Immigrants and Preterm Births: A Nationwide Epidemiological Study in Sweden.

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Immigrants and preterm births: a nationwide epidemiological study in Sweden

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ABSTRACT

Objective. To examine, nationwide, if there is an association between country of birth in mothers and preterm birth and to study whether any such association remains in second-generation immigrant women.

Methods. In this follow-up study, a nationwide research database located at Lund University, Sweden, was used to identify all preterm born singletons in Sweden between January 1, 1982, and December 31, 2006. Incidence ratios were standardized with regard to maternal age at birth, marital status, geographical region, body height, and smoking history as well as period of birth, family income, and gender of the infant. Singletons of mothers born in Sweden were used as reference group.

Results. There were 2 192 843 records for singletons over the study period, of whom 4.9% were preterm births and 0.8% were very preterm births. Increased risks of preterm birth was observed for mothers from Austria, Yugoslavia, Romania, Central Europe, and Asia. Increased risks of very preterm birth was observed for mothers from Eastern Europe, Central Europe, Africa, and Asia; these increased risks disappeared, however, in the second-generation female immigrants.

Conclusion. Country of birth in mothers affected the risk of preterm birth; maternity care should pay a special attention to women from certain population groups.

Key words: Migrants, preterm births, risk factors, incidence, Sweden

INTRODUCTION

The rate of preterm birth (PTB) is increasing in the United States and in Sweden, affecting more than 450,000 children each year in both countries combined. These infants have a greater risk of morbidity and disability compared with full-term infants, and the rates are particularly high among poor and ethnic minority populations. Medical advances, such as infertility treatments, have also contributed to the increased rates of PTB. Unfortunately, prevention has been disappointing and largely unsuccessful, in part because the etiology of PTB is poorly understood. Maternal education is one aspect of socioeconomic status that most consistently predicts poor birth outcomes [1]. Other maternal demographic, social and health-related factors have been associated with these adverse birth outcomes, such as single marital status [2], smoking [3-11], diabetes [12-14] and low social capital [15]. For example, we recently showed that women from Turkey, Iran, Asia, and Latin America, who in Sweden often live in segregated, deprived neighborhoods, [16] had more than a 50% higher risk of non-normal birth outcomes than Swedish-born women [17]. In other previous studies, we have shown that adverse health behaviors (e.g., smoking, poor diet, inactivity) that may be associated with PTB are more prevalent in deprived settings [18].

Sweden, like many countries, has experienced dramatic demographic changes during the last few decades. Due to increasing global migration, it has become a multicultural society in the new millennium. Today, approximately 20% of all people living in Sweden are first- or second-generation immigrants [19]. This large influx of immigrants, together with the nationwide health and sociodemographic data available in national registers, provides a unique opportunity to study risk of poor birth outcomes in first- and second-generation immigrants from multiple countries and regions around the world and compare the risk in these groups with the risk in native-born Swedes. The nationwide data incorporates information on the entire population over a

period of 30 years, including all Swedish born second-generation immigrants registered with their biological parents in Sweden.

Our first aim is to determine whether country of birth affects the risk of preterm birth among immigrants after accounting for maternal age at birth, marital status, geographical region, body height, and smoking history as well as period of birth, family income, and gender of the infant. The second aim is to study whether any such association remains in the second-generation immigrants.

MATERIAL AND METHODS

Data Sources

Data used in this study were retrieved from a national research database, the WomMed II Database, located at the Center for Primary Health Care Research at Lund University. This database contains information from the Swedish Medical Birth Register, i.e., on all pregnancies, prenatal care, and birth records, hospital admissions, and death records for children and mothers in Sweden between 1973 and 2006. This register covers 99% of all births in Sweden beginning in 1973 and includes prospectively collected information about complications during pregnancy and delivery [20]. WomMed II database also contains data from the National Board of Health and Welfare (in-care register, and death register), and Statistics Sweden (population register and multi-generational data). In the present follow-up from January 1, 1982 to December 31, 2006, a total of 2 192 843 singleton children with their mothers were identified.

Definition of Variables

Outcome variables

PTB (Preterm birth) was defined as <37 weeks

Very PTB was defined as <33 weeks

Individual-level sociodemographic factors

Sex: Boys and girls.

Maternal age at birth: divided into 5-year age groups as follows: 20-24, 25-29, 30-34, and 35-44 years.

Period of birth: divided into 5-year groups from 1982 through 2006.

Marital status: based on the mother's marital status at the time of birth and divided into two groups: married/co-habiting and never married/widowed/divorced.

Family income: based on the mother's family income in the year of the birth, divided by the number of people in the family, i.e., individual family income per capita. This variable was provided by Statistics Sweden (the Swedish Government-owned statistics bureau). The income parameter also took into consideration the ages of people in the family and used a weighted system whereby small children were given lower weights than adolescents and adults. The calculation procedure was performed as follows: the sum of all family members' incomes was multiplied by the individual's consumption weight divided by the family members' total consumption weight. The final variable was calculated as empirical quartiles from the distribution.

Geographic region of residence was divided into (1) large cities (cities with a population of more than 200,000, i.e., Stockholm, Gothenburg, and Malmö), (2) middle-size towns, and (3) small towns/rural areas (according to the Swedish 1990 Census). Mother's geographic region of residence was used as a proxy for the family's region of residence.

Employment: based on the mother's employment status at the time of the birth and divided into two groups: yes and no.

Maternal body height: based on the mother's body height.

Smoking history: based on the mother's smoking history during the pregnancy and divided into three groups: yes, no, and missing smoking history.

Immigration status: The WomMed II Database includes people from 64 countries and regions of birth. Immigration from a number of these countries and regions began relatively recently, so the number of people may be relatively small in certain categories. For this reason (less than 10 cases of any SGA births in the children), these countries of birth were excluded from the study. As a result, we included 10 regions (Nordic countries, Southern Europe, Western Europe, Eastern Europe, Baltic countries, Central Europe, Africa, North America, Latin America, and Asia) and 23 countries (Denmark, Finland, Norway, Greece, Italy, Great Britain/Ireland, Germany, Austria, (former) Yugoslavia, Croatia, Romania, Bulgaria, Estonia, Poland, Hungary, Chile, Turkey, Lebanon, Iran, Iraq, and Russia) in our analysis.

Statistical analysis

Risks for PTB births were calculated by maternal birth country, using estimates obtained in logistic regression analysis. Odds ratios (ORs) with a 95% confidence intervals are presented. All risk estimates were adjusted for maternal age at birth, marital status, geographical region, body height, and smoking history as well as period of birth, family income, and gender of the infant. The reference group in the analyses was children with both parents born in Sweden. Because the initial sex-specific analysis showed no sex-specific effects, data are given for both sexes together. We used SAS version 9.2 for the statistical analysis [21].

Ethical considerations

This study was approved by the Ethics Committee of the Lund University, Malmö, Sweden.

RESULTS

The first singletons of the native-born Swedish mothers constituted by far the largest group in our study. They constituted about 1,874,567 individuals; 91,849 singletons were preterm born and 15,172 were very preterm born (Table 1). This group was the reference category in the OR calculations. A total of 15,893 and 2,868 singleton children whose mothers were born outside Sweden were preterm born or very preterm born. PTB represented 4.9% and 5.0% of the births in Swedish-born and foreign-born parents, respectively. PTB birth were progressively prevalent among both Swedish-born and foreign-born mothers for the variables older maternal age at first birth, never married/widowed,/divorced, low family income, short stature, and a positive smoking history.

Table 2 shows ORs of PTB in singleton children by maternal country of birth. The risk of PTB was significantly increased among children of Austrian (1.37), Yugoslavian (1.11), Romanina (1.28), Central European (1.29) (Poland (1.30), Hungary (1.43), and Asian (1.07) (Iran (1.11) mothers. Children to mothers from Spain, Western Europe (the Netherlands, Great Britain and Ireland, and Germany), the Baltic Countries, Africa, Turkey, and Lebanon had decreased risks of being born preterm.

The risks of very PTB in singleton children by maternal country of birth was calculated separately. The risks of very PTB were increased among children to mothers from Eastern Europe

(Yugoslavia), Central Europe, Africa, and Asia (Iraq) compared to the control group. Children of Finnish mothers also had a decreased risk of very PTB.

To ascertain whether or not the increased or decreased risk of PTB in first-generation immigrant women was present in the next generation, ORs in second-generation immigrant women were calculated. The odds for PTB in the children were analyzed in the second generation by their grandmother's birth country (Table 3). Because of the limited numbers of observed events in some countries, we only used selected regions and countries. However, no large significant effects were observed, except for somewhat decreased risks in mothers originating from Nordic or a Western European countries.

DISCUSSION

The results of this study indicate that country of birth affects risk of PTB and very PTB birth in first-generation immigrant women. Mothers from Central Europe, Africa, and Asia had a significantly increased risk of delivering PTB and very PTB singletons. To our knowledge, this is the first large-scale study to investigate the association between immigration status and risk of PTB and very PTB births in first- and second-generation immigrant women; in total around 2.2 million singleton births were included in the study.

The findings of the present study represent new knowledge because the study was conducted in Sweden, which has a universal health care system including maternity clinics that cover urban as well as rural areas in the entire country. The Swedish maternity clinics offer health care free of charge to all pregnant women in Sweden. However, our findings show that even in an egalitarian

country like Sweden that offers free health care to all pregnant women there are significant individual-level associations with PTB and very PTB. We found that singletons whose mothers had a low level of family income, which can be seen as a proxy for low socioeconomic status, had a higher frequency of PTB and very PTB events. In addition, the proportion of mothers with a low family income was higher in foreign-born mothers than in native Swedish mothers (43.4% vs 20.9%).

Family income is one aspect of socioeconomic status (SES) that most consistently predicts poor birth outcomes[1]. Socioeconomic disparities in PTB are consistent findings in perinatal epidemiology both in Sweden, other European countries, and the U.S.[22-27]. For example, even in such countries as Sweden [28], Finland [29], Scotland [30], and Canada [31] with smaller socioeconomic differences than in the U.S. and universal access to high-quality prenatal care [22], there are higher rates of PTB among mothers with low income than those with high income. A Canadian case-control study found that mothers with low income had a three-fold increased odds of having preterm premature rupture of membranes [32]. Other work has shown that deterioration of SES conditions for women of reproductive age increases the risk of PTB [33]. In the U.S., data from the National Maternal and Infant Health Survey demonstrated that low educational and occupational status, especially among white mothers and fathers, and African American fathers, were significantly associated with premature delivery [22]. In addition, a study from Quebec, Canada, found that single mothers had increased risks of PTB [34].

Our findings that immigrants from Central Europe, Africa and Asia had significantly increased odds of PTB and very PTB compared with women born in Sweden are partly consistent with a previous study that showed that foreign-born women in Sweden have an increased risk of PTB

[28]. In Norway, the proportion of preterm infants was substantially larger in Asians and North Africans [27]. Socio-cultural differences in pregnancy strategies, suboptimal performance of health care routines in the perinatal care system, delay in seeking health care, inadequate medication and interpersonal miscommunication may lie behind these differences [35]. In addition, smoking, undernutrition, and diabetes have been shown to be independent determinants of PTB. Diabetes mellitus, which is increasing rapidly in women of childbearing ages, will exert an increasing burden on these birth outcomes, especially among low-income women. For example, in northern California there has been an increase in the yearly cumulative incidence of gestational diabetes mellitus independent of changes in age and ethnicity of the study population.

Many refugees have been forced to migrate and, in the migration process, they face a new society and a new language. They may also lose their social, cultural, and economic connections with their country of origin. Immigrants may often be unemployed and/or live in deprived neighborhoods, which puts them under strong pressure in their daily life.

The present study found reduced risks of PTB among women from Western European countries, Baltic countries, Africa, Turkey, and Lebanon, compared to native-born Swedish women. This is partly in agreement with the reported decreased risks of PTB in black and Hispanic migrant women in the USA [36]. In addition, we found several decreased risks for PTB among the first-generation immigrant women, but this advantage disappeared among their second-generation offspring. This is in agreement with previously reported findings from the USA [37]. The findings that the second-generation immigrant women became more similar to the reference group could partly be explained by environmental factors in the host country rather than genetic factors in the immigrant women. Similar birth outcomes were found in Nordic-born immigrant women. Underlying

mechanisms may be that Nordic countries are rather homogeneous in terms of language and culture [38].

The present study has several limitations. First, we did not have information on maternal risk factors such as excessive alcohol drinking and/or drug use that may be related to the risk of PTB and very PTB. It is also possible that residual confounding exists because socioeconomic status cannot be measured entirely by family income, educational attainment, and employment status.

This study also has a number of strengths. For instance, our study population included a well-defined open cohort of first- and second-generation immigrant women. Because of the civic registration number assigned to each individual in Sweden, it was possible to trace the records of every person for the whole follow-up period. Data on socioeconomic status were nearly 100% complete.

CONCLUSION

The findings of the present study showed that the odds of PTB and very PTB were increased or decreased in some first-generation immigrant women and that these effects disappeared in the second-generation. Maternity care should pay a special attention to women from certain population groups.

Conflict of Interest Statement

There are no conflicts of interest.

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Table 1. Total population and PTB and very PTB events in singleton births

	Mother born in Sweden						Foreign born mother					
	Total population		PTB events		Very PTB events		Total population		PTB events		Very PTB events	
Characteristics	No.	%	No.	Frequency (%)	No.	Frequency (%)	No.	%	No.	Frequency (%)	No.	Frequency (%)
Total population	1874567		91849	4.9	15172	0.8	318276		15893	5.0	2868	0.9
Age at birth (years)												
20-24	314048	16.8	17557	5.6	2798	0.9	61500	19.3	3063	5.0	487	0.8
25-29	674816	36.0	31893	4.7	4951	0.7	102651	32.3	4482	4.4	780	0.8
30-34	591186	31.5	26571	4.5	4469	0.8	93611	29.4	4535	4.8	794	0.8
35-44	294517	15.7	15828	5.4	2954	1.0	60514	19.0	3813	6.3	807	1.3
Period of birth (years)												
1982-1986	339641	18.1	18174	5.4	2752	0.8	42414	13.3	2461	5.8	399	0.9
1987-1991	445715	23.8	22391	5.0	3670	0.8	59870	18.8	3110	5.2	547	0.9
1992-1996	417657	22.3	19740	4.7	3341	0.8	73078	23.0	3620	5.0	669	0.9
1997-2001	318859	17.0	15006	4.7	2594	0.8	66197	20.8	3124	4.7	560	0.8
2002-2006	352695	18.8	16538	4.7	2815	0.8	76717	24.1	3578	4.7	693	0.9
Marital status												
Married/co-habiting	994808	53.1	46151	4.6	7225	0.7	232716	73.1	11163	4.8	2029	0.9
Never married, widowed, divorced	879759	46.9	45698	5.2	7947	0.9	85560	26.9	4730	5.5	839	1.0
Family income												
Low income	391063	20.9	22125	5.7	4013	1.0	138211	43.4	7109	5.1	1308	0.9
Middle-low income	491353	26.2	24232	4.9	3805	0.8	69121	21.7	3339	4.8	583	0.8
Middle-high income	476332	25.4	22233	4.7	3526	0.7	54901	17.2	2770	5.0	526	1.0
High income	515819	27.5	23259	4.5	3828	0.7	56043	17.6	2675	4.8	451	0.8
Urban/rural status												
Large cities	576111	30.7	25855	4.5	4277	0.7	93084	29.2	4808	5.2	850	0.9
Middle-sized towns	701294	37.4	35638	5.1	5854	0.8	58658	18.4	3232	5.5	563	1.0
Small towns/rural areas	597162	31.9	30356	5.1	5041	0.8	166534	52.3	7853	4.7	1455	0.9
Employment												
Yes	1504142	80.2	73127	4.9	12031	0.8	159565	50.1	8198	5.1	1445	0.9
Non	370425	19.8	18722	5.1	3141	0.8	158711	49.9	7695	4.8	1423	0.9
Height (cm)												
<150	2036	0.1	195	9.6	34	1.7	4343	1.4	324	7.5	48	1.1
150-159	157527	8.4	9881	6.3	1582	1.0	77849	24.5	4392	5.6	773	1.0
160-169	936324	49.9	46504	5.0	7401	0.8	149759	47.1	6919	4.6	1204	0.8
170-179	522935	27.9	21319	4.1	3513	0.7	44418	14.0	1791	4.0	339	0.8
>=180	28152	1.5	994	3.5	172	0.6	1994	0.6	82	4.1	16	0.8
Missing	227593	12.1	12956	5.7	2470	1.1	39913	12.5	2385	6.0	488	1.2
Smoking history												
No	1504783	80.3	68957	4.6	10966	0.7	266347	83.7	12446	4.7	2182	0.8
Yes	369784	19.7	22892	6.2	4206	1.1	51929	16.3	3447	6.6	686	1.3

Table 2. Risks of PTB and very PTB births by maternal birth country*

	PTB				Very PTB			
Birth country in mother	O	OR	95% CI		O	OR	95% CI	
Nordic countries	4000	0.99	0.96	1.03	649	0.96	0.89	1.04
Denmark	483	1.05	0.95	1.15	87	1.11	0.90	1.38
Finland	2821	0.99	0.95	1.03	433	**0.90**	**0.82**	**0.99**
Norway	613	1.01	0.93	1.09	116	1.12	0.93	1.34
Southern Europe	334	0.90	0.81	1.00	60	1.00	0.78	1.29
France	56	0.88	0.68	1.16	12	1.15	0.65	2.03
Greece	115	0.98	0.81	1.18	22	1.19	0.78	1.82
Western Europe	530	**0.88**	**0.81**	**0.96**	84	0.84	0.67	1.04
Great Britain and Ireland	142	**0.80**	**0.67**	**0.94**	22	0.76	0.50	1.15
Germany	248	**0.87**	**0.76**	**0.98**	38	0.79	0.57	1.09
Austria	53	**1.37**	**1.04**	**1.81**	8	1.22	0.61	2.45
Eastern Europe	1672	1.00	0.95	1.06	352	**1.26**	**1.13**	**1.40**
Yugoslavia	993	**1.09**	**1.02**	**1.16**	215	**1.40**	**1.22**	**1.61**
Romania	162	**1.28**	**1.09**	**1.50**	25	1.18	0.80	1.75
Baltic countries	50	**0.72**	**0.54**	**0.95**	6	0.51	0.23	1.15
Central Europe	1096	**1.29**	**1.21**	**1.37**	249	**1.75**	**1.54**	**1.98**
Poland	847	**1.30**	**1.21**	**1.40**	200	**1.83**	**1.59**	**2.10**
Hungary	166	**1.43**	**1.22**	**1.68**	31	**1.60**	**1.12**	**2.28**
Africa	1273	**0.92**	**0.87**	**0.97**	286	**1.24**	**1.10**	**1.40**
North America	187	0.90	0.78	1.04	32	0.93	0.66	1.32
Latin America	833	1.01	0.94	1.08	142	1.05	0.89	1.25
Chile	511	1.07	0.98	1.17	77	0.98	0.79	1.23
Asia	5518	**1.07**	**1.03**	**1.10**	932	**1.11**	**1.03**	**1.19**
Turkey	792	**0.90**	**0.83**	**0.96**	145	1.02	0.86	1.20
Lebanon	538	**0.86**	**0.78**	**0.93**	91	0.90	0.73	1.11
Iran	649	**1.11**	**1.03**	**1.21**	128	**1.33**	**1.12**	**1.59**
Iraq	820	0.95	0.88	1.02	158	1.11	0.95	1.31
Russia	211	1.00	0.87	1.15	42	1.17	0.86	1.59

O = observed events; OR = odd ratios; CI = confidence interval.

*Analysis adjusted by maternal age at birth, family income, period of birth, geographical region, maternal marital status, maternal length, and maternal smoking history. Children with Swedish-born mother were used as reference.

Table 3. Risks of PTB births in the second generation immigrant women by the children's grandmothers' birth country*

Birth country in grandmother	O	OR	95% CI	
Nordic countries	865	**0.91**	**0.85**	**0.98**
Southern Europe	42	0.91	0.66	1.24
Western Europe	59	**0.76**	**0.58**	**0.99**
Great Britain and Ireland	12	1.08	0.60	1.94
Germany	39	0.75	0.55	1.04
Eastern Europe	126	0.90	0.76	1.08
Yugoslavia	112	0.94	0.78	1.14
Central Europe	70	0.87	0.68	1.10
Poland	50	1.00	0.75	1.33
Lartin America	15	0.76	0.45	1.27
Asia	112	0.96	0.79	1.16
Turkey	77	0.94	0.74	1.18

O = observed PTB events; OR = odd ratios; CI = confidence interval.

*Analysis adjusted for maternal age at birth, family income, period of birth, geographical region, maternal marital status, maternal height, and maternal smoking history. Children with Swedish-born grandmothers were used as reference.