



Social disparities in low birth weight among Spanish mothers during the economic crisis (2007-2015)

Disparidades sociales en bajo peso al nacer en madres españolas durante la crisis económica (2007-2015)

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Abstract

Objective: to evaluate the impact of the economic crisis on the disparities in the prevalence and risk of low birth weight (LBW) according to the maternal socioeconomic profile.

Methods: the data analysed corresponds to 1,779,506 single births to Spanish mothers in the years 2007, 2009, 2011, 2013 and 2015. The temporal changes in available maternal-foetal variables are described. Secondly, the possible increase in disparities in prevalence and risk of LBW due to the occupation and education of the mother is evaluated, taking 2007 as the reference year.

Results: a trend of the maternal profile is described among women who had children during this period, with an increasing contribution of highly qualified professional and educated women, a trend already existing before the economic crisis, but which was deepened by the recession. The prevalence of LBW increased in all socio-economic groups, with a marked increase in disparities during the worst years of the economic crisis.

Conclusion: results confirm the persistence of social inequalities in perinatal health described prior to the economic crisis, as well as a possibly negative effect of the recession between 2007 and 2015. Results also confirm that disparities in LBW are more clearly associated with the educational level of mothers than with their occupation.

Key words:

Social determinants of health. Health status disparities. Educational status. Occupation.

Resumen

Objetivo: evaluar el impacto de la crisis económica sobre las disparidades en la prevalencia y en el riesgo de bajo peso al nacer (BPN) en función del perfil socioeconómico materno.

Métodos: los datos analizados corresponden a 1.779.506 partos simples de madres españolas ocurridos en los años 2007, 2009, 2011, 2013 y 2015. Se describe el cambio temporal en las variables materno-fetales disponibles. En segundo lugar, se evalúa el posible incremento de las disparidades por ocupación y educación maternas en prevalencias y riesgos relativos de BPN, considerando 2007 como el año de referencia.

Resultados: se describe un cambio en el perfil de las mujeres que decidieron tener hijos durante este periodo, con una mayor presencia de madres de alta cualificación profesional y alto nivel educativo, una tendencia ya previa a la crisis económica, pero que la recesión ha radicalizado. La prevalencia de BPN aumentó en todos los grupos maternos, con un claro incremento de las disparidades durante los peores años de la crisis económica.

Conclusión: se confirma la persistencia de desigualdades sociales en salud perinatal descritas antes de la crisis, así como el efecto negativo de la recesión en el periodo 2007-2015. Los resultados confirman, además, que las disparidades en BPN se asocian más claramente con el nivel educativo de las madres que con su ocupación.

Palabras clave:

Determinantes sociales de la salud. Disparidades en salud. Nivel educativo. Ocupación.

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INTRODUCTION

Low birth weight (LBW, births under 2,500 g) is one of the most important health indicators as it affects the viability and healthy development of neonates (1). LBW has been associated with a myriad adverse health outcomes across the life-span, including cardiovascular disease (2), premature mortality (3) and cognitive problems such as autism (4) and depression (5), among many others (6). In addition, the negative effect of foetal growth restriction could be maintained over generations (7) as a consequence of epigenetic mechanisms (8).

Even in high income countries, social inequalities in perinatal health persist (9-12). These differences can increase in times of economic recession as the result of a combination of personal, family and community factors through a decrease in material resources, a deterioration of environmental conditions, and an increase in psycho-social stress (13). Based on a global analysis, socioeconomic inequality within a country is more associated with differences in health indicators than is the absolute wealth or median income of that country (14).

After decades of economic growth, Spain has been one of the European countries most affected by the economic crisis, which started in the USA in August 2007, and affected Spain from 2008 with a growing spread of poverty and social inequality (15,16). To evaluate the negative impact of the economic recession of 2008 on perinatal health is challenging since, during the preceding decade of sustained economic growth, there was a general deterioration in neonatal indicators (except perinatal deaths) both in Spain and in most European countries. Such deterioration, which has been explained as a consequence of growing predominance of primipara mothers with an ever-increasing age at first maternity, an increase in multiple pregnancies as a result of the rise in assisted reproductive techniques (ART), and high rates of obstetric intervention (17). Specifically, over the two decades preceding the economic crisis, Spain had the greatest increase in LBW among the European countries (18), without a parallel increase in pre-term births as was the case in other countries (19). However, recent studies of the Icelandic (20), Irish (21), Greek (22) and also Spanish (23,24) populations, associate the current economic crisis with a worsening of perinatal health indicators, which are independent of the described trends before the recession. The aim of this study is to evaluate if the current economic crisis is associated with increased inequalities in LBW according to the maternal socioeconomic profile.

MATERIAL AND METHODS

The data analysed come from the Spanish Vital Statistics which collects information on all neonates in Spain who are declared in the civil register via the *Boletín Estadístico de Parto* (Statistical Birth Bulletin, SBB). Since 1996, the SBB includes, in addition to weight at birth and gestational age of neonates, the nationality of the parents and, after review in 2007, new variables such as marital status (whether the mother and father live together), the

education level of both parents and the type of delivery. Validation studies (25) have concluded that the data provided by the SBB is reliable when compared to hospital registers, albeit less so for certain categories of foreign mothers.

Compared with Spanish mothers, those coming from the three main migrant origin groups in Spain (i.e., Latin America, the Maghreb and Eastern Europe) have very different lifestyles and eating habits as well as their own reproductive patterns which associate with significant differences in pregnancy outcome (26,27). Furthermore, as in other high-income countries (16), delayed maternity in Spain is linked to a greater access to assisted delivery techniques and the resulting increase in multiple pregnancies, such that it is estimated that 70% of twin pregnancies are due to fertility treatment (28). The population analysed has therefore been limited to live single births to mothers born in Spain. The selected years analysed are 2007 (the year before the current economic crisis and the first for the new SBB register), 2009, 2011, 2013 and 2015 (the last year available). From an initial total of 2,264,271 new-borns in Spain for the selected years, the final analysed sample corresponds to 1,779,506 single births to Spanish mothers, which represents 78.6% of the initial sample and 97.5% of available data for Spanish mothers (Fig. 1).

As mentioned above, there were temporal changes in available maternal-foetal variables. We recoded the original variables

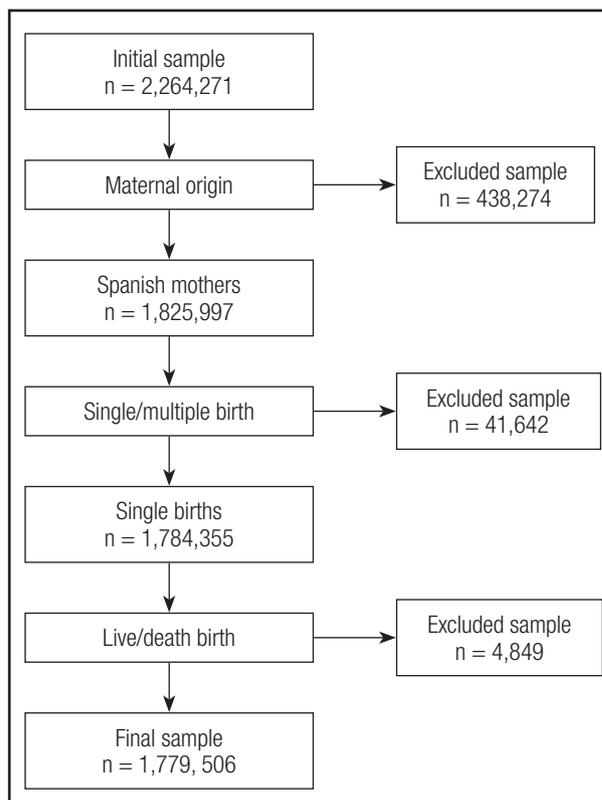


Figure 1. Inclusion/exclusion criteria of the analysed sample (years 2007, 2009, 2011, 2013, and 2015, data from SBB).

included in the SBB. Maternal occupation was recoded into the categories professionals, administrative employees, Service Sector workers, skilled workers, unskilled and Tertiary Sector workers, students and housewives. Maternal education level was recoded into university education, secondary education and primary education; maternal age into groups of mothers under 20, 20-24, 25-29, 30-34, 35-39 and 40 or over; marital status into married and living with a husband, living with a stable partner, living without a partner, including widows, divorcees and separated mothers; maternal place of residence into rural (less than 10,000 inhabitants) and urban; the number of live births into the categories of primipara and multipara mothers; weeks of gestation into preterm births (born at less than 37 weeks), term births (37-41 weeks), and post-term births (42 weeks or more); birth weight into low birth weight (LBW less than 2,500 g), normal birth weight (2,500-3,999 g) and macrosomia (equal to or over 4,000 g). The analysis also includes the original variable type of delivery (vaginal or caesarean section). For each of the variables indicated, a category of missing was established. In the case of variables of maternal occupation and education level, there is a sharp drop in the percentage of missing between 2009 and 2014, which was due to their non-inclusion in certain Autonomous Communities (political and administrative regions of Spain) for unknown reasons.

We analysed the data for a possible increase in social disparities, both in prevalence and relative risks (RR) of LBW, during the economic crisis. We assigned 2007 as the reference year the year before the beginning of the recession in Spain and its impact on the population. Poisson regressions were performed using LBW as the dependent variable, and maternal occupation and education level the independent ones. Given the increased risk of macrosomia reported in previous studies in relation to the economic crisis (23), normal weight was used as the reference category. The reference categories for maternal occupation and education level were for professional women and mothers with university studies respectively. The analyses were stratified by parity, since an interaction between both maternal occupation and education level on LBW was found. Three model specifications were compared for each parity category: model 1 presents unadjusted RR; model 2, RR adjusted only for gestational age (now included as a continuous variable) given the strong link between gestational age and birth weight (1); and model 3, RR adjusted for the remaining maternal-foetal variables, in addition to gestational age. To avoid unnecessary adjustment (28), model 3 only includes such maternal-foetal variables that significantly changed the association between LBW and occupation or education level. Education level and type of delivery were identified as adjustment variables for maternal occupation, while aside from gestational age no other maternal-foetal variable was identified for maternal education (so only models 1 and 2 were compared in Results for this second independent variable). Finally, a sensitivity analysis was carried out including and excluding the categories of missing information for both dependent variables. No significant differences were found and models without categories of missing are shown.

RESULTS

Table I shows temporal trends in the maternal-foetal variables analysed for the selected years. During the period analysed, Spanish women who became mothers did so at an increasingly older age (44.0% at 35 or over in 2015) and with a growing predominance of highly qualified professional (29.4% were professionals in 2015) and highly educated women (35.8% had university degrees that same year). Although the majority of these women were married or had a stable partner, the proportion of women without a stable partner grew significantly (up to 17.9% in 2015). Primiparity remained stable at 51%, with a slight drop in 2015. The number of Caesarean sections remained above 25%, with a slight drop in 2015. The prevalence of preterm births fell steadily from 6.1% to 5.4% (the same as post-term births, from 2.6% to 1.4%), while LBW rose from 5.9% to 6.1% and macrosomic births remaining at around 5%.

Figures 2a and 2b (Tables Ia and Ib in the Annex) show, by parity and year of birth the prevalence of LBW and the values for RR of having a new-born with LBW according to maternal occupation, with professional women the category of reference. Figures 3a and 3b (Tables IIa and IIb in the Annex) show the prevalence of LBW and RR by parity and year of birth according to level of maternal education, with mothers with university studies the category of reference.

Among primipara mothers (Fig. 2a), the prevalence of LBW rose in all maternal occupation categories between 2007 and 2015, being greater among women with less skilled work and highest among housewives (up to 9% in 2015). Among multipara mothers (Fig. 2b) the prevalence of LBW was again greater among women with less skilled work and highest among housewives, for this latter group always over 6%. This prevalence was less compared to primipara mothers and rose over the period 2009/2011 only to fall later. Disparities may be appreciated in LBW according to maternal occupation both in model 1 (unadjusted) and in model 2 (which includes only gestational age), both for primipara and multipara mothers. However, when adjustment variables are included (model 3), the RR of having a LBW newborn compared with professional mothers fell sharply, remaining significant only among housewives for all years (and for unskilled workers in 2013), and for all or most occupation categories (except students) in 2009, albeit with very low RR (around 1,0 and 1,1). A slight temporal rise can be seen in disparities in the risk of LBW among the reference category and housewives for primipara mothers in 2009 (RR = 1.20, 95% IC = 1.11-1.29) and for multipara mothers in 2011 (RR = 1.19, 95% IC = 1.10-1.30).

Regarding maternal education, the prevalence of LBW among primipara mothers increased over the period in all categories (Fig. 3a), with the highest prevalence among mothers with primary education (up to 9.6% in 2015). Among multipara mothers (Fig. 3b), LBW prevalence was again lower (maximum among housewives: 8.2% in 2015) and the increase was less evident during the economic crisis, although disparities between categories remained. After adjusting for gestational age (model 2), the RR fell compared with the unadjusted model, but remain significant. Both for primipara and

Table I. Temporal trends in maternal-foetal variables (live single births, Spanish mothers, years 2007, 2009, 2011, 2013, and 2015, data from SBB)

	2007	2009	2011	2013	2015	Temporal trend
	% (n)					p-value
Distribution	21.5 (382,277)	21.1 (374,637)	20.4 (362,819)	18.6 (330,938)	18.5 (328,835)	
<i>Age at maternity</i>						
< 20 years old	2.9 (11,082)	2.7 (10,260)	2.3 (8,409)	2.3 (7,626)	2.2 (7,226)	< 0.001
20-24 years old	5.5 (20,996)	5.3 (19,737)	4.8 (17,365)	4.7 (15,555)	4.6 (15,003)	
25-29 years old	19.3 (73,945)	17.3 (64,911)	15.4 (56,038)	14.7 (48,685)	14.4 (47,478)	
30-34 years old	41.1 (157,224)	40.2 (150,749)	38.8 (140,732)	36.6 (121,167)	34.8 (114,557)	
35-39 years old	25.9 (99,197)	28.4 (106,463)	31.5 (114,336)	33.1 (109,430)	34.1 (112,164)	
≥ 40 years old	5.2 (19,833)	6.0 (22,517)	7.1 (25,939)	8.6 (28,475)	9.9 (32,407)	
Missing	---	---	---	---	---	
<i>Maternal occupations</i>						
Professionals	20.9 (79,901)	25.8 (96,532)	30.6 (110,886)	31.8 (105,402)	29.4 (96,771)	< 0.001
Administrative employees	20.0 (76,390)	22.6 (84,828)	23.0 (83,490)	21.6 (71,349)	18.4 (60,420)	
Service Sector workers	15.1 (57,749)	17.0 (63,724)	17.5 (63,615)	18.4 (60,971)	17.6 (57,750)	
Skilled workers	2.8 (10,714)	4.5 (16,795)	2.9 (10,468)	2.6 (8,506)	2.2 (7,336)	
Unskilled and Tertiary Sector workers	5.6 (21,453)	6.8 (25,595)	6.5 (23,645)	6.2 (20,412)	5.6 (18,322)	
Students	0.9 (3,392)	1.0 (3,769)	1.3 (4,549)	1.5 (4,985)	1.5 (4,830)	
Housewives	19.6 (74,867)	18.5 (69,436)	16.6 (60,265)	16.4 (54,205)	14.5 (47,707)	
Missing	15.1 (57,811)	3.7 (13,958)	1.6 (5,901)	1.5 (5,108)	10.9 (35,699)	
<i>Maternal education</i>						
University education	30.8 (117,838)	34.9 (130,721)	38.0 (137,980)	38.4 (127,173)	35.8 (117,843)	< 0.001
Secondary education	53.2 (203,523)	52.3 (196,073)	49.1 (178,324)	46.1 (152,490)	44.3 (145,574)	
Primary education	9.7 (37,234)	9.9 (37,128)	9.0 (32,689)	8.8 (29,088)	9.1 (29,865)	
Missing	6.2 (23,682)	2.9 (10,715)	3.8 (13,826)	6.7 (22,187)	10.8 (35,553)	
<i>Marital status</i>						
Married	72.1 (275,460)	67.1 (251,207)	63.0 (228,581)	58.6 (193,981)	54.0 (177,702)	< 0.001
Unmarried with a stable partner	15.2 (58,264)	15.8 (59,127)	16.7 (60,492)	17.4 (57,587)	17.4 (57,376)	
Unmarried without a stable partner	7.0 (26,758)	9.8 (36,894)	11.6 (42,193)	13.7 (45,304)	15.0 (49,381)	
Missing	5.7 (21,795)	7.3 (27,409)	8.7 (31,554)	10.3 (34,066)	13.5 (44,376)	
<i>Residence of the mother</i>						
Rural	19.8 (75,611)	19.2 (71,868)	19.2 (69,613)	18.8 (62,217)	18.7 (61,637)	< 0.001
Urban	80.2 (306,666)	80.8 (302,769)	80.8 (293,206)	81.2 (268,721)	81.3 (267,198)	
Missing	---	---	---	---	---	
<i>Sex of new-born</i>						
Male	51.7 (197,546)	51.8 (193,916)	51.6 (187,232)	51.6 (170,611)	51.5 (169,312)	n,s,
Female	48.3 (184,731)	48.2 (180,721)	48.4 (175,587)	48.4 (160,327)	48.5 (159,523)	
Missing	---	---	---	---	---	
<i>Parity</i>						
Primipara	58.6 (224,001)	54.9 (205,550)	54.0 (195,902)	54.6 (180,580)	53.1 (174,611)	< 0.001
Multipara	41.4 (158,276)	45.1 (169,087)	46.0 (166,917)	45.4 (150,358)	46.9 (154,224)	
Missing	---	---	---	---	---	
<i>Type of delivery</i>						
CS delivery	23.6 (90,316)	(*)	25.4 (92,097)	25.7 (85,066)	25.0 (82,334)	< 0.001
Vaginal delivery	76.4 (291,961)		74.6 (270,722)	74.3 (245,872)	75.0 (246,501)	
Missing	---		---	---	---	
<i>Gestational age</i>						
Preterm birth	5.0 (19,192)	4.9 (18,520)	4.7 (17,110)	4.7 (15,663)	4.8 (15,660)	< 0.001
At term birth	74.7 (285,616)	76.3 (285,977)	78.0 (282,920)	79.1 (261,652)	80.7 (265,251)	
Post-term birth	2.6 (9,981)	2.5 (9,368)	2.2 (7,837)	1.7 (5,533)	1.4 (4,491)	
Missing	17.7 (67,488)	16.2 (60,772)	15.1 (54,952)	14.5 (48,090)	13.2 (43,433)	

(Continue in the next page)

Table I (Cont.). Temporal trends in maternal-foetal variables (live single births, Spanish mothers, years 2007, 2009, 2011, 2013, and 2015, data from SBB)

	2007	2009	2011	2013	2015	Temporal trend
	% (n)					p-value
<i>Birth weight</i>						
LBW	5.7 (21,710)	5.9 (21,927)	5.7 (20,795)	5.8 (19,252)	5.9 (19,451)	< 0.001
Normal weight	85.7 (327,640)	85.6 (320,589)	85.5 (310,356)	85.3 (282,369)	85.3 (280,424)	
Macrosomia	5.0 (19,222)	5.1 (19,078)	5.1 (18,609)	5.1 (16,758)	5.0 (16,432)	
Missing	3.6 (13,705)	3.5 (13,043)	3.6 (13,059)	3.8 (12,559)	3.8 (12,528)	

CS delivery, caesarean section delivery; LBW, low birth weight.

*Not available data.

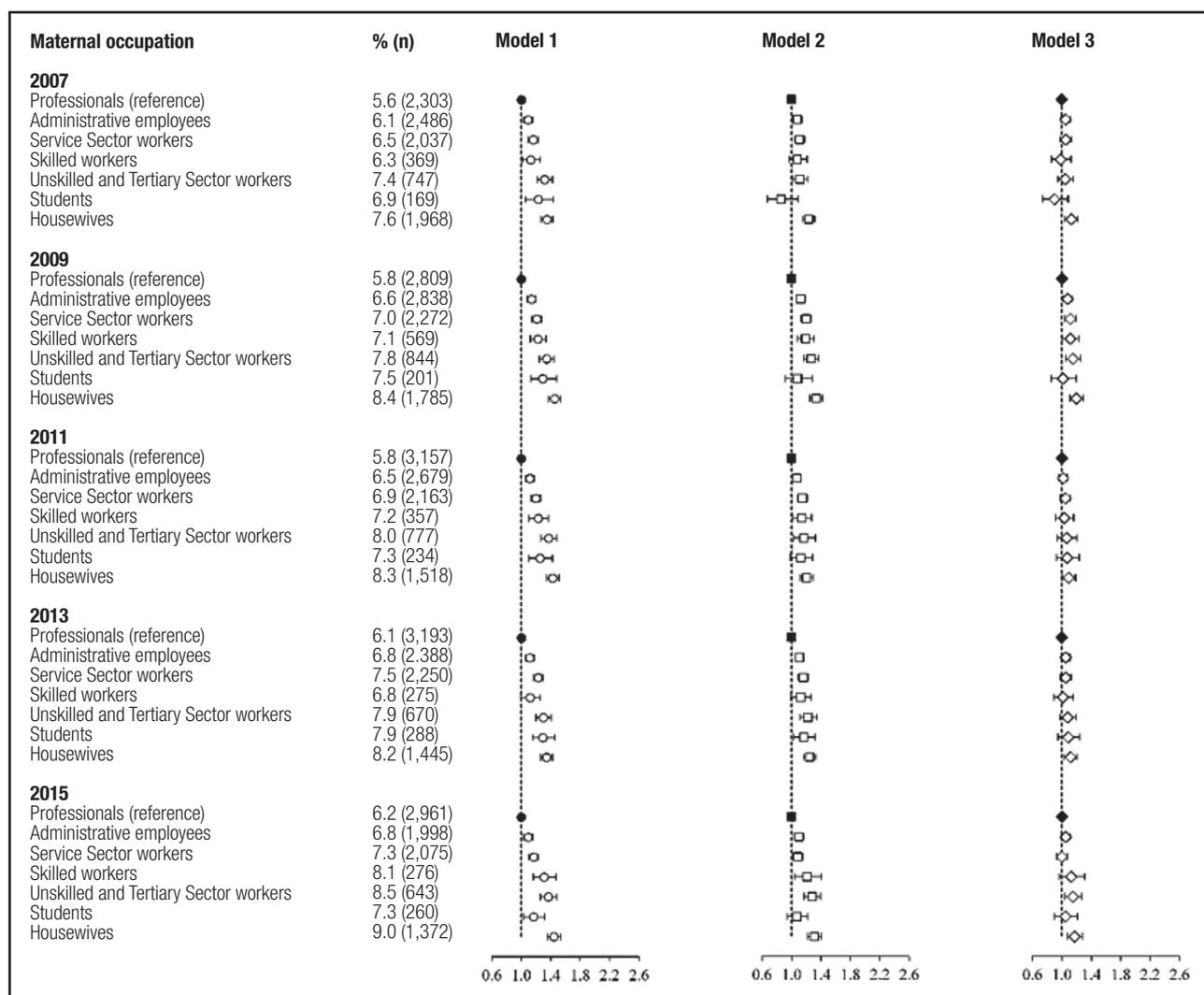


Figure 2a.

Prevalence, unadjusted and adjusted relative risk of LBW by maternal occupation and year of birth in primipara mothers. Model 1, unadjusted; model 2, adjusted for gestational age; model 3, adjusted for maternal education, type of birth, and gestational age (live single births, Spanish mothers, data from SBB).

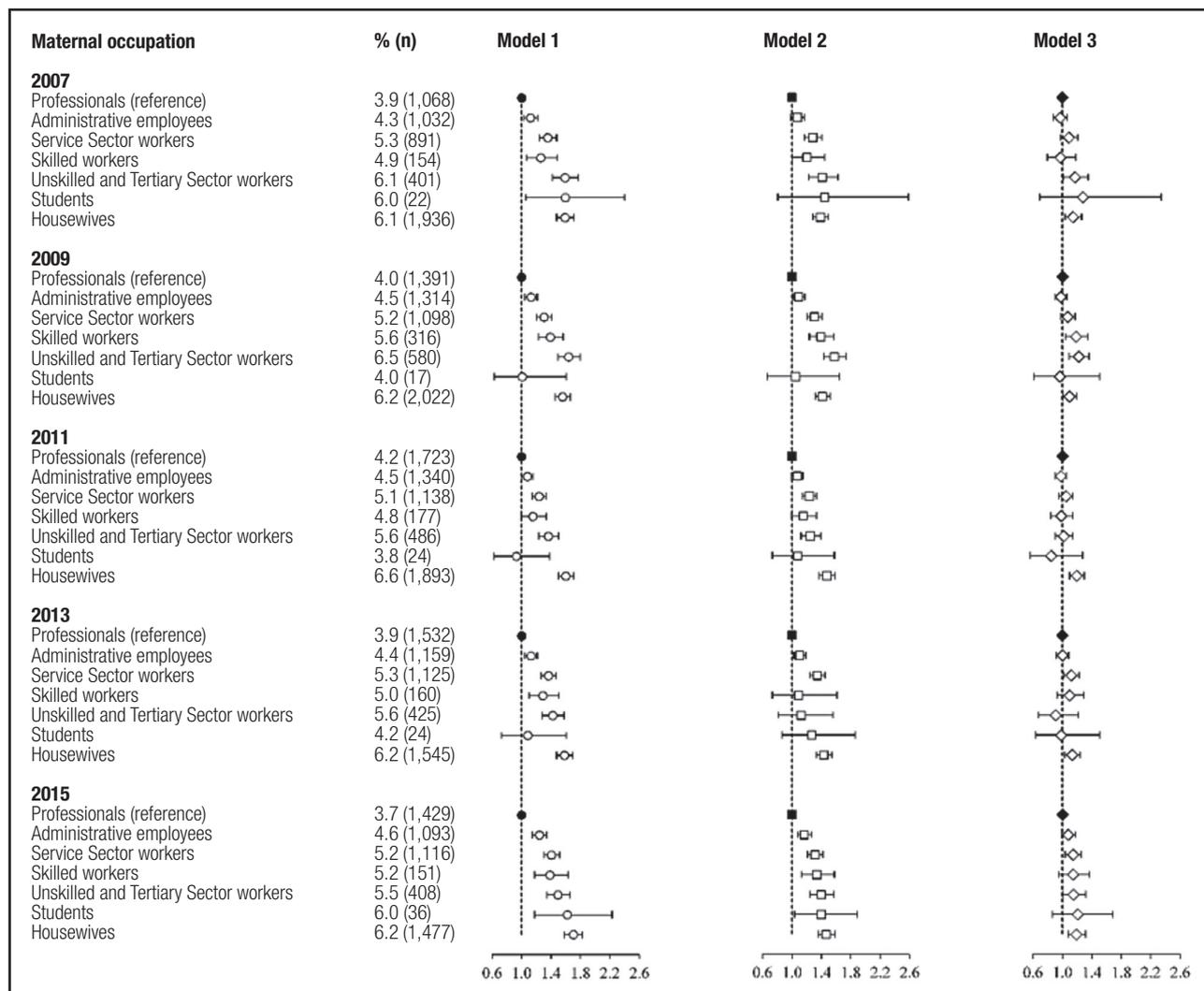


Figure 2b.

Prevalence, unadjusted and adjusted relative risk of LBW by maternal occupation and year of birth in multipara mothers. Model 1, unadjusted; model 2, adjusted for gestational age; model 3, adjusted for maternal education, type of birth, and gestational age (live single births, Spanish mothers, data from SBB).

multipara mothers and for all the years analysed the adjusted RR of being born with LBW were significantly higher among mothers with primary and secondary education than among those with university education. Adjusted RR for education categories were greater than for occupation categories, being greater among multipara mothers than primipara ones (the opposite to what happens with occupation). The tendency is also clearer towards a temporal increase in disparities in adjusted risk of being born with LBW according to maternal education in 2009, both for primipara (RR = 1.39, 95% IC = 1.30-1.49) and multipara (RR = 1.81, 95 % IC = 1.67-1.97) mothers.

CONCLUSION

This study shows that during the years of economic crisis in Spain there has been an increase in the prevalence of LBW, and a

persistence and increase of social inequalities in LBW (according to adjusted RR). At the same time, a change can be observed in the profile of women having children during this period, with a greater contribution of highly qualified professional women and those with high levels of education. Given that these social categories are linked to good birth outcomes, it is possible that the persistence of social inequalities reported in this study hides or underestimates the negative effect of the crisis on pregnancy on the prevalence and risk of LBW. Our study also shows that differences in birth weight are more clearly connected with the maternal education level than with maternal occupation. The limitations of this study include the fact that the analysis carried out was limited to the information compiled by the SBB, which does not include variables which are relevant for evaluating gestation conditions and pregnancy outcome, such as maternal health, anthropometry, eating habits, weight gain during gestation, and

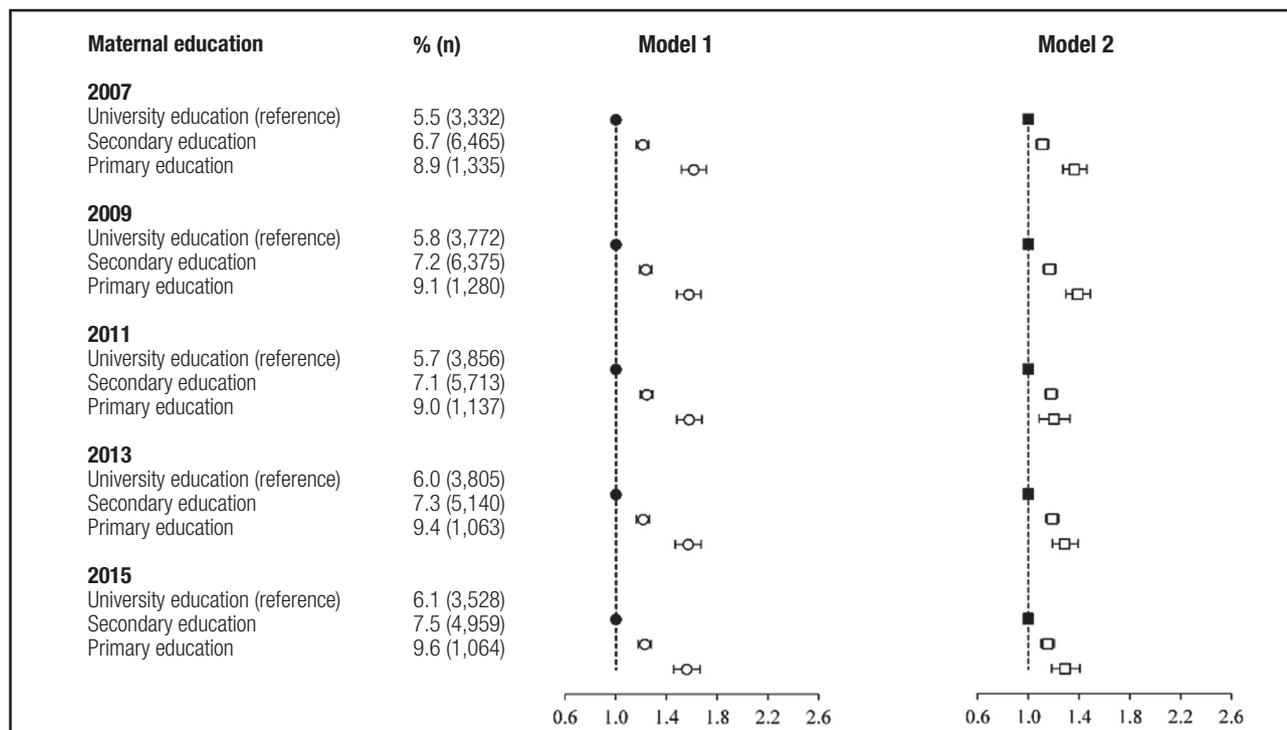


Figure 3a.

Prevalence, unadjusted and adjusted relative risk of LBW by maternal education and year of birth in primipara mothers. Model 1, unadjusted; model 2, adjusted for gestational age (live single births, Spanish mothers, data from SBB).

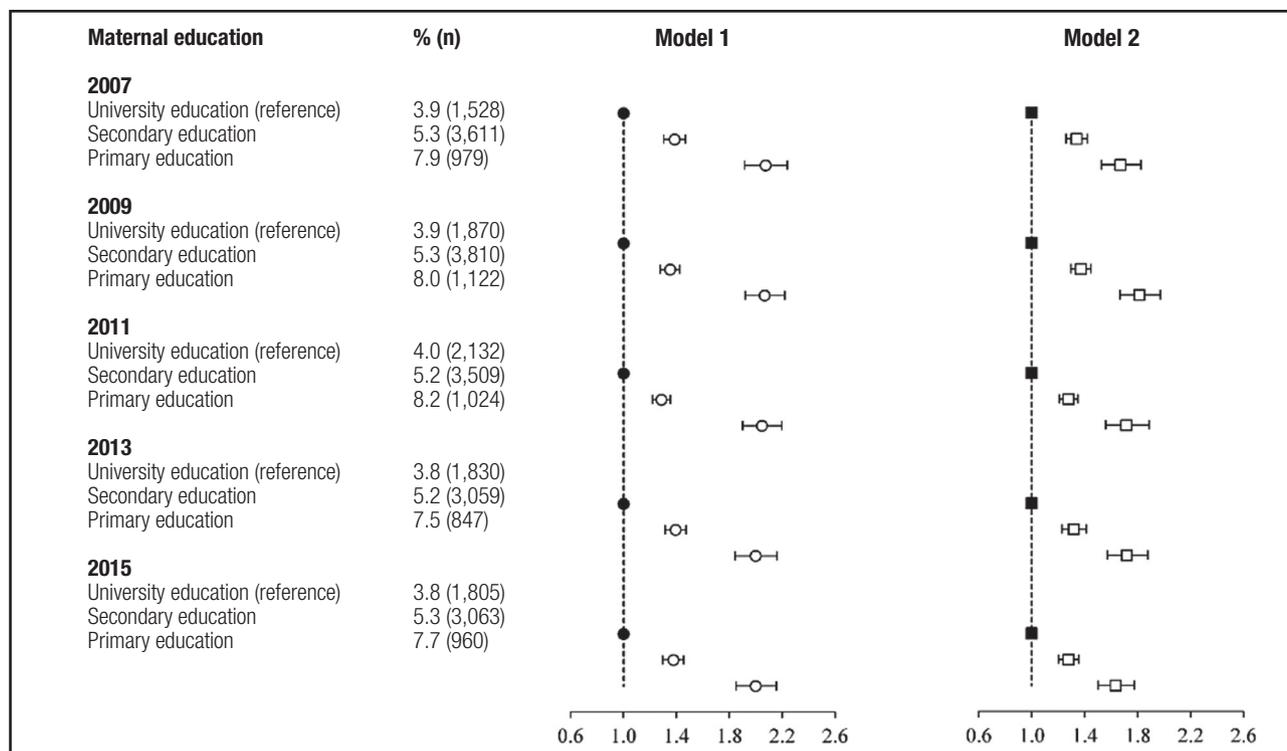


Figure 3b.

Prevalence, unadjusted and adjusted relative risk of LBW by maternal education and year of birth in multipara mothers. Model 1, unadjusted; model 2, adjusted for gestational age (live single births, Spanish mothers, data from SBB).

stress levels. On the other hand, the SBB provides data at the national level which allow a sound and reliable evaluation of temporal trends in maternal profile, obstetric practices, and perinatal health associated to demographic, social and economic changes in the country.

The results confirm the persistence of the social inequalities in perinatal health described before the crisis (29,30), as well as the negative effect of the crisis (23,24) over a wider period (2007-2015) than that observed previously. At the same time, our results show how the economic crisis may have deepened some tendencies previously seen in the profile of Spanish mothers (31), intensifying the presence of women with better socio-economic positions, or in other words, limiting the reproductive opportunities for the most socio-economically vulnerable women. In fact, the decrease of fertility in the country since 2008 was one of the more immediate consequences of the economic crisis, a decrease to which Spanish women with a lower socio-economic status, along immigrant residents are primarily contributing.

Spanish primipara mothers are increasingly older, and with greater marital stability (31). Delayed maternity has been associated with a worsening of perinatal indicators, with increasing access to ART (and consequently an increased rate of multiple pregnancies), and with increasing obstetric interventionism (32). Analyses of the Spanish population for the period of the current economic crisis (24) confirm that the delay in the age at first maternity is a significant adjusted factor for delayed foetal growth, but with a very limited clinical impact. This could be due to the fact that delayed maternity is linked to greater material resources and level of education, greater marital stability, and better maternal care, which, ultimately, all favour better perinatal indicators (33).

Despite these trends in the socio-economic profile of Spanish, we must underline that the results show that the prevalence of LBW increased for all socio-economic categories of mothers during the economic crisis, in a sustained way among primipara mothers, but only during the worst years of the recession (2009 and 2011) among multipara mothers. Thus, for example, among primipara mothers the prevalence of LBW increased among housewives by 18.4% between 2007 and 2015, but also increased by 10.7% among professionals, and even increased more among women with university education than among those with primary studies (10.7% compared with 7.8%, respectively). These findings point to the general impact of the economic crisis on gestation –as has been described in other European countries (34)– through

increased maternal stress, a hypothesis explored in Varea et al. (2016) (24). Clearly, following a period of economic prosperity, the Spanish population have experienced an unexpected and prolonged period of psychological uncertainty since 2008, which has affected almost all social sectors, independently of an immediate or major drop in their living conditions (35). Future population analyses of wider temporal series will allow an evaluation of the impact of the economic crisis on perinatal health indicators, independent of those derived from previous trends in the maternal profile and the increase in obstetric intervention (23,31).

The results also show that disparities in the risk of having a new-born with LBW are more clearly linked to differences in the maternal education than to occupation, as well as their increase during the economic crisis. After adjusting for education, type of delivery and gestational age, the RR of having a new-born with LBW among occupation categories as compared with professional mothers lost significance or were very low ($RR \approx 1.1$, for housewives and the other categories during the worst years of the economic crisis). On the other hand, adjusted (only for gestational age) RR of having a new-born with LBW for women with primary or secondary education remained significant for both categories and all years, as compared to university graduates. Our analysis found that maximum disparities in LBW were by education level among multipara mothers, with RR between 1.6 and 1.8. Among multipara mothers, the educational gradient represents the extremes of the spectrum of multiple births, with well-qualified women, with good economic resources and marital stability predominantly having two live births as opposed to mothers with a low level of education and limited resources, who became mothers at a young age and had families with three or more births (*data not included*). As has been described in other European countries (36), these mothers are those taking responsibility for managing very limited family budgets and for coping with the deterioration of the domestic economy during the recession.

To sum up, the results of this study confirm that maternal education highlights the social inequalities and their possible impact on pregnancy and birth outcome better than maternal occupation (33). Education, in part, determines occupational level, but education also favours healthy maternal habits, including earlier and better prenatal care, appropriate weight gain during pregnancy, reduced parity, and greater marital stability (37,38). A higher level of maternal education is considered the clearest vehicle for the positive intergenerational transmission of human capital and for the intergenerational reduction of social inequalities (39).

Annex. Table Ia. Relative risk and 95% confidence interval for LBW by maternal occupation in primipara mothers (live single births, Spanish mothers, years 2007, 2009, 2011, 2013, 2015, data from SBB)

	Model 1	Model 2	Model 3
	RR (95% IC)	RR (95% IC)	RR (95% IC)
<i>2007</i>			
Professionals (reference)	1.00	1.00	1.00
Administrative employees	1.09 (1.03-1.15)	1.08 (1.02-1.14)	1.05 (0.99-1.12)
Service Sector workers	1.16 (1.10-1.23)	1.11 (1.04-1.18)	1.05 (0.98-1.13)
Skilled workers	1.13 (1.01-1.25)	1.08 (0.96-1.21)	0.98 (0.86-1.12)
Unskilled and Tertiary Sector workers	1.32 (1.21-1.42)	1.11 (1.01-1.22)	1.04 (0.95-1.15)
Students	1.23 (1.06-1.43)	0.85 (0.67-1.09)	0.90 (0.74-1.09)
Housewives	1.35 (1.27-1.43)	1.23 (1.16-1.31)	1.13 (1.04-1.22)
<i>2009</i>			
Professionals (reference)	1.00	1.00	1.00
Administrative employees	1.14 (1.08-1.20)	1.12 (1.06-1.19)	1.08 (1.02-1.14)
Service Sector workers	1.21 (1.15-1.28)	1.20 (1.13-1.27)	1.11 (1.04-1.19)
Skilled workers	1.23 (1.12-1.34)	1.19 (1.08-1.31)	1.11 (1.01-1.23)
Unskilled and Tertiary Sector workers	1.34 (1.25-1.45)	1.26 (1.16-1.37)	1.15 (1.05-1.26)
Students	1.29 (1.13-1.48)	1.08 (0.91-1.28)	1.01 (0.86-1.20)
Housewives	1.45 (1.37-1.54)	1.33 (1.25-1.42)	1.20 (1.11-1.29)
<i>2011</i>			
Professionals (reference)	1.00	1.00	1.00
Administrative employees	1.12 (1.06-1.17)	1.07 (1.02-1.13)	1.01 (0.96-1.07)
Service Sector workers	1.20 (1.13-1.26)	1.15 (1.09-1.21)	1.05 (0.98-1.12)
Skilled workers	1.23 (1.11-1.37)	1.14 (1.02-1.27)	1.03 (0.92-1.16)
Unskilled and Tertiary Sector workers	1.37 (1.27-1.48)	1.17 (1.03-1.32)	1.06 (0.94-1.20)
Students	1.25 (1.10-1.42)	1.13 (0.99-1.29)	1.07 (0.93-1.24)
Housewives	1.43 (1.34-1.51)	1.20 (1.12-1.29)	1.09 (1.01-1.19)
<i>2013</i>			
Professionals (reference)	1.00	1.00	1.00
Administrative employees	1.11 (1.06-1.17)	1.11 (1.05-1.17)	1.05 (0.99-1.11)
Service Sector workers	1.23 (1.17-1.29)	1.16 (1.09-1.23)	1.05 (0.99-1.12)
Skilled workers	1.12 (0.99-1.26)	1.12 (0.99-1.27)	1.01 (0.89-1.15)
Unskilled and Tertiary Sector workers	1.30 (1.20-1.41)	1.22 (1.11-1.34)	1.08 (0.97-1.19)
Students	1.29 (1.15-1.45)	1.17 (1.03-1.32)	1.09 (0.95-1.25)
Housewives	1.34 (1.26-1.42)	1.24 (1.17-1.33)	1.12 (1.03-1.21)
<i>2015</i>			
Professionals (reference)	1.00	1.00	1.00
Administrative employees	1.09 (1.03-1.15)	1.10 (1.04-1.16)	1.05 (0.99-1.12)
Service Sector workers	1.17 (1.11-1.23)	1.08 (1.02-1.15)	1.00 (0.93-1.07)
Skilled workers	1.31 (1.16-1.47)	1.21 (1.05-1.40)	1.12 (0.96-1.31)
Unskilled and Tertiary Sector workers	1.37 (1.26-1.48)	1.28 (1.17-1.40)	1.15 (1.04-1.27)
Students	1.17 (1.03-1.32)	1.07 (0.94-1.22)	1.05 (0.90-1.21)
Housewives	1.44 (1.35-1.53)	1.31 (1.22-1.40)	1.17 (1.08-1.28)

RR, Relative risk; 95% IC, 95% confidence interval.

Model 1, unadjusted; model 2, adjusted for gestational age; model 3, adjusted for maternal education, type of delivery, and gestational age.

Annex. Table Ib. Relative risk and 95% confidence interval LBW by maternal occupation in multipara mothers (live single births, Spanish mothers, years 2007, 2009, 2011, 2013, 2015, data from SBB)

	Model 1	Model 2	Model 3
	RR (95% IC)	RR (95% IC)	RR (95% IC)
<i>2007</i>			
Professionals (reference)	1.00	1.00	1.00
Administrative employees	1.12 (1.03-1.22)	1.07 (0.98-1.17)	0.97 (0.88-1.07)
Service Sector workers	1.35 (1.24-1.48)	1.28 (1.17-1.41)	1.09 (0.97-1.21)
Skilled workers	1.26 (1.07-1.48)	1.20 (1.00-1.44)	0.97 (0.79-1.18)
Unskilled and Tertiary Sector workers	1.59 (1.42-1.77)	1.41 (1.23-1.62)	1.17 (1.01-1.35)
Students	1.59 (1.06-2.40)	1.44 (0.81-2.58)	1.28 (0.70-2.34)
Housewives	1.59 (1.48-1.71)	1.39 (1.29-1.50)	1.14 (1.03-1.26)
<i>2009</i>			
Professionals (reference)	1.00	1.00	1.00
Administrative employees	1.13 (1.05-1.21)	1.09 (1.01-1.17)	0.98 (0.90-1.06)
Service Sector workers	1.30 (1.21-1.41)	1.30 (1.20-1.41)	1.07 (0.98-1.17)
Skilled workers	1.39 (1.23-1.56)	1.39 (1.24-1.57)	1.18 (1.04-1.34)
Unskilled and Tertiary Sector workers	1.64 (1.49-1.80)	1.58 (1.43-1.74)	1.22 (1.09-1.36)
Students	1.01 (0.63-1.61)	1.05 (0.67-1.65)	0.96 (0.62-1.51)
Housewives	1.56 (1.46-1.66)	1.41 (1.32-1.52)	1.10 (1.01-1.19)
<i>2011</i>			
Professionals (reference)	1.00	1.00	1.00
Administrative employees	1.08 (1.01-1.16)	1.07 (0.99 -1.15)	0.98 (0.91-1.06)
Service Sector workers	1.23 (1.15-1.33)	1.24 (1.14-1.34)	1.05 (0.96-1.14)
Skilled workers	1.15 (0.99-1.34)	1.15 (0.99-1.34)	0.98 (0.84-1.15)
Unskilled and Tertiary Sector workers	1.36 (1.24-1.50)	1.25 (1.12-1.39)	1.02 (0.91-1.14)
Students	0.93 (0.63-1.38)	1.08 (0.73-1.57)	0.85 (0.56-1.27)
Housewives	1.60 (1.50-1.70)	1.47 (1.37-1.58)	1.19 (1.10-1.30)
<i>2013</i>			
Professionals (reference)	1.00	1.00	1.00
Administrative employees	1.13 (1.05-1.21)	1.10 (1.02-1.19)	1.00 (0.92-1.09)
Service Sector workers	1.36 (1.26-1.47)	1.34 (1.25-1.45)	1.12 (1.02-1.23)
Skilled workers	1.29 (1.10-1.51)	1.09 (0.73-1.61)	1.10 (0.93-1.29)
Unskilled and Tertiary Sector workers	1.42 (1.28-1.58)	1.13 (0.81-1.56)	0.91 (0.67-1.22)
Students	1.08 (0.73-1.61)	1.27 (0.87-1.86)	0.98 (0.64-1.51)
Housewives	1.58 (1.48-1.69)	1.43 (1.33-1.54)	1.13 (1.03-1.24)
<i>2015</i>			
Professionals (reference)	1.00	1.00	1.00
Administrative employees	1.24 (1.15-1.34)	1.17 (1.07-1.26)	1.08 (0.99-1.18)
Service Sector workers	1.41 (1.30-1.52)	1.31 (1.21-1.42)	1.14 (1.03-1.26)
Skilled workers	1.38 (1.18-1.63)	1.33 (1.13-1.58)	1.14 (0.96-1.37)
Unskilled and Tertiary Sector workers	1.49 (1.34-1.66)	1.40 (1.24-1.57)	1.15 (1.00-1.32)
Students	1.62 (1.18-2.23)	1.40 (1.04-1.89)	1.21 (0.87-1.68)
Housewives	1.70 (1.59-1.83)	1.46 (1.36-1.58)	1.19 (1.08-1.31)

RR, Relative risk; 95% IC, 95% confidence interval.

Model 1, unadjusted; model 2, adjusted for gestational age; model 3, adjusted for maternal education, type of delivery, and gestational age.

Annex. Table IIa. Relative risk and 95% confidence interval for LBW by maternal education in primipara mothers (live single births, Spanish mothers, years 2007, 2009, 2011, 2013, 2015, data from SBB)

	Model 1	Model 2
	RR (95% IC)	RR (95% IC)
<i>2007</i>		
University education (reference)	1.00	1.00
Secondary education	1.21 (1.16-1.26)	1.11 (1.06-1.16)
Primary education	1.61 (1.52-1.71)	1.36 (1.27-1.46)
<i>2009</i>		
University education (reference)	1.00	1.00
Secondary education	1.23 (1.19-1.28)	1.17 (1.12-1.22)
Primary education	1.57 (1.48-1.67)	1.39 (1.30-1.49)
<i>2011</i>		
University education (reference)	1.00	1.00
Secondary education	1.24 (1.19-1.29)	1.18 (1.13-1.23)
Primary education	1.58 (1.48-1.68)	1.20 (1.09-1.33)
<i>2013</i>		
University education (reference)	1.00	1.00
Secondary education	1.21 (1.17-1.26)	1.19 (1.14-1.24)
Primary education	1.57 (1.47-1.67)	1.29 (1.19-1.39)
<i>2015</i>		
University education (reference)	1.00	1.00
Secondary education	1.23 (1.18-1.28)	1.15 (1.10-1.20)
Primary education	1.56 (1.46-1.66)	1.29 (1.18-1.41)

RR, Relative risk; 95% IC, 95% confidence interval.

Model 1, unadjusted; model 2, adjusted for gestational age.

Annex. Table IIb. Relative risk and 95% confidence interval for LBW by maternal education in multipara mothers (live single births, Spanish mothers, years 2007, 2009, 2011, 2013, 2015, data from SBB)

	Model 1	Model 2
	RR (95% IC)	RR (95% IC)
<i>2007</i>		
University education (reference)	1.00	1.00
Secondary education	1.38 (1.31-1.47)	1.34 (1.26-1.42)
Primary education	2.07 (1.92-2.24)	1.67 (1.53-1.82)
<i>2009</i>		
University education (reference)	1.00	1.00
Secondary education	1.35 (1.28-1.43)	1.37 (1.30-1.45)
Primary education	2.06 (1.92-2.22)	1.81 (1.67-1.97)
<i>2011</i>		
University education (reference)	1.00	1.00
Secondary education	1.28 (1.22-1.35)	1.28 (1.21-1.35)
Primary education	2.04 (1.90-2.19)	1.71 (1.56-1.89)

(Continue in the next page)

Annex. Table IIb (Cont.). Relative risk and 95% confidence interval for LBW by maternal education in multipara mothers (live single births, Spanish mothers, years 2007, 2009, 2011, 2013, 2015, data from SBB)

	Model 1	Model 2
	RR (95% IC)	RR (95% IC)
<i>2013</i>		
University education (reference)	1.00	1.00
Secondary education	1.39 (1.32-1.47)	1.32 (1.23-1.41)
Primary education	2.00 (1.84-2.16)	1.72 (1.57-1.88)
<i>2015</i>		
University education (reference)	1.00	1.00
Secondary education	1.37 (1.30-1.45)	1.28 (1.20-1.35)
Primary education	2.00 (1.85-2.15)	1.63 (1.50-1.77)

RR, Relative risk; 95% IC, 95% confidence interval.

Model 1, unadjusted; model 2, adjusted for gestational age.

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