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Preterm, Low Birthweight Deliveries and Farmwork Among Latinas in California

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Abstract

Objective—To examine the association between preterm, low birthweight (PTLBW) delivery and maternal occupation among Latina women in California.

Methods—A cohort of 1,024 Latina women in Stockton, California was followed from baseline to delivery. The association between PTLBW delivery and maternal occupation (farmwork, non-farmwork, no work) was analyzed using multiple logistic regression models.

Results—Demographic characteristics varied widely between the three occupation groups. The adjusted odds ratio of a PTLBW delivery for farmworkers compared to women who did not work was 1.28 (95% CI, 0.65–2.54).

Conclusions—We did not observe a statistically significant association between PTLBW delivery and farmwork in this population. However, the relationship between acculturation and risky health behaviors suggests that studies investigating the association between maternal employment and adverse pregnancy outcomes among Latinas need to account for a participant's acculturation status.

Introduction

Agricultural workers are exposed to numerous physical, chemical, and biologic hazards that represent a risk for adverse pregnancy outcomes. The intense physical labor involved in farmwork may be associated with poor birth outcomes.^{1–6} Farmworkers engage in repetitive body motions, demanding and uncomfortable body postures, as well as long shifts with few breaks. Other reproductive hazards include acute trauma⁷, excessive heat exposure⁸, and agrochemicals, including pesticides.⁹ Despite the spectrum of reproductive hazards in agriculture, relatively few epidemiological studies have investigated the effects of agricultural work on pregnancy outcomes.^{1–6}

The “Latina paradox” is based on the observation that immigrant Latina women experience higher rates of preterm, low birthweight (PTLBW) deliveries the longer they live in the U.S. It has been studied for nearly two decades.^{10,11} Given the large number of Latina families who migrate to the U.S. and perform farmwork, often as a first occupation, one possible

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contributing factor for these worsening birth outcomes among Latina women is occupational hazards encountered while working.¹² Potential exposures to agrochemicals as well as physical exertion, such as stoop labor and occupational stress, might lead to higher rates of PTLBW delivery among women doing farmwork.

Accurate data are limited on the number of farmworkers, especially the number of female farmworkers, in California. However, according to an enumeration study by Larsen, there were over 700,000 migrant and seasonal farmworkers (men and women) in California in 2000.¹³ Also, the U.S. Census Bureau estimated that nearly 6.4 million Hispanic females were living in California in 2006. Thirty-five percent (2.2 million) were in the workforce, and, of these, 32% were employed as farm or other manual labor.¹⁴

We conducted a prospective cohort study enrolling 1,024 pregnant Latina women, primarily of Mexican heritage, in Stockton, California; this study was called the Study of Hispanic Acculturation, Reproduction, and the Environment (SHARE). The objective of this study was to examine the association between PTLBW delivery and maternal occupation. We further sought to investigate and understand the relationship between maternal occupation and acculturation-related risk behaviors for PTLBW delivery.

Methods

Study Participants

SHARE researchers collected data from 1999-2001, during which they recruited 1,287 pregnant Latina women of predominantly Mexican origin at prenatal care visits at six clinics affiliated with the OB/GYN medical group at San Joaquin General Hospital in Stockton, California. The six clinics provided care to essentially all women delivering at San Joaquin General Hospital. The majority of women (67%) who received prenatal care through the San Joaquin OB/GYN medical group were Mexican immigrants with varying lengths of U.S. residency. Eligible participants had to be non-white Latina females, reside in San Joaquin County, and receive their prenatal care at one of the clinics affiliated with San Joaquin General Hospital.

Of the 1,287 women recruited, 1,121 (87%) completed the baseline questionnaire. Birth outcome data for 1,069 (95%) of these women were successfully abstracted. Refusal rate was low (<2%) and usually for non-medically related reasons. After excluding 10 multiple live births, 19 spontaneous abortions, 8 elective abortions, and 8 births with missing birth outcome data, there were 1,024 women, aged 13 to 45 years, who completed the baseline questionnaire, delivered a single live infant (1,019) or stillbirth (5), and whose infants' birth outcome data were complete.

Data Collection

The SHARE study received approval from the University of California, Davis, Institutional Review Board. Study participants provided informed consent prior to enrollment in the study. SHARE data were obtained via standardized, computer-assisted questionnaires administered by bilingual (English and Spanish) interviewers at prenatal clinics. Interviewers did not encounter women who spoke neither English nor Spanish (i.e. an indigenous language). The interview assessed demographic information, acculturation level, reproductive history, nutritional intake, sexual history/behavior, known risk factors associated with poor pregnancy outcomes, such as tobacco use and substance abuse, as well as employment and occupational exposures. Participants were recruited primarily at their first prenatal visit.

Upon delivery, field researchers obtained participants' and their newborn infants' medical charts and abstracted obstetrical history, maternal physical exam and laboratory test results, pregnancy complications, and method of delivery. Data abstracted from infant charts included birthweight, gestational age, and maturity ratings at delivery. Maternal and infant discharge diagnoses were also recorded.

Definition of Outcome Variables

The primary outcome of interest was a preterm or low birthweight (PTLBW) delivery. A preterm (PT) delivery was defined as an infant delivered at a gestational age greater than 20 weeks but less than 37 weeks. A low birthweight (LBW) delivery was defined as an infant delivered weighing less than 2,500 grams. Only single live births or stillbirths were included in the final analyses.

Definition of Covariates

Key variables of interest were maternal occupation, acculturation, and smoking, drinking, and drug use during pregnancy. The mothers' occupation was categorized as farmwork, non-farmwork, or no work and was determined from three questionnaire items:

1. "In the last 12 months, have you ever worked more than 20 hours a week outside of the home?"
2. "In what kind of business or industry did you work during the last 12 months?"
3. "What was your job or occupation in this business or industry?"

Participants were classified as "no work" if they answered "no" to the first item. The Occupational Classification System Manual (OCSM) created for the U.S. Department of Labor's Bureau of Labor Statistics was used to code the women's occupation into the remaining two groups.¹⁵ The OCSM was a special adaptation of the U.S. Census Index of Occupations. The Census Index of Occupations was developed to organize and make understandable the thousands of industries and occupations obtained from the decennial Census of Population.

Women in the farmwork category included farmworkers as well as cannery workers and/or sorters who worked on farms. Women in the non-farmwork category included service workers, clerical workers, professionals, administrators, managers, laborers (except farm), and domestic workers, etc.

Participants also answered questions regarding their physical stress at the time of the questionnaire. The questions assessed the number of hours per day standing, getting up and down from a sitting position, lifting heavy objects, bending over, squatting, and number of hours and days worked during the first three months of pregnancy. Questions about smoking, drinking, and illicit drug use during pregnancy were asked directly during the baseline interview. Using the smoking, drinking and drug use variables, a risk index ranging from 0 to 3 was created that indicated the number of health-related risky behaviors engaged in during pregnancy.

Acculturation was measured using a twelve-item, modified version of the Acculturation Rating Scale for Mexican Americans-II (ARSMA-II).¹⁶ ARSMA-II was an updated, reliable measure of acculturation, applicable to a culturally diverse population of individuals of Mexican origin or descent. ARSMA-II was predominantly language-based and comprised of Mexican- and Anglo-oriented scales. There were 12 questions in total, six for each scale, assessing the language the individual used to read, speak, watch TV, and think. The instrument used a 5-point Likert scale to score the response to each question. We derived

individual raw composite acculturation scores by calculating the difference between each woman's mean scores for the Mexican- and Anglo-orientated scales. Using pre-set cutoff points, we developed a five-level Linear Acculturation Scale with level 1 representing Mexican orientation and level 5 representing Anglo orientation.¹² Specifically, ARSMA-II scale defines the five levels (Levels 1-5) as 1) very Mexican oriented, 2) Mexican oriented to approximately balanced bicultural, 3) slightly Anglo oriented bicultural, 4) strongly Anglo oriented, 5) very assimilated; anglicized.

Statistical Analysis

For continuous variables, one-way ANOVA was performed using an F-test to measure the association between the three work categories (farmwork, non-farmwork, or no work), with Scheffe's method used to test the statistical significance ($p < 0.05$) of pairwise comparisons of work categories. For categorical variables, a chi-square test was used to measure the association with maternal work category. Multiple logistic regression models were created to determine whether farmworkers and non-farmworkers were at a greater risk of PTLBW delivery compared to women who did not work, after controlling for potential confounders, such as age, gravidity (≥ 1 vs. 0), and level of acculturation. The model was created using expert judgment of important covariates and the results from bivariate analyses. All analyses were performed using STATA release 8.0 (STATA Corporation, College Station, TX).¹⁷ An alpha (α) of 0.05 was used in all analyses. For the multivariate analyses, we made the missing at random (MAR) assumption to address the low fraction of missing data.¹⁸

Results

There were 142 (13.9%) farmworkers, 255 (24.9%) non-farmworkers, and 627 (61.2%) women who did not work during the 12 months prior to baseline. Non-farmworkers primarily held service (32.7%), sales (18.4%), and clerical (17.7%) positions.

When maternal characteristics were examined by work category, we found that over 90% of the farmworkers were immigrants (97.4% from Mexico), and their average number of years in the U.S. was less than 7 (Table 1). A higher percentage of women who did not work (20.7%) and did non-farmwork (47.5%) were born in the U.S. compared to farmworkers (8.5%). Farmworkers were also less educated than non-farmworkers and older than the women who did not work. A smaller percentage of farmworkers had a yearly family income over \$20,000 than non-farmworkers, and a higher proportion of farmworkers were married or living as married compared to women in the other two work groups. The distribution of acculturation levels differed between the three work groups with nearly 90% of farmworkers in the Level I acculturation group (very Mexican oriented) compared to 36.9% and 71.7% of the women in the non-farmwork and no work categories, respectively (Figure 1).

Smoking, drinking, and drug use during pregnancy were highest among non-farmworkers (Table 1). Farmworkers and women who did not work had similar rates of drinking during pregnancy (2.9% and 2.8%), but farmworkers had a lower smoking rate during pregnancy (1.4% and 3.0%), and none reported drug use during pregnancy. Women in the non-farmwork and no work categories reported two or more behavioral risk factors (smoking, alcohol use, or drug use during pregnancy) approximately ten and four times as frequently, respectively, as farmworkers.

When physical stress was examined by work category, we found that farmworkers generally reported more physical stress, but the results were inconsistent. Farmworkers spent more hours standing than women who did not work, and they worked more days per week and hours per day than non-farmworkers (Table 2). Non-farmworkers, on average, reported more hours bending over, and squatting than women who did not work. Also, women who

did not work reported similar levels of lifting heavy objects, bending over, and squatting as farmworkers.

Of the 1,024 deliveries, 84 babies (8.2%) were PTLBW, and unadjusted PTLBW rates did not vary between work categories (Table 3). Overall rates of PT and LBW delivery were 7.0% and 4.7%, respectively, and unadjusted rates did not vary between work categories. Birthweight and gestational age also did not vary between work categories.

The unadjusted logistic regression model showed the odds ratio of PTLBW for farmworkers compared to women who did not work was 1.07 (95% CI, 0.55-2.06). The multiple logistic regression model (simultaneously adjusted for age, gravidity, and acculturation) showed the odds ratio of PTLBW for farmworkers compared to women who did not work was 1.28 (95% CI, 0.65-2.54) (Table 4).

We found similar results for PT and LBW deliveries (Table 4). The model also showed that, compared to women who were very Mexican oriented (Level I), slightly Anglo oriented bicultural and strongly Anglo oriented (acculturation levels III and IV, respectively) women were approximately three times as likely to experience a PTLBW delivery. The association between higher acculturation and PTLBW was maintained without occupation in the multivariate model, although a dose-response was not observed between PTLBW and the levels of acculturation. Again, we found similar results for PT and LBW deliveries. These analyses also showed that women over the age of 34 years were more than three times as likely to deliver a PTLBW, PT, or LBW infant as women aged 18-34 years (Table 4). We also found that primigravida women were at an elevated risk for all three adverse pregnancy outcomes compared to women with at least one previous pregnancy, although the odds ratios were not statistically significant.

Discussion

We did not observe a significant association between PTLBW delivery and farmwork in this population. While multivariate models showed that farmworkers were at an elevated risk of all three adverse pregnancy outcomes (preterm (PT) delivery, low birthweight (LBW), or preterm, low birthweight (PTLBW) delivery), the differences were small and not statistically significant.

These findings are consistent with the limited number of studies examining farmwork and pregnancy outcome among Latina women. Fenster and Coye examined the birthweight of infants born to Latina women employed in agriculture.⁶ They reported overall and farmworker-specific LBW rates of 1.8% and 1.6%, respectively, for singleton infants of Latina women presenting to two rural health care centers in California. By comparison, we found much higher overall (4.7%) and farmworker-specific (4.9%) LBW delivery rates than in the previous study. As in the present study, Fenster and Coye did not find a significant association between LBW delivery and maternal occupation using the same work categories. However, the low incidence of LBW delivery might have hindered their ability to detect a difference in LBW rates between work categories. In addition, their results might have been biased by only including women enrolled in a special program designed to increase access to prenatal care services.⁶

We found a relationship between occupation and the likelihood of engaging in behaviors that are known risk factors for adverse pregnancy outcomes, such as smoking, drinking, and drug use during pregnancy, similar to Fenster and Coye. The relationship between occupation and risky health behaviors is reflected by the acculturation levels of women in the three work categories. In addition to this study (data not shown), previous research has shown that increased acculturation status among Latina women is significantly associated

with increased risky health behaviors.^{11,19-22} Specifically, Latina women who are highly acculturated in the U.S. are more likely to smoke cigarettes, drink alcohol, use drugs, and engage in more risky sexual activities than less acculturated Latina women. There is no dispute among researchers that these behaviors have an adverse impact on birth outcomes.^{23,24}

This study confirmed the previously reported increased risk of adverse pregnancy outcomes among more acculturated Latina women.^{10,11,25,26} Most of the previous studies used maternal birthplace and/or language preference as proxies for acculturation rather than formal acculturation scales. Use of these proxies assumes that U.S.-born or English-speaking women are more acculturated than foreign-born or Spanish-speaking women.

This study also highlights the physical stress among non-farmworkers and non-working women. While it is assumed that the physical work involved in farmwork is the greatest, non-farmworkers in our study reported more hours bending over and squatting than farmworkers. In addition, the women who did not work outside the home reported similar levels of lifting heavy objects, bending over, and squatting as farmworkers, raising the issue of physical stress among unemployed Latina women. This observation has not been found elsewhere and may be the result of the physical stress indicators specifically used in the study.

This study had several limitations. First, the small number of farmworkers (n = 142) and PTLBW deliveries (n = 84) limited the statistical power to measure the relationship between adverse pregnancy outcome and maternal occupation. Farmworkers had a slightly elevated independent risk of PTLBW, PT, and LBW deliveries compared to women who did not work; however, the respective elevated risks were not statistically significant. Similarly, despite possible different etiologies for growth restriction and preterm birth, we used PT or LBW deliveries as the main birth outcome to increase power due to the small number of farmworkers as well as PT and LBW deliveries, respectively. The small number of farmworkers also limited the number of variables that we could adjust for in our multivariate analyses. The small number of farmworkers and PTLBW deliveries may have been the result of recruiting participants from prenatal care clinics or from the geographic location of the study.

The multivariate model did not directly adjust for known behavioral risk factors for adverse pregnancy outcomes, including smoking, drinking, and drug use. These variables were not included in the final multivariate model for two reasons. First, none of these variables was independently associated with PTLBW, PT, or LBW deliveries. Second, the relatively small number of adverse pregnancy outcomes limited the number of variables that could be included in the final multivariate model. However, the model probably sufficiently adjusted for smoking, drinking, and drug use via the acculturation variable, which was significantly associated with the behavioral risk factors.

The results of this study only apply to Mexican-Americans since 97.4% of the immigrants in the study came from Mexico and nearly all of the U.S.-born population was of Mexican ancestry. Previous studies have shown differences in health behaviors (smoking and drinking) between Hispanic subgroups from Mexico, Puerto Rico, Cuba, and Central and South America.^{20,26,27} Also, a previous study by Fuentes-Afflick and colleagues analyzed birth certificate data and found that Puerto Rican and Central/South American women were at a higher risk of a moderately LBW delivery (1,500 g to 2,499 g) than non-Hispanic white women, while Cuban and Mexican women were not at an elevated risk.²⁸

Despite these limitations, the current work has several strengths. First, the study population was a representative sample of Latina women of primarily Mexican descent in San Joaquin

County, located in the heart of California's Central Valley and home to some 170,000 Latinas who emigrated to the U.S. largely from Mexico. The majority of women (67%) receiving prenatal care through the San Joaquin OB/GYN medical group were Mexican immigrants with varying lengths of U.S. residency. The six clinics provided care to essentially all women delivering at San Joaquin General Hospital. In addition, the study lost only a small percentage of participants to follow-up (4.5%), had a relatively large sample size ($N = 1,024$), and used birth outcome data manually abstracted from medical records rather than from the mothers' self-reports. The study also used a validated, more accurate acculturation scale rather than a proxy, such as birthplace and/or language preference, to assess acculturation.²⁹⁻³³

Our results have methodological implications for future research, as well as outreach and translational importance. The relationship between acculturation and risky health behaviors suggests that studies investigating the association of maternal employment and adverse pregnancy outcome among Latinas need to account for a participant's acculturation status. Over 85% of the farmworkers in the study were low-accultured women, and low acculturation acted as a marker for a lifestyle associated with more favorable birth outcomes among Latina mothers. Failure to adequately adjust for acculturation or the associated risky health behaviors will likely result in confounding of analyses by acculturation.

This study also suggests that public health officials should target recent female Latina immigrants and particularly farmworkers to prevent the increase in PTLBW delivery associated with increased acculturation.¹¹ Farmworkers were generally low-accultured, which was associated with a better pregnancy risk profile, than women in the other work groups. However, as Latina women spend more time in the U.S. and increase their level of acculturation, they may be more likely to engage in risky health behaviors, such as drinking, smoking, drug use, and increased risky sexual activity, thereby increasing their risk of experiencing an adverse pregnancy outcome.

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Figure 1. Percent of study population in Level I (black), Level II (dark grey), Level III (grey), Level IV (light grey), and Level V (white) acculturation levels by maternal work category.

TABLE 1
Selected Maternal Characteristics by Maternal Occupation

	Maternal Occupation			p-value
	No Work (n=627)	Non-Farmwork (n=255)	Farmwork (n=142)	
Maternal age; mean (SE) *	24.7 (0.26)	25.3 (0.36)	26.2 (0.49)	0.028
Education (years); mean (SE) *	8.3 (0.12)	10.7 (0.16)	7.1 (0.25)	<0.001
Years living in U.S.; mean (SE) *,†	5.4 (0.12)	9.4 (0.46)	6.6 (0.45)	<0.001
Month prenatal care began; mean (SE) *	4.2 (0.08)	3.9 (0.11)	4.2 (0.15)	0.059
Born in U.S.; % (n) **	20.7 (130)	47.5 (121)	8.5 (12)	<0.001
Family income >\$20K; % (n) **	9.9 (29)	21.4 (37)	9.0 (8)	0.001
Married/Living as Married; % (n) **	76.9 (482)	65.1 (166)	89.4 (127)	<0.001
Number of sexual partners; % (n)				
>1 in past year **	3.9 (24)	7.1 (18)	4.2 (6)	0.115
>5 in lifetime **	3.7 (23)	11.2 (28)	2.9 (4)	<0.001
Smoking during pregnancy; % (n) **	3.0 (19)	3.5 (9)	1.4 (2)	0.472
Alcohol use during pregnancy; % (n) **	2.9 (18)	7.1 (18)	2.8 (4)	0.011
Drug use during pregnancy; % (n) **	1.1 (7)	1.6 (4)	0.0 (0)	0.343
Gravidity; % (n) **				0.370
0 previous pregnancies	31.2 (195)	31.4 (80)	25.4 (36)	
≥ 1 previous pregnancies	68.9 (431)	68.6 (175)	74.7 (106)	

SE indicates standard error

* p-value based on one-way ANOVA

** p-value based on chi-square test

† foreign-born respondents only

TABLE 2
Physical Stress* Among Study Population by Maternal Occupation

	Maternal Occupation			p-value**
	No Work (n=627)	Non-Farmwork (n=255)	Farmwork (n=142)	
Hours standing per day	3.05 (0.076)	3.41 (0.116)	3.68 (0.138)	<0.001
Hours getting up and down from a sitting position	2.94 (0.059)	3.09 (0.083)	3.19 (0.106)	0.098
Hours lifting heavy objects per day	0.24 (0.032)	0.38 (0.066)	0.24 (0.071)	0.084
Hours bending over per day	0.95 (0.056)	1.25 (0.099)	0.97 (0.121)	0.020
Hours squatting per day	0.27 (0.034)	0.65 (0.080)	0.25 (0.070)	<0.001
Days worked per week during first 3 months of pregnancy	NA	5.02 (0.048)	5.44 (0.102)	0.006
Hours worked per day during first 3 months of pregnancy	NA	7.47 (0.116)	8.36 (0.145)	0.001

* Mean (SE)

** p-value based on one-way ANOVA

TABLE 3
Distribution of Birth Outcomes for Overall Study Population and by Maternal Occupation

	Maternal Occupation			
	Overall (N=1,024)	No Work (n=627)	Non-Farmwork (n=255)	Farmwork (n=142)
PTLBW; % (n) *	8.2 (84)	8.0 (50)	8.6 (22)	8.5 (12)
PT; % (n) *	7.0 (72)	6.9 (43)	6.7 (17)	8.5 (12)
LBW; % (n) *	4.7 (48)	4.6 (29)	4.7 (12)	4.9 (7)
Birthweight; grams (SE) **	3361.3 (17.1)	3357.9 (21.7)	3373.3 (35.6)	3354.7 (44.3)
Gestational Age; weeks (SE) **	39.61 (0.07)	39.73 (0.09)	39.57 (0.15)	39.58 (0.16)
Male sex; % (n) *	52.6 (537)	51.8 (323)	53.3 (136)	54.9 (78)

SE indicates standard error

* p-value based on one-way ANOVA

** p-value based on chi-square test

TABLE 4
Multivariate Logistic Regression Models for Adverse Pregnancy Outcomes*

	Adverse Pregnancy Outcome		
	PTLBW OR (95% CI)	PT OR (95% CI)	LBW OR (95% CI)
Age			
18 – 34 years	1.00	1.00	1.00
< 18 years	0.75 (0.30, 1.87)	1.07 (0.42, 2.73)	0.97 (0.32, 2.93)
> 34 years	3.70 (1.96, 7.00)	3.63 (1.86, 7.10)	3.99 (1.81, 8.80)
Gravidity			
≥ 1	1.00	1.00	1.00
0	1.62 (0.96, 2.72)	1.39 (0.78, 2.46)	1.55 (0.78, 3.06)
Maternal Occupation			
No Work	1.00	1.00	1.00
Non-Farmwork	0.77 (0.43, 1.39)	0.76 (0.40, 1.45)	0.72 (0.33, 1.57)
Farmwork	1.28 (0.65, 2.54)	1.52 (0.76, 3.04)	1.30 (0.54, 3.11)
Acculturation			
Level I	1.00	1.00	1.00
Level II	1.45 (0.61, 3.42)	1.34 (0.53, 3.36)	1.39 (0.46, 4.24)
Level III	2.92 (1.52, 5.61)	2.65 (1.31, 5.35)	3.26 (1.44, 7.35)
Level IV	3.03 (1.31, 7.01)	2.13 (0.81, 5.63)	3.45 (1.24, 9.63)
Level V	1.80 (0.78, 4.17)	1.79 (0.73, 4.36)	1.16 (0.33, 4.14)

OR indicates odds ratio

* Model includes age, gravidity, maternal occupation and acculturation