immigrants with their American counterparts, showing the importance of this parameter.^{6,18} This is also the first study to assess the relationship between naturalization and pregnancy outcome, although previous studies have suggested the importance of integration policies in assessing perinatal health of immigrants.^{5,7}

Cultural orientation, attitude towards health care utilization and health behaviour after arrival could not be addressed with vital statistics. It is not known how these factors may be influenced by naturalization. Health providers are mostly not aware of the naturalization status but are rather always aware of the region of origin of the patient, and misinterpretation or insufficient medical attention related to an immigrant status should affect similarly naturalized and non-naturalized mothers.¹⁹ From the patient's perspective, naturalization in itself offers access to a larger set of maternity care, to social benefits and might offer self-confidence, but it is not possible to know the extent of these hypotheses. From a medical perspective, increasing attention from medical providers towards immigrant mothers' needs is necessary. The identification of behavioural and structural differences among naturalized and non-naturalized pregnant women should make it possible to improve perinatal mortality rates.

In conclusion, naturalized immigrant mothers experience less perinatal mortality than their non-naturalized counterparts. Future

studies should explore the interaction between different regions of origin and circumstances for immigration and naturalization.

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Conflicts of interest: None declared.

Key points

- This is the first study to assess the relationship between naturalization and pregnancy outcome within the same generation.
- When analysing specifically the most prevalent nationality subgroups, mortality rates were higher in non-naturalized mothers regardless their specific mortality rate.
- These new findings on the relationship between naturalization status and health outcome should be taken into account when discussing liberalization of naturalization policies.
- Some factors continue to be unfavourable regarding perinatal mortality in immigrants.
- The identification of behavioural and structural differences among naturalized and non-naturalized pregnant women should make it possible to improve perinatal mortality rates.

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Excess mortality in women of reproductive age from low-income countries: a Swedish national register study

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Background: Cause-of-death statistics is widely used to monitor the health of a population. African immigrants have, in several European studies, shown to be at an increased risk of maternal death, but few studies have investigated cause-specific mortality rates in female immigrants. **Methods:** In this national study, based on the Swedish Cause of Death Register, we studied 27 957 women of reproductive age (aged 15–49 years) who died between 1988 and 2007. Age-standardized mortality rates per 100 000 person years and relative risks for death and underlying causes of death, grouped according to the International Statistical Classification of Diseases and Related Health Problems, 10th Revision, were calculated and compared between women born in Sweden and in low-, middle- and high-income countries. **Results:** The total age-standardized mortality rate per 100 000 person years was significantly higher for women born in low-income (84.4) and high-income countries (83.7), but lower for women born in middle-income countries (57.5), as compared with Swedish-born women (68.1). The relative risk of dying from infectious disease was 15.0 (95% confidence interval 10.8–20.7) and diseases related to pregnancy was 6.6 (95% confidence interval 2.6–16.5) for women born in low-income countries, as compared to Swedish-born women. **Conclusions:** Women born in low-income countries are at the highest risk of dying during reproductive age in Sweden, with the largest discrepancy in mortality rates seen for infectious diseases and diseases related to pregnancy, a cause of death pattern similar to the one in their countries of birth. The World Bank classification of economies may be a useful tool in migration research.

Introduction

Substantial inequalities in mortality between ethnic groups have been found in several countries.^{1–3} The mortality risk of immigrant populations may be higher or lower than the native population and can vary greatly by cause of death, cause of migration, origin, sex and age.^{4–8} Few studies have investigated cause-specific mortality rates in female immigrants.^{4–6,8} To reduce excess mortality, one needs to understand the factors causing the differences in risks. Cause-of-death statistics are widely used to monitor the health of the general population or specific groups of the population. Therefore, studies on causes of death are important for health planning and setting priorities to disease prevention.

Women of reproductive age are exposed to the risk of pregnancy complications, which globally account for 14% of deaths in this age group.⁹ Studies from the UK, France and The Netherlands indicate that maternal mortality rates have tended to increase, whereby immigrants, especially Africans, have been shown to have a higher risk of maternal mortality.^{10–12} However, it has not always been possible to establish a causal link by adjusting for obstetric or well-known social risk factors.

Sweden today is a multi-ethnic society, having a higher proportion of foreign-born inhabitants than Great Britain or the USA.¹³ In 2007, 17% of all women of reproductive age in Sweden were foreign born.¹⁴ After the culmination of the labour immigration of the 1950s and 1960s, new waves of refugees from conflict