

# Preterm birth and maternal occupation in a Hispanic population

## Abstract

**Introduction:** The goal of this study was to examine the differences in preterm birth (PTB) among Hispanic and non-Hispanic White women in regard to occupation in the service industry. PTB outcomes for Hispanic women by country of origin were also analyzed.

**Methods:** We conducted a retrospective population-based study using Nevada's electronic birth records from January 2010 to December 2014 to extract maternal and infant characteristics and information on occupation. We calculated crude and adjusted odds ratios of PTB (<37 weeks) using multiple logistic regression.

**Results:** Hispanic women working in the service industry had higher odds of delivering a premature infant (AOR=1.40; 95% CI=1.04-1.89). By nativity, women from Spain (AOR=1.93; 95% CI=1.02-3.64) and Central South America (AOR=1.26; 95% CI=1.09-1.44) had higher odds of a PTB. Hispanic mothers who were students had increased odds of PTB. Maternal risk factors associated with PTB included: high school education or less, previous PTB, Medicaid status, and smoking and/or drinking during pregnancy. Prenatal care utilization was a protective factor for PTB.

**Conclusion:** Hispanic women working in the service industry are exposed to environmental tobacco smoke which increases their risk of PTB. The increased odds could be further modified by nativity. Therefore, maternal occupation should be accounted for when examining ethnic disparities in preterm birth.

**Keywords:** preterm birth, Hispanic, nativity, maternal occupation, service industry, environmental tobacco smoke, ethnic disparity

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## Background

Preterm birth (PTB) rates still remain high in the United States (US) today and rates are especially magnified in racial/ethnic minorities. Advances in neonatal medicine and public health interventions have enabled preterm neonates to survive; however, preterm infants experience significant morbidity and mortality in the perinatal period and throughout their lifespan. It is vital to identify groups with disparities in PTB in order to develop targeted strategies. One of the main goals of the Healthy People 2020 initiative is to "achieve health equity, eliminate disparities, and improve the health of all groups." Research has shown that Hispanics have the same if not better health and birth outcomes compared to non-Hispanic White women.<sup>1-5</sup> However; it is of utmost importance to continue exploring factors that contribute to ethnic disparities in PTB especially in race/ethnic minority groups. The Hispanic population in Nevada continues to grow and has risen from 124,419 in 1990 to 781,886 in 2014, an increase of 528%.<sup>6</sup> This growth has been greater in urban areas with 29.2% of Hispanic residents living in the urban counties of Clark, Washoe, and Carson City. Hispanics fall behind other race/ethnic groups in graduation rates. In 2013-2014, the Nevada high school graduation rate for Hispanics was 65% compared to 77% among Whites.<sup>7</sup> One of the factors associated with low high school graduation rates among Hispanics is the need to financially support their families living in the US or in their native countries of origin.<sup>7</sup>

In Nevada, the biggest industries are tourism, gaming, and entertainment. These service-sector occupations mainly employ

low-wage and low-skilled workers; therefore, high school drop outs and unskilled immigrants are able to obtain employment in these establishments without a General Educational Development (GED) or high school diploma. In 2015, approximately 340,700 Nevadans worked in the leisure and hospitality industry<sup>7</sup> including occupations in entertainment, accommodation and food service in establishments such as casino hotels and restaurants. Since smoking is allowed in casinos, workers are exposed to second hand smoke also known as environmental tobacco smoke (ETS). Recently, ETS has become a public health concern<sup>8-10</sup> because it is associated with chronic illnesses such as lung cancer<sup>9,10</sup> and heart disease<sup>11</sup> and poor birth outcomes including low birth weight, prematurity, and small for gestational age.<sup>12,13</sup> One of the biological pathways for environmental exposure to carbon dioxide (CO<sub>2</sub>), a component of cigarette smoke, is that it affects delivery of oxygen to the fetus and greater accumulation levels cause slower elimination in a fetus.<sup>14</sup> Several studies have evaluated the role of ETS on humans. Trout et al.<sup>8</sup> found ETS exposure was higher in a sample of casino employees compared to the general population. The study also reported that casino employees working in "non-smoking tables" did not have a less exposure to ETS compared to employees working at smoking tables. These results were not unexpected considering non-smoking tables are generally located in close proximity to smoking areas within the casino. Nicotine and carbon monoxide compounds found in cigarette smoke are also present in ETS. Research indicates that smoking in pregnancy increases the likelihood of delivering a preterm baby even after controlling for various confounders.<sup>14-17</sup> Wahabi et al.<sup>18</sup> reported that

Saudi Arabian infants whose mothers were exposed to second-hand smoke (from their spouses smoking in the house) had significantly lower mean birth weight compared to their un-exposed counterparts. A study conducted in Canada<sup>16</sup> found that women exposed to ETS during pregnancy were more likely to have a preterm birth at 34 weeks of gestation.

Other studies have been conducted to assess how maternal occupational exposure impacts preterm birth, with a special focus on psychological and physical stress<sup>8,12,13,19</sup>. Savitz et al.<sup>12</sup> reported that women who worked as electrical operators, janitors, textile workers, or food service employees had an elevated risk of delivering premature infants compared to mothers who worked as clerks. Studies have been conducted in the US to evaluate race/ethnic disparities in preterm birth; however, they did not adjust for nativity.<sup>20–23</sup> It is important to study the outcomes of various Hispanic ethnic subgroups because they differ in the cultural, behavioral and socioeconomic factors. Von Ehrenstein et al.<sup>13</sup> studied the role of maternal occupations on PTB among Hispanic women born in the US and those born outside the country (foreign-born). Their results showed that prematurity was associated with US-born Hispanic women working in shift work and physically demanding jobs. However, the association was not present in the foreign-born group. In Von Ehrenstein's study, foreign-born is a broad categorization and does not provide specific outcomes for each Hispanic subgroup. The Nurses' Health Study<sup>11</sup> conducted in North Carolina did not find increased risk of PTB in nurses. This study did not also account for nativity. To our knowledge, research has not focused on PTB outcomes for women in the service industry. The goal of this study was to assess how PTB among Hispanics differ from non-Hispanic Whites as it relates to occupation in the service industry. We hypothesize that women who work in the service industry have elevated levels of PTB with higher odds ratios among Hispanic women and effects could be further modified by factors such as nativity.

## Materials and methods

### Pregnancy and demographic information

We conducted a retrospective population-based study using Nevada's electronic birth records from January 2010 to December 2014. We extracted infant characteristics on sex (male, female) and gestation age (<37 weeks and ≥37 weeks). We retrieved maternal information on race (non-Hispanic White, Hispanic) and Hispanic subgroups (Mexican, Cuba, Puerto Rico, El Salvador, Spain), previous preterm birth (yes, no) payment source for the pregnancy (Private insurance, self-pay, Medicaid, other), and prenatal care (first, second and third trimester). We excluded births to non-Nevada residents, twins or multiple gestations, and births with missing information on covariates. The final sample was 58,840 with 28,891 non-Hispanic White women and 29,949 Hispanic women. We refer to Non-Hispanic White as White in the rest of the paper.

### Occupational exposure to environmental tobacco smoke

We used the 1990 Standard Occupational Classification (SOC) System from the bureau of labor and statistics to categorize the mother's occupation. Occupation information in the birth certificate is self-reported by mothers. Service industry was used as a proxy for work in an environment that exposed a pregnant woman to secondhand smoke. According to the Nevada Clean Indoor Air Act, smoking is

allowed in casinos, stand-alone bars, strip clubs, and brothels. Areas that primarily sell food, on or off the premises, such as restaurants and grocery stores do not allow smoking. To be in compliance with this regulation, restaurants located inside casinos do not allow smoking. Categories in the service industry include: arts, entertainment and recreation, accommodation and food service, casino hotels and gaming industries, food services and drinking places, full-service restaurants, and limited-service restaurants. The authors are aware that 'service industry' is a broad categorization and some of the workers in this classification may not be exposed to ETS. This study limitation is discussed in detail in the discussion section. We also assessed the risk of being unemployed on PTB.

### Statistical methods

To be consistent with existing literature,<sup>12,13,19</sup> we chose office and administrative support occupations as the reference group for the service industry based on the assumption that this group is less likely to be exposed to harmful work and ETS compared to other occupations. We calculated crude and adjusted odds ratios of PTB (<37 weeks) using multiple logistic regressions for occupation. We conducted separate analysis for Hispanic subgroups by nativity (Mexican, Cuba, Puerto Rico, El Salvador, and Spain). We adjusted for the following covariates in the final model: race/ethnicity (White-reference), age (20–34-reference), education (>12 years-reference), marital status (married-reference), source of payment (private insurance-reference) and prenatal care (first trimester-reference). We conducted the analyses using SAS version 9.4 (SAS Institute, Cary, NC). We obtained ethics approval for this study from the University of Nevada, Reno, and University Institutional Review Board.

### Results

Descriptive statistics are displayed in Table 1. The total birth distribution between Whites and Hispanics was similar with majority of the women residing in an urban area. Majority of the women in the study were homemakers and the distribution of both Whites and Hispanics in the service industry was comparable. Whites were more likely to smoke and use alcohol during pregnancy, be unemployed, and have history of PTB compared to Hispanics. Hispanics were more likely to be teenage mothers (15–19 years), not have a high school diploma, unmarried, overweight or obese (BMI of 25–30 and >30 respectively), be on Medicaid, and have late prenatal care (care received in the second or third trimester). In the model that controlled for race/ethnicity and occupation only, Hispanic women working in the service industry compared to those working in administrative support had increased odds of PTB (adjusted odds ratio [AOR]=1.40; 95% confidence interval [CI]=1.04–1.89) (data not shown). However, the association was weakened in the adjusted model because the CIs included the null value (AOR=1.31; 95% CI=0.96–1.77) (Table 2). Odds ratios for PTB were higher for Hispanic women who were students (AOR=1.46; 95% CI=1.08–1.97) (data not shown). We found increased odds ratios for PTB related to teenage mothers (AOR=1.28; 95% CI=1.14–1.44) and mothers aged 35–44 (AOR=1.42; 95% CI=1.28–1.58) (Table 2). Maternal risk factors associated with PTB among Hispanic women included: high school education or less, previous preterm delivery, and being underweight (BMI<18.5) and obese (BMI >30). In addition, Hispanic mothers who were on Medicaid had increased odds of PTB as well as those who smoked during pregnancy and/or combined smoking and drinking during pregnancy (Table 2). Receiving prenatal care in the second or third

trimester was a protective factor for PTB (AOR=0.80; 95% CI=0.74-0.86 and AOR=0.78; 95% CI=0.62-0.91 respectively) (results not shown). The distribution by mother's Hispanic ethnic group is displayed in Table 3. In the model that controlled for mother's Hispanic ethnic group, we found that working in the service industry was associated with PTB (AOR=1.40; 95% CI=1.04-1.89). Central

South American (AOR=1.26; 95% CI=1.09-1.44), and women from Spain (AOR=1.93; 95% CI=1.02-3.64) had higher odds of a PTB. We also found that students (AOR=1.60; 95% CI=1.19-2.15) and homemakers (AOR=1.46; 95% CI=1.12-1.90) had increased odds of delivering a premature infant (data not shown).

**Table 1** Maternal and infant characteristics by preterm birth category

Characteristics	Non-Hispanic white		Hispanic	
	<37 Weeks N: 2040(%)	37+Weeks N: 26,851(%)	<37 Weeks N: 2309(%)	37+Weeks N: 27,640(%)
<b>Infant Characteristics</b>				
<b>Infant sex</b>				
Male	1,108(54.3)	13,788(51.4)	1,253(54.3)	14,011(50.7)
Female	932(45.7)	13,063(48.7)	1,056(45.7)	13,629(49.3)
<b>Maternal Characteristics</b>				
<b>Mother's occupation</b>				
Executive, Administrative, and Managerial	33(1.6)	508(1.9)	23(1.0)	211(0.8)
Professional Specialty	246(12.1)	3479(13.0)	22(1.0)	462(1.7)
Technicians and Related Support	0	45(0.2)	1(0.0)	9(0.0)
Sales	68(3.3)	1,053(3.9)	100(4.3)	1,106(4.0)
Administrative Support	28(1.4)	547(2.0)	31(1.3)	500(1.8)
Service, Rather than Private Household & Protective Service	93(4.6)	1,256(4.7)	103(4.5)	1,230(4.5)
Precision Production, Craft and Repair	0	4(0.0)	2(0.1)	3(0.0)
Machine Operators, Assemblers and Inspectors	8(0.4)	79(0.3)	4(0.2)	38(0.1)
Homemaker	1,320(64.7)	16,550(61.7)	1,748(75.7)	20,785(75.2)
Student	93(4.6)	1,194(4.4)	143(6.2)	1,424(5.2)
None	151(7.4)	2,127(7.9)	132(5.7)	1,872(6.8)
<b>RUCA</b>				
Urban Town	1,797(88.1)	23,561(87.7)	2,217(96.0)	26,361(95.4)
Large Rural Town	146(7.2)	1,943(7.2)	43(1.9)	697(2.5)
Small Rural Town	65(3.2)	908(3.4)	33(1.4)	463(1.7)
Isolated Small Rural Town	32(1.6)	439(1.6)	16(0.7)	119(0.4)
<b>Age group</b>				
15-19	178(8.7)	1,742(6.5)	352(15.2)	3,728(13.5)
20-24	475(23.3)	6,248(23.3)	545(23.6)	7,595(27.5)
25-29	569(27.9)	8,560(31.9)	523(22.7)	7,256(26.30)
30-34	491(24.1)	6,937(25.8)	506(21.9)	5,533(20.0)
35-44	327(16.0)	3,364(12.5)	383(16.6)	3,528(12.8)
<b>Education</b>				
<12 years	317(15.5)	3,097(11.5)	1,156(50.1)	13,210(47.8)
12 years	665(32.6)	7,629(28.4)	720(31.2)	8,999(32.6)
>12 years	1,058(51.9)	16,125(60.1)	433(18.8)	5,431(19.6)
<b>Marital status</b>				
Married	1,380(67.6)	19,332(72.0)	1,164(50.4)	13,352(48.3)
Never Married	660(32.4)	7,519(28.0)	1,145(49.6)	14,288(51.7)

Table Continued..

Characteristics	Non-Hispanic white		Hispanic	
	<37 Weeks N: 2040(%)	37+Weeks N: 26,851(%)	<37 Weeks N: 2309(%)	37+Weeks N: 27,640(%)
<b>Infant Characteristics</b>				
<b>BMI category</b>				
<18.5	168(8.2)	1,454(5.4)	96(4.2)	926(3.4)
18.5-24.9	987(48.4)	14,130(52.6)	935(40.5)	11,885(43.0)
25-30	418(20.5)	5,950(22.2)	704(30.5)	8,271(29.9)
>30	467(22.9)	5,317(19.8)	574(24.9)	6,558(23.7)
<b>Payment source</b>				
Medicaid	716(35.1)	8,345(31.1)	932(40.4)	10,675(38.6)
Private Insurance	769(37.7)	11,147(41.5)	345(14.9)	4,674(16.9)
Self-pay	171(8.4)	2,305(8.6)	796(34.5)	9,490(34.3)
Other	384(18.8)	5,054(18.8)	236(10.2)	2,801(10.1)
<b>Tobacco and alcohol use</b>				
None	1,687(82.7)	23,593(87.9)	1,687(82.7)	27,035(97.8)
Tobacco	336(16.5)	3,083(11.5)	336(16.5)	536(1.9)
Alcohol	4(0.2)	101(0.4)	4(0.2)	47(0.2)
Both	13(0.6)	74(0.3)	13(0.6)	22(0.1)
<b>Previous preterm birth</b>				
Yes	263(12.9)	734(2.7)	181(7.8)	450(1.6)
No	1,777(87.1)	26,117(97.3)	2,128(92.2)	27,190(98.4)
<b>Prenatal care</b>				
First	1,614(79.1)	21,032(78.3)	1,569(68.0)	17,142(62.0)
Second	344(16.9)	4,654(17.3)	624(27.0)	8,847(32.0)
Third	82(4.0)	1,165(4.3)	116(5.0)	1,651(6.0)

Abbreviations: RUCA = Rural Urban Commuting Area; BMI=Body Mass Index.

**Table 2** Adjusted odds ratios for preterm birth among hispanic women: Nevada, 2010-2014

Characteristic	Unadjusted odds ratio	Adjusted odds ratio <sup>1</sup>
<b>Maternal race/ethnicity</b>		
White	Reference	Reference
Hispanic	1.1(1.03-1.17)	1.08(1.00-1.16)*
<b>Mother's occupation</b>		
Administrative support	Reference	Reference
Service, Rather than Private Household & Protective Service	1.40(1.04-1.89)	1.31(0.96-1.77)
<b>Mother's age group</b>		
20-24	Reference	Reference
15-19	1.32(1.18-1.47)	1.28(1.14-1.44)*
25-29	0.94(0.86-1.02)	0.94(0.86-1.03)
30-34	1.09(0.99-1.19)	1.11(1.01-1.22)*
35-44	1.40(1.27-1.55)	1.42(1.28-1.58)*
<b>Mother's Education(years)</b>		
>12	Reference	Reference
<12 years	1.31(1.21-1.41)	1.27(1.15-1.39)*
12 years	1.20(1.12-1.30)	1.19(1.09-1.30)*

Table Continued..

Characteristic	Unadjusted odds ratio	Adjusted odds ratio <sup>1</sup>
<b>Previous preterm birth</b>		
No	Reference	Reference
Yes	5.12(4.57-5.74)	5.14(4.58-5.77)*
<b>BMI category</b>		
18.5-24.9		Reference
<18.5	1.50(1.31-1.72)	1.45(1.26-1.66)*
25-30	1.07(0.99-1.15)	1.04(0.96-1.12)
>30	1.19(1.10-1.28)	1.14(1.05-1.23)*
<b>Source of payment</b>		
Private insurance	Reference	Reference
Medicaid	1.23(1.14-1.33)	1.12(1.02-1.22)*
Other	1.12(1.01-1.24)	1.08(0.98-1.20)
Self-pay	1.16(1.07-1.27)	1.12(1.01-1.24)*
<b>Tobacco and alcohol use during pregnancy</b>		
None	Reference	Reference
Tobacco	1.43(1.29-1.60)	1.42(1.26-1.60)*
Alcohol	1.14(0.64-2.00)	1.23(0.69-2.18)
Both	2.43(1.46-4.02)	2.36(1.40-3.98)*
<sup>1</sup> Adjusted for occupation, race/ethnicity, age, education, previous preterm birth, BMI, source of payment, prenatal care, smoking and alcohol use during pregnancy.		
Abbreviations: BMI=Body mass index.		
*p-value <0.05		

**Table 3** Adjusted odds ratios for hispanic mothers by ethnic group

Characteristic	N	Adjusted odds ratio
<b>Mother's occupation</b>		
Administrative Support	1,106	Reference
Service industry	2,682	1.40(1.04-1.89)*
<b>Hispanic ethnic group</b>		
Non-Hispanic	28,855	Reference
Central South American	2870	1.26(1.09-1.44)*
Cuban	414	0.91(0.61-1.34)
Dominican	63	0.65(0.20-2.06)
Latin American	19	2.43(0.71-8.35)
Mexican	24,383	1.05(0.98-1.12)
Puerto Rican	478	1.36(1.00-1.85)
Spaniard	89	1.93(1.02-3.64)*
Other Spanish/Hispanic	1,633	1.11(0.92-1.34)
*p-value <0.05		

## Discussion

We found increased ORs for PTB in Spaniard and Central South American women working in the service industry. The pronounced effects found in these groups could mean that foreign-born Hispanic women are more likely to work in the service industry causing an increased exposure to ETS. This is consistent with the finding that Hispanics in Nevada were more likely to report being exposed to second-hand smoke at the workplace compared to Whites.<sup>2</sup> This finding also adds to our knowledge on the contributory factors for PTB among Hispanics. Von Ehrenstein et al.<sup>13</sup> found that foreign-born Hispanics with occupations in building and grounds cleaning and maintenance were more likely to have PTB. Even though our study focused on the service industry, this categorization is broad and would be difficult to tease out the effects from each job included in this category. However, our study indicates that women working in the service sector are more likely to be exposed to ETS and this could be a contributor to PTB. Particular attention should be paid on whether the mother worked in that environment before, during or a part of their pregnancy.

We also found pronounced effects of PTB among students and homemakers. This could be explained by the fact that 15.2% of the Hispanic women who had a PTB were teenagers (15-19 years old) and half (50.1%) did not have a high school diploma. Nevada has a low high school graduation rate for Hispanics and most of the dropouts get employment in occupations that do not provide health insurance. This is consistent with Yang et al.<sup>2</sup> finding that Hispanics in Nevada were 2.37 times more likely to report not having insurance. Morales et al. (2002) also reported that Hispanics have lower education levels, a lower socioeconomic status, less access to medical care, and lack health insurance. Uninsured women generally have limited access to essential health services in the prenatal period, during pregnancy, and in the post-natal period. Optimal health throughout a woman's lifespan is an integral part to improving birth outcomes.

Previous preterm delivery was a strong predictor for PTB in our study. The association did not change in the logistic regression that controlled for potential confounders such as race/ethnicity, age, education, method of payment for delivery, BMI, prenatal care, smoking and alcohol use during pregnancy. This finding is consistent with Mercer and colleagues<sup>24</sup> who found that women with a history of prematurity were 2.5 times more likely to have a PTB in subsequent pregnancies. Goldenberg et al.<sup>25</sup> reported that the recurrence of PTB among women with previous PTB ranged between 15% to over 50%. The biological mechanism of a PTB recurring is not exactly clear, however, it has been posited that a spontaneous PTB in one pregnancy is likely to lead to another spontaneous PTB in future pregnancies.<sup>24,25</sup> Intrauterine infections have also been linked to recurring PTB.<sup>26,27</sup>

We found evidence that study participants who smoked during pregnancy had increased ORs for PTB. This was also true when smoking was combined with alcohol use during pregnancy. Our findings concur with existing research which has depicted that smoking is associated with PTB.<sup>15,16,28</sup> Smoking and drinking during pregnancy have severe obstetric complications including: spontaneous abortion, placental abruption, miscarriage, preterm birth and stillbirth.<sup>15,17,18</sup> Smoking cessation and alcohol use during pregnancy is one of the Healthy People 2020 objectives that are aimed at increasing abstinence from alcohol, cigarettes, and illicit drugs in pregnancy. Public health prevention strategies should focus on effective smoking cessation interventions while paying close attention to linguistic and cultural differences of various Hispanic ethnic groups. Our study found that

high school education or less was associated with PTB. Graduating from high school is associated with increased earnings, better health, and an overall decrease in reliance on publicly funded services such as Medicaid. As such, Nevada should look into raising the high school graduation rates and college enrollment rates for Hispanics by addressing associated barriers.

## Study limitations and strengths

To our knowledge, this is the first study to examine PTB outcomes of Hispanic women in the service industry. In addition, our study is population-based and controlled for several Hispanic ethnic groups working in the service industry. The study findings can be generalized to Hispanic populations in the US that have identical ethnic make-up. One of our study limitations is the broad nature of the service industry categorization leading to inaccurate measurement of ETS. Standard Occupational Classification (SOC) system provides very broad categorizations for occupations making it difficult to account for sub-categories such as casino workers. Future research should focus on conducting surveys with casino employees in order to make more accurate conclusions about pregnancy outcomes related to occupation, however, even such a study would be subject to recall bias of risk factors and subsequent underestimation of risks. Since we used data from the birth certificate in which behavioral risk factors are self-reported, we may have underestimated risk factors such as smoking and alcohol use during pregnancy and weight status.<sup>29-30</sup>

## Conclusion

Our study provides evidence that Hispanic women working in the service industry are exposed to ETS and this could be a contributory factor to PTB. Therefore, maternal occupation should be considered when addressing ethnic disparities in preterm birth. We also found that majority of Hispanic women were homemakers, students, had low education levels and did not have insurance. In order to reduce PTB among Hispanic women, it is necessary to develop culturally and linguistically targeted intervention strategies to increase high school graduation and college enrollment rates.

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## Conflict of interest

The author declares no conflict of interest.

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