

European Population Conference, 2010 Vienna, 1-4 September

## **Testing the epidemiological paradox through birthweight in the Spanish context. *A true or an artificial effect?***

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### EXTENDED ABSTRACT

#### **Background**

Countries with long immigration histories have found systematic evidence showing similar or even better health outcomes in migrants when compared with the host population, in spite of the fact that immigrants come from poorer socioeconomic contexts and experience social and other disadvantages in the host country. This phenomenon was first defined in the research literature as the ‘epidemiologic paradox’ by Markides and Coreil in 1986 (1986: 253) and, since then, it has been found in different contexts (United States, Germany, France, Belgium, Canada, and others). This paradox has been observed in several health dimensions; such as infant mortality (Gutmann et al, 1998; Landale et al, 2006; Forbes and Frisbie, 1991; Hummer et al, 1999), general mortality (Anson, 2004; Razum et al, 1998), reproductive outcomes (Hummer, 1999; Rosemberg et al, 2005; Padilla et al, 2002; Wingate and Alexander, 2006; Guendelman et al, 1999), morbidities (McDonald and Kennedy, 2004; Jasso et al, 2004; Newbold, 2006) and mental health (Vega et al, 1998; Lou and Beajout, 2005).

In the whole body of evidence relating to the epidemiologic paradox, the well known low birth weight paradox (LBW paradox) (Fuentes-Afflick *et al*, 1998 and 1999; Scribner *et al*, 1989; Brown *et al*, 2006:197; Overpeck *et al*, 1999; Hessel and Fuentes-Afflick, 2000; Leslie *et al*, 2006; Harding *et al*, 2006) has supported its existence more than any other dimension of health studied so far. Low birth weight (LBW) is not subject to some important weaknesses found in the measurement of mortality and morbidity, since it does not suffer from diagnosis bias (as does morbidity) and is not effected by subsequent return to the country of origin (as could occur with infant and adult mortality). All new births have to be included in the civil register even if they die or return to the country of origin, as registration is a condition for receiving burial

permission or legally leaving the country and, thus, provide us with complete information on birthweight and gestational age. In addition, birthweight is an important outcome in epidemiology because of its association both with maternal and infant health. Birthweight depends on several domains related to the mother (health behaviour, reproductive health) and is a good predictor of the newborn's future health, under the premise that what happened at the beginning of life influences the rest of it, following the Barker hypothesis on foetal programming (Barker, 1995; 2001; 2007) and the critical period hypothesis from a life-course perspective (Kuh and Ben-Shlomo, 2004).

A wide range of studies have demonstrated that foreign-born mothers have a lower probability of having LBW babies when compared with native-born mothers, but none have given any conclusive explanation to support these findings. More importantly, all of these studies have focussed on uncovering the mechanism that underlies this paradox rather than contemplating the possible existence of an artificial effect due to methodological and measurement bias. It is possible to identify at least three groups of hypotheses for the existence of the LWB paradox from the research literature: First, understanding the epidemiological paradox as a consequence of a selection effect related to the migration processes, otherwise known as the 'healthy migrant effect' (Palloni & Arias, 2003:1; Wingate, Alexander *et al.* 2006:491; Wiking *et al.*, 2003:581)). Although this selectivity explanation is a feature of migration studies (Ravenstein's law of migration (1885, 1889), stating that immigrants are predominantly urban, young adults, male and more educated than the population of origin, there is not any evidence demonstrating that this process exists with respect to health. In any case, the epidemiological paradox is defined in comparison with the host population as the reference group, which makes this explanation irrelevant. Second, it can be said to exist as a result of some unobserved characteristics, for instance, it is often mentioned that diabetes, obesity and lower smoking rates could explain the LBW paradox in the case of Latin American immigrants living in the United States (Overpeck *et al.*, 1999: 946; Brown *et al.*, 2007:197e.6) as all of these factors contribute to having heavier babies. Nevertheless, this hypothesis is not supported by empirical evidence in studies where this information is available (Hessol *et al.*, 2000:519; Chung *et al.*, 2003:1060). Third, it has been suggested that the LBW paradox exists as a result of culture, lifestyle and different dietary habits that characterize these migrant populations (Chung *et al.*, 2003:1062). Familial integrity, higher estimation of familiar roles and social support

have been also identified as possible cultural features of the Latin-American population in the United States that influence the favourable reproductive outcomes (Fuentes-Afflick *et al*, 1999:152). Unfortunately, this last explanation has not been sufficiently tested to date.

### **Our scope**

The major aims of this paper are to: 1) test whether the low birth weight paradox is present in the Spanish context as in other countries. In addition to the fact that Spain has a short migration history, it has some peculiarities that make it an interesting example to contribute to the international debate. The immigrant population in Spain is mainly first generation, there is universal access to the health service and Spain is a multicultural host country which allows exploring different groups of origin, 2) explore the possibility that these results could be explained by an artificial effect based on the conceptualization of the risk population and the methodology commonly applied.

This paper will contribute to a better understanding of the LBW paradox by exploring the conceptualization of the risk population. Low birth weight has traditionally been conceptualized as babies below a certain weight, normally below 2,500 grams (less than 5 lb, 8 oz.). Although generally accepted in the literature concerned with birth weight, especially within demography, this threshold has many theoretical problems that should be taken into account when studying the epidemiologic paradox. It is an arbitrary level which is applied universally, even when it is known that anthropometric measures vary in different geographic and socio-cultural contexts (Rooth, 1980). Alternative birth weights have been used in individual studies as definitions of LBW but these have not been widely recognised (Rooth, 1980; Wilcox, 1983, 2001). As it is considered that there is no gold standard to define the population at risk of LBW, this paper has studied the low birth weight paradox using different thresholds to assess whether health differences between immigrants and Spaniards vary according to the specific cut off point used

### **Data & methods**

The analysis was based on vital information data from Madrid's community provided by the Madrid Statistic Institute (IE) for the years 2005 and 2006 (144,616).

This contains health information (birth weight and gestational age) as well as socio-demographic variables (such as mother's civil status, parent's age, profession and nationality). The analysis was based on vital information data from the population of Madrid's community provided by the Madrid Statistic Institute (IE) for the years 2005 and 2006 ( $n = 144,616$ ). This contained birth and late foetal death data (older than 28 gestational weeks), health information (self-reported birthweight and gestational age) and as socio-demographic variables (such as mother's civil status, parent's age, profession and nationality). We selected babies who were born alive as a singleton birth (as it is known that multiple birth babies growth is reduced from 33-35 gestational weeks (Alonso Ortiz, 2002) and had available information on weight (8,338 cases have been excluded). These four conditions of data availability would not create some bias as the proportion of missing data was 7.45% for immigrants and 10.22% for Spaniards although there were differences in the proportion of stillbirths (lower in immigrants). Thus, the final sample size was 130,642 (20.80% of immigrants). The migration status was classified according to mother's nationality and has been categorized as the six following country groups: (a) Africa, (b) North American and Caribbean –excluding US and Canada-, (c) South America (d) Asia –without Japan- and Oceanic –without Australia-, (d) European Union of 15 members and other rich countries – included US, Canada, Australia and Japan and Israel- and (e) Europeans outside EU-15.

Five different models were run varying the threshold that measures the risk population in order to assess the low birth weight paradox (2,500 grams, Wilcox approach based on the residual and main distribution and -2 standards deviation as Rooth suggested) and linear regression to test the birth weight paradox based on grams and z-score values.

## **Results**

When the total birth weight distribution is considered the paradox is present in the six origin groups studied, meaning that, on average, all foreign mothers have heavier babies than Spaniards after controlling for some important socio-demographic variables. This pattern is less clear exploring into the low birth weight since it varies not just depending on the origin but also from the specific threshold used. The common cut-off point fixed in 2,500 grams captures an important part of the main distribution instead of

the actual population at risk so, when the Wilcox threshold is used, a better estimation is found, which in some cases shows the health advantage effects for migrant mother births disappear. According to these results, the paradox is still present in births to mothers from South America, North American and Caribbean and less clear in the African mothers. On the contrary, newborns from UE-15 and other rich countries and European outside the EU-15, Asians and Oceanic mothers vary depending of the cut of point used, suggesting that the LBW paradox appears as an artificial effect for these groups.