

## ORIGINAL ARTICLE

# Is individual social deprivation associated with adverse perinatal outcomes? Results of a French multicentre cross-sectional survey

A. LELONG<sup>1,3</sup>, L. JIROFF<sup>2</sup>, M. BLANQUET<sup>1,3</sup>, C. MOURGUES<sup>1,3</sup>, M.-C. LEYMARIE<sup>1,3</sup>, L. GERBAUD<sup>1,3</sup>,  
D. LÉMERY<sup>2,3,4</sup>, F. VENDITTELLI<sup>1,2,3,4</sup>

<sup>1</sup> Service de Santé Publique, CHU de Clermont-Ferrand, Clermont-Ferrand Cedex 1, France; <sup>2</sup> Service de Gynécologie Obstétrique, CHU de Clermont-Ferrand; <sup>3</sup> Clermont Université, Université d'Auvergne, EA 4681, Peprade (Périnatalité, grossesse, Environnement, PRATIques médicales et DEveloppement), Clermont-Ferrand, France; <sup>4</sup> Réseau de Santé Périnatale d'Auvergne, France

## Key words

Adverse perinatal outcomes • Preterm birth • Individual Social deprivation • EPICES score

## Summary

**Introduction.** French national health programmes take into account social deprivation in their implementation, those targeting perinatal outcomes, especially. The main aim of the present work was to assess the association between individual social deprivation and adverse perinatal outcomes.

**Methods.** A multicentre cross-sectional population-based survey was performed between October and December 2007. Eligible women delivered a baby in one of the three maternity hospitals of Clermont-Ferrand area, and read and spoke French fluently. Women who had undergone voluntary termination of pregnancy were excluded. Individual social deprivation was measured by the EPICES score. Standard prenatal follow-up defined by having less than 7 consultations and quality of prenatal care defined by having at least four consultations were measured. Adverse perinatal outcomes were measured by a composite criterion defined

by women who had the occurrence of the three main causes of pregnancy-related disorders: preterm delivery, and/or diabetes, and/or obstetrical hypertension.

**Results.** Of the 471 eligible women, 464 were finally included. One hundred and fifteen (24.78%) women were socially deprived. The most deprived women had poor standard prenatal follow-up ( $p = 0.003$ ) and poor quality of prenatal care (0.03). Nationality was the sole confounding factor identified. Deprived women had a two-fold greater risk of adverse perinatal outcomes, adjusted odds ratio 1.95 [1.15; 3.29].

**Discussion.** Social deprivation was associated with adverse perinatal outcomes. Social deprivation should be systematically screened in pregnant women standard follow-up, among migrant women, especially.

## Introduction

The process of deprivation was defined first by J. Wreszinski and P. Townsend who also reported that deprivation is the main cause of inequalities in health [1-4]. The French High Committee on Public Health reports of 1998 revealed inequalities in health among the most deprived and pregnant women especially, with lower follow up and higher adverse perinatal outcomes as preterm delivery [5, 6]. Several studies have already shown an association between socioeconomic deprivation and adverse birth outcomes [7-16]. Whole of those studies measured deprivation by using geographical indices limited by "the ecological bias" [17, 18]. Actually, four French surveys dealt with individual social deprivation and adverse perinatal outcomes [19-22].

The Europeristat report on perinatal health indicators published in 2010 revealed that the French early and late neonatal mortality rate per 1,000 live birth was 2.4 ranking France at seventeenth. It also showed that maternal mortality rate in 2006-2010 was 8.4 per 100,000 live birth far from the Sweden rate at 3.1. Considering those results, a French national perinatal program was devel-

oped between 2005 and 2007 aiming to improve access to perinatal health care service for the most deprived pregnant women and to reduce maternal and perinatal morbidity and mortality by 40% and 15%, respectively. National guidelines concerning prenatal care of pregnant women and the importance of identifying those in a vulnerable situation have been developed by the French National Authority for Health in 2007 (<http://www.has-sante.fr>).

The main aim of the present work was to assess the association between individual social deprivation and adverse perinatal outcomes.

## Methods

### BACKGROUND

In 2009, the urban area of Clermont-Ferrand had 259,702 inhabitants and three maternity hospitals, two public of level III with obstetric, neonatology and neonate recovery units and one private of level II with obstetric and neonatology units. These maternity units were coordi-

nated by the perinatal network of Auvergne (Réseau de Santé Périnatale Auvergne-RSPA). In 2011, 2,857 births were registered.

French pregnant women follow-up has been established by the decree number 92-143 of February the 14th, 1992. Women with low-risk pregnancies undergo a standard prenatal follow-up of 7 consultations (one before the end of the third month and one visit a month), and three ultrasound examinations (one between 11 and 13 weeks, one between 20 and 24 weeks, and one between 30 and 35 weeks). The French national health insurance fund reimburses this follow-up.

In France, health examination centres, providing free medical consultations to recipients of the national health insurance for salaried workers, developed in 2002 a reliable individual score of deprivation, called the EPICES (Evaluation de la Précarité et des Inégalités de santé dans les Centres d'Examens de Santé - Evaluation of Deprivation and Inequalities in Health Examination Centres) [23-26]. This score is composed by 11 items on marital status, health insurance status, economic status, family support and leisure activity during the last 12 months (Appendix 1). It has been validated on a cohort of 197,389 persons [19, 27, 28]. The EPICES score is computed by adding each question coefficient to intercept whenever the answer is "yes". The higher the score, the more deprived the women is. A reliable threshold of 30.17 was previously identified with deprived persons having a score equal to or above 30.17 [19].

## PATIENTS

Eligible women delivered a baby in one of the three maternity hospitals of Clermont-Ferrand area and had a fluent command of spoken and written French. Women who delivered a foetus by medical abortion were not included in the study.

## METHODS

A multicentre cross-sectional population-based survey was carried out between October, the 25<sup>th</sup>, and December the 27<sup>th</sup>, 2007.

Sociodemographic and medical data was collected in women medical record by healthcare professionals or during the interview performed by the research team. The interview was performed during the hospital stay, at the postpartum period, by a member of the research team.

Data was gathered about socio-demographic status, family status; couple vs. single (women not married or not living with a partner) and professional status; employed, unemployed, parental leave and other (pupil, student, and trainee). Medical and obstetrical data was collected, including parity (number of children the women had, excluded the current delivery), obstetrical history of induced abortion (voluntary termination of pregnancy before 14 weeks), miscarriage (spontaneous abortion < 22 weeks), and caesarean section. Then, labour and delivery characteristics, post-partum haemorrhage (> 1 litre), birth weight and percentile, calculated from gestational age and sex according to the AUDIPOG curves (<http://www.audi-pog.net/>) and five-minutes Apgar score were gathered.

Standard prenatal follow-up defined by 7 consultations and quality of prenatal care defined by at least four visits during pregnancy were measured.

The EPICES score was calculated for each women included in the survey and ranked in the deprived category when it was equal to or above 30.17.

Adverse perinatal outcomes were measured by a composite criterion. This criterion included the three main causes of pregnancy-related disorders: preterm delivery (< 37 weeks of gestation), gestational diabetes and high blood pressure during pregnancy (gestational hypertension, pre-eclampsia, and eclampsia) ([www.engof.asso.fr](http://www.engof.asso.fr)). The criterion was quoted 1 if women had preterm delivery, and/or gestational diabetes, and/or high blood pressure during pregnancy.

All participants gave their informed consent to be enrolled. Data coming from computerized medical records were reported to the French National Commission for Data Protection (CNIL- Commission Nationale de l'Informatique et des Libertés) (N° 1268114). Under French law, this study was exempt from approval by an ethics committee.

## STATISTICAL ANALYSES

Descriptive analysis assessed women's characteristics and prevalence of social deprivation. Bivariate analysis was performed by using Chi-square test or Fisher's exact test for qualitative variables and with Student t-test or Wilcoxon test for quantitative variables. First, association between EPICES score and the composite criterion was assessed. Second, relationship between EPICES score and explanatory variables associated with adverse perinatal outcomes in the literature; age, nationality, employment status, tobacco smoke during pregnancy and having medical history of induced abortion, was performed to identify variables that can be confounders. Third, the Mantel-Haenszel method was performed to identify and to consider variables being real confounding factors. A threshold of 10% was taken for the Mantel-Haenszel method to not neglect real confounding factors [29]. Then, a multivariate analysis was performed by using logistic regression that included EPICES score, real confounding factors identified and interactions between EPICES and confounding factors. Results of the logistic regression were presented through the adjusted Odds Ratio (aOR) with their 95% confident interval (95%CI). All the other statistical analyses were performed with a meaningful threshold of 5%. Statistical analysis was performed on SAS software (V9.3. SAS Institute Inc., Carry, NC, 2002-2003).

## Results

Among the 477 women who delivered a baby, 471 women were eligible and 464 (98%) were finally included; seven women did not give their informant consent to be enrolled. Of the women included, (92%) were French, aged 29 years old (standard deviation 5.05) and 46% lived single. Deprived women were younger, migrants,

**Tab. I.** Descriptive and bivariate analysis of women's sociodemographic characteristics in the overall sample and according to the social deprivation status.

	Overall sample N = 464 %	Non-deprived N = 349 %	Deprived N = 115 %	p
<b>Age (years)</b>				
< 17	0.65	0.0	2.61	< 0.001
17 ≤ age < 25	18.36	10.63	41.74	
25 ≤ age < 35	69.11	76.15	47.83	
≥ 35	12.53	13.22	10.43	
<b>Family status (single)</b>	46.34	42.12	59.13	0.002
<b>Nationality</b>				
French	92.46	96.85	79.13	< 0.001
EU migrants	1.08	0.57	2.61	
Non-EU migrants	6.47	2.58	18.26	
<b>Level of education</b>				
No schooled	0.43	0.29	0.87	< 0.001
Primary/Secondary school	20.91	12.32	46.96	
High school	15.95	12.32	26.96	
Higher education	62.72	75.07	25.22	
<b>Employment status</b>				
Employed	73.32	84.10	40.87	< 0.001
Parental leave	1.08	1.16	0.87	
Unemployed	2.82	1.73	6.09	
Other	22.78	13.01	52.18	

lived single, had lower level of education, and less employed (Tab. I).

More deprived women smoked during pregnancy ( $p = 0.001$ ). They also had had more frequently voluntary termination of pregnancy ( $p < 0.001$ ). Prenatal follow-up were poor among the most deprived women who were four fold without quality of prenatal care and two fold without a standard perinatal follow-up (Tab. II). A significance difference of birth weight has been identified according to the social deprivation with more ba-

bies having low birth weight ( $< 2,500$  g) or high birth weight ( $\geq 4,000$  g) in deprived women (Tab. III).

Women's nationality was the sole confounding factor identified ( $p = 0.011$ ). Individual social deprivation was associated with adverse perinatal outcomes in the bivariate analysis with RR equal to 1.49 (95%CI: [1.01-2.21]). The multivariate analysis endorsed this result with aOR equal to 1.95 (95%CI: [1.15-3.29]) after adjustment on nationality (Tab. IV). The a posteriori power of our study ( $\alpha = 0.05$ ) was 62% (unilateral test).

**Tab. II.** Descriptive and bivariate analysis of women's medical and obstetric characteristics and of new born medical characteristics in the overall sample and according to the social deprivation status.

	Overall sample % (N)	Non-deprived % (N)	Deprived % (N)	p
<b>Parity (Nulliparous)</b>	39.44 (464)	41.55 (349)	33.04 (115)	0.11
<b>Type of pregnancy (single)</b>	97.63(464)	97.42(349)	98.26(115)	1.00
<b>Pregnancy Tobacco smoke (yes)</b>	17.06 (463)	13.79 (348)	26.96 (115)	0.001
<b>BMI<sup>a</sup> during pregnancy (<math>\geq 25</math>)</b>	22.63 (464)	22.92 (349)	21.74 (115)	0.79
<b>Obstetrical history</b>	(463)	(348)	(115)	
Induced abortion	12.28	9.17	21.74	< 0.001
Miscarriage	14.87	16.33	10.43	0.12
Caesarean section	7.76	7.16	9.57	0.40
<b>Prenatal follow-up</b>	(460)	(348)	(112)	
< 4 prenatal visits	1.30	0.57	3.57	0.03
< 7 prenatal visits	10.43	8.05	17.86	0.003
<b>Preterm birth (&lt; 37 weeks of gestation) (yes)</b>	9.24 (476)	8.10 (358)	12.71 (118)	0.13
<b>High blood pressure during pregnancy (yes)</b>	7.46 (456)	6.45 (341)	10.43 (115)	0.16
<b>Gestational Diabetes (yes)</b>	5.05 (455)	4.69 (341)	6.14 (114)	0.54

<sup>a</sup> BMI: Body Mass Index

**Tab. III.** Descriptive and bivariate analysis of obstetrical data about labour and delivery and of new born medical characteristics in the overall sample and according to the social deprivation status.

	Overall sample % (N)	Non-deprived % (N)	Deprived % (N)	p
<b>Onset of labour</b>	(474)	(356)	(118)	
Spontaneous labour	63.50	63.76	62.71	0.98
Induction of labour	22.36	22.19	22.88	
Elective caesarean section	14.14	14.04	14.41	
<b>Mode of delivery</b>	(476)	(356)	(118)	
Caesarean sections	21.43	21.79	20.34	0.74
During labour	34.31	35.90	29.17	0.54
Before labour	65.69	64.10	70.83	
<b>PPH<sup>a</sup> (yes)</b>	4.22 (474)	3.63 (358)	6.03 (116)	0.29
<b>Birth weight (grams)</b>	(476)	(358)	(118)	
< 1,500	2.32	2.81	0.85	0.03
1,500 ≤ weight < 2,500	5.91	4.49	10.17	
2,500 ≤ weight < 4,000	86.71	88.48	81.36	
≥ 4,000	5.06	4.21	7.63	
< 5 <sup>th</sup> percentile	4.83	4.75	5.08	0.88
<b>Five-minute Apgar score ≤ 4</b>	1.68 (475)	1.12 (357)	2.54 (118)	0.37

<sup>a</sup> PPH: Post-Partum Haemorrhage.

**Tab. IV.** Results of the bivariate and multivariate analysis for adverse perinatal outcomes according to the social deprivation status.

	Bivariate analysis			Multivariate analysis	
	Non-deprived % (N)	Deprived % (N)	Crude RR <sup>a</sup> [95%CI <sup>b</sup> ]	Adjusted OR <sup>c</sup> [95%CI <sup>b</sup> ]	p
Composite criterion	16.48 (358)	24.58 (118)	1.49 [1.01; 2.21]	1.95 [1.15; 3.29]	0.012

<sup>a</sup> RR: Relative Risk; <sup>b</sup> CI: Confident Interval; <sup>c</sup> Adjusted OR: Adjusted Odds Ratio on the nationality (French vs. foreigner)

## Discussion

### MAIN RESULTS

Women who were socially deprived were exposed to higher risk of adverse perinatal outcomes. They also had poor prenatal follow-up and poor quality of prenatal care.

### COMPARISONS WITH OTHER STUDIES

Four French studies have already identified association between individual social deprivation and perinatal indicators [19, 20-22]. Sass et al. showed that EPICES score was associated to poor gynaecologic follow-up (adjusted OR 2.09 [2.02; 2.16]) [19]. Gayral-Taminh et al. revealed that socioeconomic and social deprivation measured by an individual questionnaire of 67 items were associated to preterm birth (aOR 1.38 [1.06; 1.79]) and five-minute Apgar score < 7 (aOR 2.98 [1.43; 6.18]) [20]. Convers et al. reported higher prevalence of gestational diabetes, high blood pressure during pregnancy and intrauterine growth restriction in the most deprived women [22]. The last French national perinatal survey performed in 2010

showed poor prenatal follow-up in migrant and in women having low income status (aOR 1.4 [1.1; 1.9]) [21]. Several American and European studies also revealed association between socioeconomic deprivation and adverse perinatal outcomes by measuring deprivation with geographical indices [8-16, 30-35]. Most of the surveys identified a significant relationship between preterm birth and neighbourhood deprivation [10, 12-16, 30, 32-34]. Additional works revealed an association between other adverse perinatal outcome and deprivation as small for gestational age [15], low apgar score at 5 minutes after birth [15], low birth weight [31], perinatal mortality [9, 15, 34], stillbirth [16]. The review of literature also revealed that association existed between adverse perinatal outcomes and deprivation was weighted by pregnant women migration status with misunderstood causal mechanisms as ours findings [11, 15, 35].

### IMPLICATIONS

Deprived women had specific characteristics, they were migrants, younger, with less social support, lower level of education, lower employment rate, poorer medical follow-up and riskier behaviour (tobacco smoke espe-

cially). Migrant status need to be considered in particular because it was the only confounding factor identified even though one of the inclusion criteria was fluent command of spoken and written French. It would be interesting therefore to do a deep analysis in these women known to have limited access to care [36]. This result also underlines that deprived women deserve specific consideration not only by various healthcare professionals like obstetricians, midwives, psychiatrist and general practitioners, but also by social workers. Consequently, family policy that takes into account the whole family, from the beginning of pregnancy to the post-partum period should be implemented in maternity hospitals. Such a program should take into consideration medical and social needs deprived women have and also develop appropriate educational processes.

Various tools exist to measure deprivation based on composite indices per geographic area like Townsend, Carstairs, NZDep index and one index from a North American study [1, 2, 23, 24]. EPICES score is the only one that measures individual deprivation. Our results were congruent with those of the literature, the EPICES score seems to be a reliable tool to measure deprivation in pregnant women [37]. The item on physical activity could be irrelevant in the context of pregnancy. It appeared that it was not the case according with the literature that underlined the importance to maintain regular physical activity during pregnancy [38, 39]. The EPICES score should be therefore included systematically in standard follow-up of pregnant women.

#### STRENGTH AND LIMITS

It was a multicentre population-based study performed on a moderate sample size with high participation rate. The research team decided to not include pregnant women having a voluntary termination of pregnancy considering psychological reasons. Women having termination of pregnancy, 10.6 for 1,000 women aged from 15 to 49 years in Auvergne in 2006 (from the regional observatory of the health of Auvergne; www.ors-auvergne.org), are a specific group that deserve to be investigated apart. There is therefore no selection bias. Our statistical analysis was limited by insufficient statistical power.

#### Conclusions

Deprived women were at higher risk of poor prenatal follow-up, poor quality of prenatal care and adverse perinatal outcomes. The EPICES score seemed to be a reliable tool to identify deprived pregnant women. Further research is needed therefore to assess adverse perinatal outcomes under the prism of individual social deprivation and to look for barriers that prevent pregnant women to fulfil standard follow-up.

#### ACKNOWLEDGMENT

We would like to thank the AUDIPOG Sentinel Network (The Association of Users of Computerized Data in Pediatrics, Obstetrics and Gynaecology - Association

des Utilisateurs de Dossiers Informatisés en Pédiatrie, Obstétrique et Gynécologie), who took part in this project.

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■ Received on January 21, 2015. Accepted on May 27, 2015.

■ Correspondence: Audrey Lelong, Service de Santé Publique, CHU de Clermont-Ferrand, 7, place Henri Dunant, 63058 Clermont-Ferrand Cedex 1, France - Tel. +33 473750604 - Fax +33 473750619 - E-mail: a\_lelong@chu-clermontferrand.fr

## Appendix 1 EPICES score

(Evaluation de la Précarité et des Inégalités de santé dans les Centres d'Examens de Santé - Evaluation of Deprivation and Inequalities in Health Examination Centres)

Questions	Yes
Do you sometimes meet with a social worker (welfare worker, educator)?	10.06
2. Do you have complementary health insurance (mutual insurance)?	11.83
3. Do you live as a couple?	8.28
4. Are you a homeowner or will you be one in the near future?	8.28
5. Are there periods in the month when you have real financial difficulties in facing you needs (food, rent, electricity)?	14.80
6. Have you participated in any sports activities in the last 12 months?	6.51
7. Have you gone to any shows (cinema, theatre) in the last 12 months?	7.10
8. Have you gone on holiday during the past 12 months?	7.10
9. Have you seen any family members in the past six months (other than your parents or children)?	9.47
10. Did you have difficulties (financial, family or health), is there anyone around you who could take you in for a few days?	9.47
11. Did you have difficulties (financial, family or health), is there anyone around you who could help you financially (material aid such as lending you money)?	7.10
Intercept	75.14