Sociodemographic and environmental risk factors of preterm delivery and small-for-gestational-age babies

Wojciech Hanke[1], Jarosław Kalinka[2], Wojciech Sobala[1]

[1] Department of Environmental and Occupational Epidemiology, Nofer Institute of Occupational Medicine, Łódź, Poland
[2] Institute of Gynecology and Obstetrics, Medical University of Łódź, Poland

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SUMMARY

The purpose of this study was to determine the influence of sociodemographic and environmental risk factors on preterm delivery (PD) and small-for-gestational-age (SGA) babies in the population of the Łódź region of Poland. The rapid socio-economic transformations in Poland and the associated behavioral changes of the society seen since the early 1990's may have generated new risk factors or simply intensified the impact of those already known. The study group comprised 987 women from this region who gave birth to a child during the period between June 1, 1996 and November 30, 1996. The enrolment criteria included only singleton, non-malformed pregnancies past the 22nd week. The SGA group comprised 66 women while the comparison group comprised 809 women. The PD group included 52 women with preterm delivery and was compared with the reference group of 824 women with term delivery. Logistic regression models were applied to examine the relationship between the probability of the two pathologies and the risk factors under investigation. The mother's age below 19, marital status described as 'single', 3 prior deliveries or more and a history of unemployment during pregnancy were found to be independent, statistically significant risk factors for preterm delivery. An urban residency, low maternal height (below 1.55 m), marital status described as 'single' and smoking during pregnancy were all found to be independent, significant risk factors for SGA. The women delivering for the second time had a reduced risk of SGA. Among the clinical variables, only first trimester hemorrhage proved to be a significant risk factor of this pathology. The socio-economic and environmental risk factors described in this paper play an important role in the pathogenesis of PD and SGA. The spectrum of risk factors should be periodically re-evaluated in order to determine their significance and to monitor for new hazards.

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INTRODUCTION

The identification of risk factors which may influence either pregnancy duration or fetal growth in utero has been the subject of several studies [1-5]. The significance of such clinical variables as various obstetric pathologies, medical complications of pregnancy and chronic disorders (heart disease, hypertension, diabetes, chronic renal disease, lung disease and musculoskeletal disorders) is well documented [6-11].

Sociodemographic and environmental factors are also thought to have an impact on pregnancy outcome [12-19]. However, their predictive value varies to a much higher extent across the studies, compared with those of a purely medical nature, which may be due to the country-specific characteristics of the various populations examined and to methodological differences [2].

The demand for data in this research area has been on the increase recently. The rapid socio-economic transformations in Poland and the associated behavioral changes of the society observed since the early 1990's may have generated new risk factors or simply intensified the impact of those already known.

The purpose of the present study was to determine the sociodemographic and environmental risk factors of preterm delivery (PD) and small-for-gesta-

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Correspondence address: Wojciech Hanke MD PhD, Department of Environmental and Occupational Epidemiology, Nofer Institute of Occupational Medicine, ul. Teresy 8, skr. pocz. 199, 90-950 Łódź, Poland, e-mail: wojt@porta.imp.lodz.pl

tional-age (SGA) babies in the population of the Łódź region of Poland which is characterised by particularly high rate of these pathologies. The findings from this project will be important both for every day clinical practice and for implementation of national health programs for reducing the high incidence of PD and SGA babies in our country.

MATERIAL AND METHODS

The study group comprised 987 women from the Łódź region of Poland who gave birth to a child during the period between June 1, 1996 and November 30, 1996. However, the project was continued until the end of May 1997. All women delivering on randomly selected days within the 6 month study period in 26 hospitals providing maternity services for the region were enrolled. In order to evaluate the validity of sample selection, the number of women covered by the study was compared with that calculated from routine data for the whole population of delivering women. As the data for 1996 were not yet available, the 1995 records were used. In the Łódź region (with a population of about two million people) 10.151 deliveries were registered during the respective six month period of 1995. Assuming that the number of deliveries in 1996 was similar, the sample of 987 examined women constituted about 10% of all the deliveries. Sample size calculations were performed to determine the number required to detect differences between PD/SGA and reference groups. All hypotheses were tested at the level of significance 0.05.

The enrolment criteria included only singleton, non-malformed pregnancies terminated over the 22nd week. Since the aim of the study was to evaluate the sociodemographic and environmental risk factors, the women with medical problems diagnosed before pregnancy (heart failure, hypertension, diabetes, chronic renal disease, lung disease) were later excluded from the study to reduce the number of confounding variables [2]. The data were collected by physicians who administered a standard questionnaire covering sociodemographic, constitutional, medical, employment and occupational issues as well as the patient's smoking status. The physicians were instructed to verify the data on pre-pregnancy medical history, antenatal medical care and medical complications of pregnancy using available medical records. No part of the questionnaire was filled by the patient herself. Pregnancy duration was calculated as the period starting from the first day of the last menstruation and was verified by ultrasound. Preterm delivery refers to the birth at a gestational age of less than 37 completed weeks (less than 259 days). The gestational age of the new-borns was evaluated according to the Dubowitz scale and SGA was diagnosed when the birth weight was below the 10th percentile of the standard curves for Central Poland (Brzozowska's scale). Women who reported smoking at least one cigarette per day were classified as smokers. Hypertension was diagnosed when blood pressure was above 140/90 mmHg.

Out of 987 women selected for the interview, 947 were finally examined. Those not examined included 12 women with structural malformations of the fetus, 12 with multiple pregnancy, 5 with intrauterine death of the fetus and 11 women who declined consent. Seventy-two women with chronic diseases diagnosed before or within the first three months of pregnancy were excluded. The remaining 875 women were eligible for the analysis.

Logistic regression models were applied to examine the relationship between the probability of the two pathologies and the risk factors under study.

Univariant analysis includes only the evaluation of single variables and does not take into account the possible interactions among other variables. Consequently, the determination of independent risk factors was based on a multivariant analysis, which allows elimination of the confounding factors. The impact of particular risk factors was presented as odds ratios (OR) which along with their 95% confidence intervals (CI) were calculated using SPSS Programme. The power of the study to detect the risk of 2.0 for factors manifested in 30 % of the control population was calculated to be 80%.

RESULTS

The univariant analysis of the characteristics of mothers with PD revealed that they were more frequently residents of the urban area of the Łódź region, older than 30 years of age, had a low level of education and described their marital status as 'single' (Table1). The recent loss of a job was connected with a significant increase in PD risk. The insufficient time for relaxation at home (heavy workload from household activities) also significantly contributed to the risk of PD. No significant differences were noted with regard to the constitutional variables (maternal height, pre-pregnancy weight, body mass index). Smoking in pregnancy proved to be considerably significant (OR=2.41) when the combined group of non-smokers and

Table 1. Maternal risk factors and risk of preterm delivery (PD) - univariate analysis.

Variable	PD	Control	OR 95% CI
Place of residence			
- urban	20	184	2.24 (1.20-4.18)
- non-urban	31	640	reference
Previous deliveries			
0	15	358	reference
1	12	236	1.21 (0.52-2.80)
2	10	136	1.75 (0.71-4.27)
≥3	14	94	3.55 (1.56-8.11)
Maternal age:			
- 18	4	34	2.65 (0.74-8.58)
19-30	27	608	reference
31-	20	182	2.47 (1.30-4.69)
Education:			
- primary only	37	415	2.60 (1.34-5.14)
- college or university	14	409	reference
Living standard:			
- low or very low	15	149	1.89 (0.96-3.67)
- satisfactory, high, very high	36	675	reference
Marital status:			
- married	40	746	reference
- unmarried	11	78	2.63 (1.22-5.57)
Body mass index (kg/m^2)			
- 19.7	15	201	1.37 (0.68-2.73)
19.8-26.0	28	515	reference
26.1-	3	90	0.61 (0.12-2.05)
Height (m)			
-1.60	30	465	1.25 (0.62-2.58)
1.61-1.70	13	252	reference
1.71-	4	96	0.81 (0.22-2.75)
Prepregnancy weight (kg):			
-45	4	23	3.09 (0.81-10.77)
46-55	19	338	reference
56-65	19	284	1.19 (0.59-2.40)
66-	9	170	0.94 (0.39-2.25)
Employment status:			
- employed	28	481	reference
- housewife	15	295	0.87 (0.44-1.73)
- unemployed	8	48	2.86 (1.13-7.04)
Possibility to rest at home:			
- sufficient	37	695	reference
- limited or very limited	14	129	2.04 (1.02-4.03)

Variable	PD	Controls	OR 95% CI
Time of first prenatal visit			
- before 12 week	31	505	reference
- ≥ 12 week	20	315	1.03 (0.56-1.91)
First trimester hemorrhage			
- no	49	792	reference
- yes	2	32	1.01 (0.11-4.16)
Hypertension			
- no	47	789	reference
- yes	4	35	1.92 (0.55-5.97)
Anemia			
- no	45	691	reference
- yes	6	133	0.69 (0.26-1.74)
Proteinuria and/or oedema in pregnancy (II or/and III trymeter)			
- no	48	782	reference
- yes	3	42	1.16 (0.28-4.10)
Smoking in pregnancy			
- nonsmokers & occasional smokers	42	773	reference
- heavy smokers (> 5 cig./day)	8	51	2.41 (1.1-5.93)
Passive smoking			
- no	13	344	reference
- yes	38	480	2.09 (1.06-4.21)
Sex of infant			
- male	29	424	reference
- female	22	400	0.80 (0.44-1.47)

Table 2. Maternal risk factors of preterm delivery (PD) - univariate analysis (cont.).

Variable	Adjusted OR	95% CI
Maternal age:		
- 18	3.02	p=0.073
19-30	reference	reference
31-	1.70	p=0.134
Previous deliveries		
0	reference	reference
1	1.48	p=0.355
2	2.04	p=0.131
≥3	4.72	p=0.004
Employment status:		
- employed	reference	reference
- housewife	0.676	p=0.265
- unemployed	2.67	p=0.021
Marital status:		
- married	reference	reference
- single	2.56	p=0.029

Table 3. Adjusted odds ratios of preterm delivery (PD) - multivariate analysis.

Table 4. Maternal risk factors and risk of small-for-gestational-age (SGA) babies - univariate analysis.

Variable	SGA	non-SGA	OR 95% CI
Place of residence			
- urban	41	179	2.14 (1.26-3.62)
- non-urban	25	630	reference
Previous deliveries			
0	35	338	reference
1	10	238	0.41 (0.19-0.84)
2	9	137	0.63 (0.30-1.36)
≥3	12	96	1.21 (0.60-2.42)
Maternal age:			
- 18	3	35	1.85 (1.05-3.25)
19-30	45	590	reference
31-	18	184	1.28 (0.72-2.27)
Education:			
- primary only	39	413	1.39 (0.83-2.30)
- college or university	27	396	reference
Living standard:			
- low or very low	19	145	1.85 (1.05-3.25)
- satisfactory, high, very high	47	664	reference
Marital status:			
- married	50	736	reference
- unmarried	16	73	3.18 (1.64-6.20)
Body mass index (kg/m^2)			
- 19.7	21	195	1.34(0.78-2.35)
19.8-26.0	40	501	reference
26.1-	3	94	0.40 (0.08-1.30)
Height (m)			
-1.55	7	26	3.64 (1.47-8.96)
1.56-1.60	14	115	1.64 (0.85-3.15)
1.61-1.70	36	487	reference
1.71-	9	166	0.73 (0.35-1.55)
Prepregnancy weight (kg):			
-45	6	21	4.14 (1.52-11.29)
46-55	30	273	1.59 (0.91-2.81)
56-65	23	334	reference
66-	5	174	0.42 (0.15-1.12)
Employment status:			
- employed	40	469	reference
- housewife	19	291	0.77 (0.43-1.35)
- unemployed	7	49	1.67 (0.71-3.94)
Possibility to rest at home:			
- sufficient	53	679	reference
- limited or very limited	13	130	1.28 (0.68-2.42)

Table 5. Maternal risk factors and risk of small-for gestational-age (SGA) babies - univariate analysis (cont.).

Variable	SGA	non-SGA	OR 95% CI
Time of first prenatal visit			
- before 12 week	41	495	reference
- ≥ 12 week	25	310	1.03 (0.78-2.19)
First trimester hemorrhage			
- no	60	781	reference
- yes	6	28	2.79 (1.11-7.00)
Hypertension			
- no	61	775	reference
- yes	5	34	1.86 (0.71-4.95)
Anemia			
- no	55	681	reference
- yes	11	128	1.06 (0.95-3.65)
Proteinuria and/or oedema in pregnancy (II or/and III trymeter)			
- no	62	768	reference
- yes	4	41	1.20 (0.41-3.48)
Smoking in pregnancy			
- nonsmokers & occasional smokers	55	762	reference
- heavy smokers (> 5 cig./day)	11	47	3.35 (1.58-6.55)
Passive smoking			
- no	22	335	reference
- yes	44	474	1.41 (0.83-2.40)
Sex of infant			
- male	27	426	1.61 (0.96-2.67)
- female	39	383	reference

occasional smokers were compared with those smoking more than 5 cigarettes a day (Table 2). The proportions of non-smokers, occasional smokers and heavy smokers were 80.8%, 12.6%, 6.6%, respectively. The effect of passive smoke exposure was also strongly manifested (OR=2.09).

The risk ratios for other maternal characteristics (time of first prenatal visit, hypertension, anaemia, proteinuria or/and edema in the current pregnancy) were above the value of one; however, no statistical significance was noted.

In the stepwise multiple logistic regression model the mother's age below 19, single marital status, at least 3 prior deliveries and unemployment during pregnancy were found to be independent, statistically significant risk factors of preterm delivery (Table 3).

The univariant analysis of the characteristics of mothers who delivered SGA and non-SGA babies (Tables 4 and 5) indicated that the former were more frequently the residents of the urban part of the Łódź region and had low family incomes. Women who described their marital status as 'single' had more than a three-fold higher risk of having SGA baby. Also, maternal height and low prepregnancy weight appeared to be significant SGA risk factors. A similar trend could be noted for the body mass index (BMI); however, it was not confirmed due to a small number of subjects with BMI values over 26.0. The women delivering their second child were found to have a lower SGA risk. No significant differences were observed with regard to age, education, employment status and relaxation time at home.

The pregnancies complicated by first trimester hemorrhage constituted a significant risk factor of delivering SGA babies (Table 5). Smoking in pregnancy proved to be considerably significant (OR=3.35) when the combined group of nonsmokers and occasional smokers was compared with those smoking more than 5 cigarettes a day.

Variable	Adjusted OR	95% CI
Place of residence		
- urban	1.92	1.08-3.43
- non-urban	reference	
Previous deliveries		
0	reference	
1	0.3682	0.17-0.81
2	0.6107	0.26-1.40
≥3	0.8772	0.39-1.88
Height (m)		
-1.55	3.51	1.36-9.11
1.56-1.60	1.96	0.99-3.88
1.61-1.70	reference	
1.71-	0.49	0.20-1.16
Marital status:		
- married	reference	
- unmarried	2.35	1.12-4.93
Smoking in pregnancy		
- nonsmokers & occasional smokers	reference	
- heavy smokers (> 5 cig./day)	2.86	1.29-6.34
First trimester hemorrhage		
- no	reference	
- yes	2.61	1.0-7.06

Table 6. Adjusted odds ratios of small-for-gestational-age (SGA) - multivariate analysis.

The values of risk ratios relating to other maternal characteristics (time of first prenatal visit, hypertension, anemia, proteinuria or/and edema in present pregnancy) were not significant.

In the stepwise multiple logistic regression model the urban residency, low maternal height (below 1.55 m), marital status described as 'single', and smoking in pregnancy were found to be independent, statistically significant risk factors of delivering SGA baby (Table 6). The women delivering for the second time presented a reduced SGA risk. Among the clinical variables only the first trimester hemorrhage significantly contributed to a high risk of SGA.

DISCUSSION

Several regional health programs for reducing the high incidence of PD and SGA have been implemented in Poland over the last decade. Within these programs the high risk groups of pregnant women were distinguished based mainly on the diagnosis of medical risk factors. From the wide spectrum of the socio-occupational and environmental hazards, only cigarette smoking was considered. The economic and behavioural changes observed in Poland recently give rise to the question of whether the spectrum of PD and SGA risk factors should not be extended to cover other socio-occupational variables. The adoption of this approach requires, however, monitoring a wide range of factors in order to disclose the newly generated ones and re-evaluate the significance of those already identified [20]. For example, unemployment, which is a relatively new phenomenon in Polish society, proved to be a risk factor for preterm delivery.

From a practical point of view, the number of risk factors should be limited. Only then will it be possible to take them into consideration in clinical practice, as well as in comprehensive national health programs. The results of our study revealed that almost half of the analyzed risk factors of SGA and PD proved to be important in the univariant analysis (Tables 1, 2, 4, 5). This may result from the fact that this analysis does not take into account the various interactions between the factors. The application of the multivariate model allowed limit-

ing the number of risk factors of SGA to six, and of PD to four independent factors. As we can see the multivariate analysis is now a requirement if one attempts to identify independent risk factors [21].

Our analysis indicated that the variables displayed in Tables 3 and 6 are the most important, independent socio-economic and environmental risk factors of PD and SGA which should not be neglected either in every day clinical practice or at the regional level of prenatal care. Some of the relationships which were not manifested at this stage of the study may be revealed while the project progresses and the final analysis will be completed.

CONCLUSIONS

1. The socio-economic and environmental risk factors described in this paper play an important role in the pathogenesis of PD and SGA.
2. The recently developed epidemiological approach toward the identification of independent risk factors should be applied periodically to re-evaluation of the significance of the previously identified factors as well as to reveal new ones.

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