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Risk factors of preterm birth and low birth weight babies among Roma and non-Roma mothers: a population-based study

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Background: In 2009, 8.4% of live births in Hungary were low birth weight (LBW) and 8.7% were preterm (PTB). Roma are disproportionately represented in Northern Hungary where LBW and PTB are highest in the country (10.3% equally). This study evaluates the risk factors for LBW and/or PTB among the Roma and non-Roma populations in two Northern Hungarian counties. **Methods:** We conducted a retrospective cohort study of 5469 non-Roma and 2287 Roma mothers who gave birth in 2009. Women were visited by the Maternal and Child Health Service nurses and completed in-person structured surveys on demographic, socio-economic, cultural and lifestyle factors. These data were combined with biometric data from hospital records. Bivariate statistics and a logistic regression analyses were used to determine risk factors for LBW and PTB. **Results:** Roma had a higher incidence of PTB and LBW babies compared with non-Roma women (PTB 9.9% vs. 7.1%, LBW 12.2% vs. 6.5% $P = 0.001$). However, ethnicity was not related to PTB and LBW in multivariable analyses, when controlling for socio-demographic and lifestyle characteristics. Factors associated with LBW and PTB include being underweight, advanced maternal age, and smoking. **Conclusion:** Strategies that ensure healthy lifestyles must be well integrated in family-based interventions and in the schools, with special consideration for Roma women who have a higher prevalence of deleterious lifestyles and poor birth outcomes. Ensuring a healthy body weight and no smoking has important implications for the mother and foetus.

Introduction

Socio-demographic and lifestyle factors, such as maternal education, poverty, stress, smoking and alcohol, can influence birth outcomes namely through the maternal–foetal supply.[1–3] Recent comparative studies of birth outcomes between Roma and majority populations of Central Europe have been published.[4–6] Based on these reports showing unfavourable birth outcome of Central European Roma,[7–9] we conducted a retrospective cohort study to compare risk factors for preterm (PTB) and low birth weight (LBW) among Roma and non-Roma women in the regions with the highest percentage of the Roma population. Recent Hungarian studies have shown that Roma often have poor health resulting from low socio-economic status (SES), severe social exclusion, behavioural patterns and the environment all of which could influence birth outcomes.[10–14]

In the 2000s, the proportion of LBW (<2500 g.) and PTB (<37 weeks gestation) levelled off at ~8 % of all live births in Hungary.[15] In 2009, 8.4% of all babies in Hungary were LBW at birth, which is the highest among European Union (EU) member countries (Greece 9.6%, Bulgaria 8.5%).[16] The same year, the EU-average was 6.8%, and the lowest proportion was reported in Finland (4.3%). The last retrospective and nationwide study about Roma babies born in 1973–83 hypothesized that Hungary's PTB/LBW rates have stagnated due to the rapidly growing Roma population and their disproportionately high rates of poor birth outcomes.[17]

In 1991, according to rough estimates, the Roma population size was 400 000 to 600 000, i.e. 4–6% of the total population.[18] In 2001,

when the last census endeavoured to assess ethnicity, self-reported data of 196 046 Roma is believed to be an under-representation of the actual Roma population living in Hungary.[19] The latest domestic calculation[20] estimates the proportion of the Roma population to be four-times higher (800 000). The EU Framework for National Roma Integration Strategies contains an annex (last updated 14 Sept. 2010), which indicates that Hungary's total population is 9 930 915 and the average estimation of Roma is 700 000 (400 000–1 000 000), i.e. 7.05%.[21] A growing population of Roma has important implications for ensuring healthy birth outcomes and appropriate health service provisions for women of reproductive age and their offspring. As indicated earlier, in 2009, 8.4% of live births in Hungary were LBW and 8.7% were PTB. Roma are disproportionately represented in Northern Hungary where LBW and PTB were highest in the country (10.3% equally). The aim of this study was to evaluate the risk factors for LBW and/or PTB among the Roma and non-Roma populations in two Northern Hungarian counties.

Methods

Sample

We used the 2009 data of the Central Statistical Office to identify the county proportions of LBW and/or PTB in Hungary. In Borsod-Abaúj-Zemplén (BAZ) County, LBW and PTB were equally 9.9%, whereas in Szabolcs-Szatmár-Bereg (Szabolcs) County, LBW was 9.8% and PTB was 8.6%. Our goal was to conduct a census of mothers who delivered a baby between 1 January and 31 December 2009 and identify risk factors for LBW and PTB.

Inhabitant mothers with live births in the two counties ($N = 12\,733$) were visited in their homes using the register of the local Maternity and Child Health Service (MCHS) for this retrospective cohort study. 29% ($n = 3693$) did not participate either because they were not home at the time the interviewer tried to reach them or indicated that the time was inconvenient to be interviewed and requested that the interviewer return. All contacts were made twice. Ultimately, $n = 9040$ (71.0%) consented to participate in the study. We sequentially excluded women from the analytical sample because of the purpose of this research: multiple births ($n = 74$), missing data on birth weight or weeks gestation ($n = 110$), and missing data on ethnicity ($n = 1094$) or self-identified ethnicity as mixed race ($n = 21$). The final sample included 7756 women who self-identified as Roma ($n = 2{,}287$) or non-Roma ($n = 5{,}469$), who had a singleton live birth in 2009, and whose newborns' birth weight and gestational age were known. With few exceptions, all deliveries in Hungary are performed in hospitals; therefore, gestational age and birth weight were based on hospital records at the time of birth. Interviews were conducted between 1 January and 30 June 2010. Respondents and non-respondents were equally represented in the sub-regions of both counties.

Measurement

Biometric data (number of gestational weeks) of mothers and infants (birth weight) were taken from the register of the local MCHS and the hospital records, respectively. Mothers' hospital admissions during pregnancy were also registered from hospital data. Attending local service ≤ 4 times indicated underutilization of services. The overwhelming majority (96.5%) attended prenatal care 5 or more times during their pregnancy, (prenatal care is a requirement to receive the maternity benefit from the social health insurance). Biometric data of mothers measured by the MCHS were used to calculate body mass index (BMI) as weight in kilograms divided by height in meters squared (weight (kg)/[height $(m)^2$]). BMI was converted to a categorical variable using the cut-off values (underweight ≤ 18.49, normal weight = 18.5–24.9, overweight = 25–29.9, obese = 30 or greater) proposed by the WHO Expert Committee in 1995.[22]

The questionnaire included standardized measures of demographic, socio-economic and lifestyle characteristics. Ethnicity was self-reported. Demographic data included the mothers' age, marital status and the number of children. SES was measured by educational level, income/capita in the family, housing conditions and the mothers' employment status before birth.

Although there is no legal poverty level in Hungary, the statistical poverty level is published annually by the Central Statistical Office and can be used as a proxy for poverty status. Based on the EU standard, 60% of the median income equals the income poverty level, which was HUF 60 000 (exactly 59 599)/month/consumption unit in 2009. Levels were defined by percentage of this sum as deep poverty <50%, poverty 50–80%, at poverty level 81–120%, sufficient 121–150% and wealthy >150%. Information about the housing conditions was ascertained as it follows: full amenities = connected to the water supply mains, to the sewage system and operational central heating; partial amenities = connected to the water supply mains, connection neither to the sewage system nor operational individual heating; without amenities = no connection to the water supply mains, to the sewage system nor operational individual heating.

Lifestyle questions included tobacco use and alcohol consumption. Smoking habits during pregnancy were based on the records of the local MCHS as smoked or did not smoke during pregnancy. Non-smokers during pregnancy included those who were prior non-smokers, as well as those who quit when they learned they were pregnant. Exposure to second-hand smoke (SHS) in confined spaces during pregnancy was measured by self-report: frequently (every day), sporadically (at least once a month, but not daily) or never exposed. Alcohol consumption during pregnancy was measured as consumption of wine or beer in categories at least once a week, less than per week and never. Frequency of coffee consumption (comprising also the daily coffee drinkers) was measured as at least every other day, once or twice a week or sporadically/never. Nutritional characteristics concerned the consumption of fresh fruits, vegetables, dairy and meet products in four distinct frequency categories. For multivariable analyses, all nutritional consumption variables (fruit, vegetables, caffeine, dairy and meat) were categorized as non-daily versus daily consumption.

Analysis

Bivariate statistics of all variables in the study were conducted using Pearson's chi-square and *t*-tests to compare Roma and non-Roma populations. Multivariable logistic regression analyses were used to determine the risk factors listed earlier and potentially associated with PTB versus at term birth and LBW versus normal birth weight as dependent variables. Results are reported in ORs and 95% CI. SPSS (version 15.0) was used for all statistical analyses.

Human Subjects' Protection

The Institutional Review Board at Semmelweis University, Budapest, Hungary where the research was led, approved this study. All women provided informed consent before their participation in this study.

Results

Description of the Sample

There were 2287 Roma and 5469 non-Roma mothers, who participated in this study. Only three non-Roma expectant mothers never attended the free and accessible prenatal services operated by local governments and financed by the social health insurance system (table 1). The overwhelming majority (96.5%) attended prenatal care five or more times during their pregnancy. Hospital admissions occurred less frequently among Roma (20.8%) than non-Roma (23.0%) women and proportionally less Roma were cared for in the hospital ($P < 0.05$).

Table 1 Frequency of attending prenatal outpatient care and number of hospital days among Roma and non-Roma women with live, singleton births in 2009

Variable	Overall *N* = 7756	Roma *n* = 2287	Non-Roma *n* = 5469	*P*-value[a]
Outpatient care (*n*, %)				<0.001
Never attended	3	0 (0.0)	3 (0.1)	
1–4 times	271	146 (6.4)	125 (2.3)	
5 or more times	7546	2.141 (93.6)	5341 (97.7)	
In-patient care (*n*, %)				<0.05
no admission	6025	1811 (79.2)	4214 (77.1)	
1–10 days	1296	369 (16.1)	927 (17.0)	
11–30 days	316	71 (3.1)	245 (4.5)	
31 days or more	119	36 (1.6)	83 (1.5)	

[a]Pearson's chi-square test.

Table 2 Pregnancy outcomes among Roma and non-Roma women with singleton live births in 2009

Variables	Overall *N* = 7756	Roma *n* = 2287	Non-Roma *n* = 5469	*P*-value
Gestational age in weeks = x (SD)	38.7 (1.8)	38.4 (1.9)	38.8 (1.7)	<0.001
PTB (<37 weeks) % (*n*)	7.9 (612)	9.9 (226)	7.1 (386)	<0.001
Variable	***N* = 7756**	***n* = 2287**	***n* = 5469**	***P*-value**
Weight in g at delivery = x (SD)	3212 (549)	3002 (507)	3300 (543)	<0.001
LBW (<2500 g) % (*n*)	8.2 (633)	122 (279)	6.5 (354)	<0.001

T-tests were used for comparing continuous variables (weeks, grams) and Pearson's chi-square tests were used for categorical variables (PTB, LBW). x = Arithmetic mean, SD = Standard deviation.

Pregnancy outcomes by ethnicity are presented in table 2. Gestational age and birth weight of Roma newborns in the whole sample was lower (0.4 weeks and 298 g at $P < 0.001$) than that of non-Roma newborns. Cumulative incidence of LBW cases ($n = 633$) was almost twice as high among Roma ($n = 279$, 12.2%) versus non-Roma ($n = 354$, 6.5%) women ($P < 0.001$). In addition, cumulative incidence of PTB cases ($n = 612$) was higher among Roma (9.9%) versus non-Roma (7.1%), ($P < 0.001$). The PTB–LBW correlation was as follows: 135 (5.9%) newborns were both PTB and LBW among Roma women compared with 218 (4.0%) among non-Roma women. There were 144 (6.3%) newborns among Roma and 136 (2.7%) among non-Roma delivered after the 37th week but weighed <2500 g (Intrauterine Growth Retardation = IUGR) at $P < 0.001$.

Family characteristics differed significantly between Roma and non-Roma women. Roma women were more likely to be <18 years of age at the time of birth of the referent child. They also had larger family sizes compared with non-Roma women; they were more than twice as likely to have 3–13 children. Non-Roma were also more likely to be legally married.

Roma women fared significantly worse than non-Roma women across all biometric, socio-economic variables and lifestyle factors with the exception of BMI and alcohol consumption ($P < 0.001$) (table 3). The lower educational attainment of Roma was most remarkable: there was one person who graduated from college or university compared with 27.4% of non-Roma. The overwhelming majority (86.3%) of Roma living in deep poverty, are much less likely to live in a house with full amenities and were significantly more likely to be unemployed before delivery.

Alcohol use was rarely reported by either group, whereas personal tobacco smoking and exposure to SHS was significantly higher among Roma than non-Roma women. The overall prevalence of smoking during pregnancy was 29.8% ($n = 1764$). Nearly the half (47.3%) of Roma women were smoking during pregnancy, but

Table 3 Biometric, demographic and socio-economic characteristics of Roma and non-Roma women with live, singleton births in 2009

Variables	Overall (*N*)	Roma (*n*, %)	non-Roma (*n*, %)	*P*-value[a]
	7717	**2270**	**5447**	<0.001
Age in years x, (SD)	27.8 (6.0)	24.2 (6.0)	29.3 (5.3)	
minimum–maximum	13–46	13–45	14–46	
Age categories (*n*, %)				<0.001
41+	104	22 (1.0)	82 (1.5)	
<18	285	228 (10,0)	57 (1.0)	<0.001
18–34	6354	1872 (82.5)	4482 (82.3)	0.570
35–40	974	148 (6.5)	826 (15.2)	<0.001
BMI (kg/m^2)	**7365**	**2167**	**5198**	
x, (SD)	22.93 (4.80)	22.00 (4.73)	23.32 (4.77)	equal variances assumed
minimum–maximum	12.33–62.28	12.33–52.07	14.01–62.28	
BMI categories (*n*, %)				
Underweight	1047	488 (22.5)	559 (10.8)	
Normal	4423	1242 (57.3)	3181 (61.2)	<0.001
Overweight	1238	296 (13.7)	942 (18.1)	<0.001
Obesity	657	141 (6.5)	516 (9.9)	<0.001
Education (*n*, %)	**7730**	**2274**	**5456**	
<8 grades	710	615 (27.0)	95 (1.7)	
Completed 8 grades[b]	2149	1371 (60.3)	778 (14.3)	<0.001
Secondary	3374	287 (12.6)	3087 (56.6)	<0.001
University/college	1497	1 (0.0)	1496 (27.4)	<0.001
Employment before birth (*n*, %)	**7725**	**2272**	**5453**	
Employed	3293	116 (5.1)	3177 (58.3)	
Unemployed	1806	876 (38.2)	939 (17.2)	<0.001
Varia[c]	2626	1289 (56.7)	1337 (24.5)	<0.001
Marital Status (*n*, %)	**7726**	**2277**	**5449**	
Married	4114	591 (26.0)	3523 (64.7)	
Non-contractual cohabitation	3212	1527 (67.1)	1685 (30.9)	<0.001
Separated/divorced	120	51 (2.2)	69 (1.3)	<0.001
Single/Widowed	280	108 (4.7)	172 (3.2)	<0.001
No. of children	**7691**	**2265**	**5426**	<0.001
x, (SD)	2.2 (1.5)	3.0 (1.9)	1.9 (1.1)	
minimum–maximum	1–13	1–13	1–13	
No. of children categories (*n*, %)				
1–2	5420	1083 (47.8)	4337 (79.9)	
3–13	2271	1182 (52.2)	1089 (20.1)	<0.001
Level of income/capita (*n*, %)	**7487**	**2234**	**5253**	
Deep poverty	3381	1929 (86.3)	1452 (27.6)	
Poverty	2124	255 (11.4)	1869 (35.6)	<0.001
At poverty level	1213	32 (1.4)	1181 (22.5)	<0.001
Sufficient/Wealthy	769	18 (0.8)	751 (14.3)	<0.001
Housing conditions (*n*, %)	**7312**	**2150**	**5162**	
Without amenities	1527	1185 (55.1)	342 (6.6)	
Full amenities	4482	364 (16.9)	4118 (79.8)	<0.001
Partial amenities	1303	601 (28.0)	702 (13.6)	<0.001
Dietary habits				
Fresh fruits (*n*, %)	**7703**	**2271**	**5432**	<0.001
Less than every day	2311	1180 (52.0)	1131 (20.8)	
Every day	5392	1091 (48.0)	4301 (79.2)	
Vegetables (*n*, %)	**7701**	**2270**	**5431**	<0.001
Less than every day	3050	1333 (58.7)	1717 (31.6)	
Every day	4651	937 (41.3)	3714 (68.4)	
Dairy products (*n*, %)	**7697**	**2269**	**5428**	<0.001
Less than every day	2218	1054 (46.5)	1164 (21.4)	
Every day	5479	1215 (53.5)	4264 (78.6)	
Meat products (*n*, %)	**7670**	**2252**	**5418**	<0.001
Less than every day	2791	980 (43.5)	1811 (33.4)	
Every day	4879	1272 (56.5)	3607 (66.6)	
Tobacco, alcohol and coffee				
Smoking during pregnancy (*n*, %)[d]	**7685**	**2266**	**5419**	<0.001
Smoking	1764	1069 (47.3)	695 (12.8)	
No smoking	5921	1197 (52.8)	4724 (87.2)	
ETS in confined spaces (*n*, %)	**7617**	**2261**	**5374**	<0.001

(continued)

Table 3 Continued

Variables	Overall (*N*)	Roma (*n*, %)	non-Roma (*n*, %)	*P*-value[a]
Yes	3627	1730 (77.1)	1897 (35.3)	
Never	3990	513 (22.9)	3477 (64.7)	
Alcohol (wine/beer) (*n*, %)	**7529**	**2226**	**5303**	0.457
At least every other week	622	192 (8.6)	430 (8.1)	
Never	6907	2034 (91.4)	4873 (91.9)	
Coffee (*n*, %)	**7615**	**2245**	**5370**	<0.001
Less than every day	4030	992 (44.2)	3038 (56.6)	
Every day	3706	1253 (55.8)	2332 (43.4)	

[a]*t*-test for continuous and Pearson's chi-square test for categorical variables.
[b]Primary school.
[c]Disabled, student, etc.
[d]Registered by Maternity and Child Health Service.
SD = Standard deviation.

only 12.8% of non-Roma women continued smoking. Related to the pre-pregnancy habits, more than a half (51.2%) of Roma were current and regular smokers at the time they learned they were pregnant, most of whom (89.3%) continued to smoke throughout their pregnancy. Among non-Roma, 31.4% were smokers when they learned that they were pregnant, and only 14.7% of the smokers continued to smoke during pregnancy. In addition, Roma were >3 times as likely to be frequently exposed to SHS in confined spaces. Concerning differences in nutritional and dietary characteristics, non-Roma women were significantly more likely to consume fruits, vegetables, dairy and meet products at least once per day than Roma women were.

Table 4 demonstrates factors in a multivariable logistic regression model associated with LBW and PTB. LBW was associated with hospital treatment, body weight, age and number of children. Women who were admitted to the hospital were 85% more likely to have a LBW baby compared with those not admitted (OR = 1.85, 95% CI = 1.51–2.28). In addition, being underweight versus normal weight (OR = 1.47, 95% CI = 1.16–1.88) or overweight (OR = 1.69, 95% CI = 1.21–2.36) were significantly correlated with LBW. However, being obese offered no protective effect compared with being underweight. Women 41 years or older at the time of the birth of the referent child increased the odds of an LBW more than 2-fold for all comparison age groups: vs. <18 years OR = 2.80, 95% CI = 1.32–5.93, vs. 18–34 years OR = 3.08, 95% CI = 1.68–5.63, and vs. 34–40 OR = 2.28, 95% CI = 1.20–4.31). Having larger family size (3+ children) was associated with a 29% increased odds of having a LBW baby (OR 1.29, 95% CI = 1.03–1.61) and being employed versus disabled, student, etc. increased the risk of an LBW by 40% (OR = 1.40, 95% CI = 1.03–1.89). Women living in housing without amenities versus full amenities or partial amenities increased the likelihood of LBW (OR = 1.49, 95% CI 1.08–2.04 and OR = 1.34, 95% CI = 1.02–1.77, respectively). Smoking during pregnancy more than doubled the likelihood of LBW (OR = 2.24, 95% CI = 1.77–2.84).

PTB was influenced by hospital treatment (OR = 1.72, 95% CI = 1.40–2.11), BMI (underweight versus normal weight OR = 1.33, 95% CI = 1.03–1.72 and overweight OR = 1.46, 95% CI = 1.04–2.04), age (41 years or more vs. <18 years OR = 2.41, 95% CI = 1.31–5.15, 18–34 years OR = 2.99 95% CI = 1.65–-5.41, 34–40 OR = 2.12, 95% CI = 1.13–3.95), being employed versus disabled, student, etc. (OR = 1.43 95% CI = 1.07–1.92) and smoking during pregnancy (OR = 1.89, 95% CI = 1.48–2.42). Self-identified Roma ethnicity was unrelated to LBW and PTB in the multivariable analyses, after controlling for other demographic, socio-economic and lifestyle factors.

Table 4 Multivariable logistic regression model ($n = 6303$) of LBW and PTB by demographic, health, social and lifestyle characteristics among Northern Hungarian women

Variables[a]	LBW			PTB		
	OR	95% CI	*P*-value	OR	95% CI	*P*-value
Roma/non-Roma	0.89	0.68–1.16	0.248	0.97	0.73–1.28	0.718
Hospital treatment yes/no	1.85	1.51–2.28	<0.001	1.72	1.40–2.11	<0.001
BMI underweight versus...						
Normal weight	1.47	1.16–1.88	<0.01	1.33	1.03–1.72	<0.05
Overweight	1.69	1.21–2.36	<0.01	1.46	1.04–2.04	<0.05
Obese	1.32	0.90–1.94	0.065	1.23	0.84–1.81	0.348
Age 41+ versus...						
<18 years	2.80	1.32–5.93	<0.01	2.41	1.13–5.15	<0.05
18–34	3.08	1.68–5.63	<0.001	2.99	1.65–5.41	<0.001
35–40	2.28	1.20–4.31	<0.05	2.12	1.13–3.95	<0.05
Married versus...						
Non-contractual cohabitation	0.85	0.68–1.05	<0.05	0.90	0.73–1.12	0.221
Separated/divorced	1.82	0.76–4.35	0.133	1.58	0.67–3.74	0.333
Single/widowed	0.86	0.53–1.38	0.601	1.07	0.64–1.80	0.585
Having 3+children/1–2 children	1.29	1.03–1.61	<0.05	1.24	0.98–1.55	0.051
Education <8 grades versus...						
8 grades (primary school)	0.95	0.70–1.28	0.736	0.93	0.67–1.30	0.939
Secondary	1.11	0.74–1.66	0.234	1.03	0.67–1.59	0.559
University/college	1.45	0.85–2.50	0.065	1.23	0.73–2.10	0.317
Employed before birth versus...						
Unemployed	1.06	0.78–1.42	0.689	1.04	0.78–1.39	0.888
Varia (disabled, student, etc.)	1.40	1.03–1.89	<0.05	1.43	1.07–1.92	<0.05
Deep poverty versus...						
Poverty	1.10	0.83–1.45	0.437	1.00	0.76–1.32	0.838
At poverty level	1.28	0.85–1.91	0.331	1.07	0.74–1.56	0.893
Sufficient and wealthy	0.87	0.56–1.36	0.533	0.83	0.55–1.26	0.224
Housing no amenities versus....						
Full amenities	1.49	1.08–2.04	<0.05	1.13	0.82–1.57	0.854
Partial amenities	1.34	1.02–1.77	<0.05	1.09	0.81–1.47	0.694
Smoking yes/no during pregnancy	2.24	1.77–2.84	<0.001	1.89	1.48–2.42	<0.001
ETS yes/no during pregnancy	1.05	0.83–1.33	0.834	1.00	0.80–1.26	0.849
Non-daily consumption of...(vs. daily)						
Fruit	1.04	0.81–1.32	0.993	0.97	0.80–1.32	0.796
Vegetable	1.07	0.85–1.35	0.444	1.02	0.78–1.24	0.904
Dairy	1.11	0.89–1.38	0.379	1.05	0.76–1.20	0.579
Meat	1.07	0.87–1.31	0.627	0.94	0.86–1.30	0.474
Caffeine	1.04	0.85–1.28	0.831	0.97	0.84–1.26	0.899

[a]Reference categories are always on the first place.

Discussion

The primary aim of this study was to identify possible risk factors associated with LBW and PTB, with a special emphasis on similarities and differences among Hungarian Roma and non-Roma women. A recent study of birth outcomes among Roma women and their infants in the Czech Republic demonstrated that nutritional status, dietary and smoking habits among the Roma were worse than those of the majority population.[9] Additionally, an earlier Roma study stressed the significance that the Roma's lower educational level plays an essential part in unfavourable birth outcomes[8]

Our research reinforces earlier findings and offers additional insights into the impact of social and behavioural factors

contributing to poor birth outcomes among Roma and non-Roma women. Roma ethnicity in itself was not a significant correlate of LBW or PTB in multivariable models. However, we found significant differences in risk factors associated with LBW and PTB as indicated earlier. These factors (e.g., smoking, poor nutritional status) were more common among self-identified Roma women in bivariate analyses. Roma women were more than twice as likely to be underweight than non-Roma (22.5% vs. 10.8%), which was associated with an increased odds of PTB and LBW. Routine smoking is also very high among Roma (51.2%) and non-Roma (31.4%) women living in Northeastern Hungary. More striking, however, is the fact that most non-Roma were much more likely to quit spontaneously at the time of pregnancy compared with Roma women. Among smokers, 89.3% of Roma continued to smoke while pregnant compared with only 14.7% of non-Roma. Given the consistent and compelling literature on the risks of tobacco use among pregnancy, this finding has important public health significance and provides a strong plausible explanation for the large differences in LBW outcomes between these two populations. [3,23] The fact that IUGR occurs more than twice as often among Roma than non-Roma (6.3% vs. 2.7%, respectively) indicates that IUGR is a serious problem among the Roma population that warrants greater attention.

The number of children is a complex socio-economic indicator of the demographic cycle within a given community and reflects both the cultural preferences and social support systems that promote or deter childbearing in the family. In our sample, nearly half (46.0%) of Roma women have 3–6 children compared with 19.5% of non-Roma and 6.1% compared with 0.5% have 7–13 children. Having three or more children was associated with an increased risk for LBW in this study. Interventions focused on family planning and health risks associated with multiple births is warranted, but must be undertaken judiciously recognizing the cultural significance of large family size in the Roma community.

Lack of amenities, as a proxy good measure of socio-economic status, was also predictive of LBW in the multivariable model. When analysing the bivariate results, nearly 80% of non-Roma women were living in houses with full amenities compared with only 17% of Roma women. Collectively, the socio-economic and behavioural indicators among Roma women likely explain the significantly higher incidence of PTB and LBW observed among these women.

Several limitations must be considered while interpreting the results of this study. First, self-reported data suggests that almost one-third (29.5%) of all live born infants were Roma in BAZ and Szabolcs counties in 2009. Lacking relevant ethnicity distribution of the entire population in Hungary and consequently in these counties, it is impossible to know whether Roma have disproportionately higher birth rates than non-Roma (albeit larger family size among Roma women suggest that the Roma likely do have disproportionately higher birth rates). Another limitation includes the reliance of self-reported data on behavioural factors that may be socially undesirable (e.g. alcohol and tobacco use) during pregnancy and the potential impact of recall bias given that, this was a retrospective cohort study.

Despite these limitations, there are several strengths of this study worth noting. First, the sample includes ~10% of all births in Hungary during 2009, with a disproportionate representation among the Roma. This large sample of Roma mothers' birth outcomes allows more robust statistical analyses, and it is the largest study of birth outcomes among Roma women ever conducted. In addition, our study includes medical records data at the time of birth that improves the reliability of the biometric data by not relying on self-reports subject to recall errors. The in-person interviews also provide an opportunity for the interviewer to probe for answers that may not have otherwise been available through other forms of self-reported data collection (e.g. mailed or telephone surveys). Although including numerous social and behavioural factors, we were able to identify potential points of intervention to address modifiable risk factors related to poor birth outcomes among Roma and non-Roma women in Hungary. Although there may be under-reporting of certain behavioural characteristics (e.g. alcohol, tobacco), there remained a high prevalence of tobacco use among women in this sample and a low incidence of quitting when pregnant. This finding suggests either that women do not necessarily view tobacco use as 'undesirable' during pregnancy or that the tobacco use is extraordinarily high among expectant mothers, especially Roma women. Under-reporting would have biased the results towards rather than away from the null, so the findings would therefore be more conservative.

Roma ethnicity (self-identifying as Roma and belonging to a Roma community) is a complex predictor of poor socio-economic and behavioural characteristics that are correlated with poor birth outcomes. Thus, although poverty alleviation and improved education are critical to the health of the whole country, there is still a need for tailored interventions that address the modifiable and highly prevalent behavioural risk factors within the Roma community. Opportunities for public health intervention based on our findings include decreasing tobacco use and ensuring a healthy weight at time of pregnancy.

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Key points

- Almost twice as many Roma as non-Roma Hungarian women give birth to an LBW baby. The cumulative incidence of LBW babies among Roma exceeds the country's average by ~4% and the average of the EU by >5%.
- The main sources of disadvantage among Roma mothers who give birth to PTB/LBW babies include a significantly higher smoking prevalence, being underweight and lower SES position.
- Health education programmes targeted and tailored to the specific needs of Roma are necessary to address the economic and social conditions of pregnant Roma mothers to ensure healthy outcomes for mother and baby alike.

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Psychosocial stress during pregnancy is related to adverse birth outcomes: results from a large multi-ethnic community-based birth cohort

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Background: Prevalence rates of psychosocial stress during pregnancy are substantial. Evidence for associations between psychosocial stress and birth outcomes is inconsistent. This study aims to identify and characterize different clusters of pregnant women, each with a distinct pattern of psychosocial stress, and investigate whether birth outcomes differ between these clusters. **Methods:** Latent class analysis was performed on data of 7740 pregnant women (Amsterdam Born Children and their Development study). Included constructs were depressive symptoms, state anxiety, job strain, pregnancy-related anxiety and parenting stress. **Results:** Five clusters of women with distinct patterns of psychosocial stress were objectively identified. Babies born from women in the cluster characterized as 'high depression and high anxiety, moderate job strain' (12%) had a lower birth weight, and those in the 'high depression and high anxiety, not employed' cluster (15%) had an increased risk of pre-term birth. **Conclusions:** Babies from pregnant women reporting both high levels of anxiety and depressive symptoms are at highest risk for adverse birth outcomes.