Low birth weight in Spain associated with sociodemographic factors

Carmen Rodríguez, Enrique Regidor, Juan L. Gutiérrez-Fisac

Abstract

Study objective – To describe the effect of different social and demographic characteristics on low birth weight (LBW) (less than 2500 g) in Spain, in both preterm (less than 37 weeks' gestation) and term infants (between 37 and 42 weeks' gestation).

Design – The study used data obtained from the Spanish birth registry.

Setting – The study was based on those live born infants registered in 1988 from provinces where the birthweight details were completed in at least 99.5% of the birth registration records.

Participants – A total of 1332 preterm LBW infants, 1292 term LBW infants, and 38 967 controls were included in the study.

Measurements and main results – The odds ratio (OR) calculated by logistic regression was used as the measure of association between LBW and the socio-demographic variables. The highest ORs of preterm LBW were found in mothers younger than 20 years (1.32; 95%CI 0.98, 1.77) and older than 34 years (1.28; 95%CI 1.04, 1.59), in unmarried mothers (1.68; 95%CI 1.36, 2.07), and in fathers with manual occupations (1.26; 95%CI 1.08, 1.46). In term, live born infants the highest ORs were found in adolescent mothers (1.63; 95%CI 1.25, 2.14), in first born live born infants (1.38; 95%CI 1.09, 1.74) or the fourth born or more (1.28; 95%CI 0.91, 1.80), in unmarried mothers (1.55; 95%CI 1.27, 1.90), in housewives (1.13; 95%CI 0.99, 1.29), and in fathers with manual occupations (1.21; 95%CI 1.04, 1.42).

Conclusions – The results have allowed documentation of the risk of preterm and term LBW in various age and social groups in Spain.

(*J Epidemiol Community Health* 1995;49:38-42)

Birth weight is the strongest single factor associated with perinatal and neonatal mortality, and is also a significant determinant of both post-neonatal mortality and infant mortality.¹⁻² Since 1976, the term low birth weight (LBW) has been applied to all newborns weighing less than 2500 g. LBW may be a result of preterm birth (during the first 36 weeks of gestation) or of intrauterine growth retardation. The frequency of these causes of LBW varies considerably in different parts of the world; in developed societies most LBW infants are preterm, while in developing countries intrauterine growth retardation predominates.³ In Spain,

4.9% of live born infants in 1988 weighed less than 2500 g at birth, and, of these, 53.7% were born before the 37th week of gestation.⁴

According to Kramer the determinants of intrauterine growth retardation are sufficiently well documented – smoking is the most important single factor in developed nations, followed by inadequate nutrition during gestation and low maternal weight at pregnancy outset. The causes of preterm birth are not well known, however, and Kramer recommends that factors related to socioeconomic conditions be studied.⁵

Different studies⁶⁻¹³ have established a significant association between LBW and a number of sociodemographic variables. This finding is of particular interest from a public health perspective since it permits the identification of population groups at whom preventive interventions should be targeted. Although it is desirable to study the individual factors that determine LBW in live preterm and term infants,⁵ the study of Ferraz *et al*¹² has been the only one in which a distinction has been made between LBW due to preterm birth and that caused by intrauterine growth retardation.

This study is aimed to describe the effect of different sociodemographic characteristics on LBW in Spain, in both preterm and term infants.

Methods

Data were obtained from information contained in the statistical bulletin of birth, provided by the National Institute of Statistics on magnetic tape. This document, filled out by the infant's parents or relatives at the time of the birth, is recorded in the civil register, and contains information on the birth and selected sociodemographic characteristics of the parents.

Of the 418 919 live born infants registered in 1988, we used only the 52 200 from those provinces in which the birth weight item was completed at least 99.5% of the time. This represents 12.5% of all live born infants in that year. In this way we avoided the selection bias that could have occurred if we had chosen either all births or a sample of all births in Spain, since whether or not birth weight is recorded in the statistical bulletin of birth could be related to the presence of LBW. Furthermore, selecting the provinces in which this variable is consistently well filled out does not influence the association under investigation, regardless of the prevalence of LBW or the frequency of the sociodemographic factors that are being studied.

Subdirección General
de Epidemiología
Ministerio de Sanidad
y Consumo, Paseo del
Prado 18-20,
28071 Madrid, Spain
C Rodríguez
E Regidor
J L Gutiérrez-Fisac

Correspondence to:
Dr C Rodríguez.

Accepted for publication
18 May 1994

Table 1 Percentage distribution of characteristics of the infants included in the study

	Weight<2500 g		≥ 2500 g (n=38 967)
	Preterm (n=1332)	Term (n=1291)	
Maternal age (y)			
<20	4.7	6.0	3.6
20–24	17.9	22.5	18.0
25–29	38.7	38.4	42.5
30–34	27.5	24.2	26.1
35+	11.3	8.9	9.8
Live born children			
One	41.6	49.7	51.1
Two	37.6	32.5	36.0
Three	15.2	12.3	9.2
Four or more	5.6	5.5	3.8
Marital status			
Married	90.2	89.2	93.5
Unmarried	9.8	10.8	6.5
Maternal activity			
Outside	37.1	36.6	39.9
At home	58.3	58.9	55.8
Other*	4.6	4.6	4.3
Paternal occupation			
Non-manual	22.1	21.3	26.3
Manual	68.9	68.5	64.9
Other*	8.9	10.2	8.8
Birth number			
Singleton	77.1	81.9	99.3
Multiple	22.9	18.1	0.7
Normality of birth			
Normal	77.3	88.1	93.6
Dystocic	22.7	11.9	6.4
Weeks of gestation			
37	–	14.3	3.5
38	–	20.7	12.4
39	–	18.7	20.0
40	–	41.3	53.7
41	–	4.1	7.7
42	–	0.9	2.7
Infant sex			
Male	49.6	42.8	51.9
Female	50.4	57.2	48.1
Size of municipality of residence			
<10 000	21.4	21.5	23.3
10 001–20 000	12.5	11.3	12.5
20 001–50 000	17.4	18.3	16.9
50 001–100 000	8.9	9.2	8.3
>100 000	39.8	39.7	39.0

*“Other” includes armed forces professionals, students, retired persons, persons who could not be classified, and those for whom no occupation was available.

Table 2 Association between low birth weight and maternal age, number of live born children, marital status of the mother, maternal activity, and paternal occupation in Spain, 1988. (Odds ratio (OR)* and 95% confidence intervals (95% CI))

Variable	Preterm infants		Term infants	
	OR	(95% CI)	OR	(95% CI)
Maternal age (y)				
<20	1.32	(0.98, 1.77)	1.63	(1.25, 2.14)
20–24	1.07	(0.90, 1.27)	1.34	(1.14, 1.57)
[25–29]†	1.00	–	1.00	–
30–34	1.21	(1.04, 1.41)	1.09	(0.93, 1.27)
35+	1.28	(1.04, 1.59)	0.96	(0.75, 1.21)
Live born children				
One	1.09	(0.88, 1.36)	1.38	(1.09, 1.74)
Two	1.02	(0.83, 1.25)	1.04	(0.83, 1.29)
[Three]	1.00	–	1.00	–
Four or more	0.90	(0.65, 1.24)	1.28	(0.91, 1.80)
Marital status				
[Married]	1.00	–	1.00	–
Unmarried	1.68	(1.36, 2.07)	1.55	(1.27, 1.90)
Maternal activity				
[Outside]	1.00	–	1.00	–
At home	1.16	(1.01, 1.32)	1.13	(0.99, 1.29)
Other‡	1.25	(0.93, 1.68)	1.04	(0.77, 1.39)
Paternal occupation				
[Non-manual]	1.00	–	1.00	–
Manual	1.26	(1.08, 1.46)	1.21	(1.04, 1.42)
Other‡	1.01	(0.80, 1.29)	1.10	(0.87, 1.39)

* Odds ratio adjusted for variables in the table and birth number, type of delivery, infant sex, size of municipality of residence and weeks of gestation (the latter only in term infants).
† The reference category is shown in brackets.
‡ “Other” includes armed forces professionals, students, retired persons, persons who could not be classified, and those for whom no occupation was available.

Preterm LBW infants were defined as all those with a birth weight of between 500 and 2499 g born before 37 weeks’ gestation. Term LBW infants had the same birth weight as the first group and a gestational age of between 37 and 42 weeks. As a control group for comparison with both groups, we chose all term infants with a weight between the 10th and

90th centiles in relation to sex and gestational age. Thus, the controls were the term infants with sufficient weight for gestational age, which ranged between 2500 and 4150 g. A total of 41 590 live born infants (79.7% of the sample) met the criteria for inclusion in the study.

Table 1 shows the distribution of the infants included in the analysis in relation to the age, marital status, and activity of the mother; the number of live born children (including the current one) in the family; father’s occupation; birth number and type of delivery; sex of the infant; size of the municipality of residence, and weeks of gestation. (The distribution in relation to weeks of gestation is shown only for term infants.) Details of these variables were adequately filled out for all individuals in the study.

The variable “maternal activity” is derived from information on the mother’s occupation, recoded into three categories: outside the home (professional and the like, government and business managers, administrators and the like, salespersons, persons working in service industries, or those working in agriculture, fishing, industry or construction; at home (homemakers); and other (students, retired persons, and those who could not be classified).

The variable “father’s occupation” was considered an indicator of socioeconomic status and was grouped into three categories: non-manual occupations (professional and the like, government and business managers, administrators and the like); manual (salespersons, persons working in service industries, or those working in agriculture, fishing, industry or construction); and others (military personnel, students, retired persons, persons who could not be classified, and those for whom occupation was unknown). It was considered preferable to group occupation into manual/non-manual categories because the different occupations mentioned correspond to the major breakdowns in the national classification of occupations and they cannot be ordered hierarchically according to socioeconomic level. The lack of detail about occupation in the statistical bulletin of birth is what makes it impossible to assign individuals to a particular socioeconomic category.

The odds ratio (OR) was used as the measure of association between LBW and maternal age, number of live born infants, marital status of the mother, maternal activity, and father’s occupation. It was calculated by logistic regression, taking the group at lowest risk of LBW as the reference category for each variable. The procedure used was the logistic regression of SPSS/PC+.14 With the two models obtained, one for preterm infants and the other for term infants, we calculated the ORs for each variable adjusted for all the others. The variables birth number, type of delivery, weeks of gestation (this only for term infants), infant’s sex, and size of the municipality of residence, were also included in the analysis due to their potential confounding effects.

Finally, we examined the possible influence of socioeconomic background on the relationship between age and LBW by calculating

Figure 1. Association between low birth weight in live born preterm infants and mother's age in relation to socioeconomic group in Spain, 1988. (Values odds ratio (95% confidence interval).) Odds ratios were adjusted for live born children, marital status, maternal activity, birth number, type of delivery, infant sex, and size of municipality of

Figure 2. Association between low birth weight in live born term infants and mother's age in relation to socioeconomic group in Spain, 1988. (Values odds ratios (95% confidence interval).) Odds ratios were adjusted for live born children, marital status, maternal activity, birth number, type of delivery, weeks of gestation, infant sex, and size of the municipality of residence.

the association between the mother's age and LBW in each socioeconomic group. In the calculation of the corresponding ORs we controlled for all the aforementioned variables.

Results

Table 2 shows the ORs of the association between the different socioeconomic variables and LBW for both preterm and term infants.

Maternal age has a "U" shaped relationship with preterm LBW infants. Although the ORs were not statistically significant in mothers between 20 and 24 years of age and in those younger than 20 years, the strength of the association is greater for mothers in the latter age group and in those older than 34 years, whose respective ORs are 1.32 and 1.28 times higher than those of the 25-29 year age group which was taken as a reference. In term LBW infants, however, the OR was higher in those less than 20 and in those 20 to 24 years of age, with the strength of the association tending to

decrease with increasing age of the mother, although the ORs were not statistically significant from 30 years of age onward. The test for trend did not turn out to be statistically significant ($p=0.2$).

The results obtained with regard to the number of live born children were not statistically significant in preterm LBW live born infants. In term infants, the first live born child had the highest OR and this was statistically significant.

With regard to marital status, in both preterm and term infants, unmarried mothers had higher ORs than married ones. Likewise, the strength of the association was greater in mothers who stayed at home than in those who worked outside the home.

With regard to father's occupation, it can be seen that the strength of the association was higher in manual workers than in the group of non-manual workers, in both preterm and term LBW infants.

Finally, figures 1 and 2 show the ORs by maternal age in non-manual and manual workers. As in the previously mentioned results, the ORs showed a "U" shaped relationship in preterm infants and a decreasing trend in term infants, although, in most cases, these ORs were not statistically significant. Of note is the relationship found with preterm LBW infants in non-manual workers, where mothers older than 34 had the highest OR, 1.72 times higher than the reference group.

Discussion

Although in many cases the ORs found were not statistically significant, the strength of the association between maternal age and preterm LBW infants is similar to the results of other studies which have examined the relationship between prematurity and maternal age.^{6,12-13} The same is not true, however, for the association obtained in term LBW infants. In most studies that have examined the relationship between maternal age and LBW,^{7,13} the strength of the association is in the form of a "U" shaped curve and not a decreasing trend as we found. This could be because LBW is usually studied independently of weeks of gestation, with the result that many preterm infants are included since prematurity is the principle component of LBW in developed countries.

However, the inconsistent results found with term LBW infants cannot be attributed only to a different methodology. In another study that included only term LBW infants,¹² the association between maternal age, after adjusting for various factors, was also strongest in those less than 20 and older than 34 years of age. Another possible explanation for the finding of the present study could be that the influence of socioeconomic background varies with the age of the mother. This hypothesis has also been rejected, however, since the strength of the association shows the same trend in non-manual and manual workers, as can be observed in figure 2.

An explanation for this result must undoubtedly be sought in other factors which

have been seen to increase the probability of having an infant with intrauterine growth retardation – factors such as maternal height and prepregnancy weight,¹⁵ caloric intake,¹⁶ and consumption of alcohol and tobacco^{17–21} which have not been included in the present study because they are not collected in the statistical bulletin of birth. In Spain the 1987 prevalence of smoking, which has repeatedly been indicated as the most important determinant of intrauterine growth retardation in developed countries, was 8% in women over age 34 and 51% in those between 25 and 29 years of age.²²

These factors have also been taken into account in studies of the relationship between maternal age and prematurity. Nevertheless, the fact that the same results have been found in preterm LBW infants in this study, where these factors have not been controlled, may be a reflection of their small importance in preterm LBW infants.

The variable “number of live born children”, the only aspect of the obstetric history that is included in the statistical bulletin of birth, has been used as an approximation of parity. Most empirical evidence shows that second and third born children have the lowest risk of both prematurity and LBW. However, although the results of this study in term LBW infants are in accordance with these findings, the association between parity and preterm infants was not statistically significant. This is probably because the number of live born infants is not a good substitute for parity in this group, since mothers of a preterm infant often have a history of perinatal mortality.²³

The results with regard to marital status of the mother and socioeconomic status measured by father's occupation, are similar to those of other studies.^{7–13} That is, there is a greater risk of prematurity and intrauterine growth retardation in unmarried mothers and in low socioeconomic groups. Although it has been pointed out that the independent effect of each of these variables should be isolated by controlling for different factors pertaining to the mother's obstetric, personal, and social history, the fact is that studies that have included only some of these factors, as well as those that have included all of them, have yielded similar results. Furthermore, even though in developed countries it has repeatedly been recommended that the influence of socioeconomic status should be separated from that of smoking, since women of low socioeconomic levels are more likely to be smokers than those of higher levels, in Spain the inverse is true: women of all ages in the group of non-manual workers have a higher prevalence of smoking than women classified as manual workers.²² In summary, these findings with relation to the socioeconomic status of the woman confirm the important role smoking plays in both prematurity and in LBW.

The analysis by different socioeconomic background of the mother did not provide any new findings in term LBW infants. However in preterm LBW infants, although the association with the mother's age presented the classic “U” shaped curve in both socioeconomic groups, in the women classified as non-manual workers

the strength of the OR was greater in those older than 34 years than in those younger than 20, the opposite of the results obtained when all preterm infants were analysed together. In developed countries, it has been pointed out that psychosocial factors in the mother are important modifiers of the risk of having a preterm infant; stress and anxiety have been the most widely identified specific factors.^{24–25} In this regard, it may be that upper socioeconomic class women older than 34 in Spain are subjected to a greater number of stressful events in their lives than younger women. Although no empirical evidence is available, it is known that women of 34 years of age and older, in general, combine paid work of a certain responsibility with housework, while a large number of younger women in the same socioeconomic group share the housework with their partner or hire a maid. The education and formation of women over 34 in a time characterised by authoritarianism and social organisation strongly discriminatory against women may explain this different behaviour.

On the other hand, in developed countries, an inverse relationship has been noted between the duration of gestation and birth weight in relation to the type of physical activity carried out by the mother. As it is difficult to separate energy expended in leisure time physical activity from that expended at work, the mother's work activity is usually used as an indirect indicator of physical activity. In our study we found less risk for both preterm LBW infants and intrauterine growth retardation in women who had a job outside the home than in those who did only housework. With the exception of jobs in which the pregnant women spends most of the day on her feet, which have been shown to have a greater risk of preterm birth,²⁶ most studies have also found a significant reduction in the risk of prematurity and LBW among working women.²⁷ Although this has been attributed to the fact that women's work in developed countries is generally sedentary and requires little energy expenditure, in the case of Spain, where the rate of unemployment is among the highest in the European Union, one must take into account the added energy expended by many women who say they do only housework, but who may also have a paid part-time activity without a work contract.

With regard to the quality of the data used, the information on birth weight, filled out by the child's parents at the time of inscription in the civil register, can be considered reliable since, given its personal and social importance, it is usually recalled accurately.^{28–29}

In summary, these results, obtained by statistical analysis of data in the Spanish birth registry, have allowed us to document the risk of LBW in various age and social groups and have confirmed the findings of different studies in other countries.

1 Williams RL, Chen PM. Identifying the sources of the recent decline in perinatal mortality in California. *N Engl J Med* 1982;306:207–14.

2 McCormick MC. The contribution of low birth weight to infant mortality and childhood morbidity. *N Engl J Med* 1985;312:82–90.

- 3 Villar J, Belizan JM. The relative contribution of prematurity and fetal growth retardation to low birth weight in developing and developed societies. *Am J Obstet Gynecol* 1982;143:793-8.
- 4 Instituto Nacional de Estadística. *Movimiento de la Población Española 1988. Tomo I. Resultados a nivel nacional*. Madrid: INE, 1992.
- 5 Kramer MS. Determinants of low birth weight: methodological assessment and meta-analysis. *Bull World Health Organ* 1987;65:663-737.
- 6 Pickering RM, Murray GD, Forbes JF. Pre-term foetal life times in Scotland. *Population Studies* 1986;40:115-27.
- 7 Pickering RM. Relative risks of low birthweight in Scotland 1980-2. *J Epidemiol Community Health* 1987;41:133-9.
- 8 Lieberman E, Ryan KJ, Monson RR, Schoenbaum SC. Risk factors accounting for racial differences in the rate of premature birth. *N Engl J Med* 1987;317:743-8.
- 9 Kleinman JC, Kessel SS. Racial differences in low birth weight. *N Engl J Med* 1987;317:749-53.
- 10 Stein A, Campbell EA, Day A, McPherson K, Cooper PJ. Social adversity, low birth weight, and preterm delivery. *BMJ* 1987;295:291-3.
- 11 Brooke OG, Anderson HR, Bland JM, Peacock JL, Stewart CM. Effects on birth weight of smoking, alcohol, caffeine, socioeconomic factors, and psychosocial stress. *BMJ* 1989;298:795-801.
- 12 Ferraz EM, Gray RH, Cunha TM. Determinants of preterm delivery and intrauterine growth retardation in north-east Brazil. *Int J Epidemiol* 1990;19:101-8.
- 13 Sanjose S, Roman E. Low birthweight, preterm, and small for gestational age babies in Scotland, 1981-1984. *J Epidemiol Community Health* 1991;45:207-10.
- 14 Norusis MJ. *SPSS/PC+ advanced statistics 4.0 for the IBM PC/XT/AT and PS/2*. Chicago: SPSS Inc, 1990.
- 15 Fedrick J, Aldestein P. Factors associated with low birth weight of infants delivered at term. *Br J Obstet Gynaecol* 1978;85:1-7.
- 16 Tafari H, Naeye RL, Gobeze A. Effects of maternal undernutrition and heavy physical work during pregnancy on birth weight. *Br J Obstet Gynaecol* 1980;87:222-6.
- 17 Meyer MB, Jonas BS, Tonascia JA. Perinatal events associated with maternal smoking during pregnancy. *Am J Epidemiol* 1976;103:464-76.
- 18 Abel EL. Smoking during pregnancy: a review of effects on growth and development of offspring. *Hum Biol* 1980;52:593-625.
- 19 Stein Z, Kline J. Smoking, alcohol and reproduction. *Am J Public Health* 1983;73:1154-6.
- 20 Mills JL, Graubard BI, Harley EE, Rhoads GG, Berendes HW. Maternal alcohol consumption and birthweight. How much drinking during pregnancy is safe? *JAMA* 1984;252:1987-9.
- 21 Peacock JL, Bland JM, Anderson HR. Effects on birthweight of alcohol and caffeine consumption in smoking women. *J Epidemiol Community Health* 1991;45:159-63.
- 22 Ministerio de Sanidad y Consumo. *Encuesta nacional de salud*. Madrid: Ministerio de Sanidad y Consumo, 1989.
- 23 Fedrick J, Anderson ABM. Factors associated with spontaneous pre-term birth. *Br J Obstet Gynaecol* 1976;83:342-50.
- 24 Newton RW, Webster PAC, Binu PS, Maskrey N, Phillips AB. Psychosocial stress in pregnancy and its relation to the onset of premature labour. *BMJ* 1979;iii:411-3.
- 25 Newton RW, Hunt LP. Psychosocial stress in pregnancy and its relation to low birth weight. *BMJ* 1984;288:1191-4.
- 26 Teitelman AM, Welch LS, Hellenbrand KG, Bracken MB. Effect of maternal work activity on preterm birth and low birth weight. *Am J Epidemiol* 1990;131:104-13.
- 27 Rabkin CS, Anderson HR, Bland JM, Brooke OG, Chamberlain G, Peacock JL. Maternal activity and birth weight: a prospective, population-based study. *Am J Epidemiol* 1990;131:522-31.
- 28 Little RE. Birthweight and gestational age: Mother's estimates compared with state and hospital records. *Am J Public Health* 1986;76:1350-1.
- 29 Gayle HD, Yip R, Frank MJ, Nieburg P, Binkin NJ. Validation of maternally reported birth weights among 46,637 Tennessee WIC program participants. *Public Health Rep* 1988;103:143-7.