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ORIGINAL PAPER

Understanding the Universality of the Immigrant Health Paradox: The Spanish Perspective

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Abstract This study sought the existence of an immigrant health paradox by evaluating the relationship between region of origin and the perinatal indicators of low birth weight and preterm birth in Spain. The data consist of individual records from the 2006 National Birth Registry of Spain. Mother's origin was divided into eleven groups based on geographic region. We calculated the frequency of Low Birth Weight (LBW) and Prematurity. Logistic regressions were conducted evaluating relationship between origin and LBW and origin and prematurity. After adjusting for socio-demographic variables mothers from Sub-Saharan Africa had an increased probability of having a neonate of LBW over the Spanish mothers, whereas in the mothers of the rest of regions the probability was lower. No differences were found in prematurity in babies born to foreign mothers when compared to babies born to Spanish mothers. While our findings largely support an immigrant paradox with regard to low birth weight, they also suggest that region of origin may play an important role.

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Introduction

Theoretical/Conceptual Background

Kyriakos Markides first coined the concept of the Latina Paradox, also known as "Hispanic Health Paradox" and "Immigrant Health Paradox" in 1986, while studying infant mortality in the Latina population of the US. The paradox relates to findings that "Latinos in the US tend to have significantly better health and mortality statistics than the average population despite generally low socioeconomic factors" [1].

In recent years, multiple studies have been conducted in the US confirming a Latino Health Paradox, but without giving rise to a universally accepted explanation for the paradox. Issues of access to care and native country have been suggested as possible contributing factors. A 2003 article examining birth outcomes in the Mexican population of North Carolina confirmed the difficulty encountered when attempting to explain the immigrant health paradox, as issues of access to care often impeded evaluation [2]. A recent study realized in California by Gould et al., observed that (East) Asian women gave birth to infants with lower birth weights when compared to European American and Mexican women, despite having better socio-demographic indicators.

This "Immigrant Health Paradox" in birth outcomes has proven to be a phenomenon that extends beyond the Latina immigrant population of the US. An epidemiological paradox has also been noted when evaluating the fetal weight of babies born to North African women in Belgium [3, 4].

In order to confirm the universality and understand the causes of the Immigrant Health Paradox, immigrants from multiple regions must be evaluated conjunctly and independently of issues of access to care.

Spain provides a unique opportunity for evaluating perinatal implications of the immigrant health paradox. In the period 2000–2005, immigration increased by 21.6% as opposed to a 1.9% increase in the rest of Europe [5]. In this period Spain absorbed approximately 4 million people, increasing its total population in by 10%. As of 2006, at least 15% of all babies born in Spain were born to immigrant women [6]. Additionally, there are two characteristics of immigration in Spain that create an added value over investigations made to date in the US and other European nations. The first characteristic is the variety in the immigrants' regions of origin. This diversity can be attributed to the historic and linguistic links with Central and South America, the geographic proximity of the African continent and the cultural similarity with other European nations. The second is the extension of universal health care to foreign-born persons residing in Spain. Under article 12 of the Law of Immigrant, the Spanish health system guarantees equal access to health care for all pregnant persons living in Spain regardless of legal status [7].

This study intends to evaluate the universality of the immigrant health paradox by studying the relationship between region of origin and the perinatal indicators of low birth weight and prematurity utilizing information for all infants born in Spain in the year 2006.

Methods

Participants and Data

The data consist of individual records from the 2006 National Birth Registry of Spain. In this year Spain had 482,957 births. The Spanish National Birth Registry provides limited socio-demographic information about the mother including country of origin, age, profession of mother and father and marital status. We utilized this registry to obtain data pertaining to birth weight, gestational age, multiple verses single gestation and the above-mentioned socio-demographic characteristics.

For the purpose of our research we have divided the mother's origin into one group for Spain and ten other groups based on geographic region. The 11 total groups include: Spain, Sub-Saharan Africa, North Africa, Central America and Mexico, South America, Caribbean, US and Canada, Asia, Middle East, Rest of EU Europe, and Non EU Europe. Two groups, Oceania, and a final category defined by the database as "No relationship with Spain", were not considered as their combined N only accounted for 55 births.

The mothers ranged in age from 12 to 55. We divided ages into three categories as follows: ages 12–19, ages 20–34, and ages 35 and above. In obstetrics, adolescents are known to have increased risk for preterm labor and infant mortality. Women age 35 or older are considered to be of Advanced Maternal Age (AMA) in pregnancy and may also have increased risk of poor obstetric outcomes [8]. Martial status was predefined by the database as married or not married. We used maternal and paternal profession as proxies for socio-economic status as they were the most appropriate information provided by the Spanish national database. Other information, such as educational achievement or income, is not collected. The national database divides the maternal and paternal profession variable into 12 categories based on job skill or level of professionalism.

Collection Measures

Data was collected through accessing the publically available 2006 National Birth Registry of Spain and evaluating it once formatted for SPSS version 13.

Analysis

Our analysis has included low birth weight and prematurity, as they are important indicators of perinatal health [9]. In particular birth weight has been noted to be the "most important determinant of perinatal, neonatal, and post-natal outcomes" according to a 2008 report from the Canadian Institute of Health Economics [10].

Low birth weight (LBW) is generally attributed to either preterm birth or restricted fetal (intrauterine) growth [11]. As we will evaluate preterm birth as a separate variable we have removed preterm infants from the analysis of LBW. Low Birth Weight is defined as a weight less than 2,500 g; prematurity is defined as gestational age of less than 37 weeks completed [12].

Additionally, we removed multiple births from both the LBW analysis and the preterm analysis, as multiple gestations are known to have 10–50% prevalence of growth restriction, as well as a two to five times increased chance of being born preterm [13, 14].

Our initial analysis evaluated the frequency of low birth weight in each of the 11 regions. Removing preterm and multiple births, 378,190 births remained. With a total of 8,993 missing birth weights, 369,197 births were considered in birth weight evaluation.

Then, a logistic regression was completed to evaluate the relationship between region of origin and LBW. Spain was used as the indicator region so that it could be

observed whether coming from any of the 10 remaining regions was related to low birth weight. This analysis was adjusted for marital status, profession of mother, profession of father, and mother's age. The adjustments were completed separately and conjunctly to identify which, if any, factor had a greater impact, or if socio-demographic factors would have synergistic effect on outcomes.

A similar analysis of frequency of preterm birth was completed. The gestational age was missing in 13.5% of the births in the 2006 National Registry; therefore the analysis of preterm births was completed using 402,925 births.

Another logistic regression was performed evaluating the relationship between region of origin and preterm birth. Again, Spain was used as the region of reference for comparison. Adjustments were made for marital status, profession of mother, profession of father, and mother's age as in the previous analysis. All analysis was completed using SPSS version 13.

As our research was conducted utilizing publically available statistics and information, ethics committee authorization was not required. However, as the research was conducted within an academic setting, it was approved by the appropriate university entities prior to its initiation.

Results

In 2006, 83.5% of babies were born to Spanish mothers, 5.7% were born to mothers from South America, 3.8% North Africa, 3.9% from other EU nations, and less than 1% from Sub-Saharan Africa, Asia, the Mideast, Caribbean, Mexico/Central America, US/Canada, and Non EU Europe.

Table 1 depicts the socio-demographic information for each region including marital status, age, and maternal and paternal profession. The greatest percentage of unmarried mothers came from South America, with 58.6% single. In the EU nations marital status was nearly evenly spread with 48.7% of all mothers being unmarried as opposed to 25.8% in Spain. The lowest prevalence of single motherhood was observed in the North African population where only 11.3% of the population was registered as unmarried.

The oldest population was observed from the US/Canada region with 31.3% of mothers being age 35 and over. In the Spanish population 26.2% of mothers were 35 years old and over. The greatest prevalence of adolescent pregnancy was found in the Sub-Saharan population with 4% of mothers being between the ages of 12 and 19.

With regard to profession, a range of 18.2–50.6% and 17.6–50.1% of the maternal and paternal profession, respectively were unable to be defined. Less than 1% of mothers and fathers were registered as dependent on government monies (retirement, disability, unemployment etc.). The greatest percentage of women from the two most professional categories was noted in women from the US/Canada at 34.3% as opposed to 20.5% of Spanish women. The lowest was noted from women in North Africa at 1%. Women from North Africa had the highest percentage of registration as housewives at 40.8% as opposed to 18.6% of Spanish women. Asian, South American and Caribbean women were the most likely to work in service fields at rates of 17.4, 19.2, and 21%, respectively.

In the two most professional categories, partners of women from the US/Canada (39.5%) and the Middle Eastern (30.3%) regions were most represented. A rate of 27% was observed in those from Mexico/Central America and 22% of fathers of babies born to Spanish mothers. Work in construction and transport was among the most common professions (24% or greater) with the exclusion of partners of women from the Middle East, US/Canada, and Asia. A military presence was noted in the partners of women from the US/Canada as 10.7% were members of the armed forces. Also, 5.7% of the partners of women from North Africa worked in agriculture.

Figure 1 shows the prevalence of LBW in each of the regions. Mothers from Sub-Saharan Africa had the greatest frequency of low birth weight babies, as 4% of all full term singletons weighed less than 2,500 g. LBW was also observed in 3.4% of neonates with mothers from Asia. Spanish mothers had the third highest frequency of low birth weight babies, 2.9% of all full term singletons born weighed less than 2,500 g. The lowest rate of 1.6% was observed in babies born to mothers from the US and Canada.

Table 2 shows the results of the logistic regression using LBW. In the crude analysis, mothers from Sub-Saharan Africa had 45% increased possibility of having a neonate of LBW over the Spanish population, while the lowest Odds Ration (OR) of 0.61 was seen in the South American population. With the exception of Sub-Saharan Africa, all immigrant groups with significant findings had OR's lower than 1.00.

Adjustments for marital status rendered similar odds ratios, as did adjustments for mother's profession, father's profession, profession of both together, and maternal age. Women from Sub-Saharan Africa consistently maintained an odds ratio above one with the greatest variation occurring when all socio-demographic factors were considered. All other regions except Asia consistently demonstrated less risk of delivering LBW infants than the Spanish population. Findings from the Mideast, Mexico/Central American, and US/Canada were consistently not significant.

Table 1 Selected socio-demographic characteristics of foreign and native mothers of live-born infants, Spain 2006

Characteristic %	Spain ($n = 40304$) (%)	Sub-Saharan Africa ($n = 3917$) (%)	North Africa ($n = 18504$) (%)	Middle East ($n = 238$) (%)	Asia ($n = 4541$) (%)	South America ($n = 27494$) (%)	Caribbean ($n = 2251$) (%)	Mexico/Central America ($n = 898$) (%)	US/Canada ($n = 377$) (%)	EU nations ($n = 18698$) (%)	Non EU Europe ($n = 2930$) (%)
Civil status											
Married	74.2	62.2	88.7	87	74.6	41.4	58.6	61.9	81.4	51.3	58.5
Not married	25.8	37.8	11.3	13	25.4	58.6	41.1	38.1	18.6	48.7	41.5
Mother's age											
12–19 years old	2.3	4	5.8	3.8	1.7	6.4	8.3	3	1.6	6.7	2.4
20–34 years old	71.4	83.8	77.8	78.2	83.2	78.0	76.2	78.5	66.5	77.9	84.6
35–55 years old	26.2	12.2	16.5	18.0	15.1	15.6	15.6	18.5	31.8	19.9	13.0
Mother's profession											
Prof./technicians	18.7	2.15	0.8	11.3	1.7	5.1	7	15.7	31.6	9.6	11.5
Public/business admin	1.8	0.7	0.2	2.9	1.2	0.4	1.1	1.9	2.7	1.3	1.3
Admin. personnel	18	2.1	0.5	5	1.3	4.3	3.4	8.9	10.3	6.5	5.3
Commerce/sales	6.4	1.3	0.6	3.8	4.8	2.4	2.6	2.1	1.6	2.5	2.3
Service fields	11.5	10.6	5.5	4.2	17.4	19.2	21	11	2.9	12.9	13.2
Agriculture	0.9	0.6	1.1	0.4	0.2	1.2	0	0	0	1	0.6
Construction/transport	4.9	3	2.4	2.1	3	3.3	3.3	1.4	0.8	3.3	3
Armed forces	0.2	0.1	0.1	0	0.4	0.2	0.1	0.1	2.7	1	0.1
Students	0.6	2.6	0.4	3.4	0.45	2.5	3	3.5	1.6	0.6	1.5
House wives	18.6	26.9	40.8	27.7	18.9	30.9	25.6	32	24.7	25	21.9
Retired/gov. supported	0.1	0	0	0	0	0	0	0	0.3	0	0.1
Not classified	18.2	50	47.5	39.1	50.6	30.3	32.9	23.4	21	37.1	39.2
Father's profession											
Prof./technicians	18	3.8	1.7	18.5	3.2	7	9.7	22.8	29	10.1	10.9
Public/business admin	4	1.4	1.2	11.8	2.9	1.7	3.2	4.7	10.5	3.8	4.9
Admin. personnel	8.2	1.9	0.9	5	1.3	2.7	3.5	6.8	7.2	2.7	4.1
Commerce/sales	5.4	2.1	3.6	7.1	6.1	2.8	3.2	3.7	4.8	3.1	3.8
Service fields	8.8	7.3	7.4	11.8	24.7	11	13.3	9.2	6.4	9.6	7.6
Agriculture	2.5	2.1	5.7	0.85	0.7	2.9	1.4	1.3	0.8	3.6	2.5
Construction/transport	33.8	34.7	35.5	13.4	9.8	39.8	28.9	24.1%	8.2%	33.4	32.1
Armed forces	1.2	0.5	0.4	0.4	0.4	0.6	0.5	1.1	10.7	0.4	0.6

Table 1 continued

Characteristic %	Spain ($n = 40304$) (%)	Sub-Saharan Africa ($n = 3917$) (%)	North Africa ($n = 18504$) (%)	Middle East ($n = 238$) (%)	Asia ($n = 4541$) (%)	South America ($n = 27494$) (%)	Caribbean ($n = 2251$) (%)	Mexico/Central America ($n = 898$) (%)	US/Canada ($n = 377$) (%)	EU nations ($n = 18698$) (%)	Non EU Europe ($n = 2930$) (%)
Students	0.1	0.6	0.1	0.8	0.3	0.8	0.7	1.3	1.6	0.2	0.2
House wives	0.1	0.3	0.2	0	0.4	0.2	0.2	0.2	1.3	0.2	0.3
Retired/gov. supported	0.3	0.2	0.6	0.4	0.2	0.2	0.5	0.2	0.3	0.2	0.3
Not classified	17.6	45.1	42.6	29.8	50.1	30.3	35	24.6	19	32.5	32.8

Source: Spain 2006 National Statistic

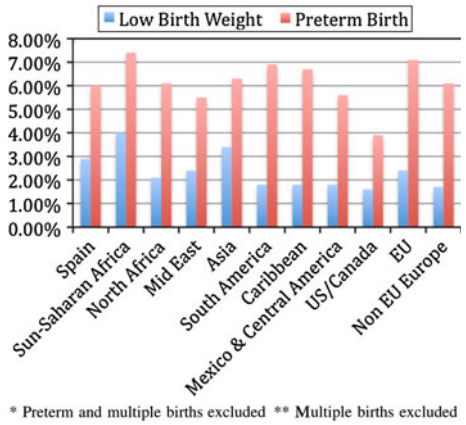

Fig. 1 Frequency of low birth weight* and preterm births** by maternal region of origin, Spain 2006

Also depicted in Fig. 1, is the frequency of prematurity in each of the regions. Again, women from Sub-Saharan Africa had the highest frequency: 7.4% of neonates were preterm. The frequency for neonates born to women from Spain was 6%. Neonates with mothers from the US/Canada group had the lowest frequency of premature births: 3.9%.

Table 3 shows the results of the logistic regression using preterm delivery as the dependent variable. In the crude analysis findings were significant to 95% in babies born to mothers from North Africa, South American, and EU regions with odds ratios of 0.91, 1.08, and 1.13, respectively. In the adjustment for each socio-demographic variable only mothers from EU nations had an OR that was consistently significant with a magnitude slightly greater than that of the Spanish population. When all socio-demographic variables were added to the model, none of the odds ratios were significant. The highest OR was observed for neonates from Sub-Saharan region (OR 1.13, confidence interval 0.98–1.31), and the lowest OR was observed for neonates from US/Canada region (OR 0.64, confidence interval 0.96–1.08).

Discussion

The results of this investigation demonstrate decreased risk of low birth weight in the immigrant population with respect to Spanish population, with the notable exception of women from Sub-Saharan Africa. In our study, women from Sub-Saharan Africa were 36% more likely than Spanish women to give birth to a full term singleton weighing less than 2,500 g, after the adjustments for socio-demographic factors.

When evaluating preterm birth, women from South America were more likely than Spanish women to have a preterm birth in the crude analysis as well as when each of

Table 2 Logistic regression. Odds ratio (OR) crude and adjusted for low birth weight by maternal region of origin, Spain 2006

Mothers' region of origen	Crude analysis		Marital status		Maternal age		Profession mother		Profession father		All	
	OR	IC 95%	OR	IC 95%	OR	IC 95%	OR	IC 95%	OR	IC 95%	OR*	IC 95%
Spain	1		1		1		1				1	
Sun-Saharan Africa	1.45*	1.19–1.77	1.40*	1.15–1.71	1.39*	1.14–1.69	1.39*	1.10–1.63	1.41*	1.15–1.72	1.36	1.12–1.66
North Africa	0.75*	0.66–0.85	0.80*	0.70–0.90	0.70*	0.62–0.80	0.68*	0.60–0.77	0.70*	0.61–0.79	0.71	0.62–0.80
Mid East	0.83	0.31–2.24	0.87	0.32–2.34	0.81	0.30–2.19	0.79	0.29–2.14	0.84	0.31–2.27	0.84	0.31–2.28
Asia	1.19	0.97–1.47	1.19	0.97–1.47	1.15	0.94–1.42	1.10	0.90–1.36	1.14	0.92–1.40	1.18	0.91–1.39
South America	0.61*	0.55–0.68	0.55*	0.49–0.61	0.58*	0.52–0.64	0.57*	0.51–0.63	0.60*	0.54–0.67	0.55	0.49–0.61
Caribbean	0.63*	0.44–0.91	0.57*	0.39–0.82	0.59*	0.41–0.86	0.60*	0.41–0.86	0.62*	0.42–0.91	0.56	0.38–0.82
Mexico and Central America	0.63	0.37–1.10	0.61	0.35–1.06	0.61	0.36–1.07	0.61*	0.35–1.06	0.62	0.35–1.11	0.60	0.34–1.07
US/Canada	0.60	0.25–1.44	0.61	0.25–1.48	0.60	0.25–1.44	0.60	0.25–1.44	0.62	0.26–1.50	0.63	0.26–1.52
EU	0.86*	0.78–0.96	0.80*	0.72–0.89	0.81*	0.73–0.91	0.82*	0.73–0.91	0.82*	0.74–0.92	0.76	0.68–0.85
Non EU Europe	0.60*	0.43–0.83	0.57*	0.41–0.78	0.58*	0.42–0.80	0.57*	0.41–0.79	0.52*	0.37–0.74	0.50	0.35–0.70

* $P < 0.05$, preterm and multiple births excluded from the model

Table 3 Logistic regression. Odds ratio (OR) crude and adjusted for premature infants by maternal region of origin, Spain 2006

Mothers' region of origen	Crude analysis		Marital status		Maternal age		Profession mother		Profession father		All	
	OR	IC 95%	OR	IC 95%	OR	IC 95%	OR	IC 95%	OR	IC 95%	OR	IC 95%
Spain	1		1		1		1		1		1	
Sub-Saharan Africa	1.12	0.97–1.29	1.24*	1.07–1.42	1.22*	1.06–1.41	1.12	0.97–1.29	1.18*	1.02–1.36	1.13	0.98–1.31
North Africa	0.91*	0.84–0.98	1.01	0.94–1.09	1.00	0.93–1.08	0.91*	0.84–0.98	0.96	0.89–1.03	0.95	0.88–1.02
Mid East	0.86	0.45–1.62	0.91	0.48–1.72	0.91	0.48–1.71	0.86	0.45–1.62	0.92	0.49–1.73	0.90	0.47–1.70
Asia	0.96	0.83–1.12	1.05	0.90–1.21	1.04	0.90–1.20	0.96	0.83–1.12	1.00	0.86–1.16	0.98	0.84–1.14
South America	1.08*	1.03–1.14	1.15*	1.10–1.22	1.14*	1.08–1.20	1.08*	1.03–1.14	1.10*	1.04–1.16	1.02	0.96–1.08
Caribbean	1.06	0.88–1.27	1.12	0.93–1.35	1.11	0.92–1.33	1.06	0.88–1.27	1.12	0.93–1.36	1.05	0.87–1.27
Mexico and Central America	0.89	0.66–1.22	0.93	0.68–1.26	0.92	0.68–1.25	0.89	0.66–1.22	0.92	0.67–1.26	0.89	0.65–1.22
US/Canada	0.62	0.35–1.10	0.62	0.35–1.11	0.63	0.35–1.11	0.62	0.35–1.10	0.64	0.36–1.15	0.64	0.96–1.08
EU	1.13*	1.06–1.20	1.19*	1.12–1.27	1.18*	1.11–1.26	1.13*	1.06–1.21	1.14*	1.07–1.22	1.09	0.87–1.29
Non EU Europe	0.95	0.80–1.13	1.01	0.85–1.19	1.00	0.84–1.18	0.95	0.80–1.13	0.99	0.83–1.18	0.95	0.65–1.22

* $P < 0.05$, multiple births excluded from the model

the socio-demographic factors was considered in isolation. The opposite was seen in women from US/Canada. However, in the final analysis considering all factors conjunctly, these findings became insignificant.

Our results indicate that when all regions of immigration are considered, greater complexity is illustrated, and the Immigrant Health Paradox does not appear to be universally applicable. A recent study realized in California by Gould et al. indicated a similar importance (relevance) of region of origin. In this study (East) Asian immigrant women gave birth to infants with lower birth weights when compared to European American and Mexican women, despite having better socio-demographic indicators. Although this would disprove the immigrant health paradox, the same study demonstrated that Mexican women gave birth to less low birth weight children despite poor socio-demographic indicators [15]. These finding suggest that certain regions may be more susceptible to poor outcomes, despite their socio-demographic make up. In our study, only infants born to women from Asian and Sub-Saharan Africa demonstrated frequencies of LBW infants higher than those born to Spanish women, although only the results for women from Sub-Saharan Africa were significant.

In Spain, both documented and undocumented immigrants are legally entitled to health care. As we do not have reason to assume a variation in the access to healthcare depending on the region of origin or legal status, it is

unlikely that findings pertaining to women from Sub-Saharan Africa are due to barriers to access to care. Instead, we believe a probable explanation for the LBW results of the Sub-Saharan African immigrants could be a general state of poor health when compared to women of other origins. Several studies carried out in Spain have shown that mortality in immigrants is lower than mortality in Spanish people, except in the case of men and women from Sub-Saharan Africa [16, 17].

While LBW is recognized as the greatest indicator of perinatal health, we chose to include prematurity in our analysis as it is also an important indicator, both as a cause for LBW and as a separate phenomenon [18]. Prematurity has been linked to increased mortality as well as morbidity including respiratory disease, gastrointestinal disorders, growth and nutrition problems, anemia, cerebral palsy and vision and hearing deficits [19].

A rise in preterm birth in developed countries and particularly in European women has become a growing cause for concern and led to various hypotheses about the cause of this trend [20]. Recent increases in rates of preterm birth in developed countries have been attributed to an increase of multiple gestations as result of assisted reproductive technology as well as an increase in preterm cesarean section and inductions of labor [21].

However, several studies also including preterm birth in their analysis of perinatal factors have also found the existence an immigrant paradox. A study by El Reda et al. observed that the Arabic population of Michigan had fewer preterm births than the native-born population despite their high-risk socio-demographic profile [22]. Another study conducted in Sweden by Rasmussen et al. similarly found "remarkably small" differences in rate of preterm labor between immigrant and native Swedish populations [23]. A third study completed in Montreal found greater risk of preterm birth in foreign-born mothers, but only in the subset that held a university education- not those with lesser education [24]. However, a study completed in Brescia, Italy demonstrated and increased prevalence in premature birth in infants born to immigrant women. Similar to our own findings, mothers from Sub Saharan Africa often had increased rates of negative perinatal indicators [25].

New Contributions to the Literature

This work provides an unusual analysis of the Immigrant Health Paradox as all immigrant groups are given equal consideration in an effort to prove or disprove the universality of the immigrant health paradox. As previously mentioned, using data from Spain is especially useful due the great diversity in the immigrant population found in the country, as well as due to the lack of barriers to health care for pregnant foreigners. Finally, this research provides an important point of departure for further examination of the health of Sub-Saharan African women and their perinatal outcomes, as in our findings they deviated from the pattern of better perinatal health indicators in immigrant groups when compared to native populations.

Limitations

A meta-analysis by Kramer for the Bulletin of the World Health Organization considers biophysical characteristics such as race, maternal and paternal height, weight, nutritional intake, general morbidity, malaria, and pre-pregnancy weight to be important determinants of LBW. In general, premature birth is linked to a variety of biomedical factors including genetic predisposition, infection, short stature and poor weight gain. It has also been linked to several social factors or behaviors including young maternal age, maternal occupation, stress levels, poverty and smoking and drug use [26]. Unfortunately our study was unable to control for these characteristics [27].

Additionally, an amplification of the socio-demographic factors considered in this study may have led to more conclusive findings. Information about gestational age at initiation of prenatal care, number of prenatal visits, maternal parity, infant sex, birth spacing, and history of previous low birth weight or premature infants may have enriched our current findings. Information about lifestyle habits such as workload, overall state of health and habits such as drug use, alcohol consumption and smoking may also play an important role in future research. Alcohol and drug use are strictly forbidden in some of the cultures of Spain's immigrant populations. Adherence to these cultural norms, along with healthy lifestyle habits, could have contributed to a lower incidence of LWB in the immigrant populations.

Closing

The Immigrant health paradox has become an important concept in social epidemiology. However, despite hypothesis such as the healthy immigrant theory, there still is not a concrete understanding of what factors contribute or detract from the phenomena. While our findings support an immigrant paradox with regard to low birth weight in most immigrant groups, they suggest that region of origin should also be considered as a possible factor, although other characteristics such as lifestyle habits and drug use also warrant consideration.

The increase in LBW infants born to women from Sub-Saharan Africa despite comparable socio-economic indicators leads us to question the role that biologic factors

such as their overall state of health and nutrition may play. Further detailed evaluation and comparison of specific immigrant groups is warranted to increase understanding of the immigrant health paradox.

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