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# Explaining the Low Risk of Preterm Birth Among Arab Americans in the United States: An Analysis of 617 451 Births

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## What's Known on This Subject

It has been shown that women of Arab ethnicity are at lower risk for adverse birth outcomes than white women in the United States and Europe.

## What This Study Adds

Little is known about the determinants of adverse birth outcomes among Arab Americans or about factors that may contribute to the lower risk for adverse birth outcomes among Arab American women compared with white American women.

## ABSTRACT

**OBJECTIVES.** Arab Americans have a lower risk for preterm birth than white Americans. We assessed factors that may contribute to the association between ethnicity and preterm birth risk in Michigan, the state with the largest concentration of Arab Americans in the United States. Factors assessed as potential contributors to the ethnicity/preterm birth risk association were maternal age, parity, education, marital status, tobacco use, and maternal birthplace.

**METHODS.** Data were collected about all births in Michigan between 2000 and 2005. Stratified analyses, trivariate analyses, and manual stepwise logistic regression model building were used to assess potential contributors to the ethnicity/preterm birth risk association.

**RESULTS.** Arab ethnicity was associated with lower preterm birth risk compared with non-Arab white subjects in the unadjusted model. Maternal birthplace inside or outside the United States explained 0.17 of the difference in preterm birth risk between Arab ethnicity and non-Arab white mothers; ethnic differences in marital status and tobacco use explained less of the observed ethnic difference in preterm birth risk. In the final model adjusted for all explanatory variables, Arab ethnicity was no longer associated with preterm birth risk.

**CONCLUSIONS.** Maternal birthplace, marital status, and tobacco use may contribute to the preterm birth risk difference between Arab ethnicity and non-Arab white mothers. Additional work is needed to consider the mechanisms relating factors such as maternal birthplace and marital status to ethnic differences in preterm birth risk.

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This work is not the result of a clinical trial.

### Key Words

Arab American, ethnicity, preterm birth, birth outcomes

### Abbreviations

PTB—preterm birth  
AE—Arab ethnicity  
NAW—non-Arab white  
SES—socioeconomic status  
OR—odds ratio  
CI—confidence interval

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**A**RAB ETHNICITY (AE), or ancestral, cultural, or linguistic heritage or identity that traces back to 1 of 22 Arab countries, is associated with lower risk for adverse birth outcomes compared with white women in both the United States<sup>1</sup> and Europe.<sup>2</sup> In the United States, it has been shown that women with self-reported AE are 16% less likely than white women to have preterm births (PTBs).<sup>3</sup>

Although AE is associated with lower risk for PTB, persons of AE have, in general, worse health than do white Americans.<sup>4–8</sup> In addition, persons of AE in the United States have substantially lower socioeconomic status (SES) than white Americans<sup>9</sup>; low SES has, in turn, been associated with a range of adverse morbidities and mortalities among other racial and ethnic groups.<sup>10,11</sup> The observation that Arab Americans have lower PTB risk than white Americans despite their lower SES is a paradox that has been previously discussed in scientific literature but remains unexplained.<sup>1,2</sup> There have been several primary explanations posited in the literature that may explain the association between AE and lower risk of PTB compared with other racial and ethnic groups. We considered the following 6 explanations.

First, teenagers and mothers >35 years of age have been shown to have a higher risk for PTB.<sup>12–15</sup> There are proportionately fewer AE mothers who have children when <16 years of age and >35 years of age compared with

**TABLE 1** Descriptive Statistics and Bivariate Associations Between Each Covariate and PTB

	Total No.	%	PTB	
			n (%)	P
Ethnicity				<.01
NAW	597 937	75.99	55 917 (9.35)	
Arab	19 514	2.48	1593 (8.16)	
Mother/infant characteristics				
Parity				<.01
0 previous	241 540	39.20	23 023 (9.53)	
1 previous	205 079	33.30	17 436 (8.50)	
2 previous	105 765	17.20	9787 (9.25)	
≥3 previous	62 119	10.10	6978 (11.23)	
Unknown	1533	0.25	187 (12.20)	
Marital status				<.01
Unmarried	165 688	26.90	16 284 (9.83)	
Married	450 348	73.10	41 127 (9.13)	
Mother's age, y				<.01
<20	49 871	8.10	4832 (9.69)	
20–25	142 121	23.07	12 175 (8.57)	
26–30	178 416	28.96	15 540 (8.71)	
31–35	160 287	26.02	15 342 (9.57)	
36–40	70 752	11.49	7634 (10.79)	
≥41	14 547	2.36	1874 (12.88)	
Education				<.01
<11 y	91 203	14.80	8783 (9.63)	
GED or equivalent	191 680	31.12	17 679 (9.22)	
College	255 591	41.49	23 529 (9.21)	
Masters or above	8538	11.13	6397 (9.33)	
Unknown	9024	1.46	1023 (11.34)	
Mother's place of birth				<.01
Foreign	61 811	10.03	4773 (7.72)	
United States	554 225	89.97	52 638 (9.50)	
Tobacco use				<.01
None	512 863	83.25	46 444 (9.06)	
Yes	103 173	16.75	10 967 (10.63)	

GED indicates General Equivalency Diploma.

white Americans<sup>16</sup>; this difference in maternal age distribution could account for differences in PTB risk between AE and white mothers.

Second, parity has also been shown to affect birth outcomes: older primiparous mothers are at increased risk for adverse birth outcomes.<sup>17–19</sup> In a study by Gilbert and colleagues,<sup>15</sup> minority women accounted for 36% of primiparous mothers >40 years of age and 61% of primiparous mothers between 20 and 29 years of age; therefore, minorities are less likely to be older and primiparous than white mothers. Because minority mothers are generally less likely to be older and primiparous than white mothers, AE mothers may also be less likely to be older and primiparous, which may explain the ethnicity/PTB risk association.

Third, higher levels of maternal education are associated with lower risk for adverse birth outcomes.<sup>20–24</sup> AE women are better educated than the general population of American women.<sup>25</sup> Therefore, differences in education between AE mothers and white mothers may account for differences in PTB risk.

Fourth, pregnancy out of wedlock has been shown to be associated with higher risk for PTB.<sup>26–29</sup> Among mothers who gave birth in Michigan between 2000 and 2001, 96.2% of AE mothers were married at time of birth

compared with 72.5% of white mothers.<sup>16</sup> Therefore, differences in rates of pregnancy out of wedlock could explain the ethnicity/PTB risk association.

Fifth, tobacco use during pregnancy has also been shown to increase risk for adverse birth outcomes.<sup>30–34</sup> It has been shown that AE mothers are less likely to use tobacco during pregnancy than their white counterparts,<sup>35</sup> possibly contributing to the ethnicity/PTB risk association in question.

Sixth, maternal birth outside of the United States has been shown to be associated with lower risk of adverse birth outcomes.<sup>30–34</sup> AE mothers are more likely to be foreign-born than white mothers.<sup>1,16</sup> Differences in rates of maternal birth outside of the United States between AE and white mothers may, in part, explain differences in PTB risk.

Although there have been other explanations in the literature that could potentially contribute to the association between AE and risk for PTB, such as differences in socioeconomic status<sup>36</sup> or psychosocial stress,<sup>37–45</sup> we were limited to these 6 by the covariates available in the data analyzed here. It was the purpose of this study to systematically assess each of these 6 possible explanations as contributors to the association between AE and PTB risk by using data about all birth outcomes in Mich-

igan, the state with the highest per capita population of Arab Americans.

## PATIENTS AND METHODS

### Data

Data were collected on all births in the state of Michigan between September 2000 and March 2005. Data were compiled from the birth records of the state of Michigan by the Michigan Department of Community Health.

The primary outcome of interest was PTB; infants with gestation of <37 weeks were considered to be PTBs.<sup>46</sup> Birth data in the state of Michigan includes information on race, ethnicity, and ancestry (including Arab ancestry). Therefore, self-reported Arab ancestry was used as to delineate AE cases, and self-reported race was used to classify non-Arab white (NAW) mothers. Along with ethnicity, the following covariates were collected: marital status at parturition, parity, maternal age, maternal education, maternal tobacco use during pregnancy, and maternal birthplace (United States or foreign).

This study was reviewed by the University of Michigan Health Science Institutional Review Board and the institutional review board of the Michigan Department of Community Health.

### Analysis

We assessed PTB risk among AE and NAW mothers. We used 2-tailed  $\chi^2$  tests to identify significant associations ( $\alpha = .05$ ) between each of the covariates of interest and PTB, as well as between each ethnicity and each covariate of interest.

Covariates significantly associated with both ethnicity and PTB were considered as variables that could potentially contribute to the association between AE and lower PTB risk. These variables were included in trivariate logistic regression models of the association between AE and PTB risk. The contribution of each covariate was calculated as the absolute change in adjusted odds ratio (OR) in the trivariate model compared with the bivariate model. A final multivariable regression model was built: all variables that were found to contribute to the association between AE and PTB risk were added sequentially in a stepwise fashion to determine the effect of subsequent variable addition on the relation between AE and PTB risk. Variables were added in order from those that most strengthened the ethnicity/risk association to those that most explained it.

SAS 9.1 (SAS Institute, Inc, Cary, NC) was used to carry out all statistical analyses. Statistical significance was set at the  $P = .05$  level.

## RESULTS

We collected data on 617 451 births. Table 1 shows descriptive statistics and 2-tailed  $\chi^2$  tests between each covariate and PTB. The prevalence of PTB among NAW mothers was 9.4% and 8.2% among Arab American mothers. In stratified analyses, each of the covariates of interest, namely maternal age, education, parity, marital

**TABLE 2** Bivariate Associations Between Maternal Ethnicity and Covariates of Interest

Mother/Infant Descriptives	NAW, %	Arab Ethnicity, %	P
Parity			<.01
0 previous	39.39	34.22	
1 previous	33.46	28.52	
2 previous	17.10	19.18	
$\geq 3$ previous	9.82	17.44	
Unknown	0.23	0.63	
Marital status			<.01
Unmarried	27.73	4.09	
Married	72.27	95.91	
Mother's age, y			<.01
<20	8.19	5.60	
20–25	23.01	24.67	
26–30	28.90	30.75	
31–35	26.09	24.22	
36–40	11.48	11.76	
$\geq 41$	2.34	3.00	
Education			<.01
<11 y	14.55	21.84	
GED or equivalent	31.01	34.04	
College	41.87	31.09	
Masters or above	11.18	9.75	
Unknown	1.40	3.28	
Mother's place of birth			<.01
Foreign	7.46	80.67	
United States	92.54	19.33	
Tobacco use			<.01
None	82.83	94.93	
Yes	15.76	3.33	

GED indicates General Equivalency Diploma.

status, tobacco use, and maternal birthplace was significantly associated with PTB.

Table 2 shows the associations between maternal ethnicity and covariates of interest as well as  $P$  values for 2-tailed  $\chi^2$  tests between each of the dyads; there was a significant association between maternal ethnicity and each of the covariates. The prevalence of pregnancy out of wedlock was lower among AE mothers (4.1%) than among NAW mothers (27.7%). AE mothers were also less likely to report tobacco use (3.3%) than NAW mothers (15.8%). Finally, 80.7% of AE mothers were foreign-born compared with 7.5% of NAW mothers.

Table 3 shows trivariate logistic regression models with PTB as the dependant variable and ethnicity and each of the potential contributor covariates individually as independent variables. In the unadjusted model, there was a significant association between AE and lower risk for PTB (OR: 0.76 [95% confidence interval (CI): 0.72–0.79]). Adjusting for age had no effect on the association between AE and risk for PTB, whereas the association was strengthened after adjusting for both parity (OR: 0.73 [95% CI: 0.70–0.77]) and education (OR: 0.74 [95% CI: 0.71–0.78]). Adjusting for the following potential contributors weakened the association between AE and PTB risk: tobacco use (OR: 0.77 [95% CI: 0.74–0.81]), marital status (OR: 0.82 [95% CI: 0.78–0.87]), and maternal birthplace (OR: 0.93 [95% CI: 0.89–0.98]). Ethnic differences in maternal birth-

**TABLE 3** Trivariate Logistic Regression Models of the Association Between Ethnicity and PTB Adjusted for Potentially Contributing Variables

Variables	Model 1		Model 2		Model 3		Model 4		Model 5		Model 6		Model 7	
	OR	CI	OR	CI	OR	CI	OR	CI	OR	CI	OR	CI	OR	CI
Ethnicity														
NAW	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref
Arab	0.76	0.72–0.79	0.76	0.72–0.79	0.74	0.71–0.78	0.73	0.70–0.77	0.82	0.78–0.87	0.77	0.74–0.81	0.93	0.89–0.98
Mother's age, y														
<20			1.13	1.10–1.16										
20–25			Ref	Ref										
26–30			0.97	0.95–0.99										
31–35			1.06	1.04–1.09										
36–40			1.23	1.20–1.26										
≥41			1.53	1.46–1.60										
Education														
<11 y					1.2	1.20–1.28								
GED or equivalent					1.1	1.08–1.14								
College					1.0	1.02–1.07								
Masters or above					Ref	Ref								
Unknown					1.5	1.40–1.54								
Parity														
0 previous							Ref	Ref						
1 previous							0.92	0.90–0.93						
2 previous							1.04	1.06–1.12						
≥3 previous							1.44	1.40–1.47						
Unknown							1.64	1.48–1.81						
Married														
Yes									0.77	0.76–0.78				
No									Ref	Ref				
Tobacco use														
None											Ref	Ref		
Yes											1.23	1.21–1.26		
Mother's place of birth														
United States													Ref	Ref
Foreign													0.74	0.72–0.76

Ref indicates reference group; GED, General Equivalency Diploma.

place, marital status, and tobacco use explained 0.17, 0.06, and 0.01 of the difference in PTB risk between AE and NAW mothers, respectively.

Table 4 shows stepwise logistic regression model with PTB as the dependant variable and ethnicity as the main independent variable sequentially adjusted for each of the variables that either strengthened or explained the ethnicity/PTB risk association. In the final, fully adjusted model, there was no association between AE and risk for PTB (OR: 0.96 [95% CI: 0.91–1.01]).

## DISCUSSION

In a study of 617 451 births in the state of Michigan from 2000 to 2005, we found that significant differences in rates of tobacco use, extra-marital pregnancy, and foreign birth between AE and NAW mothers explained the association between AE and lower PTB risk.

We found that tobacco use contributed to the relationship between AE and lower PTB risk in our analysis. Although it has been shown that AE mothers are less likely to smoke than NAW mothers,<sup>35</sup> to our knowledge, there are have been no studies published that document the relevance of maternal tobacco use as a contributor to

the relationship between AE and risk for adverse birth outcomes.

Our finding that marital status was a contributor to the association between AE and lower PTB risk is consistent with several studies that have suggested differences in marital rates among ethnic and racial groups as partial explanations for differences in risk for adverse birth outcomes.<sup>2,47–52</sup>

Finally, our finding that maternal birthplace contributed to the association between AE and lower risk for PTB is consistent with a small body of work that has shown that maternal foreign birth is a moderator of the association between race/ethnicity and lower risk for adverse birth outcomes among several other minority groups, including black Americans, Asian Americans, and Hispanic Americans.<sup>1,2,47,50,51,53,54</sup> Of particular note, Cervantes and colleagues<sup>51</sup> showed that among 57 324 live births in Chicago in 1994, Mexican-born Hispanic women had significantly lower risks for PTB than their American-born counterparts.

To our knowledge, there are only 2 published studies that have assessed maternal birthplace in relation to the birth outcomes of AE mothers. Guendelman and col-

**TABLE 4** Logistic Regression Models of the Association Between Ethnicity and PTB With Potentially Contributing Variables Added Stepwise

	Model 1		Model 2		Model 3		Model 4		Model 5		Model 6	
	OR	CI	OR	CI	OR	CI	OR	CI	OR	CI	OR	CI
Ethnicity												
NAW	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref
Arab	0.76	0.72–0.79	0.73	0.70–0.77	0.72	0.69–0.76	0.74	0.71–0.78	0.81	0.77–0.85	0.96	0.91–1.01
Parity												
0 previous			Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref
1 previous			0.916	0.90–0.93	0.92	0.91–0.94	0.92	0.90–0.94	0.95	0.93–0.97	0.95	0.93–0.97
2 previous			1.036	1.02–1.06	1.04	1.12–1.06	1.03	1.01–1.05	1.07	1.05–1.09	1.07	1.04–1.09
≥3 previous			1.436	1.40–1.47	1.42	1.38–1.45	1.40	1.37–1.43	1.45	1.42–1.49	1.45	1.42–1.48
Unknown			1.637	1.48–1.81	1.47	1.32–1.62	1.43	1.29–1.58	1.43	1.29–1.59	1.46	1.31–1.61
Education												
<11 y					1.17	1.14–1.21	1.12	1.09–1.16	0.96	0.93–0.99	0.98	0.95–1.01
GED or equivalent					1.07	1.04–1.10	1.04	1.01–1.07	0.94	0.91–0.97	0.93	0.91–0.96
College					1.03	1.00–1.05	1.02	0.99–1.05	0.98	0.95–1.01	0.97	0.94–0.99
Masters or above					Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref
Unknown					1.38	1.31–1.45	1.33	1.26–1.40	1.23	1.17–1.29	1.25	1.19–1.31
Tobacco use												
None							Ref	Ref	Ref	Ref	Ref	Ref
Yes							1.17	1.15–1.19	1.12	1.10–1.15	1.10	1.08–1.13
Married												
Yes									0.78	0.77–0.79	0.79	0.78–0.81
No									Ref	Ref	Ref	Ref
Mother's place of birth												
United States											Ref	Ref
Foreign											0.77	0.75–0.79

Ref indicates reference group; GED, General Equivalency Diploma.

leagues<sup>2</sup> assessed the birth outcomes of North African women in Belgium and France. They found that North African immigrants to Belgium were 23% less likely to have preterm infants than native-born North African women. El Reda and colleagues<sup>1</sup> assessed PTB risk among the Arab American population in Michigan and found that despite lower socioeconomic profiles, there was a lower prevalence of PTB among foreign-born Arab American women than among either American-born NAW women or American-born Arab American women.

It remains unclear why marriage or foreign birth confer an advantage in birth outcomes to AE mothers. It is possible that this advantage can be explained by maternal risk behavior patterns associated with marriage and/or maternal birthplace. It is also possible that this advantage is explained by prenatal care habits, dietary differences, attitudes toward family and childbirth, or levels of community social cohesion encountered by foreign-born AE women. Each of these factors has been shown to be associated with risk for adverse birth outcomes in other analyses,<sup>7,21,33,55,56</sup> although none was available for direct assessment in this study.

There are several limitations on the findings of this study. First, our study used a limited covariate set. Although we attempted to include variables representing all of the hypotheses that could explain the association between AE and lower PTB risk, there are others that were not accounted for. Of particular note, the only traditional socioeconomic variable that we included was maternal education; the paucity of socioeconomic vari-

ables in our study could have compromised our ability to assess the role of socioeconomic differences in contributing to the association between AE and lower PTB risk. This also precludes socioeconomic comparison across ethnicities.

Second, our work is limited by the accuracy of birth certificate data recorded in vital registry files. Gestational age data used in this study to determine cases of PTB was obtained by the Michigan Department of Community Health using the clinical estimate of gestational age. It has been shown that clinical estimates of gestation can be inaccurate in infants with small fetal size, which is associated with maternal age, female gender, smoking, and high altitude.<sup>57–61</sup> It has also been shown that tobacco use estimates in birth certificate data can be unreliable.<sup>62,63</sup> Third, because the difference in PTB risk between AE and NAW women is small (1.2% difference in PTB risk), our findings may be of limited clinical significance.

Fourth, the generalizability of our study is limited because our data comes from only 1 US state, and AE women in Michigan may not be representative of AE women in the rest of the United States. For example, although AE women are generally better educated than their non-Arab counterparts,<sup>25</sup> AE mothers in our sample were less likely to report education greater than high school than NAW mothers. Discrepancies in the demographics of AE women in Michigan compared with AE women in the remainder of the United States may be partly explained by the dynamics of Arab immigration to the United States, which is thought to have occurred in



3 waves. The first, beginning in 1875 and ending in 1924, was comprised largely of Syrian and Lebanese immigrants, most of whom were uneducated and worked unskilled jobs in the United States. The second wave came after World War II, after pro-immigration policy reforms. The majority in this wave came to the United States fleeing postwar political upheavals in Egypt, Syria, Iraq, and Palestine. Compared with those who immigrated during the first wave, this group was better educated, spoke fluent English, and worked white-collar jobs in the United States. The third and largest wave of Arab immigration to the United States began in 1965 and ended in the late 1990s; this wave was the best educated compared with Arab immigrants during the other 2 waves. It is possible that demographic trends among AE women in Michigan differ from those in the rest of the United States because the AE population in Michigan is disproportionately comprised of offspring of immigrants from the first 2 waves who came to the United States to work unskilled jobs in the automobile industry, and were generally less educated than their counterparts who came during the third and largest wave of Arab immigration.<sup>64-69</sup>

## CONCLUSIONS

This work raises several questions that might be fruitfully addressed in future research. First, future research should assess possible mediators of the association between AE and other adverse birth outcomes, such as low and very low birth weight. Second, there is extensive literature recounting an association between Hispanic ethnicity and lower risk for adverse birth outcomes<sup>50,52,70-74</sup>; potential mediators of the association between Hispanic ethnicity and risk for PTB should also be studied. Third, future research should seek to identify factors that may mediate the marital status and maternal birthplace hypotheses: differences in prenatal care habits, diet, attitudes toward childbirth, and levels of social cohesion between married and unmarried and American and foreign-born mothers should be areas of focus for future work.

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