Brazilian Journal of Medical and Biological Research (2007) 40: 1203-1210
ISSN 0100-879X

Do socioeconomic factors explain why maternal smoking during pregnancy is more frequent in a more developed city of Brazil?

V.S. Ribeiro[1], F.P. Figueiredo[2], A.A.M. Silva[2], R.L.F. Batista[2], M.A. Barbieri[3], F. Lamy Filho[1], M.T.S.S.B. Alves[2], A.M. Santos[2] and H. Bettiol[3]

[1]Departamento de Medicina III, [2]Departamento de Saúde Pública, Universidade Federal do Maranhão, São Luís, MA, Brasil
[3]Departamento de Puericultura e Pediatria, Faculdade de Medicina de Ribeirão Preto, Universidade de São Paulo, Ribeirão Preto, SP, Brasil

Correspondence
V.S. Ribeiro
Rua dos Rouxinóis
Condomínio Alphaville
Bloco 2, Apto. 402, Renascença II
65075-630 São Luís, MA
Fax: +55-98-3235-3020
E-mail: zmribeiro@gmail.com

Research supported by FAPESP (No. 93/0525-0) and CNPq (Nos. 523474/96-2 and 520664/98-1).

Received October 10, 2006
Accepted June 4, 2007

Abstract

The prevalence of smoking during pregnancy in Ribeirão Preto, a rich Brazilian city, was significantly higher (21.4%) than in São Luís (5.9%), a less developed city. To assess which variables explain the difference in prevalence of smoking during pregnancy, data from two birth cohorts were used, including 2846 puerperae from Ribeirão Preto, in 1994, and 2443 puerperae from São Luís, in 1997/98. In multivariable analysis, risk of maternal smoking during pregnancy was higher in São Luís for mothers living in a household with five or more persons (OR = 1.72, 95%CI = 1.12-2.64), aged 35 years or older (OR = 1.98, 95%CI = 0.99-3.96), who had five or more children (OR = 2.10, 95%CI = 1.16-3.81), and whose companion smoked (OR = 2.20, 95%CI = 1.52-3.18). Age of less than 20 years was a protective factor (OR = 0.55, 95%CI = 0.33-0.92). In Ribeirão Preto there was association with maternal low educational level (OR = 2.18, 95%CI = 1.30-3.65) and with a smoking companion (OR = 3.25, 95%CI = 2.52-4.18). Receiving prenatal care was a protective factor (OR = 0.24, 95%CI = 0.11-0.49). Mothers from Ribeirão Preto who worked outside the home were at a higher risk and those aged 35 years or older or who attended five or more prenatal care visits were at lower risk of smoking during pregnancy as compared to mothers from São Luís. Smoking by the companion reduced the difference between smoking rates in the two cities by 10%. The socioeconomic variables in the model did not explain the higher prevalence of smoking during pregnancy in the more developed city.

Key words
• Smoking
• Pregnancy
• Risk factors
• Perinatal complications
• Placenta previa

Introduction

The relation between smoking during pregnancy and the occurrence of perinatal complications has been clearly demonstrated in the literature. Smoking mothers have more preterm deliveries (1), children with intrauterine growth restriction (2), preterm rupture of membranes (3), placental abruption (4), placenta previa (5), and infections dur-

ing pregnancy (6). Intrauterine exposure to tobacco is also directly related to an increased risk of stillbirth and of death during the first year of life (6,7), to sudden death syndrome in infancy (6), and to a higher risk of death during later stages of childhood (8,9).

The prevalence of smoking during pregnancy in developed countries was 25% in France in 1988 (2) and 18% (among whites) and 14% (among blacks) in the United States throughout the 1990 decade (10). In Brazil, smoking during pregnancy varies widely, with a prevalence of 7.2% in Manaus (North), 16.8% in Fortaleza (Northeast), 16.1% in São Paulo (Southeast), and 31.9% in Porto Alegre (South) (11). In the 1990 decade, the prevalence in Pelotas (State of Rio Grande do Sul, South) was 33.2% (12), with this percentage reaching 44.2% at the beginning of pregnancy (13). In Brazilian studies, among the factors that have been related to smoking during pregnancy particularly important are low schooling, multiparity, the consumption of alcoholic drinks, a smoking companion (11), low income, and absence of prenatal care (14).

To our knowledge, no study has been designed to investigate why maternal smoking rate during pregnancy is higher in more developed Brazilian cities and to what extent socioeconomic inequalities are able to explain the difference in rates. The aim of the present study was to investigate if socioeconomic factors explain why maternal smoking during pregnancy is higher in Ribeirão Preto (21.43% in 1994), a more developed city located in the Southeast (15), than in São Luís (5.94% in 1997/98), a less developed municipality in the Northeast of Brazil (16).

Material and Methods

The data used in the present investigation were obtained from two birth cohort studies conducted in São Luís, State of Maranhão (MA), in 1997/98 and in Ribeirão Preto, State of São Paulo (SP), in 1994.

Systematic sampling stratified according to the maternity hospital was used in São Luís. The study covered 94% of all hospital births during a period of one year and was carried out at public hospitals of the Unified Health System (SUS in the Portuguese acronym), and at hospitals covered by insurance and/or private. One seventh of the deliveries that occurred during a period of 1 year, from March 1, 1997 to February 28, 1998, including resident and non-resident subjects, liveborns or stillborns and singletons or multiple births were investigated. Only data concerning residents and liveborn singletons were included in the present study. A questionnaire was applied to the puerperae, usually soon after delivery, after they gave informed consent. The questionnaire contained identification, demographic and socioeconomic data, as well as questions about reproductive health and utilization of prenatal services. A total of 2443 observations were recorded, with a 5.9% prevalence of maternal smoking being identified (16).

In Ribeirão Preto, information was collected from all puerperae over a period of four consecutive months (one third of all deliveries) from April 25 to August 25, 1994. This collection was based on a previous study showing that there was no seasonality of births along the year or of some of the other variables considered in the study (e.g., low birth weight, preterm birth, maternal age at delivery, and multiple births) (15). Considering only liveborn singletons from families residing in the municipality, the sample consisted of 2846 births, and a 21.4% prevalence of maternal smoking was identified (15). The study covered 98% of all births that occurred in the city during the study period. The methodological procedures of the two studies have been described in detail in other publications (15-17).

The study variables were analyzed separately in each city both in the non-adjusted

and adjusted model. The factors associated with maternal smoking were first identified using a simple logistic regression model (18). For the construction of the adjusted model, a model containing all the selected variables that might be related to maternal smoking was used as the starting point. Next, the joint logistic model with the two cities in the same model was considered, including the "city" variable, which was coded as 1 = Ribeirão Preto and 0 = São Luís. The interactions between the study site and the remaining factors selected were tested and those found to be statistically significant were included in the final model together with the main effects. Finally, a combined sequential model was analyzed. The crude odds ratio (OR) of maternal smoking was calculated according to "city" to estimate the non-adjusted difference in the maternal smoking rate during pregnancy between the two towns. Next, each variable was adjusted together with the "city" variable, and this adjusted OR was compared to the crude OR. If the variable reduced the adjusted OR compared to the crude OR by at least 10%, it was considered to explain some of the difference in maternal smoking rate between the two towns. At the end, the adjusted OR was calculated for all variables studied.

Data were analyzed using the Stata statistical package, version 8.0 (19). P values <0.05 were considered to be significant and P values of 0.10 to 0.05 were considered to be marginally significant.

Results

In the non-adjusted analysis (Table 1), the factors significantly associated with smoking during pregnancy in both cities were: number of household residents equal to or higher than five, parity of five or more, companion's smoking habit, and maternal schooling of four years or less. Maternal age of 35 years or more was a risk factor for smoking during pregnancy only in São Luís; absence of a companion and maternal schooling of 11 years or less were significantly associated with smoking during pregnancy only in Ribeirão Preto. Maternal work outside the home was not associated with smoking habit in either city. Primiparity, maternal age of less than 20 years, one to four or five or more prenatal visits, and family income of more than five minimum wages were protective factors against smoking in both cities.

In the adjusted model, the São Luís and Ribeirão Preto studies were first analyzed separately. In São Luís, the variables that continued to be associated with maternal smoking were five or more household residents, parity of five or more, and companion's smoking habit. Age of less than 20 years continued to be a protective factor, whereas age of 35 years or more continued to be a risk factor with borderline significance. In Ribeirão Preto the adjusted model showed association of maternal smoking with companion's smoking habit and with maternal schooling of four years or less. Prenatal visits were a strong protective factor, while primiparity and income of more than five minimum wages had a marginal protective effect (Table 2).

When the joint logistic models for both cities was considered, five or more household residents, companion's smoking habit and maternal schooling of 4 years or less were associated with a higher risk of smoking during pregnancy, while primiparity and family income of five or more minimum wages were associated with a lower risk. Three interaction terms were kept in the final model. There was a significant interaction between the "city" variable and the following variables: maternal work outside the home, maternal age, and number of prenatal visits (Table 3). The Ribeirão Preto mothers who worked outside the home had a higher risk of smoking and the mothers aged 35 years or more and with five or more prenatal visits had a lower risk of smoking during pregnancy compared to São Luís mothers.

In the combined sequential model, the risk of maternal smoking during pregnancy was 4.32 times higher for Ribeirão Preto than for São Luís women. Only companion's smoking habit reduced this higher risk by more than 10%, to 3.95 (Table 4).

Table 1. Non-adjusted analysis of the factors associated with smoking during pregnancy in Ribeirão Preto, SP, 1994 and in São Luís, MA, 1997/98.

Variables	Ribeirão Preto (1994)			São Luís (1997/98)		
	N = 2846	Smoking (%)	OR (95%CI)	N = 2443	Smoking (%)	OR (95%CI)
Marital status*						
With a companion	2381	20.6%	1	1850	5.7%	1
Without a companion	347	27.4%	1.48 (1.14-1.91)	592	6.8%	1.20 (0.82-1.75)
Not known	118	2.5%		1	0%	
Maternal work outside the home						
No	1709	22.2%	1	1836	6.21%	1
Yes	1032	20.2%	0.88 (0.73-1.06)	606	5.12%	0.81 (0.54-1.22)
Not known	105	0%		1	0%	
Residents per household*+						
1 to 4	1906	18.1%	1	965	3.7%	1
5 or more	823	29.3%	1.87 (1.55-2.27)	1477	7.4%	2.06 (1.40-3.02)
Not known	117	1.7%		1	0%	
Parity*+						
2 to 4	1496	23.3%	1	1148	7.0%	1
1	1156	15.5%	0.59 (0.48-0.72)	1190	3.4%	0.46 (0.31-0.68)
5 or more	166	39.8%	2.15 (1.54-3.00)	105	23.8%	4.17 (2.52-6.90)
Not known	28	0%		-	-	
Smoking companion*+						
No	1633	13.3%	1	1733	4.1%	1
Yes	1081	33.7%	3.32 (2.74-4.02)	692	15.5%	2.76 (1.97-3.88)
Not known	132	5.3%		18	5.6%	
Schooling (years)*+						
12 or more	369	11.4%	1	119	3.4%	1
5 to 11	1652	18.1%	1.73 (1.22-2.44)	1898	4.8%	1.46 (0.53-4.06)
0 to 4	633	33.5%	3.79 (2.64-5.45)	420	11.4%	3.71 (1.31-10.51)
Not known	192	18.2%		6	16.7%	
Age (years)*+						
20 to 34	2069	21.0%	1	1620	6.4%	1
35 or more	271	24.7%	1.22 (0.90-1.64)	102	15.7%	2.71 (1.53-4.79)
<20	499	17.4%	0.77 (0.60-1.00)	719	3.5%	0.52 (0.34-0.82)
Not known	7	0%		2	0%	
No. of prenatal visits*+						
None	75	58.7%	1	201	11.9%	1
1 to 4	312	32.4%	0.33 (0.19-0.55)	619	6.1%	0.48 (0.28-0.83)
5 or more	2210	18.2%	0.15 (0.09-0.24)	1595	5.2%	0.40 (0.25-0.65)
Not known	249	16.1%		28	0%	
Family income (minimum wages)*+						
<3	597	27.1%	1	1244	6.8%	1
3 to 4.9	466	23.6%	0.83 (0.63-1.10)	419	6.7%	0.98 (0.63-1.52)
5 or more	951	14.8%	0.47 (0.36-0.60)	617	3.6%	0.50 (0.31-0.81)
Not known	832	21.0%		163	6.1%	

Data are reported as number and percent or as odds ratio (OR) with 95% confidence interval (CI) in parentheses.
*P < 0.05 within variable group, Ribeirão Preto. +P < 0.05 within variable group, São Luís.

Discussion

Particularly noteworthy was the low prevalence of smoking during pregnancy in São Luís (5.9%). In Brazil, decreasing prevalences of smoking during pregnancy were observed in the 1990 decade in the North-South direction, 33.2% in Pelotas (South) (14), 22.1% in São Paulo (Southeast), 21.1% in Fortaleza (Northeast), and 9.1% in Manaus (North) (11). Ribeirão Preto (21.4%) perfectly fitted the profile of the Southeast Region. However, although being geopolitically part of the Northeast Region, the State of Maranhão has sociocultural characteristics typical of the North Region and, coincidentally, the prevalence of smoking in São Luís was closer to that observed in Manaus. In developed countries, these rates range from 10.2% in the United States (20) to 25% in France (2).

In São Luís, in contrast to Ribeirão Preto, low schooling was not associated with smoking in the multivariable analysis. Low schooling is understood as a factor limiting the access of these persons to information about the risks of tobacco smoking. Low schooling has been reported to be associated with tobacco smoking since adolescence (21,22). Marital status was not significantly associated with maternal smoking during pregnancy in either city. These data are in contrast to those obtained in other Brazilian cities (São Paulo, Rio de Janeiro, Porto Alegre, and Pelotas) where low schooling and absence of a husband/companion (with the exception of Pelotas for the last item) were important risk factors for smoking during pregnancy (11,13,14). Thus, low schooling and marital status did not explain the differences in the prevalence of maternal smoking during pregnancy between the two cities studied here.

Some Brazilian studies have demonstrated the association between smoking during pregnancy and low income (13,14) and have reported that the rate of dropping the smoking habit up to the 22nd week of pregnancy is higher among the strata with higher income (14). This association was confirmed here since the category of income of five minimum wages or more was a protective factor against smoking both in Ribeirão Preto and in São Luís. The risk of smoking in São Luís, but not in Ribeirão Preto, was higher for women who lived in households with 5 or more residents. However, income or number of household members did not explain the differences in the prevalence of maternal smoking during pregnancy between the two cities.

Table 2. Adjusted analysis of the factors associated with smoking during pregnancy in Ribeirão Preto, SP, 1994 and in São Luís, MA, 1997/98.

Variables	Ribeirão Preto (1994)	São Luís (1997/98)
	OR (95%CI)	OR (95%CI)
Maternal work outside the home		
No	1	1
Yes	1.29 (0.98-1.70)	0.76 (0.48-1.20)
Residents per household+		
1 to 4	1	1
5 or more	1.30 (0.96-1.75)	1.72 (1.12-2.64)
Parity+		
2 to 4	1	1
1	0.74 (0.55-1.00)	0.70 (0.45-1.09)
5 or more	1.05 (0.61-1.79)	2.10 (1.16-3.81)
Smoking companion*+		
No	1	1
Yes	3.25 (2.52-4.18)	2.20 (1.52-3.18)
Maternal schooling (years)*		
12 or more	1	1
5 to 11	1.36 (0.87-2.14)	1.16 (0.39-3.47)
0 to 4	2.18 (1.30-3.65)	1.71 (0.53-5.48)
Maternal age (years)+		
20 to 34	1	1
35 or more	0.96 (0.62-1.46)	1.98 (0.99-3.96)
<20	0.71 (0.47-1.06)	0.55 (0.33-0.92)
No. of prenatal visits*		
None	1	1
1 to 4	0.38 (0.17-0.83)	0.58 (0.32-1.05)
5 or more	0.24 (0.11-0.49)	0.60 (0.34-1.04)
Family income (minimum wages)		
<3	1	1
3 to 4.9	1.06 (0.76-1.48)	1.16 (0.72-1.86)
5 or more	0.73 (0.52-1.01)	0.66 (0.38-1.13)

Data are reported as odds ratio (OR) with 95% confidence interval (CI) in parentheses. *P < 0.05 within variable group, Ribeirão Preto. +P < 0.05 within variable group, São Luís.

Table 3. Adjusted analysis of the factors associated with smoking during pregnancy in a joint model. Ribeirão Preto, SP, 1994 and São Luís, MA, 1997/98.

Variables	OR (95%CI)
Main effects	
Residents per household*	
1 to 4	1
5 or more	1.39 (1.10-1.76)
Parity*	
2 to 4	1
1	0.73 (0.57-0.93)
5 or more	1.38 (0.93-2.06)
Smoking companion*	
No	1
Yes	2.88 (2.34-3.54)
Maternal schooling (years)*	
12 or more	1
5 to 11	1.30 (0.86-1.98)
0 to 4	2.03 (1.28-3.24)
Family income in minimum wages	
<3	1
3 to 4.9	1.10 (0.84-1.44)
5 or more	0.71 (0.54-0.94)
Interactions	
Maternal work outside the home and city*	
No	1
Yes	1.80 (1.07-3.02)
Maternal age (years) and city*	
20 to 34	1
35 or more	0.38 (0.18-0.82)
<20	1.46 (0.79-2.68)
No. of prenatal visits and city*	
None	1
1 to 4	0.69 (0.26-1.82)
5 or more	0.42 (0.17-1.03)

Data are reported as odds ratio (OR) with 95% confidence interval (CI) in parentheses. *P < 0.05 within the variable group.

Table 4. Adjusted analysis of the factors associated with smoking during pregnancy in a combined sequential model. Ribeirão Preto, SP, 1994 and São Luís, MA, 1997/98.

Adjustment	OR (95%CI)	% Reduction of risk with inclusion of the variable(s)
City	4.32 (3.57-5.23)	-
City and marital status	4.54 (3.75-5.52)	6.6%
City and maternal work outside the home	4.41 (3.65-5.36)	2.7%
City and number of household residents	5.37 (4.39-6.56)	31.6%
City and parity	4.18 (3.45-5.07)	-4.2%
City and companion's smoking habit	3.95 (3.25-4.80)	-11.1%
City and maternal schooling	4.34 (3.57-5.28)	0.6%
City and maternal age	4.09 (3.38-4.96)	-6.9%
City and number of prenatal visits	5.28 (4.30-6.49)	28.9%
City and family income	4.82 (3.89-5.96)	15.1%
For all factors	4.76 (3.69-6.15)	13.3%

Data reported as odds ratio (OR) with 95% confidence interval (CI) in parentheses compare the risk of smoking during pregnancy in Ribeirão Preto with the risk in São Luís.

The smoking habit of the companion had a strong influence on maternal smoking in both cities. The risk of smoking during pregnancy was three times higher in Ribeirão Preto and twice higher in São Luís for women whose companions smoked, in agreement with other Brazilian studies. In the South of the country (Pelotas) having a companion who smoked increased by 85% the risk of smoking for pregnant women (13). The smoking habit of the companion contributed to explaining the difference in the prevalence of smoking during pregnancy between the two cities.

Among the biological factors, parity (having five or more children), although associated with smoking in both cities, did not contribute to explaining the higher prevalence of smoking in Ribeirão Preto.

Pregnant women younger than 20 years had a lower risk of smoking during pregnancy only in São Luís. This agrees with what was observed in the 1990 decade in the South Region, where smoking was less frequent in the extreme age groups (younger than 20 and older than 40 years) (14), but disagrees with what was observed in developed countries (USA), where a higher risk of smoking has been reported among women younger than 20 years (8). Joint multivariable analysis revealed interaction between maternal age and city: if the pregnant woman was 35 years old or older and resided in Ribeirão Preto, she had a 38% lower risk of smoking during pregnancy than women of the same age range residing in São Luís. Thus, maternal age explained the higher prevalence of smoking during pregnancy in Ribeirão Preto, since pregnant women aged 20 to 24 years, which are more numerous in the population, had a higher risk of smoking in this city.

In the joint multivariable model in which the interactions were tested, three variables contributed to explaining the differences in the prevalence of smoking during pregnancy between the two cities: mother working out-

side the home, maternal age and number of prenatal visits. Pregnant women residing in Ribeirão Preto who worked outside the home had an 80% higher chance of smoking than those residing in the Maranhão capital. Ribeirão Preto women with a greater number of prenatal visits had a lower risk of smoking during pregnancy compared to São Luís women. Thus, attending prenatal visits was important for the prevention of smoking in Ribeirão Preto, as also observed in studies conducted in other Brazilian cities, which demonstrated a possible positive effect of prenatal care on giving up smoking (11,14). Previous studies (16,23) have pointed out the low quality of prenatal care in São Luís, a fact showing the still existing potential for the reduction of smoking during pregnancy in this city.

The population studies conducted in São Luís and Ribeirão Preto involved samples representing at least 94% of the pregnant women in the two cities, a fact that reduces the possible occurrence of selection bias. The information was obtained from public and private services. There is the possibility of an underestimate of smoking rates (information bias) as a function of the reluctance of pregnant women, intimidated by social demands, to openly recognize this habit or to declare their real cigarette consumption, situations that have been reported in the literature (24,25). Although biological indicators such as urinary nicotine levels were not investigated for comparison with the replies of the puerperae to the questionnaire, a high level of correspondence (sensitivity, specificity and predictive values) has been demonstrated between replies to questionnaires and urinary nicotine levels in studies on smoking during pregnancy (26), supporting once again the importance of the epidemiological studies presented here.

In conclusion, it was possible to demonstrate that pregnant women living in Ribeirão Preto have a greater chance of smoking if they work outside the home. Conversely, they are protected against smoking if they are 35 years old or older and if they receive five or more prenatal visits. The socioeconomic variables studied contributed little to the explanation of the higher risk of maternal smoking during pregnancy in Ribeirão Preto compared to São Luís. Among the variables investigated, a smoking companion, maternal age, maternal work outside the home, and receiving prenatal visits explained a small part of the difference. Cultural factors may have contributed to the differences in the rates of maternal smoking during pregnancy between these two cities. It is possible that in less developed areas maternal smoking during pregnancy is seen as undesirable or socially inadequate. Studies using qualitative methods are needed to investigate this possibility.

References

1. Kyrklund-Blomberg NB, Cnattingius S. Preterm birth and maternal smoking: risks related to gestational age and onset of delivery. *Am J Obstet Gynecol* 1998; 179: 1051-1055.
2. Nabet C, Ancel PY, Burguet A, Kaminski M. Smoking during pregnancy and preterm birth according to obstetric history: French national perinatal surveys. *Paediatr Perinat Epidemiol* 2005; 19: 88-96.
3. Spinillo A, Capuzzo E, Iasci A, Nicola S, Piazzi G, Baltaro F. Sociodemographic and clinical variables modifying the smoking-related risk of low birth weight. *Int J Gynaecol Obstet* 1995; 51: 15-23.
4. Ananth CV, Smulian JC, Vintzileos AM. Incidence of placental abruption in relation to cigarette smoking and hypertensive disorders during pregnancy: a meta-analysis of observational studies. *Obstet Gynecol* 1999; 93: 622-628.
5. Chelmow D, Andrew DE, Baker ER. Maternal cigarette smoking and placenta previa. *Obstet Gynecol* 1996; 87: 703-706.
6. Tuthill DP, Stewart JH, Coles EC, Andrews J, Cartlidge PH. Maternal cigarette smoking and pregnancy outcome. *Paediatr Perinat Epidemiol* 1999; 13: 245-253.
7. Wisborg K, Kesmodel U, Henriksen TB, Olsen SF, Secher NJ. Exposure to tobacco smoke *in utero* and the risk of stillbirth and death in the first year of life. *Am J Epidemiol* 2001; 154: 322-327.
8. Schramm WF. Smoking during pregnancy: Missouri longitudinal

study. *Paediatr Perinat Epidemiol* 1997; 11 (Suppl 1): 73-83.
9. Hofvendahl EA. Smoking in pregnancy as a risk factor for long-term mortality in the offspring. *Paediatr Perinat Epidemiol* 1995; 9: 381-390.
10. Ananth CV, Kirby RS, Kinzler WL. Divergent trends in maternal cigarette smoking during pregnancy: United States 1990-99. *Paediatr Perinat Epidemiol* 2005; 19: 19-26.
11. Kroeff LR, Mengue SS, Schmidt MI, Duncan BB, Favaretto AL, Nucci LB. Correlates of smoking in pregnant women in six Brazilian cities. *Rev Saúde Pública* 2004; 38: 261-267.
12. Horta BL, Victora CG, Menezes AM, Halpern R, Barros FC. Low birthweight, preterm births and intrauterine growth retardation in relation to maternal smoking. *Paediatr Perinat Epidemiol* 1997; 11: 140-151.
13. Halal IS, Victora CG, Barros FC. Determining factors of smoking habit and its cessation during pregnancy in an urban locality in the southern region of Brazil. *Rev Saúde Pública* 1993; 27: 105-112.
14. Horta BL, Victora CG, Barros FC, dos Santos I, Menezes AM. Tobacco smoking among pregnant women in an urban area in southern Brazil, 1982-93. *Rev Saúde Pública* 1997; 31: 247-253.
15. Bettiol H, Barbieri MA, Gomes UA, Andrea M, Goldani MZ, Ribeiro ER. Perinatal health: methodology and characteristics of the studied population. *Rev Saúde Pública* 1998; 32: 18-28.
16. de Silva AA, Coimbra LC, da Silva RA, Alves MT, Lamy FF, Carvalho LZ, et al. Perinatal health and mother-child health care in the municipality of São Luís, Maranhão State, Brazil. *Cad Saúde Pública* 2001; 17: 1413-1423.
17. Cardoso VC, Simões VMF, Barbieri MA, Silva AAM, Bettiol H, Alves MTSSB, et al. Profile of three Brazilian birth cohort studies in Ribeirão Preto, SP and São Luís, MA. *Braz J Med Biol Res* 2007; 40: 1165-1176.
18. Hosmer DG, Lemeshow S. *Applied logistic regression*. New York: Wiley-Interscience; 1998.
19. Stata Corporation. *Stata Statistical Software*. [Computer program]. Release 8.0. College Station; 2003.
20. Hoyert DL, Mathews TJ, Menacker F, Strobino DM, Guyer B. Annual summary of vital statistics: 2004. *Pediatrics* 2006; 117: 168-183.
21. Menezes AM, Goncalves H, Anselmi L, Hallal PC, Araujo CL. Smoking in early adolescence: evidence from the 1993 Pelotas (Brazil) Birth Cohort Study. *J Adolesc Health* 2006; 39: 669-677.
22. Menezes AM, Hallal PC, Horta BL. Early determinants of smoking in adolescence: a prospective birth cohort study. *Cad Saúde Pública* 2007; 23: 347-354.
23. Coimbra LC, Silva AA, Mochel EG, Alves MT, Ribeiro VS, Aragao VM, et al. Factors associated with inadequacy of prenatal care utilization. *Rev Saúde Pública* 2003; 37: 456-462.
24. Klebanoff MA, Levine RJ, Morris CD, Hauth JC, Sibai BM, Ben CL, et al. Accuracy of self-reported cigarette smoking among pregnant women in the 1990s. *Paediatr Perinat Epidemiol* 2001; 15: 140-143.
25. Ford RP, Tappin DM, Schluter PJ, Wild CJ. Smoking during pregnancy: how reliable are maternal self reports in New Zealand? *J Epidemiol Community Health* 1997; 51: 246-251.
26. Pickett KE, Rathouz PJ, Kasza K, Wakschlag LS, Wright R. Self-reported smoking, cotinine levels, and patterns of smoking in pregnancy. *Paediatr Perinat Epidemiol* 2005; 19: 368-376.