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MATERNAL-FETAL MEDICINE

Obstetric and perinatal outcomes among immigrant and non-immigrant women in Berlin, Germany

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Abstract
Background In Germany, regular immigrants and their descendants have legal and financial access to health care equal to the general citizenry. Nonetheless, some of their health outcomes are comparatively unfavorable, and that is only partially explained by their lower socioeconomic status (SES). The aim of this study was to assess whether this disparity exists also for obstetric and perinatal outcomes.
Methods We compared obstetric and perinatal outcomes between immigrant women (first or second generation) and non-immigrant women, delivering at three maternity hospitals in Berlin, Germany, 2011–2012. Multivariable logistic regression analysis was used to assess immigrant status and other possible risk factors for the baby being delivered preterm, small for gestational age (SGA), or transferred to neonatal care.
Results The final database retained 6702 women, of whom 53.1% were first- or second-generation immigrants. First-generation Turkish immigrant women had significantly lower odds of preterm birth (OR 0.37, $P < 0.001$), SGA (OR 0.60, $P = 0.0079$), and transfer of the newborn to neonatal care (OR 0.61, $P = 0.0034$). Second-generation immigrant women had significantly lower odds of preterm birth (OR 0.67, $P = 0.0049$) or transfer of the newborn to neonatal care (OR 0.76, $P = 0.0312$). Moreover, women with education below university level, age 35+, or smokers had higher odds for poor outcomes.
Conclusions This study provides strong evidence that health disparities for obstetric and perinatal health outcomes do not exist in immigrants relative to native Germans, but exist instead in women without post-secondary-level education compared to women with such education, regardless of ethnicity or migration history.

Keywords Immigrant · Second-generation immigrant · Pregnancy · Obstetric outcomes · Perinatal outcomes · Education level · Germany

Abbreviations

ANC	Antenatal care
BMI	Body mass index
GW	Gestation week
OR	Odds ratio
SGA	Small for gestational age
95% CI	95% confidence interval

Introduction

Immigrants and their children may experience less favorable health outcomes than the native population of the host country due to language-based and culture-based communication barriers, economic barriers, and possibly

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discrimination [1–3]. Accordingly, immigrant status has often been seen as a risk factor for unfavorable pregnancy outcomes [4–8]. Immigrants have considerably more preterm births, a higher proportion of newborns who are small for gestational age (SGA), and a higher frequency of surgical deliveries compared to non-immigrant women [9–16].

But such findings are heterogeneous and not independent of the social and health care systems of the host countries, the countries of origin of immigrants, the heterogeneity of the immigrant population, and the time period under study. First, immigration status may not be the main determinant; instead, immigrants may simply have higher rates of some other unfavorable socioeconomic factor that also exists in the native population [17]. Second, some immigrant populations, such as Mexicans in the US, have better perinatal outcomes than non-immigrant women, in spite of being socio-economically disadvantaged, the "immigrant paradox" [2] or "Latina paradox" [18]. Third, there are indications for adaptation processes, both in the health services ("intercultural opening") as well as among immigrants and their descendants, possibly leading to improved health outcomes over time [19, 20] and in the next generations.

Germany has an immigrant population (first-generation immigrants and the second-generation of their children) of about 15 million persons, corresponding to 18.9% of the total population [21]. The largest immigrant groups originate from Turkey and from the former Eastern Bloc. Regular immigrants (meaning those who already have proper legal status to be residing in Germany) have equal rights of access to health care as the non-immigrant native population, and obstetric care is covered by the statutory health insurance. Our study compared the provision and outcomes of obstetric care among immigrants and non-immigrants in Berlin, Germany, a city with a large immigrant population. The large proportion of immigrant women in the obstetric setting in Berlin can be explained by three facts: (1) the large portion (29%) of immigrants in the Berlin population [22], (2) the immigrant population is on average younger so more women are of childbearing age [23], and (3) immigrant women give birth to more children than non-immigrant women [24]. The objective of our study was to determine if there are health disparities in obstetric and perinatal health outcomes between immigrants and non-immigrants in Berlin, Germany.

Methods

Ethics

The Charité Ethics Committee approved the study (approval dated 18 February 2009; no registration number given). Data protection regulations were observed in the survey and in the linkage to hospital data.

Setting and study population

Berlin has 20 maternity hospitals, all of which are public. In 2012, 34,700 children were born in these hospitals. Detailed information about the sociodemographics, ethnicity, or migration history of women delivering is not routinely available for Berlin or for other federal states in Germany. The data for this study were collected in three major maternity hospitals in the inner city of Berlin: (1) the Virchow Campus site of the Charité University Hospital, (2) the *Vivantes Klinikum am Urban*, a secondary care hospital, and (3) the *Vivantes Klinikum Neukölln*, a tertiary care hospital).

The inclusion criteria were as follows: all women with permanent residence in Germany, age 18 or older. The exclusion criteria were as follows: (1) under age 18, (2) tourists not resident in Germany, (3) women terminating a pregnancy, (4) and women with miscarriages and stillbirths (fetal death in utero ascertained at hospital admission and before onset of labor).

Migration status was determined based on the parents' country of birth, whether or not the subject herself had immigrated, and native language [25]. Women who immigrated themselves were classified as first-generation immigrants; women born in Germany to parents who had immigrated to Germany were classified as second-generation immigrants. Women who had one first-generation immigrant parent and one native German parent ($n = 314$) were censored in the statistical analysis. (Previous analyses had shown them to be quite similar to women with two German parents.)

Data collection

Data were collected between January 2011 and January 2012, daily in a two-shift system. Female interviewers administered standardized questionnaires (described further below) in face-to-face interviews. For each subject, data were collected at two time points: (1) on admission to the delivery room (T1) and (2) on the second or third day postpartum in the maternity wards (T2). The questionnaire data were then linked to the antenatal care (ANC) records of the mothers and to obstetric data collected routinely in all maternity hospitals for quality assurance purposes.

Questionnaires

The questionnaires were pre-tested prior to starting data collection for the study. They included 23 sociodemographic and behavioral items, 9 items related to care, and 8

items related to migration. The questionnaires were available in eight languages besides German (Arabic, English, French, Kurdish, Polish, Russian, Spanish, and Turkish) covering the most frequent immigrant language groups in Berlin. When other languages were needed, translators asked the questions in those other languages and then filled in the patients' responses for them on a German questionnaire form.

Main outcome variables

The pre-defined main outcomes were preterm birth, small for gestational age (SGA), and transfer to a neonatal unit. "Preterm birth" was defined as delivery before gestational week (GW) 37. Gestational week was calculated as the actual date of birth minus the estimated date of conception. The estimated date of conception was set just after the last menstrual period, as is common practice in Germany, but if there were large discrepancies on the early ultrasound between the measured and expected size of the fetus, then the date of conception was adjusted according to the actually measured size of the fetus on the ultrasound, as is common practice in Germany and internationally. The definition of SGA is based on a reference dataset comprising the birth weights of 2.3 million singleton pregnancies, stratified by sex and week of pregnancy [26]. SGA was defined as a weight lower than the 10th percentile in the corresponding sex/gestational week group. Transfer to a neonatal care unit (yes/no) referred to immediate perinatal transfer and was based on routine perinatal data collection.

Other variables

For further analysis, the age of the pregnant women was grouped as 18–24, 25–29, 30–34, ≥35 years. Educational achievement was measured by the highest graduation level, and was categorized into three levels: low (no education/primary school), medium (secondary education), and high (technical collage/vocational school, a-level vocational diploma). Maternal height was analyzed in centimeters, and maternal weight was analyzed in kilograms. Parity was coded as nullipara (no previous births) vs. multipara (one or more previous births). Smoking was originally recorded into three categories: "non-smoking," "smoking sometimes," and "smoking regularly," but smoking "sometimes" and "regularly" were combined for regression analyses. The 5-min Apgar score was coded dichotomously (0–6 vs. 7–10). Umbilical cord pH was also coded dichotomously (≤ vs. >7.10). The questionnaire asked the patients to rate their knowledge of German as one of the following categories: native speaker, very good, good, intermediate, little, none. In regression analyses, these answer options were collapsed into two categories: low (answer options "little" or "none") vs. sufficient (all other answer options).

Statistical analysis

Multivariate logistic regression analyses were conducted to assess the effects of migration status on birth outcomes while controlling for potential confounders such as age and parity. Linear regression analyses were used for collinearity diagnostics and logistic regression analyses with a stepwise forward selection to detect possible interaction. Neither collinearity nor interaction was found. Three separate multivariable logistic regressions were then performed with the dependent outcome variables: (1) preterm birth, (2) SGA, or (3) transfer to a neonatal care unit. These three regression analyses served to assess the influence of migration status on those obstetric and perinatal outcomes, while adjusting for other covariates that might confound the influence of migration status.

Covariates for those regression models were chosen from a medical perspective, i.e., the covariates are known medical or sociodemographic risk factors for the outcomes. All regression models were adjusted for the following covariates: age bracket, education level, gestational diabetes, parity, and smoking. In addition to the covariates used in all models, the regression model for preterm birth was also adjusted for the covariates of the height and weight of the mother. In addition to the covariates used in all models, the regression model for SGA was also adjusted for the covariates of the height of the mother, the weight of the mother, and whether or not the birth was preterm. In addition to the covariates used in all models, the regression model for transfer to a neonatal care unit was also adjusted for the covariates of arterial umbilical cord pH value, Apgar score, and whether or not the birth was preterm.

The statistics software SAS 9.3 was used. The significance level was set at $P < 0.05$.

Treatment of missing data

Missing data were imputed. It was assumed that data were missing at random, i.e., that they were not influenced by unobserved data. Imputation procedures using the average of five iterations based on linear, Poisson, and polytomous regression analyses were applied with IVEware [27]. Imputation of maternal height was based on migration status and age; imputations of maternal weight were based on migration status, age, height, and parity. Imputations of missing data for smoking, GW of the first ANC visit, and the total number of ANC check-ups were based on age, migration status, and education level.

Sensitivity analyses were performed with all imputed variables. Five iterations with randomly defined missing values were carried out for each univariate, bivariate, or multivariate analysis. The portion of defined missing values was set equal to actual missing values. Estimates (i.e., adjusted ORs) were similar to the respective imputed model and within the confidence intervals (details not shown).

Results

Enrollment

The flow of subjects from hospital admission, through screening and enrollment, and on to participation in the study and retention in the database, is presented in Fig. 1. Based on the raw numbers in the left-hand column of the figure, the contact rate was 95.5%, the eligibility rate was 97.0%, the rate of consent/enrollment/participation was 94.9%, and the rate of retention in the final database was 93.4%. Altogether, the final database reported here captured 82.2% of all the women admitted for delivery to these three hospitals during the study period. No attempt was made to compare the subjects in the final database to the women not in the final database.

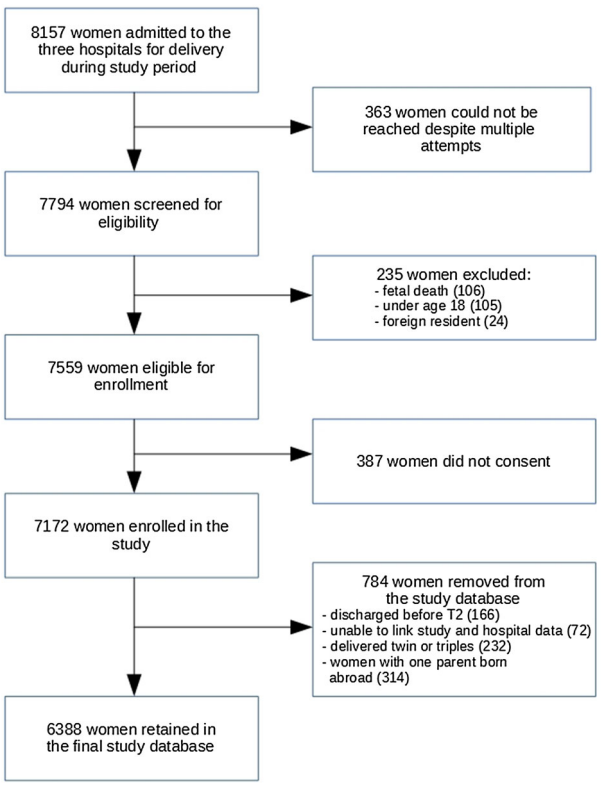

Fig. 1 Flowchart patients recruiting corresponding to inclusion and exclusion criteria

Imputation of missing data

Among the 6388 women retained in the final database, data for maternal height were missing for 13.1%. Information on maternal weight was missing for 6.6% at the first examination and for 9.5% at birth. Information on smoking was missing for 4.1%. Information about the timing of the first antenatal check-up, in terms of GW, was missing for 5.6%. Information about the total number of antenatal check-ups was missing for 7.6% of the women. All these missing data were imputed, as described above in the "Methods."

Sample characteristics

More than half of the women enrolled had immigrated or descended from immigrants. The largest first-generation immigrant groups originated from Turkey and Lebanon, and those groups were analyzed separately. Other countries of origin were combined as "high income," "upper middle income," and "low income and lower middle income," according to the gross national income schema of the World Bank [28]. The "high-income countries" group was just over half Polish (51.4%) with the remaining a mix of many countries. The "upper middle-income countries" group included primarily Bulgarian (15.8%), Russian (14.8%), Serbian (11.8%), Bosnian (8.4%), and Macedonian (8.0%) immigrants. The "low-income and lower middle-income countries" group included primarily immigrants from Kosovo (16.9%), Syria (10.8%), Vietnam (8.0%), Pakistan (6.5%), and Morocco (6.1%). The exact number of first-generation immigrant women from each country of origin is presented in "Appendix 1." The parents of second-generation women originated predominantly from Turkey/Turkey (60.0%) and Lebanon/Lebanon (16.1%). The countries of origins of the parents of second-generation women are presented in "Appendix 2."

With the exception of first-generation immigrant women from high-income countries, immigrant women were less well educated, more often not nullipara, and less often made use of antenatal classes, pregnancy exercises, and antenatal care by midwives (Table 1). Second-generation immigrant women were on average slightly younger.

Use of prenatal care

Table 1 also shows data on uptake of ANC, obstetric care, delivery mode, and neonatal parameters by migration status. All women attended a community-based gynecologist

Table 1 Patient characteristics and use of ANC, by migration status

$N = 6388$ (retained in the final database)	Non-immigrants	1st-generation immigrants					2nd-generation women
		Low- and lower middle-income countries[a]	Upper middle-income countries[a]	High-income countries[a]	Turkey	Lebanon	
Participants: *n* (%)	2831 (44.3)	474 (7.4)	677 (10.6)	459 (7.2)	665 (10.4)	354 (5.5)	928 (14.5)
Age in years: median (range)	31 (18–50)	30 (18–47)	29 (18–43)	31 (18–46)	29 (18–46)	28 (18–43)	27 (18–44)
Highest educational level (%)							
No qualification/primary school	3.0	15.4	28.4	7.4	40.3	26.8	9.4
Secondary school	46.6	38.4	36.6	29.4	48.1	52.8	74.1
University/technical collage/ vocational school/a-level vocational diploma	50.4	46.2	35.0	63.2	11.6	20.3	16.5
Self-assessed proficiency in the German language							
Sufficient	100.0	70.0	72.8	87.6	66.3	76.6	99.0
Low	<0.1	30.0	27.2	12.4	33.7	23.4	1.00
BMI at first exam: mean (SD)	24.3 (5.4)	25.1 (5.0)	24.2 (5.2)	23.4 (4.6)	25.6 (4.6)	25.7 (5.4)	25.2 (5.3)
BMI at birth: mean (SD)	29.2 (5.5)	29.7 (4.8)	28.6 (5.2)	28.3 (4.8)	30.3 (4.5)	30.1 (5.2)	30.3 (5.1)
Smoking (%)							
Regularly	14.1	5.3	18.9	15.3	15.3	15.8	19.9
Sometimes	5.0	1.7	7.1	4.8	5.9	3.7	10.0
Parity > nullipara (%)	44.0	63.1	60.0	51.2	74.6	75.1	55.2
Uptake of ANC (%)							
Attended resident gynecologist[b]	99.8	100.0	99.9	100.0	99.9	100.0	100.0
Also attended gynecologist in hospital	49.5	45.4	42.8	49.7	48.0	51.4	46.2
Antenatal care by midwife	64.4	25.5	24.7	52.3	19.4	17.2	36.5
Pregnancy exercises	23.4	6.1	8.1	18.5	3.3	3.7	8.7
Antenatal classes	37.5	8.9	11.8	25.7	3.5	2.3	11.2
Utilization of ANC							
GW of first antenatal check-up	9	10	10	9	9	9	9
Number of antenatal check-ups	11	10	10	11	11	11	11
Delivery mode (%)							
Normal vaginal delivery	52.8	57.6	61.5	60.0	69.3	74.9	61.3
Vacuum extraction/forceps	9.8	7.2	6.1	10.0	9.2	5.1	9.9
Elective cesarean	14.8	12.9	11.7	13.3	10.5	9.3	10.7
Emergency cesarean	22.6	22.4	20.8	20.7	11.0	10.7	18.1

[a] Definition according to The World Bank [25]

[b] Either self-reported visits or visits derived from the existence of a maternity card (with documented pregnancy risks or documented antenatal check-ups)

for ANC, and about 50% of them were also seen by a hospital-based gynecologist. The timing and number of ANC visits did not differ substantially except for a small group of women who attended very late (data not shown), about whom we have reported previously [29]. With the exception of first-generation immigrant women from high-income countries, immigrant women made seldom use of antenatal classes, pregnancy exercises, and antenatal care by midwives, in contrast to non-immigrant women (Table 1). The lower use was not explained by differences in parity between immigrant and non-immigrant groups.

Delivery outcomes

Turkish and Lebanese women had emergency cesareans much less often than all other groups (Table 1).

Obstetric and perinatal outcomes

Overall, 9.0% of the births were preterm, 8.2% of the newborns were SGA, and 15.1% of them had to be transferred to a neonatal care unit immediately postpartum. Table 2 shows the obstetric and perinatal outcomes, according to the migration status of the mother. Immigrant and second-generation women delivered a higher proportion of newborns at term compared to non-immigrant women (92.2 vs. 89.8%, $P < 0.001$). Newborns from non-immigrant women were transferred more frequently than newborns from the other groups, with the exception of newborns of second-generation women (Table 2). One-third of transferred newborns had a birth weight below 2500 g, and 40.6% of transferred newborns were preterm; 45.8% of all newborns had at least one of those two outcomes. Neonatal outcomes such as umbilical cord pH and Apgar score tended to be equally good or slightly better among first-generation immigrants compared to non-immigrants (Table 2). After adjusting for obstetric and sociodemographic parameters, no statistically significant differences in arterial umbilical cord pH and Apgar score were found (data not shown).

The odds of delivery preterm were statistically significantly higher for women who were age 35+, had lower education level, and smokers, but significantly lower for women who were heavier or multipara (Table 3). Furthermore, in comparison to non-immigrants, first-generation Turkish and Lebanese immigrant women and second-generation immigrants had statistically significantly lower odds of giving birth preterm, when adjusting for the other covariates (Table 3). Those results remained significant after the exclusion of elective cesarean sections and medical inductions of labor (details not shown).

The odds of delivering an SGA newborn were statistically significantly higher for women with lower levels of education and smokers, but significantly lower for mothers who were taller, heavier, multipara, gestationally diabetic, or delivering preterm (Table 4). In the raw data, the size of the newborns was not associated with the migration status of the mother, but in the adjusted regression analysis first-generation Turkish immigrant women had statistically significantly lower odds of delivering an SGA baby and first-generation Lebanese immigrant women had statistically significantly higher odds of delivering an SGA baby, in comparison to non-immigrants (Table 4).

The odds of the newborn being transferred to a neonatal care unit were statistically significantly lower if the mother

Table 2 Obstetric and perinatal outcomes by migration status of the mother

$N = 6388$ (retained in the final study database)	Non-immigrants	1st-generation immigrants					2nd-generation women
		Low-/lower middle-income countries[a]	Upper middle-income countries[a]	High-income countries[a]	Turkey	Lebanon	
Birth weight in grams	3330 (2230/4200)	3330 (2275/4090)	3290 (2230/4205)	3330 (2215/4060)	3390 (2540/4220)	3290 (2380/4155)	3340 (2440/4135)
Low birth weight (<2500 g)	246 (8.7)	32 (6.8)	58 (8.6)	37 (8.1)	25 (3.8)	25 (7.1)	55 (5.9)
Small for gestational age	238 (8.4)	29 (6.1)	63 (9.3)	36 (7.8)	39 (5.9)	44 (12.4)	73 (7.9)
Spontaneous preterm delivery (GW < 37)	254 (9.0)	34 (7.2)	58 (8.6)	36 (7.8)	23 (3.5)	17 (4.8)	61 (6.6)
Medically induced preterm delivery (GW < 37)	43 (1.5)	4 (0.8)	4 (0.6)	9 (2.0)	10 (1.5)	7 (2.0)	16 (1.7)
Arterial umbilical cord pH ≤ 7.1	87 (3.1)	7 (1.5)	22 (3.3)	10 (2.2)	11 (1.7)	5 (1.4)	23 (2.5)
Apgar score <7 points (5 min postpartum)	66 (2.3)	10 (2.1)	15 (2.2)	6 (1.3)	9 (1.4)	2 (0.6)	15 (1.6)
Newborn transferred to neonatal care unit	496 (17.5)	94 (19.8)	99 (14.6)	63 (13.7)	62 (9.3)	36 (10.2)	122 (13.2)

All values in the table are *n* (%), except birth weight is the median (5th/95th percentile)

[a] Definition according to The World Bank [25]

Table 3 Odds of preterm birth (gestational week <37) by migration status of the mother

Final model, $N = 6388$ events = 576	*n*	OR	95% CI	*P*
Non-immigrants	2831	1.00		
Low- and lower middle-income countries	474	0.73	0.50 to 1.06	0.0981
Upper middle-income countries	677	0.74	0.54 to 1.02	0.0689
High-income countries	459	0.94	0.67 to 1.31	0.6989
Turkey	665	0.37	0.25 to 0.56	<0.0001
Lebanon	354	0.55	0.35 to 0.86	0.0092
Second-generation women	928	0.67	0.51 to 0.89	0.0049
Self-assessed German language proficiency: sufficient	5688	1.00		
Self-assessed German language proficiency: low	700	1.01	0.72 to 1.40	0.9721
Age 18–24 years	1336	1.00		
Age 25–29 years	1785	1.01	0.78 to 1.31	0.9321
Age 30–34 years	1826	1.23	0.94 to 1.60	0.1364
Age 35+ years	1441	1.40	1.06 to 1.86	0.0191
Height of mother	6388	0.99	0.98 to 1.06	0.2606
Weight of mother at birth	6388	0.99	0.98 to <1.00	0.0004
University/technical college/vocational school/a-level vocational diploma	2474	1.00		
Secondary school	3080	1.68	1.35 to 2.09	0.0015
No qualification/primary school	834	1.73	1.24 to 2.43	<0.0001
Nullipara	2928	1.00		
Multipara	3460	0.80	0.67 to 0.97	0.0199
Gestational diabetes: no	6113	1.00		
Gestational diabetes: yes	275	0.87	0.55 to 1.38	0.5608
Smoking: no	5057	1.00		
Smoking: regular/sometimes	1331	1.24	1.00 to 1.53	0.0456

Alternative presentations of these analyses can be found in "Appendix 3"

was multipara but significantly higher if the mother was age 25–29 or 35+ (in comparison to women age 18–24), the mother had a secondary school-level education, the delivery was preterm, the Apgar score was 0–6, or the arterial umbilical cord pH was ≤7.10 (Table 5). Furthermore, in comparison to children born to non-immigrants, children born to first-generation Turkish immigrant women or to second-generation immigrant women had statistically significantly lower odds of being transferred to a neonatal care unit, when adjusting for the other covariates (Table 5).

Discussion

Our main findings show that, in comparison to non-immigrants, (1) first-generation Turkish immigrant women have significantly lower odds of preterm birth, SGA, and transfer of the newborn to a neonatal care unit; (2) first-generation Lebanese immigrant women have significantly lower odds of preterm birth but significantly higher odds of an SGA newborn; and (3) second-generation immigrant women have significantly lower odds of preterm birth or transfer of the newborn to a neonatal care unit. Moreover, we found strong evidence that low educational level, age 35+, and smoking are significant risk factors for poor obstetric and perinatal outcomes among women in Berlin, irrespective of their migration history.

The often-heard generalization that immigrants and their offspring in Germany have poorer health outcomes than non-immigrants is contradicted by our study, at least for obstetric and perinatal outcomes in Berlin. Those equivalent or superior health outcomes would strongly suggest that there are no major provider-level or system-level barriers specific to regular immigrants and their offspring. This point is further supported by the indirect evidence of equivalent healthcare utilization: literally all women delivering used the same route to access ANC and had sufficient uptake and numbers of ANC visits, though it is still possible that language or cultural barriers reduce the effectiveness of ANC visits for immigrant women. Most immigrant groups make substantially less use of antenatal care by midwives, pregnancy outcomes, and antenatal

Table 4 Odds of delivering a newborn who is small for gestational age (SGA: below 10th percentile), by migration status of the mother

Final model, $N = 6388$ events $= 522$	*N*	OR	95% CI	*P*
Non-immigrants	2831	1.00		
Low- and lower middle-income countries	474	0.79	0.52–1.21	0.2852
Upper middle-income countries	677	0.91	0.66–1.27	0.5910
High-income countries	459	0.94	0.64–1.37	0.7447
Turkey	665	0.66	0.43–1.01	0.0570
Lebanon	354	1.64	1.08–2.50	0.0207
Second-generation women	928	0.81	0.61–1.08	0.1521
Self-assessed German language proficiency: sufficient	5688	1.00		
Self-assessed German language proficiency: low	700	0.95	0.68–1.32	0.4929
Age 18–24 years	1336	1.00		
Age 25–29 years	1785	0.90	0.70–1.16	0.4211
Age 30–34 years	1826	1.03	0.78–1.36	0.8210
Age 35+ years	1441	1.22	0.91–1.63	0.1920
Height of mother	6388	>1.00	0.99–1.02	0.7055
Weight of mother at birth	6388	0.98	0.97–0.99	<0.0001
University/technical college/vocational school/a-level vocational diploma	2474	1.00		
Secondary school	3080	1.53	1.20–1.94	0.0005
No qualification/primary school	834	2.14	1.53–2.98	<0.0001
Nullipara	2928	1.00		
Multipara	3460	0.59	0.48–0.72	<0.0001
Gestational diabetes: no	6113	1.00		
Gestational diabetes: yes	275	0.81	0.49–1.36	0.4285
Preterm birth: no	5812	1.00		
Preterm birth: spontaneous	483	0.85	0.60–1.20	0.3492
Preterm birth: medically induced	93	0.60	0.26–1.41	0.2439
Smoking: no	5057	1.00		
Smoking: regular/sometimes	1331	1.98	1.61–2.43	<0.0001

Alternative presentations of these analyses can be found in "Appendix 4"

classes than native Germans (Table 1), but the possible relevance of this on perinatal outcomes remains undetermined. Given the otherwise excellent obstetric outcomes of women of Lebanese origin, their higher odds of delivering an SGA newborn may be more related to biological rather than to health services factors, or to our study's use of German SGA tables for all subjects.

The German health care system provides extensive outpatient (community-based) and in-patient care for all pregnant women covered by statutory health insurance. Insurance coverage for regular immigrants, second-generation women, and non-immigrant women is nearly complete. The interventions and examinations required in pregnancy are laid down in binding maternity guidelines. Since the 1980s, all German maternity hospitals must participate in a nationwide quality assurance system with standardized obstetric and perinatal data collection. However, no precise data are available in this system on the country of origin of the mothers or important sociodemographic parameters [20]. We collected such data and thus were able to assess the influence of migration on obstetric and perinatal outcomes among immigrant women compared to non-immigrant women, taking the roles of education level, age bracket, and smoking into account.

The study has a few strengths. First and foremost, the sample size was quite large, with a high participation rate and a large subsample of immigrants compared to similar European studies. Second, data collection was prospective. Third, the study was multicenter. Fourth, obstetric parameters and outcomes were assessed by medical staff in a standardized way.

This study also has several limitations that must be kept in mind. (1) Despite the large total sample size, it was still not large enough to allow for detailed analyses by ethnic or national origin besides first-generation Turkish and Lebanese, so our findings may hide further differences of some

Table 5 Odds of newborn being transferred to neonatal care unit, by migration status of the mother

Final model, $N = 6388$ events $= 972$	N	OR	95% CI	P
Non-immigrants	2831	1.00		
Low- and lower middle-income countries	474	1.41	1.04–1.90	0.0259
Upper middle-income countries	677	0.78	0.58–1.06	0.1081
High-income countries	459	0.77	0.55–1.07	0.1208
Turkey	665	0.59	0.42–0.83	0.0022
Lebanon	354	0.64	0.42–0.97	0.0350
Second-generation women	928	0.76	0.59–0.98	0.0315
Self-assessed German language proficiency: sufficient	5688	1.00		
Self-assessed German language proficiency: low	700	1.15	0.86–1.53	0.3607
Age 18–24 years	1336	1.00		
Age 25–29 years	1785	1.28	1.01–1.63	0.0398
Age 30–34 years	1826	1.07	0.83–1.38	0.5944
Age 35+ years	1441	1.44	1.10–1.87	0.0073
University/technical college/vocational school/a-level vocational diploma	2474	1.00		
Secondary school	3080	1.27	1.04–1.54	0.0166
No qualification/primary school	834	1.18	0.86–1.60	0.3064
Arterial umbilical cord pH value >7.10	6223	1.00		
Arterial umbilical cord pH value ≤7.10	165	3.10	2.12–4.54	<0.0001
Apgar score 5 min postpartum 7–10	6265	1.00		
Apgar score 5 min postpartum 0–6	123	10.48	6.55–16.79	<0.0001
Preterm birth: no	5812	1.00		
Preterm birth: spontaneous	483	22.87	18.24–28.67	<0.0001
Preterm birth: medically induced	93	6.70	4.30–10.43	<0.0001
Nullipara	2928	1.00		
Multipara	3460	0.78	0.65–0.92	0.0041
Smoking: no	5057	1.00		
Smoking: regular/sometimes	1331	0.96	0.78–1.19	0.7290

Alternative presentations of these analyses can be found in "Appendix 5"

ethnic subgroups. (2) Only 3 of Berlin's 20 hospitals participated in this study, and 2 of those 3 hospitals were tertiary university hospitals. Populations in tertiary centers are often different in several aspects from populations receiving care at other kinds of hospitals. Thus the subjects enrolled in this study may not be representative of women giving birth at other hospitals in Berlin, at non-tertiary hospitals, or at home or other non-hospital settings. (3) The medical data we used were collected for routine documentation, not for the primary purpose of a scientific study, but they should still have good reliability. (4) The study did not collect data on other relevant sociodemographic factors, such as household income, work status, or marital/relationship status. (5) Because of their low incidence, we could not compare "hard" perinatal outcomes such as neonatal mortality. (Pregnant women admitted to the delivery room with an intrauterine death were excluded from the study for ethical reasons.) (6) Some missing values had to be imputed, but we found no indications that this may have distorted the results. (7) For simplicity, the study defined SGA according to birth-weight tables for native Germans rather than using ethnic-specific birth-weight tables. This may help explain why, in our study, first-generation Lebanese immigrant women had significantly higher odds for an SGA newborn. Nonetheless, recent studies suggest that differences of birth weight for other ethnicities can only be confirmed in those other countries of origin, not among immigrants, thus suggesting that differences in birth weight are driven more by gestational nutrition than by genetics. (8) The study did not collect data on the subjects' reason(s) for immigration, because this would have been difficult to do consistently on such a large scale in this setting. But it is entirely possible that women who are suddenly forced to immigrate (e.g., war refugees) have different health outcomes than women who made a planned choice to immigrate (e.g., applied

from abroad for university admission and later decide to settle permanently in Germany). Future research should assess the health outcomes of the most vulnerable immigrants, i.e., the war refugees recently arriving to Germany.

International literature shows conflicting evidence regarding perinatal outcomes among immigrant women compared to the majority population. Some studies have identified migration status as a risk factor [4] and have reported higher perinatal mortality for example [11]. Yet other studies have found that migration is a protective factor with regard to perinatal outcomes [12, 18]. This could be due to different immigrant groups, differences in access to the health care system [10], or different integration policies [4]. In our study, obstetric and perinatal outcomes of immigrant and second-generation women are equal to, or better than, those of non-immigrant women. Thus we did not find any indications of specific deficiencies of health care access or integration policies in Berlin for obstetric outcomes.

Favorable perinatal outcomes are often explained by a "healthy migrant effect" [30] or the "immigrant," "Latina," or "epidemiological paradox" [2, 31, 32]: women who migrate are particularly healthy on average, and remain so for some time in spite of socioeconomic disadvantages they face in the host country, thanks in part to strong familial ties. Indeed, maternal risk factors such as a low level of education [33] are more prevalent among immigrant women; whereas a more advanced age [34] and being unmarried [35] are more common among non-immigrant women. These observations are compatible with a "healthy migrant" interpretation, which would also imply that the longer duration of residence in the host country would negatively affect obstetric risk. This has been observed, e.g., for preterm birth [36]. In Denmark though, Pedersen et al. [37] found an increased risk for SGA and preterm birth not only among immigrant women who had lived in the country for more than 15 years, but also among recent immigrants (<5 years in Denmark). Their findings do not correspond to ours. We were able to demonstrate lower odds for preterm birth, even among second-generation women, yet their odds of delivering an SGA newborn were not significantly lower than that of non-immigrant women. Apgar scores and perinatal transfer rates were less favorable among immigrant women in Italy, but they improved over time when access barriers were removed [10]. A Greek study, which adjusted for employment status as a proxy for socioeconomic status, found these neonatal outcomes favorable among immigrant women, similar to our study [38].

It is important to emphasize why it is commonly believed that immigrant women have worse obstetric and perinatal outcomes, even though our study shows that the opposite is the case. As seen in Tables 3, 4, and 5, lower education levels significantly increase the odds for worse health outcomes. Now as can be seen in Table 1, nearly half of all native Germans in our study had post-secondary-level education and almost none of them had less than secondary school-level education. By contrast, only a small portion of Turkish, Lebanese, or second-generation immigrants have post-secondary-level education, and with the exception of immigrants from high-income countries, a noteworthy portion of all immigrant groups have less than secondary-level education. Thus to non-scientific observers of the everyday world—including healthcare personnel—it probably does seem that immigrants often have worse health outcomes. But those cases of poor health outcomes are not because they are immigrants; instead, it is because on average they have lower education levels—something which is not as immediately apparent to casual everyday visual observation. In other words, the belief that immigrants have worse health outcomes reflects a general tendency to view patients as members of their ethnic group, but not as members of a particular educational strata.

In the future, obstetric services in Germany need to take the heterogeneity of immigrant populations into account. They comprise large subgroups of women with low-risk pregnancies; a small group at high-risk because they are not utilizing services adequately; and groups with "ethnicity-specific" risks, such as SGA in first-generation Lebanese immigrant women. In addition, it needs to be established whether antenatal and obstetric services are equally well tailored to the perceived needs and expectations of immigrants. Patient-provider language or cultural differences may negatively affect perceived quality, even if normative outcomes do not differ. The differences in the use of non-medical antenatal services seem to indicate that not all offers are equally migrant-sensitive or that there may be a lack of awareness regarding some of the services available. More generally, if health disparities are observed between immigrants and their offspring on the one hand and members of the native population on the other, these should not simply be interpreted as "ethnicity-related" problems, since they may be due to other factors that merely correlate with migration status. Besides the provision of migrant-sensitive health services, our findings stress the importance of increasing the level of education in the whole population as one measure to improve health outcomes. All healthcare providers should inquire about their patients' past education and should encourage their patients to pursue further education to at least a post-secondary level—for the sake of the long-term health of themselves and their children. Our study contributes to a large body of scientific literature showing that women and their children have better health outcomes when those women have higher levels of education. Furthermore, healthcare providers should try to ensure that all health-related information

provided to patients is available in their languages and at a reading-level that they can understand. Moreover, healthcare providers should recognize that women with low levels of education and/or from other cultures may have less general awareness and biological understanding of how their own behaviors can positively or negatively influence their health, and therefore healthcare providers should fill in these gaps in their patients' health education about their own health behaviors. Further research is still needed to better understand the mechanisms by which lower levels of education lead to poorer obstetric and perinatal health outcomes—for example, whether lower education levels create direct barriers to proper uptake of preventive health measures and/or healthcare services or whether lower educational levels are more an indirect marker or risk factor for living under conditions that are less favorable to health.

In conclusion, this large prospective multicenter study provides strong evidence that immigrants have obstetric and perinatal health outcomes that are as good or better than native Germans, but health disparities do exist for obstetric and perinatal outcomes in women without a post-secondary-level education, regardless of their ethnicity or migration history.

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Compliance with ethical standards

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Conflict of interest The authors declare that they have no conflict of interest.

Ethical standards All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards.

Human and animal rights statement This article does not contain any studies with animals performed by any of the authors.

Informed consent Informed consent was obtained from all individual participants included in the study.

Appendix 1

See Table 6.

Table 6 Countries of origin of first-generation migrants

	N	%		*N*	%
Low-income and lower middle-income countries					
Kosovo	80	16.9	Kyrgyzstan	<5	–
Syria	51	10.8	Moldova	<5	–
Vietnam	38	8.0	Bolivia	<5	–
Pakistan	31	6.5	Ivory Coast	<5	–
Morocco	29	6.1	Eritrea	<5	–
Cameroon	23	4.9	Gambia	<5	–
Ghana	22	4.6	Laos	<5	–
Ukraine	22	4.6	Niger	<5	–
Kenya	17	3.6	Philippines	<5	–
Nigeria	17	3.6	Sudan	<5	–
Bangladesh	14	3.0	Benin	<5	–
Afghanistan	13	2.7	Burundi	<5	–
Tunisia	11	2.3	Haiti	<5	–
Egypt	11	2.3	Cambodia	<5	–
Guinea, Republic	9	1.9	Congo, Republic	<5	–
Indonesia	7	1.5	North Korea	<5	–
Palestine, autonomous regions	7	1.5	Liberia, Republic	<5	–
Uzbekistan	7	1.5	Nepal	<5	–

Table 6 continued

	N	%		*N*	%
India	5	1.1	Zambia, Republic	<5	–
Yemen	<5	–	Senegal	<5	–
Congo, Democratic Republic	<5	–	Tadzhikistan	<5	–
Mongolia	<5	–	Tanzania	<5	–
Sierra Leone, Republic	<5	–	Togo	<5	–
Sri Lanka	<5	–	Uganda	<5	–
Ethiopia	<5	–	All low-income and lower middle-income countries		100
Upper middle-income countries					
Bulgaria	107	15.8	Libya	5	0.7
Russia	100	14.8	Albania	<5	–
Serbia	80	11.8	Angola	<5	–
Bosnia-Herzegovina	57	8.4	Belarus	<5	–
Macedonia	54	8.0	Dominican Republic	<5	–
Romania	51	7.5	Colombia	<5	–
Kazakhstan	34	5.0	Mexico	<5	–
Iraq	32	4.7	Costa Rica	<5	–
China	23	3.4	Ecuador	<5	–
Jordan	23	3.4	Georgia	<5	–
Algeria	17	2.5	Montenegro	<5	–
Brasil	17	2.5	South Africa	<5	–
Thailand	17	2.5	Argentina	<5	–
Azerbaiyan	7	1.0	Taiwan	<5	–
Peru	7	1.0	Turkmenistan	<5	–
Iran	6	0.9	Equatorial Guinea	<5	–
Cuba	5	0.7	All upper middle-income countries		100
High-income countries					
Poland	236	51.4	Netherland	5	1.1
France	26	5.7	Australia	<5	–
Italy	21	4.6	Finland	<5	–
Spain	17	3.7	Denmark	<5	–
USA	15	3.3	Canada	<5	–
Austria	15	3.3	Lithuania	<5	–
Greece	11	2.4	Portugal	<5	–
Japan	10	2.2	Hungary	<5	–
Czech Republic	10	2.2	Chile	<5	–
Croatia	9	2.0	Saudi Arabia	<5	–
Latvia	9	2.0	Slovakia	<5	–
Israel	8	1.7	Uruguay	<5	–
Switzerland	7	1.5	United Arab Emirates	<5	–
Great Britain and Northern Ireland	7	1.5	Estonia	<5	–
Sweden	6	1.3	Iceland	<5	–
South Korea	5	1.1	Qatar	<5	–
Kuwait	5	1.1	Slovenia	<5	–
			All high-income countries		100

The countries are grouped into three income levels, and then within each income level are presented in order of decreasing frequency of study subjects. The percentage is based on the total of subjects from a country in one of the three income levels of countries

Appendix 2

See Table 7.

Table 7 Countries of origin of the parents of second-generation migrants

Country of origin (mother)	Country of origin (father)	*n*
Missing[a]	Missing	16
	Bulgaria	<5
	Italy	<5
	Serbia	<5
	Turkey	<5
Afghanistan	Afghanistan	<5
Bosnia-Herzegovina	Bosnia-Herzegovina	9
	Croatia	<5
	Serbia	<5
Bulgaria	Bulgaria	<5
France	France	<5
Greece	Greece	10
	Turkey	<5
India	India	<5
Iraq	Iraq	<5
Israel	Israel	<5
	Hungary	<5
Italy	Italy	<5
Jordan	Israel	<5
	Jordan	<5
Cameroon	Cameroon	<5
North Korea	North Korea	<5
Kosovo	Kosovo	12
Croatia	Afghanistan	<5
	Bosnia-Herzegovina	<5
	Greece	<5
	Italy	<5
	Croatia	13
	Serbia	<5
	Slovenia	<5
Laos	Vietnam	<5
Latvia	Latvia	<5
Lebanon	Iraq	<5
	Lebanon	150
	Palestine, autonomous regions	<5
	Syria	<5
	Turkey	<5
Liberia	Liberia	<5
Morocco	Morocco	<5
Macedonia	Macedonia	5
	Pakistan	<5
	Serbia	<5
Moldova	Moldova	<5
Montenegro	Montenegro	<5
Pakistan	Pakistan	<5
Palestine, autonomous regions	Palestine, autonomous regions	9
Peru	Peru	<5
Poland	Missing	<5
	Kosovo	<5
	Netherlands	<5
	Poland	18
	Russia	<5
	Tunisia	<5
	Egypt	<5
Romania	Romania	<5
Russia	Guinea, Republic	<5
	Russia	<5
Serbia	Serbia	25
	Turkey	<5
Slovenia	Slovenia	<5
Spain	Spain	<5
Sri Lanka	Sri Lanka	<5
Syria	Jordan	<5
	Palestine, autonomous regions	<5
	Syria	5
Thailand	Thailand	<5
Czech Republic	Czech Republic	<5
Tunisia	Tunisia	5
	Egypt	<5
Turkey	Missing	<5
	Italy	<5
	Lebanon	<5
	Poland	<5
	Syria	<5
	Turkey	557
USA	Switzerland	<5
Ukraine	Ukraine	<5
Hungary	Croatia	<5
	Hungary	<5
Great Britain and Northern Ireland	Austria	<5
Vietnam	Vietnam	<5
Austria	Netherlands	<5
	Serbia	<5

The country combinations are sorted alphabetically, first by the country of origin of the mother and then within that by the country of origin of the father

[a] Mother/father not born in Germany—but country of birth not answered

Appendix 3

See Tables 8, 9, and 10.

Table 8 Alternative presentations of the analyses in Table 3, initial crude (unadjusted) regression model

Crude model, $N = 6388$ events = 576	*N*	OR	95% CI	*P*
Non-immigrants	2831	1.00		
Low- and lower middle-income countries	474	0.74	0.52–1.06	0.0977
Upper middle-income countries	677	0.86	0.65–1.15	0.3044
High-income countries	459	0.93	0.67–1.29	0.6547
Turkey	665	0.45	0.31–0.65	<0.0001
Lebanon	354	0.62	0.40–0.96	0.0302
Second-generation immigrants	928	0.77	0.59–1.00	0.0532

Table 9 Alternative presentations of the analyses in Table 3, abbreviated presentation of the final model

Abbreviated presentation of the final model presented in Table 3[a], crude model $N = 6388$, events = 576	*N*	OR	95% CI	*P*
Non-immigrants	2831	1.00		
Low- and lower middle-income countries	474	0.73	0.50–1.06	0.0981
Upper middle-income countries	677	0.74	0.54–1.02	0.0689
High-income countries	459	0.94	0.67–1.31	0.6989
Turkey	665	0.37	0.25–0.56	<0.0001
Lebanon	354	0.55	0.35–0.86	0.0092
Second-generation immigrants	928	0.67	0.51–0.89	0.0049

[a] Adjusted for self-assessed German language proficiency, age groups, height of mother, weight of mother, educational level, gestational diabetes, and smoking

Table 10 Alternative presentations of the analyses in Table 3, models for nullipara and multipara women separately

	Nullipara			Multipara		
	OR	CL	ME	OR	CL	ME
Non-immigrants	1.00			1.00		
Low and lower middle income	0.74	0.43–1.31	−0.024	0.73	0.43–1.22	−0.022
Upper middle income	0.75	0.47–1.20	−0.023	0.72	0.46–1.10	−0.023
High income	0.82	0.50–1.32	−0.017	1.05	0.65–1.71	0.004
Turkey	0.40	0.20–0.81	−0.059	0.37	0.22–0.61	−0.056
Lebanon	0.38	0.15–0.99	−0.060	0.62	0.36–1.05	−0.031
Second-generation immigrants	0.58	0.39–0.87	−0.041	0.76	0.52–1.12	−0.019
Low and lower middle income	0.75	0.43–1.32	−0.023	0.74	0.45–1.25	−0.020
Upper middle income[a]	0.58	0.38–0.87	−0.042	0.55	0.39–0.79	−0.041
High income	0.81	0.50–1.32	−0.017	1.06	0.65–1.71	0.004
Second-generation immigrants	0.59	0.39–0.88	−0.041	0.77	0.53–1.12	−0.018
Turkey	0.50	0.25–0.97	−0.048	0.44	0.28–0.71	−0.048
Lebanon	0.48	0.19–1.21	−0.050	0.73	0.45–1.20	−0.021
Second-generation immigrants	0.67	0.45–1.00	−0.031	0.96	0.68–1.37	−0.003

All models adjusted for self-assessed German language proficiency, age groups, height of mother, weight of mother, educational level, gestational diabetes, and smoking (as in Table 3)

ME marginal effects

[a] Incl. Turkey and Lebanon

Appendix 4

See Tables 11, 12, and 13.

Table 11 Alternative presentations of the analyses in Table 4, initial crude (unadjusted) regression model

Crude model, $N = 6388$, events = 522	*N*	OR	95% CI	*P*
Non-immigrants	2831	1.00		
Low- and lower middle-income countries	474	0.71	0.48–1.06	0.0920
Upper middle-income countries	677	1.12	0.84–1.50	0.4534
High-income countries	459	0.93	0.64–1.34	0.6852
Turkey	665	0.68	0.48–0.96	0.0299
Lebanon	354	1.55	1.10–2.18	0.0126
Second-generation immigrants	928	0.93	0.71–1.22	0.6040

Table 12 Alternative presentations of the analyses in Table 4, abbreviated presentation of the final model

Abbreviated presentation of the final model presented in Table 4[a], $N = 6388$, events = 522	*N*	OR	95% CI	*P*
Non-immigrants	2831	1.00		
Low- and lower middle-income countries	474	0.79	0.52–1.21	0.2852
Upper middle-income countries	677	0.91	0.66–1.27	0.5910
High-income countries	459	0.94	0.64–1.37	0.7447
Turkey	665	0.66	0.43–1.01	0.0570
Lebanon	354	1.64	1.08–2.50	0.0207
Second-generation immigrants	928	0.81	0.61–1.08	0.1521

[a] Adjusted for self-assessed German language proficiency, age groups, height of mother, weight of mother, educational level, parity, preterm birth (<GW37), gestational diabetes, and smoking

Table 13 Alternative presentations of the analyses in Table 4, models for nullipara and multipara women separately

	Nullipara			Multipara		
	OR	CL	ME	OR	CL	ME
Non-immigrants	1.00			1.00		
Low and lower middle income	0.61	0.31–1.18	−0.036	0.95	0.54–1.67	0.004
Upper middle income	0.96	0.61–1.52	−0.003	0.82	0.51–1.31	0.012
High income	1.07	0.67–1.71	0.006	0.75	0.39–1.42	0.018
Turkey	0.76	0.39–1.49	−0.022	0.64	0.37–1.11	0.033
Lebanon	1.79	0.90–3.56	0.062	1.59	0.92–2.74	−0.017
Second-generation immigrants	0.96	0.65–1.40	−0.004	0.64	0.41–1.00	0.024
Low and lower middle income	0.60	0.31–1.16	−0.037	0.99	0.56–1.73	−0.001
Upper middle income[a]	0.98	0.67–1.44	−0.001	0.82	0.57–1.18	−0.012
High income	1.06	0.66–1.70	0.005	0.76	0.40–1.45	−0.015
Second-generation immigrants	0.95	0.65–1.40	−0.004	0.64	0.41–1.00	−0.024
Turkey	0.77	0.43–1.39	−0.020	0.62	0.39–0.98	−0.026
Lebanon	1.85	1.01–3.39	0.066	1.54	1.00–2.37	0.030
Second-generation immigrants	0.98	0.68–1.41	−0.002	0.71	0.47–1.07	−0.019

All models adjusted for self-assessed German language proficiency, age groups, height of mother, weight of mother, educational level, gestational diabetes, and smoking (as in Table 4)

ME marginal effects

[a] Incl. Turkey and Lebanon

Appendix 5

See Tables 14, 15, and 16.

Table 14 Alternative presentations of the analyses in Table 5, initial crude (unadjusted) regression model

Crude model, $N = 6388$, events = 972	*N*	OR	95% CI	*P*
Non-immigrants	2831	1.00		
Low- and lower middle-income countries	474	1.17	0.91–1.49	0.2243
Upper middle-income countries	677	0.81	0.64–1.02	0.0716
High-income countries	459	0.75	0.56–0.99	0.0452
Turkey	665	0.48	0.37–0.64	<0.0001
Lebanon	354	0.53	0.37–0.76	0.0006
Second-generation immigrants	928	0.71	0.58–0.88	0.0019

Table 15 Alternative presentations of the analyses in Table 5, abbreviated presentation of the final model

Abbreviated presentation of the final model presented in Table 5[a], $N = 6388$, events = 972	*N*	OR	95% CI	*P*
Non-immigrants	2831	1.00		
Low- and lower middle-income countries	474	1.41	1.04–1.90	0.0259
Upper middle-income countries	677	0.78	0.58–1.06	0.1081
High-income countries	459	0.77	0.55–1.07	0.1208
Turkey	665	0.59	0.42–0.83	0.0022
Lebanon	354	0.64	0.42–0.97	0.0350
Second-generation immigrants	928	0.76	0.59–0.98	0.0315

[a] Adjusted for self-assessed German language proficiency, age groups, height of mother, weight of mother, educational level, parity, preterm birth (<GW37), gestational diabetes, and smoking

Table 16 Alternative presentations of the analyses in Table 5, models for nullipara and multipara women separately

	Nullipara			Multipara		
	OR	CL	ME	OR	CL	ME
Non-immigrants	1.00			1.00		
Low and lower middle income	1.87	1.21–2.90	0.075	1.08	0.72–1.63	0.007
Upper middle income	0.84	0.54–1.30	−0.017	0.72	0.47–1.08	−0.028
High income	0.74	0.46–1.19	−0.028	0.78	0.49–1.26	−0.021
Turkey	0.76	0.43–1.34	−0.026	0.48	0.31–0.74	−0.056
Lebanon	0.72	0.34–1.56	−0.031	0.57	0.35–0.94	−0.043
Second-generation immigrants	0.78	0.54–1.11	−0.025	0.71	0.50–1.02	−0.028
Low and lower middle income	2.00	1.31–3.06	0.085	1.09	0.72–1.65	0.008
Upper middle income[a]	0.90	0.59–1.37	−0.011	0.59	0.43–0.80	−0.045
High income	0.77	0.48–1.24	−0.025	0.78	0.49–1.26	−0.021
Second-generation immigrants	0.81	0.57–1.15	−0.021	0.71	0.52–1.02	−0.028
Turkey	0.76	0.44–1.32	−0.026	0.55	0.37–0.82	−0.046
Lebanon	0.71	0.34–1.50	−0.033	0.66	0.41–1.05	−0.034
Second-generation immigrants	0.80	0.56–1.13	−0.023	0.86	0.61–1.20	−0.013

All models adjusted for self-assessed German language proficiency, age groups, height of mother, weight of mother, educational level, gestational diabetes, and smoking (as in Table 5)

ME marginal effects

[a] Incl. Turkey and Lebanon

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