



# The Hispanic/Latinx Perinatal Paradox in the United States: A Scoping Review and Recommendations to Guide Future Research

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## Abstract

For decades, epidemiologists have documented a health advantage among Hispanic/Latinx individuals who live in the United States, despite their significant socioeconomic barriers. This observation is often described as the “Hispanic paradox.” In this scoping review, we aimed to summarize literature published on Hispanic/Latinx perinatal outcomes over the past two decades and place these findings within the context of the overarching “Healthy Immigrant” paradox. Studies were eligible for inclusion if they utilized large population datasets to describe rates of preterm birth, low birth weight and infant mortality among Hispanic/Latinx women living in the United States. To focus on the most recent trends, studies were excluded if they were published prior to the year 2000. Globally, Hispanic/Latinx women appear to continue to have improved perinatal outcomes compared to non-Hispanic Black infants, while rates of adverse outcomes appear similar for Hispanic/Latinx and non-Hispanic White women. However, our review emphasizes the heterogeneity of outcomes experienced by Hispanic/Latinx women. The epidemiologic advantage among Hispanic/Latinx women and their infants may be largely concentrated among specific national origin subgroups or among recently arrived foreign-born Hispanic/Latinx women. Given the disparities that exist among Hispanic/Latinx women, we provide a summary of themes to explore in future research and methodologic recommendations that may assist in identifying important subgroup differences and their determinants.

**Keywords** Ethnicity · Hispanic · Preterm birth · Low birthweight · Infant mortality · Immigrant paradox

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Racial and ethnic disparities in perinatal and infant health outcomes in the United States have been well-documented and have persisted for decades [1–3]. Many studies have focused on the disparities between non-Hispanic black (NHB) infants as compared with non-Hispanic white (NHW) infants [4, 5]. The underlying causes of these racial disparities in perinatal health outcomes have been analyzed and key determinants include socioeconomic disadvantage, poor access to health care, poor quality of delivered care, environmental exposures including discrimination and racism and worsened overall health for ethnic and racial minority populations [6–8]. Given the fact that disparities have persisted for fifty years, even after clinical, health system, and policy interventions, more recent studies have documented the adverse impact of psychosocial stress that results from individual and societal disadvantage and discrimination [2, 9, 10]. However, the observation that health outcomes

among Hispanic/Latinx<sup>1</sup> women and their infants appear to mirror outcomes among White women and infants has challenged the notion that racial/ethnic minority status alone is a consistent risk factor for adverse outcomes. The epidemiologic pattern of favorable health indicators among Hispanic individuals is often referred to as the “Hispanic paradox” because Hispanic patients tend to have many more socioeconomic, educational, health care and potentially even social discrimination-related barriers to health as compared with NHW patients, thereby making their favorable outcomes feel “paradoxical.” [6, 11, 12]. In the perinatal literature, this paradox is thought to manifest as Hispanic rates of preterm birth, low birthweight (LBW), and infant mortality (all which have significant implications for lifelong health) that are more similar to the rates seen among NHW infants than among NHB infants [1, 13, 14]. In recent years, however, concerns have been raised that the Hispanic paradox for perinatal outcomes is not consistent for all Hispanic subgroups [15, 16].

From a public health perspective, it is essential to understand Hispanic women’s perinatal outcomes because Hispanics have been the largest minority group in the US since 2001 and represented 18.3% of the US population in 2019 [17]. In addition, Hispanic women are the only subset of the population for whom the total fertility rate is above “replacement,” the level at which a given generation can exactly replace itself [14]. Thus, an accurate understanding of perinatal outcomes among Hispanics has important consequences on fiscal budgets, health care expenditures, and the health of the US as a whole [18].

In light of concerns that the Hispanic paradox may obscure the experience Hispanic subgroups who have an elevated risk of poor outcomes, we performed a scoping review aimed at synthesizing the major trends in three important adverse perinatal outcomes over the past two decades. After providing historical background on the “Hispanic paradox” and how it relates to the more global immigrant health paradox, this review summarizes literature published on Hispanic rates of: (1) preterm birth; (2) LBW or small-for-gestational age; and (3) fetal, neonatal, and infant mortality, given these outcomes’ implications on lifelong health [19, 20]. Where data are available, we review how these perinatal outcomes vary by immigration status or maternal country of origin. Finally, we provide a synthesis of themes to explore in future research and strategic recommendations

for conducting future perinatal outcomes research among Hispanic women.

## The History of the Term “Hispanic paradox” in Perinatal Literature

In 1986, Dr. Ronald Williams wrote that Mexican-born women with “Spanish surnames” in California had the lowest proportion of LBW infants, even compared with US-born non-Hispanic White women [21]. Dr. Williams’ paper is one of the earliest observations of what later was described as the “Hispanic paradox” or the “Latino health paradox.” Although the “Latino” or “Hispanic paradox” term does not exclusively relate to birth and perinatal outcomes, it has been most studied in pregnant women, particularly among Mexican-origin women [22]. The Hispanic paradox falls under the more general framework of the “epidemiologic paradox” [23] or the “immigrant health paradox” [11, 18] which describes the overarching trend of better health and educational outcomes seen among immigrant groups despite having many risk factors for adverse health status [22, 23]. Research on the immigrant paradox has documented this pattern of good health for almost all racial/ethnic immigrant subgroups, not just Hispanics [24]. However, the protective advantage of foreign-born status on health appears to dissipate after the immigrant generation or erode over time for the immigration generation [23, 25].

This observation that immigrants’ health advantage deteriorates over time has prompted explorations of disease-inducing risk factors that might exist for immigrants in the US. With respect to perinatal outcomes among Hispanic women, there is concern that more time in the US may lead to an accumulation of deleterious exposures to perinatal hazards such as agrochemicals or overt physical exertion, given the large proportion of Hispanic women who work in agriculture or around chemicals [26]. In addition, there is a broad literature base exploring the deleterious impact acculturation may have on the health of immigrants to the US. Acculturation has been defined as the changes in beliefs, attitudes, and behavior that can take place as a result of contact with a culturally dissimilar society [27]. The newest, multidimensional approach to acculturation conceptualizes it as consisting of four categories of responses that immigrants might have when arriving in a new culture: assimilation (the process of discarding the heritage culture and adopting the receiving culture), separation (maintaining only one’s heritage culture), integration or biculturalism (adopting some aspects of the receiving culture while maintaining some aspects of the heritage culture) and marginalization (rejecting both cultures) [28].

According to the multidimensional acculturation model to understand immigrant birth outcomes, the suggested

<sup>1</sup> Although these terms are not interchangeable, we will use “Hispanic” as a shortened version of Hispanic/Latinx to indicate a population of people who are either from or descended from Spanish and Portuguese speaking Latin American countries. For more details, please see our methods section.

theory is that increased levels of assimilation are associated with increased risk of poor birth and infant health outcomes because women begin to adopt riskier health behaviors and lose the protective influence of traditional culture and closely knit social support systems [25, 26, 29]. This concept of cultural buffering to explain the immigrant paradox has been heavily explored among Hispanic women, with some observing that less assimilated Hispanic women report higher vitamin and mineral intake [30], lower fat and carbohydrate intake, lower prevalence of smoking and alcohol use, and less sedentary lifestyles than either more assimilated Hispanic women or NHW and NHB women in the US [25, 26]. Others have documented that maintaining a strong identification with the sending country's original social culture has been associated with increased psychosocial resources, which may be protective in pregnancy [31]. For instance, traditional emphasis on marriage in Hispanic culture may help explain why foreign-born Hispanic women are more likely to be married at the time of their infant's birth than their US-born counterparts and may be protective against adverse birth outcomes [23]. Similarly, many Latin American societies prioritize strong interpersonal relationships and community. This, in turn, may also be creating a protective system of prenatal and postpartum support among Hispanic mothers who otherwise have little access to prenatal care [32].

Other theories for the immigrant paradox that may explain the paradoxical birth outcomes believed to exist among Hispanic women include the “healthy migrant” effect, whereby healthier women immigrate to the US in higher numbers than unhealthy women more prone to adverse birth outcomes, thereby creating a positive selection bias on health and health behaviors among immigrants [11, 25]. Finally, some worry that Hispanic women may appear to have better outcomes due to underrepresentation in population-based datasets used for research due to lack of documentation, insurance, unstable housing [33] or because of the salmon bias, in which an immigrants' unreported exit from the country prior to experiencing an adverse birth outcome leads to lower incidence rates of those outcomes [34].

The causes for the Hispanic epidemiologic paradox with respect to perinatal outcomes are thus complex and likely multifactorial. Furthermore, as the ensuing review indicates, the term appears to provide an incomplete picture of risk for poor outcomes among all Hispanic women and their infants due to significant subgroup variability.

## Methods

### Search Strategy and Study Selection

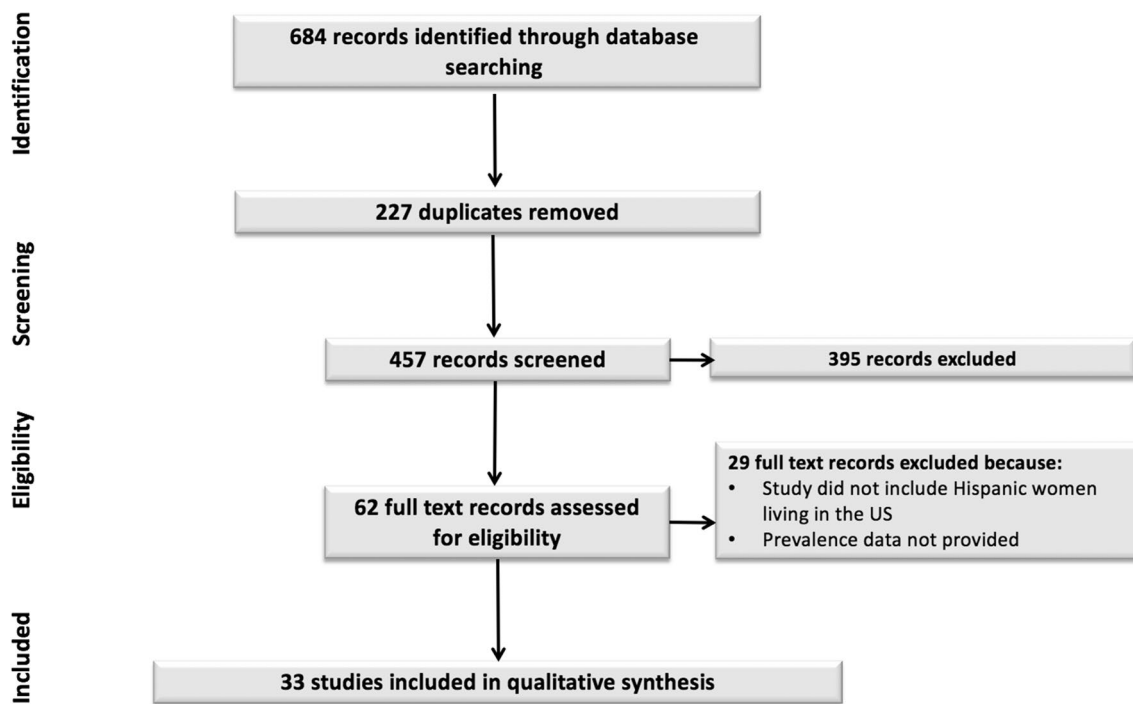
Search terms for this scoping review were agreed upon by the authors, and the search was conducted within the

PubMed and Cochrane databases. Pearlring of citations was used to identify additional sources that had not been identified during the initial searches. Article titles and abstracts were screened by the primary author and advanced for data extraction if they met the eligibility criteria. Data were extracted by the primary author and one other author (Fig. 1). The final search date was January 2018.

### Eligibility Criteria

Citations were included in this review if they described epidemiologic data regarding our outcomes of interest among Hispanic/Latinx women living in the United States using a large population-level dataset. The birth and infant health outcomes of interest were: (1) preterm birth (infants born at < 37 weeks), (2) low birthweight (LBW); or small-for-gestational age (SGA, i.e., weight < 10th percentile or 2 standard deviations of reference population); and (3) mortality during the fetal (intrauterine demise), neonatal (within the first 28 days of life) and infant (within the first year of life) periods [19, 20]. Although the diagnosis of LBW and small-for-gestational age are not mutually exclusive because an infant can be small-for-gestation and not meet the defined weight cutoff for LBW, both represent growth restriction and are risk factors for postnatal growth-stunting and other adverse health outcomes [35, 36]. In an effort to capture the epidemiologic risk associated with poor intrauterine growth at birth, these two outcomes were reviewed together.

The focus of this review was on state or national data in the US. To describe the most recent trends, studies were eligible for inclusion in this scoping review if they were published in English between 2000 and 2018. However, the studies we included analyzed data from previous decades, as far back as the 1980s. We excluded studies if they did not report any data on the incidence or prevalence of perinatal outcomes for Hispanic women living in the US or if they were not written in English. However, studies reporting data from large, diverse cities were also included, as were recent national vital statistics birth and mortality data as published by the United States Census Bureau and the Centers for Disease Control and Prevention's (CDC's) National Center for Health Statistics. Studies that included women from various racial or ethnic backgrounds were reviewed, as were those that focused exclusively on Hispanic women. Although there is ongoing controversy about the differing merits of terms like Hispanic vs. Latino(a) vs. Latinx [37, 38], we use the term “Hispanic” in this paper as a short form of “Hispanic/Latinx.” We included literature that described birth outcome epidemiology for women who were either labeled or self-identified as “Hispanic,” “Latina(o)(x)” or “Latin American” to be as inclusive as possible. When describing each paper's specific findings, we use the terminology the original authors utilized for fidelity.



**Fig. 1** Selection of studies included in the scoping review of Hispanic perinatal outcomes in the United States

This review was intended to synthesize the perinatal experience of Hispanic women with as much granularity as was reported in the literature. First, we present the literature that compares Hispanic and NHW women. Second, where literature was available, we summarize information about subgroup variation within Hispanic women by race, nativity/birthplace or country of origin. In studies that reported population estimates using regression modeling, we indicated information about the covariates analyzed in the original study. However, a detailed analysis of the evidence surrounding issues that might serve as confounders, mediators or modifiers of risk of adverse perinatal outcomes among Hispanic women (such as acculturation and immigration status) was beyond the scope of this epidemiologic review.

## Results

### Preterm Birth

The earliest studies reported on Hispanic women's risk of preterm birth using data from the 1980s and 1990s. One population-based study analyzed 1994 US birth certificates and reported that Mexican-American Hispanic women had an overall preterm birth rate of 10.6%, slightly higher than the 9.3% rate among NHW women [39]. However, after excluding infants whose birth weight exceeded the LBW cutoff (a methodology used to attempt to correct for

inaccurate gestational age data), the preterm rate was lower for Mexican-American women than NHW women (3.4% vs. 3.9%) [39]. Another study that analyzed 1994–2005 data from North Carolina reported that Hispanic women were 66% less likely to deliver preterm infants than NHW or NHB women [6]. However, two other studies of California data from this time period reported that Hispanic women had higher preterm birth rates [29, 40]. For example, one California study reported that while Hispanic women's rates of preterm birth were similar to rates among NHW women, the rates for Hispanic women were still slightly higher (18.2% vs. 17%, respectively) [29]. Of note, the California studies focused on Mexican-American women rather than Hispanic women as a composite group.

When we focused on studies that analyzed data collected since 2000, we identified 11 studies of preterm birth. The only study that reported a significantly lower risk of preterm birth for Hispanic women compared to NHW women, analyzed a large cohort (nearly 1.5 million births) among Medicaid enrollees from 14 different Southern states in the US and reported that Hispanic women were 6% less likely to deliver preterm infants [41]. On the other hand, ten studies reported that Hispanic women had a higher risk of preterm birth (Table 1). One study analyzed from the 2003 to 2010 annual population-based postpartum surveys, the California Maternal and Infant Health Assessment, reported that the prevalence of preterm birth among several subgroups of Hispanic women

**Table 1** Summary of studies comparing preterm birth rates in Hispanic/Latinx women to Non-Hispanic White (NHW) women

Study	Setting	Study time frame	Sample size	Hispanic/Latinx subgroups studied	Comparative statistics for hispanic/latinx vs. NHW women	Significance Statistic(s) Reported
Buekens et al. [39]	United States	1994	2890,898	Mexican American	10.6% vs. 9.3%	None reported
Gould et al. [29]	California	1995–1997	940,190	Foreign-born Mexican	18.2% vs. 17.3%	p < 0.01
Hessol et al. [40]	California	1995–1997	1,439,583	None	9.6% vs. 7.5%	p < 0.001
Brown et al. [6]	North Carolina	1994–2004	10,755	None	1. 8.4% vs 17.7% 2. aOR: 0.66	p < 0.001 95% CI 0.54–0.80
Stein et al. [54]	New York City	1995–2003	949,210	Caribbean, Mexican, Central American, South American	Range of prevalence/aOR: aOR 1.2-3.2 <sup>a</sup>	95% CI varied by country; all were significant.
Kitsantas 2010	North Carolina	1999–2007	1029,205	None	11.4% vs. 10.2%	p < 0.001
Flores et al. [45]	Utah	2004–2007	215,249	Foreign-born Latinas & US-born Latinas	Range of prevalence/aOR: 1. 8-10% vs. 8.1% 2. aOR 0.85–1.04 <sup>b</sup>	None reported. 95% CI varied by group <sup>b</sup>
Zhang et al. [41]	14 Southern states in the US	2006–2007	1472,912	None	1. 6.6% vs 7.2% 2. aOR 0.94	p < 0.01 95% CI 0.92-0.96
Schaaf et al. [13]	United States	1983–2011	530,784 (7 studies)	None	Range of prevalence/aOR: aORs 0.43 to 1.48 <sup>c</sup>	95% CI varied by study; no pooled estimate. <sup>c</sup>
Almeida et al. [22]	New York City	2004–2007	4443	Puerto Rican (mainland & island born), Other Latina (US & foreign born)	Range of prevalence/aOR: 1. 6.9–16% vs. 5.4% 2. aORs 1.17–1.84 <sup>d</sup>	P < 0.0001 95% CI varied by group; none were significant.
Bediako et al. [49]	United States	2013	2900,000	White Hispanics & Black Hispanics	Adjusted predicted probabilities: 7–7.69% vs. 6.19% <sup>e</sup>	95% CI varied by group; both were significant
Sanchez-Vaznaugh et al. [42]	California	2003–2010	21,227	U.S.-born Mexican Americans, U.S.-born Non-Mexican Latina, Mexican immigrants, Non-Mexican Latina immigrants	Range of prevalence/aOR: 1. 8.9-10.6% <sup>f</sup> vs. 7.3% 2. aORs 1.03–1.24 <sup>g</sup>	p < 0.0001 95% CI varied by group <sup>g</sup>
Borrell et al. [43]	New York	2000–2010	984,807	None	aRR: 1.6	95% CI: 1.5-1.6
Novak et al. [44]	Iowa	2008–2009	52,344	Foreign & US born Latina	7.5–8.9% <sup>h</sup> vs. 7.5%	None reported
Martin et al. [3]	United States	2015	3978,497	None	9.1% vs. 8.9%	None reported

<sup>a</sup>Colombian women had the lowest aOR vs. Puerto Rican women who had the highest reported aOR

<sup>b</sup>Foreign born Latinas had lower risk and US born Latinas had higher risk than NHW women. Only aOR for foreign born Latinas was significant: 95% CI 0.79–0.91

<sup>c</sup>Two studies reported a significantly decreased aOR of preterm birth among Hispanic women; three studies reported a significantly increased aOR

<sup>d</sup>Mainland born Puerto Rican women had the lowest adjusted odds of preterm birth and US born Latina women had the highest

<sup>e</sup>Black Hispanic women had the highest predicted probability with a 95% CI: 7.43-7.94. White Hispanic women's higher predicted probability was also significant (95% CI 6.89–7.02)

<sup>f</sup>Lowest prevalence was seen among Mexican immigrant women; highest prevalence was among Non-Mexican immigrant women

<sup>g</sup>Lowest odds for Mexican immigrant women; highest odds for US born Mexican American women. Only aOR for US born Mexican-American women was significant (95% CI 1.04–1.47)

<sup>h</sup>Lowest prevalence for US-born Hispanic women prior to an immigration raid; highest prevalence for US born Hispanic women after the raid

(U.S.-born vs. immigrant, Mexican vs. non-Mexican) was higher than the prevalence of preterm birth among NHW women. After adjustment for several types of covariates, including demographic characteristics, socioeconomic factors, health-related behaviors/attitudes, medical history, social support during pregnancy and experience of hardship during pregnancy, only the increased risk of preterm birth among US-born Mexican American women remained significantly higher than the risk of preterm birth among NHW women [42]. In New York City, Hispanic infants born from 2000 to 2010 had a 60% higher risk of preterm birth compared with NHW controls, after adjusting for maternal age, education, nativity status, marital status, health insurance, tobacco use during pregnancy, gestational diabetes parity and infant's sex [43]. A second study of 2004–2007 births in New York City reported NHW women were much less likely to deliver preterm infants than Hispanics (5.4% versus 8.9%) [22]. Finally, among childbearing women in Iowa from 2007 to 2008, NHW and Hispanic women had similar rates of preterm birth but there was a temporal increase in Hispanic women's rates of preterm birth (7.5 to 8.9%), while the rates among NHW women remained stable (7.5%) [44].

These state or region-wide preterm birth estimates reflect the rising negative trends seen in the most recent report by the National Center for Health Statistics for preterm birth rates among Hispanic women in the US. Using 2017 birth data, this report documented similarly higher national rates of preterm birth for almost all categories of Hispanics compared to NHW women in 2017 [3]. Rates ranged from 9.05% for Cuban women to 11.02% for Puerto Rican women, compared with NHW women's preterm birth rate of 9.05% [3].

Among the studies that searched for potential differences between Hispanic women based on race, maternal country of origin, and nativity, the majority came to the same conclusion: foreign-born Hispanic women tend to have lower rates of preterm birth than US-born Hispanic women [25, 45–48], and women who identify as both black and Hispanic have worse outcomes than Hispanic mothers who do not identify as black [49]. Not all studies, however, noted differences based on nativity to be statistically significant [22, 50, 51]. A second trend that was consistently reported was the advantage that Mexican women specifically appeared to possess over Hispanic women of other national origins. In addition, where preterm birth was consistently found to be less common among Mexican immigrant women, it was conversely more common among Puerto Rican women, particularly for those living in New York City [25, 46, 48]. In addition, two studies provided evidence that giving birth in the US may pose higher risks of adverse outcomes for Mexican women themselves, by showing lower rates of preterm birth among Mexican women delivering in Mexico when compared to: (1) Mexican immigrant women in California [11]; or (2)

Mexican women living on the US side of the Mexican-US border [48].

Interestingly, a large meta-analytic study published by Schaaf et al. summarizing preterm births from both the US and Canada over a long time frame (1983–2011) yielded neutral results [13]. However, though they found no statistically significant difference in preterm birth rates between Hispanic and NHW women in the overall meta-analysis, several of the individual papers this group included demonstrated a significantly increased risk of preterm birth for certain subgroups of Hispanic women compared to NHW, with the highest odds ratios (OR) reported among Puerto Rican women [13].

### Low Birthweight/Small for Gestational Age

When looking at the outcome of LBW, there was a similar trend towards slightly higher rates of LBW for Hispanic women compared to NHW over time [6, 23, 29, 49, 52]. The majority of the studies using data collected before 2000 show either lower rates for Hispanic women compared with NHW women overall in the US [39, 52] and in California [29] or no significant difference, in California [53] and North Carolina [6]. However, in looking at literature using more recent birth data, most studies documented a significantly higher rate of LBW among Hispanic women compared with NHW women (Table 2) [22, 40, 42–45, 49, 54]. Although comparative statistics varied, increased risks of up to 57% higher were reported [42]. These epidemiologic study-based findings mirror the most recent national estimates published by the National Center for Health Statistics. According to 2017 birth data, the LBW rate among Hispanic mothers has risen to an all-time high of 7.43%, compared with the NHW rate of 7.0%, which has been virtually stable for several years [3].

When looking at studies examining variations within the Hispanic population itself, the pattern of lower rates of LBW once again appears to favor women with the least cumulative exposure to the US, either because they are foreign-born [11, 45, 47, 55, 56] or because they are first-generation US-born women vs. second or third generation [18, 31, 51]. Notably, this effect appears to offer some advantage to black women who identify as Hispanic compared to NHB women [56], though Hispanic black women still appear to have higher rates of LBW compared to Hispanic white women [49]. We also found evidence of country of origin differences, as there was for preterm birth. For instance, one study conducted in New York City found higher rates of term SGA infants among Hispanic women compared with NHW women. However, this difference was significant only for Hispanic women from Central American and Caribbean areas and not for women from Mexico and South America [54]. Similarly, a study using 2013 US natality files found the lowest adjusted

**Table 2** Summary of studies comparing lowbirth weight rates in Hispanic/Latinx women to Non-Hispanic White (NHW) women

Study	Setting	Study time frame	Sample size	Hispanic/latinx sub-groups studied	Comparative statistics for hispanic/latinx vs. NHW women	Significance Statistic(s) Reported
Buekens et al. [39]	United States	1994	2890,898	Mexican American	5.8% vs. 6.1%	None reported
Hessol et al. [53]	California	1990–1993	1439,583	Mexican	aOR 0.98	95% CI: 0.94–1.02
Gould et al. [29]	California	1995–1997	940,190	Foreign born Mexican	5.2% vs. 5.7%	p < 0.01
Taylor et al. [52]	United States	1995–1997	126,220	Foreign born Hispanic	aOR: 1.09	95% CI: 1.08–1.10
Hessol et al. [40]	California	1995–1997	1439,583	None	4.5% vs 3.9%	p < .001
Brown et al. [6]	North Carolina	1994–2004	10,755	None	<b>SGA:</b> 1. 2.1% vs 3.1% 2. aOR 1.10	p < 0.0001 95% CI: 0.74–1.64
Johnelle et al. [23]	Texas	2001	7800	Foreign & US-born Mexican origin, other Hispanic	<b>Range of prevalence/</b> aOR: 0.8–1.34 <sup>a</sup>	95% CI varied by group; none were significant
Stein et al. [54]	New York City	1995–2003	949,210	Caribbean, Mexican, Central American, South American	<b>Term SGA:</b> Exact numbers not provided <sup>b</sup>	95% CI varied by group; all were significant except for Colombian women
Flores et al. [45]	Utah	2004–2007	215,249	Foreign & US born Latina	<b>Range of prevalence/</b> aOR: 1. 5.8–7.2% vs. 5.0% 2. aOR 0.95–1.14 <sup>c</sup>	None reported 95% CI varied by group <sup>c</sup>
Zhang et al. [41]	United States	2006–2007	1472,912	none	<b>SGA:</b> 1. 1.1% vs 2.3% 2. 2. aOR 0.55	p < 0.01 95% CI: 0.53–0.57
Almeida et al. [22]	New York	2004–2007	4443	Puerto Rican (mainland & island born), other Latina (US & foreign born)	<b>Range of prevalence/</b> aOR: 1. 3.5–9.7% vs. 4.2% <sup>d</sup> 2. aORs 1.35–2.07 <sup>d</sup>	p < 0.0001 95% CI varies by group. <sup>d</sup>
Bediako et al. [49]	United States	2013	2900,000	White Hispanics & Black Hispanics	<b>Adjusted predicted probabilities:</b> 1. 4.2–5.1% vs. 3.74% <sup>e</sup>	95% CI varied by group; both were significant. <sup>c</sup>
Sanchez-Vaznaugh et al. [42]	California	2003–2010	21,227	U.S.-born Mexican, U.S.-born Non-Mexican Latina, Mexican immigrants, Non-Mexican Latina immigrants	<b>Range of prevalence/</b> aOR: 1. 4.4–5.9% vs. 3.3% <sup>f</sup> 2. aORs 0.98–1.57 <sup>g</sup>	P = 0.005 95% CI varied by group. <sup>g</sup>
Borrell et al. [43]	New York	2000–2010	984,807	None	aRR 1.1	95% CI 1.0–1.1
Novak et al. [44]	Iowa	2008–2009	52,344	Foreign & US born Latina	<b>Range of prevalence/</b> aOR: 1. 4.5–6.4 vs. 4.4% <sup>h</sup> 2. aOR 1.22–1.25 <sup>i</sup>	None reported 95% CI varied by group; none reached significance
Martin et al. [3]	United States	2015	3978,497	none	7.21% vs. 6.93%	None reported

<sup>a</sup>US-born Mexican origin women had the lowest adjusted odds ratio (aOR), while other Hispanic women had the highest aOR

<sup>b</sup>There was a range of aOR ranging from lower to higher risk in Hispanic women compared to NHW; exact numbers not provided. South American women had the lowest risk of having term SGA infants, whereas Puerto Rican women had the highest risk

<sup>c</sup>Foreign born Latinas had lower risk and US born Latinas had higher risk than NHW women. Only aOR for US born Latinas was significant: 95% CI 1.05–1.25

<sup>d</sup>Lowest risk for non-Puerto Rican foreign born Latina women and highest risk for Island-born Puerto Rican women. All 95% CI significant except for aOR of 1.46 for US born Latina women (95% CI 0.98–2.12)

<sup>e</sup>Black Hispanic women had the highest predicted probability with a 95% CI of 6.92–7.45. White Hispanic women's higher predicted probability was also significant (95% CI 4.19–4.29)

<sup>f</sup>Lowest prevalence was seen among Mexican immigrant women; highest prevalence was among Non-Mexican US born Latinas

<sup>g</sup>Lowest odds for Mexican immigrant women; highest odds for US born Non-Mexican Latina women, which was also the only group with a significant 95% CI (1.09–2.26)

<sup>h</sup>Lowest prevalence for foreign-born Hispanic women prior to an immigration raid; highest prevalence for US born Hispanic women after the raid

<sup>i</sup>Foreign born Latinas had the highest relative risk after an immigration raid

rates of LBW among Mexican women (3.99) and women from Central and South America (3.93), and the highest among Puerto Rican women (5.54) [49].

### Fetal/Neonatal/Infant Mortality

The majority of literature documenting the risk of mortality in the fetal or infant period focused on infant mortality, with few studies exploring fetal or neonatal mortality specifically.

Although limited in number, the studies looking at fetal death suggest that the Hispanic advantage over NHB women persists, but there is also a persistent disadvantage in comparison with NHW women (Table 3). Looking at vital records from 1995 to 1997 in California, Gould et al. reported a significantly higher fetal death rate among Hispanic women compared with NHW women (4.5% vs. 3.9%) [29]. Similarly, a study comparing fetal death rates in the US in 1990–1991 with rates 10 years later in 2001–2002 found that while the fetal mortality rate was declining slowly for both NHW and Hispanic women (though notably not for NHB women), Hispanic women had higher rates of fetal mortality than NHW women at both time points [57]. The study looking at fetal death rates over the widest study time frame was conducted by Lorch et al. Looking at differences by race and ethnicity between 1993 and 2005 in three large populous states (California, Missouri, and Pennsylvania), this group found that Hispanic women had a higher risk of fetal death than NHW controls [58]. Furthermore, they noted that the Hispanic disadvantage persisted after accounting for covariates related to socioeconomic status, maternal preexisting comorbid conditions, medical complications, fetal factors, and delivery hospital characteristics. They concluded that Hispanic women had the largest percentage amongst all ethnicities of fetal death rates that were not mediated by their confounders [58]. These findings mirror the latest perinatal mortality report from the National Center for Health Statistics. In 2013, the fetal mortality rate for Hispanic women was 5.22/1000 live births, which was 7% higher than the rate for NHW women (4.88) but nearly half the rate seen among NHB women (10.53) [20].

Only four of the 15 mortality papers that met eligibility criteria compared neonatal mortality in Hispanic women with that of women of other race/ethnicities (Table 3). Although three of the four groups reported slightly lower rates of neonatal mortality among Hispanics [29, 40, 59], none of the studies found significant differences when comparing Hispanic with NHW women [29, 40, 59, 60].

Infant mortality rates have received significantly more attention than other mortality rates in the literature [61]. The most recent mortality report from the National Center for Health Statistics documented an overall infant mortality rate in the US in 2016 of 5.87 deaths/1000 live births [62]. As with all the outcomes discussed thus far, NHB infants face

an enormous burden of infant mortality compared with all other races and ethnicities in the US, with an IMR of 11.76. According to these national 2016 data, NHW infants had an IMR of 4.80 and Hispanic infants had an IMR of 5.24 [62].

These national findings of similar yet slightly higher IMR for Hispanic infants were not always reflected in studies using state-level data [63]. As with preterm birth and LBW, recent data from New York City, which has large Puerto Rican-origin and Dominican Republic-origin populations, documented an increased infant mortality risk among Hispanic women, compared with their NHW counterparts, with an odds ratio of 1.8 [CI 1.6, 2.1] [43]. Although most of the other reviewed statewide analyses showed similarly higher mortality rates among Hispanic infants (Table 3), the severity of the disparity with respect to NHW infants varied. For instance, in the 1999–2007 dataset from North Carolina, the increased rate of infant mortality seen among Hispanic women compared with NHW women was statistically significant but the difference was quite small (0.6% vs. 0.5%, respectively,  $p < .001$ ) [59]. Similarly, in a 1995–1997 birth cohort in California, where Hispanics of Mexican and Central American descent dominate, Hispanic infants had only a slightly higher IMR compared with NHW women (4.99/1000 live births vs. 4/1000) [40].

As with the other two perinatal outcomes we reviewed, the IMR advantage documented among Hispanics had a differential benefit according to subgroup; US-born Hispanic infants and Hispanic Black infants fare the worst [64–66]. In addition, risk of infant mortality appears to vary by maternal country of origin, with similar patterns to what was seen for preterm birth and LBW. Liu et al. demonstrated this pattern using New York city vital records from 1995 to 1998 [66]. Although US-born Hispanic mothers had higher IMRs than foreign-born Hispanic mothers in their dataset, the IMR among immigrants from Central America and the Caribbean were higher than the IMR among South American Hispanics [66]. Finally, Puerto Rican women and their infants again emerged in this literature as possessing among the highest rates of infant mortality. For instance, national mortality data from 2014 showed that the IMR among Puerto Rican infants was the highest among Hispanics at 6.91 deaths/1000 live births [62]. Meanwhile, the 2014 IMR among Central and South American infants living in the US in this same national vital statistics report was 3.27, which was even lower than the IMR of NHW infants (5.22/1000 live births) [62].

## Discussion

In this scoping epidemiologic review of Hispanic/Latinx preterm birth, low birth weight and infant mortality, we noted that rates among Hispanic women, in general, continue to



**Table 3** Summary of studies reporting mortality rates in Hispanic/Latinx women compared to Non-Hispanic White (NHW) women

Study	Setting	Study time frame	Sample size	Hispanic/latinx subgroups studied	Type of mortality	Comparative statistics for hispanic/ latinx vs. NHW women <sup>a</sup>	Significance statistic(s) reported
Hessol et al. [53]	California	1990–1993	1439,583	Mexican	Infant	1. 0.54% vs. 0.5% 2. aOR 0.83	p < 0.05 95% CI 0.76–0.91
Gould et al. [29]	California	1995–1997	940,190	Foreign born Mexican	1. Fetal 2. Neonatal 3. Postneonatal	1. 4.5 vs. 3.9% 2. 2.6 vs. 2.7% 3. 1.6 vs. 1.9%	p < 0.01 NS p < 0.01
Hessol et al. [40]	California	1995–1997	1439,583	None	1. Neonatal 2. Postneonatal	1. aOR 0.94 2. aOR 0.80	95% CI 0.85–1.04 95% CI 0.71–0.89
Liu et al. [66]	New York	1995–1998	3871	US born; Foreign born	Infant	<u>Range of prevalence:</u> 5.4–7.5 vs. 4.2/1000 <sup>b</sup>	None provided
Kitsantas et al. [59]	North Carolina	1999–2007	1,029,205	None	1. Neonatal 2. Postneonatal 3. Infant	1. 0.4% vs. 0.3%; aOR 0.99 2. 0.3% vs. 0.3%; aOR 0.67 3. 0.7% vs. 0.5%	p < 0.001; 95% CI 0.88–1.12 p < 0.001; 95% CI 0.57–0.79 p < 0.001
Wingate et al. [57]	United States	2001–2002	10.8 million	None	Fetal	1. 5.9 vs. 4.4/1000 2. Mortality rate ratio 1.27	None reported p < 0.05
Lorch et al. [58]	United States	1993–2005	7,104,674	None	Fetal	1. 3.6 vs 2.6/1000 2. aOR 1.05	None provided 1.03–1.08
Zhang et al. [41]	United States	2006–2007	10 million	None	Fetal	1. 0.6% vs. 0.6% 2. aOR 0.86	p < 0.01 95% CI 0.81–0.92
MacDorman et al. [20]	United States	2013	23,595	Puerto Rico, Mexico, Cuba, Central/South American	1. Fetal 2. Perinatal <sup>c</sup>	1. 4.55–6.02 vs. 4.9/1000 <sup>d</sup> 2. 5.6 vs 5.3/1000	None reported
Kochanek et al. [62]	United States	2014	2626,418	Puerto Rico, Mexico, Cuba, Central/South American	Infant	3.27–6.91 vs. 4.81/1000 <sup>d</sup>	None reported
Borrell et al. [43]	New York	2000–2010	984,807	None	Infant	aRR: 1.8	95% CI 1.6–2.1
Keene Woods et al. [63]	Kansas	2009–2011	121,458	None	Infant	Specific incidences not reported.	p = 0.817
Rice et al. [64]	USA	2007–2008	7,901,858	Hispanic white, Hispanic black	Infant	<u>Range of prevalence/aORs:</u> 1. 5.3–6.9% vs. 5.5% <sup>e</sup> 2. aOR 1.07–1.30 <sup>e</sup>	95% CI varied by group; both were significant
Wallace et al. [60]	United States	2002–2008	19,325	None	1. Neonatal 2. Perinatal <sup>f</sup>	1. 1.6% vs. 1%; aOR 1.06 2. 5 % vs. 3.5%; aOR 1.18	1. p < 0.001; 95% CI 0.71–1.60 p < 0.001; 95% CI 0.96–1.47
Mathews et al. [1]	United States	2014	Not reported.	None	Infant	5.01 vs. 4.89/1000	None provided

<sup>a</sup>Rates are written as per 1000 live births

<sup>b</sup>Lowest prevalence for foreign-born Hispanic women; highest prevalence for US born Hispanic women

<sup>c</sup>Perinatal death included neonatal deaths under age 7 days and fetal deaths at 28 weeks gestation or more

<sup>d</sup>Puerto Rican women had the highest rates; Central and South American infants had the lowest

<sup>e</sup>Hispanic Black women had the highest prevalence and adjusted OR (95% CI 1.18, 1.43) but the aOR was also significant (95% CI 1.04, 1.10)

<sup>f</sup>This cohort only included preterm infants so these rates describe mortality only among infants born preterm. Perinatal death includes stillbirths and neonatal deaths

be lower than rates observed among NHB women, despite the fact that these groups have similar risk profiles related to education, socioeconomic status, and access to health care. These observations are the foundation for the emergence of

the term “Hispanic Paradox” over 30 years ago. However, our review evidences that the parallels between Hispanic and NHW women’s perinatal outcomes that have also been used to justify the claims of a “Hispanic paradox” are not

consistent for all women who self-describe as Hispanic or are categorized as such in research. The term “The Hispanic Paradox,” and specifically the “Hispanic Birth Paradox” obscures important subgroup variation among Hispanic women and their infants; outcomes are not paradoxically “good” for all women who are categorized as Hispanic.

Besides indicating the limitations of the overarching concept of the paradox, the literature we reviewed create an evidence base for three themes that may help shed a more nuanced light on the concept of the Hispanic perinatal outcomes paradox. In order to better assist future researchers seeking to explore the Hispanic perinatal outcomes paradox by these nuances, Supplementary Table 1 summarizes the papers we reviewed that address these three important themes. The first important theme is that the protective benefits of Hispanic ethnicity often manifest most strongly among Hispanic women who are not born in the US; as such foreign-born women appear to have an additional birth advantage when compared with US-born Hispanic women. This trend fits well within the paradigm of the larger immigrant health paradox and the potential health risks associated with acculturation described earlier. It also mirrors the better birth outcomes seen among immigrant Black women compared to their US-born counterparts [67].

However, nativity alone does not appear to explain the epidemiologic trends we found among Hispanic women’s birth and infant health outcomes. A second nuance of the Hispanic paradox appears to be related to differential risk by country or region of origin. The majority of literature documenting low risk of adverse perinatal outcomes among Hispanic women focused on Mexican-born women or women from South America. Conversely, women from the Caribbean appeared to possess among the highest rates of adverse perinatal outcomes. However, even within this region there was variation, with Puerto Rican women often exhibiting the highest risk and Cuban women sometimes being reported as having the lowest rates of adverse outcomes.

Lastly, there was very limited but interesting data comparing Mexican-born women’s outcomes simultaneously on both sides of the Mexican border, which showed a slight advantage for Mexican who deliver in Mexico compared to their counterparts who deliver in the US [11, 48]. These findings are not consistent with the Healthy Migrant effect, which posits that immigrants have better health outcomes related to an overall health advantage that enables them to emigrate. Rather, this study highlights the third theme we feel warrants further investigation: the idea that the variation in Hispanic women’s perinatal outcomes may be mediated or moderated by differences in sociocultural experiences for Hispanic women living in the US. This may be acculturation or another negative risk factor associated with being a Hispanic immigrant woman who delivers in the US. For instance, there is a rapidly emerging body of literature

that links perinatal disparities in NHB women to disproportionately higher cumulative levels of stress secondary to socioeconomic disadvantage, racism and discrimination [68, 69] These associations merit exploration among Hispanic women living in the US as well.

Thus, this review highlights the fact that there is significant outcome heterogeneity of outcomes within women grouped together under a single “Latina(o)(x) or “Hispanic” category. Studying Hispanic women without attention to variations that may exist by nativity, country of origin, or even levels of acculturation does not provide the granularity needed to understand the disparate outcomes that exist within this single ethnic group. Not only are birth rates changing differently over time for Hispanic women from different countries, but also the risks of adverse perinatal outcomes are not equivalent for all women who self-identify as Hispanic.

### Limitations

Despite these strengths, this review has limitations. Our study was not designed as a meta-analysis and composite risk scores cannot be computed. This paper was rather conceptualized as a scoping review to summarize the broad range of heterogeneous epidemiological literature surrounding the three major adverse outcomes of preterm birth, LBW, and mortality in the first year of life among Hispanic women and their infants. Secondly, this review does not address the outcome of macrosomia or large-for-gestational age, which Hispanic women appear to have an increased risk of with respect to NHW and which can also have serious implications for both mother and infant [70]. By focusing on three major adverse perinatal outcomes that have the broadest literature base, we hoped to indicate where future research might focus on these topics.

### Methodologic Recommendations for Future Research

Given the large and growing number of births among Hispanic women, we have three recommendations to guide future studies of Hispanic perinatal and birth outcomes. It is important to recognize that research among socially and politically vulnerable women with language barriers, including women who may be hesitant to participate research studies due to documentation status [71], can pose challenges to accurate data collection. However, by applying advanced statistical approaches, including before and after time series analyses and difference-in-difference modeling using population-level datasets, quasi-experimental studies can explore the impact of existing social, political, legal and/or cultural environments and policy measures on perinatal outcomes. Previous utilization of

such designs has elucidated ways in which certain social policies aimed at preventing poor birth outcomes have not always had the intended consequence. For instance, one Medicaid policy analysis showed that improving access to prenatal care through legislative changes did little to change the LBW rates of Hispanic women [12]. Similarly, evidence from other quasi-experimental studies have begun to indicate a potential for evolving immigration policies to negatively impact maternal and infant health outcomes, perhaps through a decreased use of available prenatal care services [72, 73]. It is clear from our review that there is more at play in determining Hispanic women's perinatal outcomes than just individual socioeconomic and access to adequate care. Research methods must, therefore, seek to detect the impact of determinants that exist at the level of the sociocultural or political environment [74].

Secondly, understanding Hispanic perinatal outcomes will benefit from the use of large-scale maternal-infant data linkage. Meaningful explorations of the effect of social policy or naturally occurring events require large scale datasets that link maternal determinants of health with neonatal, infant and childhood outcomes on both a state and national level. Such linked datasets have the power not only to shed light on the Hispanic or overarching immigrant health paradoxes but also on how preconception and prenatal factors shape childhood and adult health in the general population. Emphasis on the creation of such datasets, even at the level of hospital electronic health records (EHRs), with increased funding allocation for the complex programming needed to manage such datasets, is necessary.

Finally, future research into the outcomes of Hispanic women must begin to attend to the differences of life experience and thus health experience that are encompassed by the broad umbrella terms of "Hispanic" or "Latina." Sufficient epidemiologic data indicates that Hispanic women whose families come from different countries or who identify as immigrants versus not, are different patients, with different protective and risk factors to their health and the health of their children. Future research must therefore be cognizant of the homogeneity fallacy that befalls many studies seeking to explore Hispanic patients' health outcomes. Population and hospital-level data must have enough granularity to allow researchers to delve into differences found within the Hispanic population. Finding sensitive ways to collect information about nativity, time spent in the US, assimilation, and overall acculturation is a priority to the development of nuanced study designs. Furthermore, the inclusion of such self-reported racial/ethnic identity and acculturation should be promoted and improved upon within electronic health records given the significant reliance on it in primary research and known inaccuracies associated with EHR-recorded data on race and ethnicity [75].

## Conclusions

Over a thirty year period, Hispanic women and their infants in the US continue to experience a health advantage compared with NHB women. However, Hispanic perinatal outcomes are not uniform, and there are clear subgroup differences in risk profiles for adverse perinatal outcomes. Future investigations into perinatal health disparities related to race and ethnicity must address subgroup variation, including nativity, country of origin and acculturation status. Through more sophisticated analytic studies, we can collect data that will allow us to more effectively engage and care for ethnic minority women and their infants in an individualized, culturally sensitive manners at every level of health care.

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