Preterm Birth and Low Birth Weight
in Hungary's Szabolcs-Szatmár-Bereg County
2009 – 2012

PhD Theses

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INTRODUCTION

Preterm birth (PTB=before 37th gestation week) and low birth weight (LBW=under 2,500 grams) are worldwide leading causative factors of the neonatal morbidity and mortality. Every year 15 million neonates are born preterm and among them die 1.1 million babies due to joining conditions and complications (Lu Gao Bert W. at al.). PTB is defined as a delivery prior to the completed 37th gestational week. However, definition of PTB is more difficult when compared with LBW because the neonate's weight is an absolutely reliable (Melamed Y, et al.).

The proportion of PTB and LBW represent 8-10% of all liver-births in Hungary. This high prevalence as a serious epidemic has in epidemic sense negative effect on the whole reproduction of the population. Researches, conducted in the past years, have proven that there is a strong correlation between LBW and chronic illnesses (cardio-vascular diseases, diabetes) that also represent public health hazards. PTB can only partially be traced back to health issues, there are primarily social factors, such as the mother's educational level, poor housing, unhealthy lifestyle (nutrition, smoking, poor personal/sexual hygiene) in the background.

AIMS

Our primary aim was to clear by means of the epidemiological survey the possible causative factors behind PTB and LBW in Hungary's less developed north-eastern region specifically in Szabolcs-Szatmár-Bereg County. The knowledge gained will open the door for further ambitions to tailor specific programs adjusted to the local circumstances. They will serve by interventional strategies to lessen the geographic and social class differences before and during the pregnancy in order to improve the health status of the new-born babies.. Because of the significant number and share of the Roma population, concerning also its increased reproductive activity, there was our special aim to analyse the circumstances along the Roma versus non-Roma dichotomy.

Special aims while analysing the potential risk factors of PTB and LBW

PTB and LBW may be caused by independent and closely interrelated factors. Using epidemiological methods, we decided for more thoroughly analysis of possible causative factors as presented below:

- the pregnant women's demographic and biometric features (age, family and nutritional status)
- neonatal parameters (primarily the gestational time and birth weight and their two-by-two combinations)
- pathologic past events in the obstetrical history (earlier PTBs and LBWs plus stillbirths)
- pathologic maternal conditions before and during the pregnancy (pre-eminently eclampsia or its imminent risks)
- usage of professional care during the pregnancy (first visit at the district nurse of the Maternity and Child Health Service (MCHS), and the number of controls during the pregnant care)
- maternal and family socioeconomic circumstances (housing, family income, labour market options)
- lifestyle features (nutritional status, coffee and alcohol consumption especially concerning tobacco smoking)
- maternal education,
- Roma versus non-Roma ethnicity (as effective independent variable related to ther dependent variables of PTB and LBW)
- settlement type and availability of health services

METHODS

We performed our questionnaire based research in 2009 and 2012 targeting only the liveborn cases in four north-eastern counties of Hungary. In these theses there are analysed only the data of the County Szabolcs-Szatmár Bereg. Our research was supervised by the Institutional Review Board of the Semmelweis University Budapest (Ref.: TUKEB 103/2009), and it was supported by the Ministry of Health. Data collecting was performed by the precinct nurses of Maternity and Child Health Service.

The questionnaire had two separated parts.

Part I.: filled out by the MCHS nurses, based on medical records. The first block of 16 questions concerned the maternal and neonatal health, the second block (17-28 Qs) the maternal behaviour during the pregnancy (tobacco smoking, coffee and alcohol

consumption) plus conditions having emerged during the pregnancy and the puerperal period.

Part II.: contained a series of questions asking parental demographic, biometric and lifestyle characteristics, (age, family status, education, occupation, labour market situation) together with ethnicity of the mother (Roma, non-Roma) There were also registered the housing circumstances (settlement type, living conditions, amenities). Further questions asked the smoking habits of mothers and the social environment alike. Not only the actual situation was concerned but also past tobacco cessation attempts by alone or supported by health professionals..

Statistical analysis was performed by the actual versions of the IBM-SPSS program. Odds ratios were calculated by 95% confidence intervals. Significant differences were accepted at $p<0.05$ level. In binary logistic and linear regression analyses we used the variables as presented above.

RESULTS

Table1: Maternal demographic, biometric and obstetrical characteristics of Roma/non-Roma subsamples in the whole sample (n=8104), of Szabolcs-Szatmár-Bereg County.

Variables	Total n (%)	Non-roma n (%)	Roma n (%)	p-values*
Age in years	**n=7893**	**n=5400**	**n=2153**	
Mean	27,9	29,24	24,49	
StD	5,98	5,48	5,91	0,001
minimum/maximum	14/49	15/49	14/44	
BMI categories (n, %)	**n=7774**	**n=5301**	**n=2134**	
Underweight=≤18,49	799(10,3)	424(8,0)	337(15,8)	
Normal=18,5–24,9; Overweight=25–29,9;	4621(59,4)	3178(60,0)	1248(58,5)	0,001
Obesity=30	1514(19,5)	1080(20,4)	357(16,7)	
	840(10,8)	619(11,7)	192(9,0)	
No. of deliveries	**n=7793**	**n=5311**	**n=2138**	
Primipara	1383(17,7)	1111(20,9)	262(12,3)	0,001
Multipara	6410(82,3)	4200(79,1)	1876(87,7)	
Method of delivery	**n=6294**	**n=5395**	**n=2165**	
Sectio caesarea	1476(23,5)	1755(32,5)	461(21,0)	0,001
Other	4818(76,5)	3640(67,5)	1701(78,6)	
Marital status	**n=7941**	**n=5421**	**n=2171**	0,001
Married	4202(52,9)	3499(64,5	488(22,5)	
Other	3739(47,1)	1922(35,5)	1683(77,5)	

** Pearson Chi-square test was used except the t-test for maternal age*

Table 2: LBW and PTB prevalence in the whole sample (n=7999).

Variables	Total n (%)	Non-Roma n (%)	Roma n (%)	p – value*
≤2499 gram	670(8,9)	366(6,8)	304(14,0)	0,001
≥2500 gram	6890(91,1)	5021(93,2)	1869(86,0)	
≤36 weeks	628(8,3)	411(7,6)	217(10,1)	0,001
≥37 weeks	6923(91,7)	4981(92,4)	1942(89,9)	

** Chi-square test*

Table 3: LBW and PTB prevalence of neonates in the 2009 (n=4320) and 2012 (n=3669) subsamples

Variables	2009 n (%)	2012n (%)	p – value*
≤2499 gram	376(8,7)	325(9,0)	0,723
≥2500 gram	3923(91,3)	3297(91,0)	
≤36 week	330(7,7)	325(8,9)	0,052
≥37 week	3941(92,3)	3313(91,1)	

* *Chi-square test*

Table 4: LBW prevalence of Non-Roma and Roma subsamples in the 2009 and 2012 samples

Weight at delivery	Non-Roma		Roma	
	2009 (n=%)	**2012 (n=%)**	**2009 (n=%)**	**2012 (n=%)**
≤2499 gram	199(7,1)	167(6,5)	148(12,8)	156(15,6)
≥2500 gram	1005(87,2)	2413(93,5)	1005(87,2)	864(84,4)
p – value*	0,369		0,099	

**Chi-squared test*

Table 5: PTB prevalence of Non-Roma and Roma subsamples in the 2009 and 2012 samples

Gestational age in weeks	Non-Roma		Roma	
	2009 (n=%)	**2012 (n=%)**	**2009 (n=%)**	**2012 (n=%)**
≤36 week	200(7,2)	211(8,1)	105(9,2)	112(11,0)
≥37 week	2589(92,8)	2392(91,9)	1040(90,8)	902(89,0)
p – value*	0,196		0,148	

* *Chi-squared test*

Table 6: Two-by-two table of gestational weeks and birth weight in the whole sample (n=7854)

Gestational age in weeks	**Weight at delivery**		**p – value***
	≤2499 gram	**≥2500 gram**	
≤36 weeks	378(4,8)	271(3,5)	0,001
≥37 weeks	316(4,0)	6889(87,7)	

* *Chi-squared test*

Table 7. Interrelation of gestational weeks and birth weight in Roma (n=2154) and non-Roma (n= 5343) subgroups of the whole sample.

Gestational age in weeks	**Non-Roma**		**Roma**	
	≤2499 gram	**≥2500 gram**	**≤2499 gram**	**≥2500 gram**
≤36 weeks	219(4,1)	188(3,5)	142(6,6)	74(3,4)
≥37 weeks	146(2,7)	4790(89,7)	156(7,2)	1782(82,7)
p – value*	0,001		0,001	

* *Chi-squared test*

Table 8: Interrelation of gestational weeks and birth weight in the 2009 (n=4264) and 2012 (n=3590) samples.

Gestational age in weeks	**2009**		**2012**	
	≤2499 gram	**≥2500 gram**	**≤2499 gram**	**≥2500 gram**
≤36 weeks	199(4,7)	129(3,0)	179(5,0)	142(4,0)
≥37 weeks	174(4,1)	3762(88,2)	142(4,0)	3127(87,1)
p – value*	0,001		0,001	

**Chi-squared test*

Table 9: Socioeconomic characteristics of mothers in the whole sample of Szabolcs-Szatmár-Bereg County (n=8104) in non-Roma and Roma subgroups

Variables	**Total n -%**	**Non roma n -%**	**Roma n -%**	**p - value***
Employed before birth	(n=7924)	(n=5420)	(n=2160)	
Employed	3275(41,0)	2991(55,2)	87(4,0)	
Unemployed	1939(24,5)	1028(19,0)	836(38,7)	0,001
Student	581(7,3)	256(4,7)	301(13,9)	
Maternity leave	2132(26,9	1127(20,8)	928(43,0)	
Varia	27(0,3	18(4,7)	8(0,4)	
Type of Settlement	(n=7427)	(n=4997)	(n=2118)	
City downtown	2531 (34,1)	2081 (41,6)	343 (16,2)	
City periphery	906 (12,2)	501 (10,0)	388 (18,7)	0,001
Village with GP and nurse	3875 (52,2)	2345 (46,9)	1345(63,5)	
Village without GP and nurse	81 (1,0)	51 (0,1)	29 (1,4)	
Village without GP with nurse	6 (0,1)	3 (0,1)	2 (0,1)	
Periphery	28 (0,4)	16 (0,3)	2 (0,1)	
Ownership of housing	(n=7903)	(n=5400)	(n=2159)	
Tenant / service apartment	87 (1,1)	54 (1,0)	28 (1,3)	
Owner	4544 (57.5)	3474 (64,3)	847 (39,2)	0,001
Parents of mother	1352(16,19)	7778(14,8)	529(24,5)	
Parents of the husband	1223 (15,3)	659 (2,1)	527(24,4)	
Joint lease	23 (0,3)	12 (0,2)	11 (0,5)	
Rented flat	454 (5,7)	308 (5,7)	122 (5,7)	
Other	220 (2,8)	115 (2,1)	95 (4,4	
Housing conditions	(n=7675)	(n=5249)	(n=2106)	
Full amenities	4718 (61,5)	4058 (77,3)	445 (21,1)	0,001
Partial amenities	1902 (24,8)	973 (18,5)	866 (41,1)	
Without amenities	1055 (13,7)	218 (4,2)	795 (37,7)	
Income:	(n=7572)	(n=5150)	(n=2121)	
≤30 000HUF	3424(45,2)	1479(28,7)	181(85,3)	0,001
≥30 000HUF	4148(54,8)	3671(71,3)	311(14,7)	

**Chi-squared test*

Table 10: Socio-demographic features of the entire maternal sample in Szabolcs-Szatmár-Bereg County (n=8104) in non-Roma and Roma subgroups.

Variables	**Total** **n -%**	**Non-roma** **n -%**	**Roma** **n -%**	**p - value***
Education	**(n=7935)**	**(n=5423)**	**(n=2171)**	
<8 basic classes	65(8,2)	98(1,8)	545(25,1)	
8 basic classes	2333(29,4	879(16,2)	1376(63,4)	
Vocational training	1444(18,2)	1151(21,1)	211(9,7)	0,001
Graduation	1000(12,6)	921(17,0)	26(1,2)	
Graduation plus	892(11,2)	844(15,6)	9(0,4)	
Bachelor degree	1168(14,7)	1112(20,5)	3(0,1)	
Master degree	440(14,7)	418(7,7)	1(0,0)	
Coffee during pregnancy	**(n=7961)**	**(n=5426)**	**(n=2176)**	
Consumption: yes	4267(59,6)	2757(50,8)	1333(61,3)	0,001
Consumption: no	3694(46,4)	2669(49,2)	843(38,7)	
Tobacco smoking	**(n=7955)**	**(n=5425)**	**(n=2173)**	
during pregnancy	1722(21,6)	687(12,7)	975(44,9)	
cessation during pregnancy	6233(78,4)	4738(87,3)	1198(55,1)	**0,001**
ETS during the pregnancy	**(n=5806)**	**(n=3739)**	**(n=1694)**	
Yes	1698(30,3)	735(19,7)	898(53,0)	
No	3908(69,7)	3004(80,3)	796(47,0)	**0,001**

* *Chi-squared test*

Table 11: Average differences of birth weights and gestational times of non-Roma and Roma neonates in deep poverty and all other income categories

	Variables	**Non-Roma**	**Roma**	**Difference**	**p-value***
Deep poverty (3424/45,2)	Birth weight in gram	3444,3	2966,9	**-177**	0,001
	Gestational age in weeks	38,6	38,3	**-0,25**	0,001
Deep poverty vs. others (4148/54,8)	Birth weight in gram	3296,9	2997,6	**-299**	0,001
	Gestational age in weeks	38,7	38,3	**-0,38**	0,001
Total (7572/100,0)	Birth weight in gram	3255,97	2976,7	**-279**	0,001
	Gestational age in weeks	38,68	38,35	**-0,326**	0,001

* *t-probe*

Table 12: Occurance of symptoms and diseases during the pregnancy in the whole sample (n=8104) and non-Roma (n=5529) and Roma subsamples (n=2201).

Variables: yes/no	**Total (%)**	**Non-Roma (%)**	**Roma (%)**	**p-value***
Oedema	1475/5905 (20,0/80,0)	1024/3958 (20,6/79,4)	393/1655 (19,2/80,8)	0,191
Proteinuria	475/6904 (6,4/93,6)	266/4712 5,3/94,7	184/1864 (9,0/91,0)	0,001
Hypertonia	569/6808 (7,7/92,3)	415/4562 (8,3/91,7)	125/1927 (6,1/93,9)	0,001
Bleeding/convulsion (≤12 weeks)	592/6787 (8,0/9,2)	398/4580 (8,0/92,0)	166/1882 (8,1/91,9)	0,877
Bleeding/convulsion (>12 weeks)	584/6795 (17,9/92,1	375/4603 (7,5/92,5)	180/1868 (8,8/91,2)	0,76
Parodontosis	684/6693 (9,3/90,7)	492/4485 (9,9/90,1)	150/1897 (7,3/92,7)	0,001
Caries	1023/6354 (13,9/86,1)	611/4366 (12,3/87,7)	368/1679 (18,0/82,0)	0,001
Varicous veins	608/6770 (8,2/91,8)	428/4549 88,6/91,4)	143/1905 (9,0/93,0)	0,024
Opstipatio	856/6523 (11,6/88,4)	702/4276 (14,1/85,9)	112/1936 (5,5/94,59	0,001
Anaemia	3220/4157 (43,6/56,4)	1879/3098 (37,8/62,2)	1230/812 (60,1/39,9)	0,001
Vaginal infections	1642/5737 (22,3/77,7)	1086/3892 (21,8/78,2)	462/1586 22,6/77,4)	0,495
Urinary infections	959/6420 (13,0/87,0)	499/4484 (9,9/90,1)	410/1638 (20,0/80,0)	0,001
Respiratory diseases	539/6899 (7,3/92,7)	364/4613 (7,3/92,7)	137/1911 (6,7/93,3)	0,356

* *Chi-squared test*

Table 13: Symptoms and diseases in the deep poverty subsample (n=3289) during the pregnancy in the whole population and non-Roma (n=1479) and Roma (n=1810) subgroups.

Variables: yes/no	**Total (%)**	**Non-roma (%)**	**Roma (%)**	**p-value***
Oedema	619/2594 (19,2/80,8)	273/1105 (19,8/80,2)	323/1381 (19,0/81,0)	0,550
Proteinuria	232/2983 (7,2/92,8)	75/1302 (5,4/94,6)	152/1552 (8,9/91,1)	0,001
Hypertonia	208/3005 (6,5/33,5)	105/1270 (7,7/92,3)	95/1608 (5,5/94,4)	0,018
Bleeding/convulsion (≤12 weeks)	235/2980 (7,3/92,8)	89/1288 (6,5/93,5)	135/1569 (7,9/92,1)	0,121
Bleeding/convulsion (>12 week)	269/2946 (8,4/91,6)	119/1258 (8,6/91,4)	137/1567 (8,0/92,0)	0,547
Parodontosis	269/2944 (8,4/91,6)	132/1244 (9,6/90,4)	119/1584 (7,0/93,0)	0,009
Caries	555/2658 (17,3/82,7)	232/1144 (16,9/83,1)	300/1403 (17,6/82,4)	0,581
Varicous veins	243/2971 (7,6/92,4)	127/1249 (9,2/90,8)	107/1597 (6,3/93,7)	0,002
Opstipatio	235/2980 (7,3/92,7)	142/1235 (10,3/89,7)	83/1621 (4,9/35,1)	0,001
Anaemia	1723/1491 (53,6/46,4)	649/728 (47,1/52,9)	1026/677 (60,2/39,8)	0,001
Vaginal infections	737/2478 (22,9/77,1)	308/1069 (22,4/77,6)	395/1309 (23,2/76,8)	0,593
Urinary infections	534/2681 (16,6/83,4)	173/1204 (12,6/87,4)	339/1365 (19,9/80,1)	0,001
Respiratory disease	193/3021 (6,0/94,0)	78/1298 (5,7/94,3)	104/1600 86,1/97,9)	0,611

* *Chi-squared test*

Table 14: Time of the started care at the MCHS and frequency of controls in the whole sample (n=8104) and non-Roma (n=5529) and Roma (2201) subgroups.

Variables: yes/no	Total	Non-Roma	Roma	p-value*
Started care				
Elemszám	**7447**	**5304**	**2143**	
Mean	11,41	10,74	13,04	0,001
StD	4,547	3,945	5,401	
minimum/maximum	4-39	1-38	4-39	
Number of controls				
Elemszám	**7493**	**547**	**2108**	
Mean	10,18	10,46	9,57	0,001
StD	3,443	3,284	3,744	
minimum/maximum	0-34	0-34	1-32	

* *Chi-squared test*

Table 15: The impact of demographic and socioeconomic maternal variables on PTB computed in binary logistic regression model.

Variables	PTB		
	EH	95% CI	p-value
Non-Roma vs. Roma	1,11	0,85-1,46	0,442
Age < 17 years vs. others	0,70	0,70-0,38	0,025
BMI underweight vs. others	1,38	1,05-1,84	0,024
Health visitor met: ≤5 /≥6	3,38	2,59-4,42	0,001
Education basic vs. more	1,39	1,03-1,87	0,029
Non-married vs. married	0,88	0,71-1,09	0,267
Unemployed vs. employed	0,96	0,74-1,26	0,788
Urban/non-urban housing	0,90	0,74-1,10	0,327
Without amenities/others	0,74	0,55-0,99	0,041
Deep poverty vs. others	0,85	0,65-1,10	0,226
Smoking during pregnancy Y/N	1,69	1,33-2,16	0,001
ETS during the pregnancy/Y/N	1,04	0,84-1,28	0,71

Table 16: Comparison of average birth weights of at-term neonates (37-42 gestational weeks, n=7253) by dichotomous maternal variables.

Variebles	Average difference	Standard error	95%CI	p-value
Non-Roma vs. Roma	261,82	12,05	285,45-238,19	0,001
Age < 17 years vs. others	311,44	32,90	375,93-246,94	0,001
BMI underweight vs. others	236,22	18,25	272,00-200,44	0,001
Non-married vs. married	172,54	11,16	194,43-150,66	0,001
Multipara/primipara	7,90	14,64	36,61-20,82	0,590
Education basic vs. more	259,26	10,99	280,81-237,72	0,001
Unemployed vs employed	166,74	11,02	188,35-145,13	0,001
Deep poverty vs. others	206,79	11,06	228,48-185,10	0,001
Amenities: yes/no	251,44	16,05	282,91-219,97	0,001
Smoking during pregnancy Y/N	322,88	13,03	348,43-297,33	0,001

Table 17: Linear regression model of at-term neonates' (37-42 gestational week) birth weights along the variables of the Table 16.

Variables	Average difference	Standard error	95%CI	p-value
Non-Roma vs. Roma	75,10	17,76	109,92-40,29	0,001
Age < 17 years vs. others	132,15	34,16	199,11-65,18	0,001
BMI underweight vs. others	157,92	19,38	195,92-119,93	0,001
Non-married vs. married	43,83	13,45	70,20-17,45	0,001
Multipara/primipara	60,95	15,73	91,80-30,11	0,001
Education basic vs. more	87,12	18,12	122,64-51,60	0,001
Unemployed vs employed	24,01	15,29	5,96-53,97	0,116
Deep poverty vs. others	24,46	15,73	55,29-6,38	0,120
Amenities: yes/no	48,31	18,88	85,31-11,31	0,111
Smoking during pregnancy Y/N	228,93	14,68	259,50-198,35	0,001

CONCLUSIONS

In our study period the average age of mothers delivered with live-born babies was 27,9 years (StD±5,9). The same outcome was 29.2 years (StD±5.4) in the non-Roma and 24.4 years (StD±5,91) in the Roma population. Concerning maternal tobacco smoking, 44.9% of pregnant Roma women smoked on daily base during the pregnancy opposed to 12.7% of the non-Roma subsample, which increased significantly the chance of PTB (OR=1.69 95%CI=1.33-2.16). Additionally, we registered low educational level, unhealthy lifestyle and low family income.

In the binary logistic model PTB was significantly interrelated with undernutrition measured by BMI (OR=1.38; 95%CI=1.05-1.84), low educational level (OR=1.39; 95%CI=1.03-1.87) and less than 5 visits at the MCHS (OR=3.38; 95%CI=2.59-4.44).

Our linear regression model shows the interrelation of variables with impact on the fetial growth as the greatest impact was realized by tobacco smoking during the pregnancy (-228,9 g) followed by the low maternal BMI value (-157,9 g). The role of Roma ethnicity went back to -75,1 gram indicating clearly that being Roma may not be considered as a firm independent variable.

The result gained show that PTB and LBW are only partly due to the health status. The leading factors are low maternal education, unfavourable living conditions, and bad habits (nutrition, tobacco smoking) Studies published recently indicate that there are interrelations between LBW and specific conditions (cardiovascular diseases, diabetes) of the adult population.

We need complex programs aiming specifically the high risk groups of pregnant women and implementing these programs must consider the collaboration of vulnerable individuals and populations. PTB and LBW prevention must be based on the early recognition of dangers and risk factors. Identification of these circumstances and their impacts on the pregnancy and discovery of thus far unknown interrelations will provide a firm base for improving the obstetrical outcomes in maternal and neonatal terms alike.

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