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ORIGINAL PAPER

# Lower Rates of Preterm Birth in Women of Arab Ancestry: An Epidemiologic Paradox—Michigan, 1993–2002

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**Abstract** *Objective:* Preterm birth (PTB), $< 37$ weeks gestation, occurs in 12.1% of live births annually and is associated with significant morbidity and mortality in the United States. Racial/ethnic subgroups are disproportionately affected by PTB. Michigan is home to one of the largest Arab-American communities in the country; however, little is known about PTB in this population. This study examined the maternal demographic profile and risk factors of preterm birth (PTB) among foreign-born and US-born women of Arab ancestry relative to US-born Whites in Michigan.

*Methods:* Using Michigan Vital Statistics data, we examined correlates of PTB for primiparous U.S.-born white ($n = 205{,}749$), U.S.-born Arab ($n = 1{,}697$), and foreign-born Arab ($n = 5{,}997$) women who had had a live-born singleton infant during 1993–2002. We examined variables commonly reported to be associated with PTB, including mother's age and education; insurance type; marital status of parents; receipt of prenatal care; mother's chronic hypertension, diabetes, and tobacco use; and infant sex.

*Results:* Foreign-born Arabs are less educated and more likely to be on Medicaid, and they receive less prenatal care than US-born Whites. Prevalence of PTB was 8.5, 8.0, and 7.5% for US-born Whites, US-born Arabs, and foreign-born Arabs, respectively. Pregnancy-related hypertension was the only predictor of PTB that these three groups had in common: Adjusted Odds Ratio (AOR) = 2.1 (95% Confidence Interval (CI) = 1.99, 2.21), AOR = 2.6 (95% CI = 1.24, 5.51), and AOR = 2.6 (95% CI = 1.55, 4.31) for US-born whites, US-born Arabs, and foreign-born Arabs, respectively.

*Conclusions:* Foreign-born Arab women in Michigan have a higher-risk maternal demographic profile than that of their US-born white counterparts; however, their prevalence of PTB is lower, which is consistent with the epidemiologic paradox reported among foreign-born Hispanic women.

**Keywords** Preterm · Birth outcomes · Ancestry · Arab

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## Introduction

Preterm birth (PTB) occurred in approximately 12.1% of all live births and in 10.6% of singletons in 2003 and is associated with significant morbidity and mortality in the United States [1, 2]. Although there has been a general decline in the PTB rate over the last 30 years, there has been a slight increase in the past few years. Furthermore, there are persistent racial/ethnic disparities in the rates of PTB. Specifically, average preterm birth rates (2001–2003) were 11.0%

among non-Hispanic whites, 17.7% among non-Hispanic blacks, 10.4% among Asians, 13.2% among Native Americans/Alaskan Natives, and 11.6% among Hispanic women in the United States [1]. PTB prevalence for these racial/ethnic subgroups was similar in Michigan during 2001–2003. However, little is known about the PTB experience of women of Arab ancestry in Michigan, despite the fact that it is home to approximately 490,000 persons of Arab ancestry, one of the largest populations of Arab immigrants outside of the Middle East [3, 4]. Births to women of Arab ancestry comprise approximately 3.0% of all the live births in the state annually [5].

Previous studies have documented perinatal outcomes among US immigrants, including lower rates of infant mortality, low birth weight, and PTB than expected based on their demographics, particularly socioeconomic status (SES) [6, 7]. Mother's birthplace has also been highlighted as an important predictor of birth outcomes among immigrant subgroups in the United States. For example, foreign-born Hispanic women, despite a high-risk demographic and socioeconomic profile, experience birth outcomes superior to those of their US-born counterparts [8–11]. A different epidemiological paradox was observed for foreign-born Asian and Asian Indian women, who, despite a better SES profile, experienced a higher incidence of low birth weight and PTB than their US-born counterparts [6, 12]. Furthermore, studies have demonstrated that perinatal outcomes, regardless of race and ethnicity, were superior in first-generation immigrant groups compared with outcomes in subsequent generations [13–17].

The study of specific ethnic and cultural groups may increase our understanding of how social and cultural determinants affect birth outcomes. Thus, the objectives of our study were to describe the association between demographic, socioeconomic, and selected clinical risk factors and to compare the outcome of PTB of women of Arab ancestry to that of US-born non-Hispanic white women in Michigan, during 1993–2002. We also attempted to examine the effects of acculturation by comparing PTB prevalence between US born non-Hispanic white women, US born women of Arab ancestry, and foreign born women of Arab ancestry.

## Methods

### Study population

We conducted a population-based study using 1993–2002 birth certificate data provided by the Vital Records and Health Data Development Section of the Michigan Department of Community Health. During this time period, there were 29,305 live births to mothers who self-reported Arab ancestry in birth certificate data. Of these, 23,748 were to foreign-born Arab mothers and 5,557 were to US-born Arab mothers. During the study time period, there were 946,936 live births to women who self-reported white race and non-Hispanic ancestry, of which 916,955 were US-born mothers. To limit the effects of correlated observations, we limited our study to primiparous mothers who gave birth to singletons, resulting in a study population of 289,204 live births to US-born whites of non-Hispanic ancestry and 9,040 live births among women of Arab ancestry (any race). We also excluded births with missing data for variables of interest (mother's age and education, expected payer source, number of named parents, prenatal care, tobacco use, chronic and pregnancy-related hypertension, diabetes, and infant sex) in the beginning rather than excluding them in the multivariate analysis stage only. The final study population was 205,749 live births to US-born white women and 7,694 to women of Arab ancestry (5,997 foreign-born and 1,697 US-born). Self-reported country of birth for the foreign-born Arab women were as follows: Iraq (32%), Lebanon (29%), Yemen (7%), Jordan (4%), Syria (5%), Israel/Jerusalem/Palestine (2%), Kuwait (2%), Egypt (2%), India (2%), Pakistan (2%), Bangladesh (1.5%), Saudi Arabia (1.3%) and a number of other countries (10.2%) that individually constituted less than 1% of the foreign-born Arab group in this study population.

### Variables

Based on the review of literature of risk factors that have been linked to PTB as well as the availability of such data in vital records, we used live birth certificate records for the study time period and obtained the following data: maternal age, race, ancestry, country of birth, and education; number of named parents, expected payer source for delivery, prenatal care, infant sex, chronic hypertension status, pregnancy-related hypertension status, diabetes (gestational or pre-existing), tobacco use during pregnancy, and calculated gestational weeks (based on last menstrual period). Martial status is currently not collected on live birth certificates in Michigan, but we used number of named parents as an indicator for such. Education level and expected payer source of Medicaid were used to describe maternal socioeconomic status. We assigned women to three racial/ancestry groups (US born non-Hispanic white, US born Arab, and foreign-born Arab) based on responses to the race, ancestry and country of birth variables. We defined the outcome of PTB as a live birth of less than 37 calculated gestational weeks.

### Data analysis

We calculated the proportion of PTB (excluding live births of less than 20 weeks gestation) and the prevalence of selected characteristics for each group of mothers. Statistical significance of differences of these proportions was assessed

**Table 1** Selected maternal characteristics for primiparous US-born white, foreign-born Arab, and US-born Arab Women, Michigan Singleton Live Births, 1993–2002

| Characteristic (%) | US-born whites ($n$ = 205,749) | US-born Arabs ($n$ = 1,697) | Foreign-born Arabs ($n$ = 5,997) |
|---|---|---|---|
| Age | | | |
| ≤19 | 12.7 | 19.1[a] | 13.2[b] |
| ≥35 | 6.5 | 5.7 | 5.9 |
| Education | | | |
| <High school or none | 10.5 | 14.1[a] | 20.6[a,b] |
| Expected source of payment | | | |
| Medicaid | 17.7 | 23.4[a] | 44.1[a,b] |
| One named parent | 16.9 | 7.5[a] | 2.0[a,b] |
| Prenatal care | | | |
| None | 0.7 | 1.1 | 1.1[a] |
| Tobacco use during pregnancy | 12.1 | 4.8[a] | 1.8[a,b] |
| Medical risks | | | |
| Chronic hypertension | 0.8 | 0.4 | 0.2[a] |
| Pregnancy-related hypertension | 6.1 | 3.2[a] | 1.9[a,b] |
| Diabetes | 2.5 | 1.7[c] | 1.9[a] |

[a]Compared with US-born white mothers, $\chi^2$ test, $p < 0.01$.

[b]Compared with US-born Arab mothers, $\chi^2$ test, $p < 0.01$.

[c]Compared with US-born white mothers, $\chi^2$ test, $p < 0.05$.

using the Chi-square test. Specifically, we compared US-born whites to foreign-born Arabs, US-born whites to US-born Arabs, and US-born Arabs to foreign-born Arabs. To examine the independent association of the selected characteristics with the outcome of PTB, separate logistic regression analyses for each group of mothers were run using SAS for Windows, Version 9.0 (SAS Institute, Cary, NC).

## Results

Table 1 summarizes the selected characteristics of mothers in each racial/ancestral group. Foreign-born Arabs had a higher-risk profile compared with US-born whites in terms of level of education completed, expected payer source for delivery, and lack of receipt of prenatal care. Specifically, foreign-born Arabs were nearly twice as likely as US-born whites to report less than high school or no education, more than twice as likely to report Medicaid as the expected payer source for delivery, and more likely to report receiving no prenatal care (Table 1). However, foreign-born Arabs were significantly less likely than US-born whites to report the following risks: have only one named parent on the birth certificate, tobacco use during pregnancy, chronic hypertension, pregnancy-related hypertension, or diabetes (Table 1).

Compared with US-born white mothers, US-born Arab mothers had a higher-risk demographic and socioeconomic profile in terms of percentage of births to teens, percentage of mothers with less than high school or no education, and proportion of mothers with Medicaid as the expected payer source (Table 1). However, US-born Arabs were significantly less likely than US-born whites to report the following risks: one named parent on the birth certificate, tobacco use during pregnancy, and pregnancy-related hypertension or diabetes (Table 1).

A comparison of the two groups of Arab mothers showed differences on a number of characteristics. Specifically, foreign-born Arabs were less likely than their US-born Arab counterparts to be younger mothers, to report one named parent on the birth certificate, to report tobacco use during pregnancy, and to have pregnancy-related hypertension (Table 1). However, foreign-born Arabs were more likely than their US-born Arab counterparts to have less than high school or no education and to report Medicaid as the expected payer source for delivery (Table 1).

The number and proportion of PTB for each racial/ancestral group are summarized in Table 2. Prevalence of PTB was 8.5, 7.5, and 8.0% for US-born whites, foreign-born Arabs, and US-born Arabs, respectively. The proportion of PTB was significantly lower for foreign-born Arab women compared with US-born whites (Table 2). The differences between US-born whites and US-born Arab women and between US-born Arabs and foreign-born Arabs were not significant (Table 2).

In multivariable logistic regression models for each racial/ancestral group, the covariates significantly associated with the outcome of PTB were different for each group, with the exception of pregnancy-related hypertension (Table 3).

**Table 2** Number and proportion (%) of preterm births for primiparous US-born White, Foreign-born Arab, and US-born Arab Women, Michigan Singleton Live Births,[a] 1993–2002

| Characteristic | US-born Whites ($n$ = 205,688) (%) | US-born Arabs ($n$ = 1,695) (%) | Foreign-born Arabs ($n$ = 5,996) (%) |
|---|---|---|---|
| Preterm (<37 weeks) | 17,463 (8.5) | 135 (8.0) | 451 (7.5)[b] |

[a]Limited to live births at ≥20 weeks gestation.

[b]Compared with US-born white mothers, $\chi^2$ test, $p < 0.05$.

**Table 3** Adjusted[a] odds ratios and 95% confidence intervals for preterm birth, by Racial/Ancestral Group—Michigan Singleton Live Births,[b] 1993–2002

| Characteristic | US-born Whites ($n$ = 205,688) | US-born Arabs ($n$ = 1695) | Foreign-born Arabs ($n$ = 5996) |
|---|---|---|---|
| Mother's age (years) | | | |
| ≤19 | 1.0 (0.98, 1.11) | 0.9 (0.50, 1.47) | 1.2 (0.93, 1.62) |
| 20–34 | **Reference** | Reference | Reference |
| ≥35 | **1.4** (**1.29**, **1.45**) | 1.3 (0.64, 2.74) | 1.0 (0.64, 1.47) |
| Mother's education | | | |
| < High school or none | **1.2** (**1.17**, **1.33**) | 1.3 (0.72, 2.27) | 1.2 (0.96, 1.55) |
| High school or higher | **Reference** | Reference | Reference |
| Expected source of payment | | | |
| Medicaid | 1.0 (0.94, 1.03) | 1.4 (0.86, 2.11) | **1.2** (**1.02**, **1.52**) |
| Private, self-pay, other | Reference | Reference | **Reference** |
| Number of named parents | | | |
| One | **1.2** (**1.18**, **1.31**) | 1.5 (0.80, 2.74) | 1.5 (0.82, 2.54) |
| Two | **Reference** | Reference | Reference |
| Prenatal care | | | |
| None | **2.3** (**1.97**, **2.59**) | **4.3** (**1.46**, **12.52**) | 1.8 (0.86, 3.59) |
| Any | **Reference** | **Reference** | Reference |
| Infant sex | | | |
| Male | **1.2** (**1.14**, **1.22**) | 1.1 (0.75, 1.53) | 1.1 (0.89, 1.31) |
| Female | **Reference** | Reference | Reference |
| Tobacco use during pregnancy | **1.1** (**1.05**, **1.16**) | 1.4 (0.67, 2.84) | 1.5 (0.83, 2.83) |
| Medical risks | | | |
| Chronic hypertension | **1.9** (**1.62**, **2.14**) | 2.3 (0.27, 19.30) | 2.8 (0.54,14.44) |
| Pregnancy-related hypertension | **2.1** (**1.99**, **2.21**) | **2.6** (**1.24**, **5.51**) | **2.6** (**1.55**, **4.31**) |
| Diabetes | **1.4** (**1.27**, **1.52**) | 0.3 (0.06, 3.24) | **2.3** (**1.31**, **3.86**) |

Data Source: Michigan Vital Records, Birth Files, 1993–2002.

[a]Adjusted for all variables shown.

[b]Limited to live births at ≥ 20 weeks gestation.

*Note*. Bold indicates $p < 0.05$.

Among US-born white women, for example, all of the covariates were significantly associated with PTB, with the exception of young age and Medicaid as the expected payer source for delivery. Medical risks of chronic hypertension (OR = 1.9, 95% CI: 1.62–2.14), pregnancy-related hypertension (OR = 2.1, 95% CI: 1.99–2.21), and diabetes (OR = 1.4, 95% CI: 1.27–1.52) were important predictors of PTB for these women. Other factors that predicted PTB among US-born white mothers were as follows: lack of prenatal care (OR = 2.3, 95% CI: 1.97–2.59), tobacco use during pregnancy (OR = 1.1, 95% CI: 1.05–1.16), number of named parents (OR = 1.2, 95% CI: 1.2, 1.18–1.31), having less than high school education (OR = 1.2, 95% CI: 1.17–1.33), and older age (OR = 1.4, 95% CI: 1.29–1.45) (Table 3).

Fewer of the covariates examined were predictors of PTB among Arab women. Among foreign-born Arab women, for example, only pregnancy-related hypertension (OR = 2.6, 95% CI: 1.55–4.31), diabetes (OR = 2.3, 95% CI: 1.31–3.86), and having Medicaid as the expected source of payment (OR = 1.2, 95% CI: 1.02–1.52) were significantly associated with PTB (Table 3). For US-born Arab women, lack of prenatal care (OR = 4.3, 95% CI: 1.46–12.52) and pregnancy-related hypertension (OR = 2.6, 95% CI: 1.24–5.51) were the only correlates significantly associated with PTB (Table 3).

## Discussion

To the best of our knowledge, this study is the first to examine PTB among Arab women immigrants in the United States. Our results describe associations similar to the epidemiological paradox that has been documented among foreign and US-born women from other racial/ethnic groups. Specifically, foreign-born Arab women, despite being at a considerable socioeconomic disadvantage (having less education, being more likely to report Medicaid as the expected payer source, and more likely to receive no prenatal care at all), have a relatively lower rate of PTB than expected. This paradox, previously described among other immigrant populations in the United States, highlights the need for continued study of ethnic minorities to elucidate how social and cultural factors work to influence birth outcomes [9, 11, 13–18]. Our results also stress the importance of collecting additional

data, beyond vital statistics, for the study of the correlates of PTB among US racial/ethnic minorities, since very few of the vital statistics variables we examined predicted PTB in women of Arab ancestry.

Foreign-born and US-born Arabs had a higher-risk profile compared to US-born whites in terms of level of completed education, expected payer source for delivery, and lack of prenatal care, yet these women did not experience a higher prevalence of PTB. A number of factors may explain this paradox. For example, the proportion of Arab women with only one named parent reported on the birth certificate was the lowest among foreign-born Arabs (2.0%) and highest for US-born whites (16.9%). The number of named parents may be an indicator for the existence of stronger family or social support or paternal involvement for these women, which, in turn, may be positively influencing their birth outcomes, particularly if number of named parents is an indicator for marital status when two parents are named [19, 20].

Tobacco use rates were also lower among Arab women. Specifically, the rate of tobacco use during pregnancy was highest among US-born whites, followed by US-born Arabs, and lowest for foreign-born Arabs. The tobacco use rates observed for these subgroups during this 10-year study period are consistent with the tobacco use rates reported for 2004 live births in Michigan; specifically, 14.5% of whites and 2.9% of Arabs [21]. Furthermore, diabetes (unknown whether gestational or not) and chronic hypertension rates were also lower among Arab groups than among whites, which may indicate a difference in the overall health status of these groups of women.

Pregnancy-related hypertension, a recognized cause of PTB, was the only predictor significantly associated with the outcome of PTB that all three groups of women had in common. A very small proportion of the women in our study had no prenatal care documented in their infant's birth record, and this finding is not consistent with the no-prenatal-care rates reported for other racial/ethnic groups in the United States [1, 22]. Lack of prenatal care was not a statistically significant predictor of PTB among foreign-born Arabs, although this may be due to small sample size since a small proportion of Arab women had no prenatal care documented in vital records data. Previous studies have documented variations in the association between lack of prenatal care and PTB, stressing the need for additional data sources (beyond vital statistics) in the study of major birth outcomes [23–25].

Results from a study of Mexican Americans found that longer residence in the United States resulted in increased risk of PTB among foreign-born Mexican Americans, indicating that acculturation plays a major role in reversing the effects of traditionally protective social and cultural factors [9]. Similarly, our results suggest that behaviors of Arab women are also being altered by residing in the United States, as evidenced by the higher rates of selected characteristics among US-born Arabs than among their foreign-born counterparts. Specifically, more US-born Arab mothers than foreign-born Arab mothers report tobacco use during pregnancy and list only one named parent on their infants' birth certificates. It is very likely that this higher rate of tobacco use among US-born Arabs is due to acculturation because previous studies have documented that smoking rates among Arab women are significantly lower than those of non-Arabs in Michigan [26]. Or, these findings could indicate that Arab women who smoke may be more likely than non-Arab women to cease tobacco use during pregnancy; if so, further study of Arab immigrants in the United States may result in the identification of factors associated with successful tobacco cessation during pregnancy.

While it is difficult to interpret what exactly the "number of named parents" variable on the birth record represents, it is clear that western culture influences this variable because US-born white women have a more than eight-fold higher rate of not listing their child's father on the birth record than do foreign-born Arab women, whereas the rate for US-born Arab women sits in between. A revision of Michigan's birth records to include marital status of the mother would allow for the study of the relationship between marital status and PTB for this subpopulation in Michigan.

The findings in this study are subject to a number of limitations. Because this study was restricted to data available on the birth certificate, a primary limitation was the unavailability of important qualitative information on such things as specific cultural behaviors [12], years of residence in the United States, acculturation, social inequality [5], and impediments to receiving prenatal care, including lack of transportation or child care services, having more pertinent health problems, fear of substance abuse discovery [13], or lack of knowledge of support services [14]. We also could not assess the importance of mothers' diets, social support, prenatal attitudes toward pregnancy, or prenatal stress as they relate to PTB. Other limitations were our use of weak indicators for important social and demographic factors, such as using Medicaid as the expected payer source for delivery services as an indicator for low-income status and maternal place of birth as a measure of acculturation. Small sample size for selected risk factors among the Arab groups, such as tobacco use, lack of prenatal care, and maternal medical risks, was also a limitation and may explain the lack of statistical significance for their association with the outcome of PTB.

We were also unable to study the relationship between marital status and PTB in our study because Michigan does not collect marital status in vital records data, and it is difficult to elucidate the meaning of the "number of named parents" field; suggestions for the revision of birth records to include marital status are currently being considered. The "number of named parents" variable might, however, provide

better insight to the mother's true household/social dynamic than a "marital status" variable would.

The reliability, validity, and completeness of information recorded in vital statistics data was also a limitation of this study; therefore, future research should include other data sources for important variables. Specifically, we excluded the following eligible primiparous women due to missing data: 28.9% of US-born White women, 14.5% of foreign-born Arab women, and 16.3% of US-born Arab women. Relevant univariate analyses which included all subjects with available data, however, did not alter the conclusions we have drawn here concerning the prevalence of PTB, the predictors of PTB, or the paradox we have reported for foreign-born. Our multivariate findings, however, may still be biased by missing data. It is also important to note that the findings we report here have limited generalizability since our study was restricted to primiparous women.

Despite these limitations, the paradox we illustrated for yet another immigrant group highlights the need for continued research among immigrant groups in the United States to enhance our understanding of how social factors influence perinatal outcomes.

The majority of routinely collected vital statistics data that has been reported to be associated with PTB among US-born whites is not as informative for Arab women (either foreign or US born). Arab immigrants in the United States are a much understudied population. Our findings suggest that continued study of this immigrant population—including the collection of data on acculturation, cultural and family habits, and social support mechanisms—may increase our understanding of the impact of social and cultural factors on maternal and child health outcomes.

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