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Interethnic mating and risk for preterm birth among Arab-American mothers: Evidence from the Arab-American Birth Outcomes Study

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Abstract

Arab ethnicity (AE) mothers have lower preterm birth (PTB) risk than white mothers. Little is known about the determinants of PTB among AE women or the role of interethnic mating in shaping PTB risk among this group. We assessed the relationship between interethnic mating and risk for PTB, very PTB, and late PTB among AE mothers. Data was collected for all births ($N = 21,621$) to AE women in Michigan between 2000 and 2005. Self-reported ancestry was used to determine paternal AE as well as to identify AE mothers. We used bivariate chi-square tests and multivariable logistic regression to assess the relationship between paternal non-AE and risk for PTB, very PTB, and late PTB among AE mothers. All analyses were also conducted among non-Arab white mothers as a control. Among AE mothers, paternal non-Arab ethnicity was associated with higher risk of PTB (OR = 1.18, 95% CI = 1.06, 1.30) and late PTB (OR = 1.24, 95% CI = 1.20, 1.38) compared to paternal Arab ethnicity. Paternal non-Arab ethnicity was not associated with risk for any outcome among non-Arab white mothers. Future studies could assess the causal mechanisms underlying the association between interethnic mating and risk for PTB.

Keywords

Arab-American; Preterm birth; Interethnic; Ethnicity; Birth outcomes

Introduction

Preterm birth (PTB) is a major contributor to perinatal and neonatal mortality, serious neonatal morbidity, and moderate to severe childhood disability in wealthy countries [1,2]. While 6–10% of all births in wealthy countries are preterm, deaths to preterm infants comprise more than two-thirds of all neonatal deaths in this context [2].

Arab ethnicity (AE) is associated with lower risk for adverse birth outcomes compared to non-Hispanic whites in both the United States [3,4] and Europe [5]. In the US, it has been shown that women with self-reported AE are 16% less likely than whites to give birth prematurely [4].

It is important to study the determinants of adverse birth outcomes among groups with systematically better birth outcomes, such as Arab-Americans, because this might improve our understanding of the social risk factors for adverse birth outcomes in general. However, there is a relative paucity of research that has considered the determinants of adverse birth outcomes among AE mothers. El Reda et al. [3] assessed the birth outcomes of AE mothers in Michigan. They found that among foreign-born AE mothers, pregnancy-related hypertension, diabetes, and use of medicaid to pay for hospital expenses were correlates of preterm birth (PTB). Among native-born AE mothers, lack of prenatal care and pregnancy-related hypertension were correlates of PTB. El-Sayed et al. [6] showed that differences in maternal birthplace and marital status explained the relationship between AE and lower risk for PTB relative to white mothers. Another study found that AE mothers in high AE community contexts were protected against low birth weight (LBW) relative to AE mothers in low AE community contexts [7].

Several studies have demonstrated a relationship between paternal factors and risk for adverse birth outcomes [8–13]. Parker and Schoendorf showed that lower paternal education and black, relative to white, race were associated with higher risk for LBW and very LBW among all births in the US between 1984 and 1988 [14]. Reichman and Teitler [15] showed that among a population-based sample of 4,621 births, paternal age was positively associated with risk for LBW. Chen et al. [10] showed among a sample of over 2.6 million singleton births that paternal age younger than twenty was associated with increased risk for PTB, LBW, small-for-gestational-age births, low APGAR scores, and neonatal and post-natal mortality.

Of particular interest in our study is the association between maternal and paternal ethnic/racial heterogeneity and risk for adverse birth outcomes. Several studies have shown that interracial (i.e., maternal and paternal racial heterogeneity) mating is associated with increased risk for adverse birth outcomes. A study of over 2.8 million singleton births showed that black-white mixed couples were at higher risk of PTB (defined in the study as <34 weeks gestation) than white couples [13]. In another study, Getahun et al. [11] showed that, among a sample of over 21 million births, black-white mixed mating was associated with increased risk for stillbirth. In a study of over 500,000 births, Palomar et al. [12] showed that black-white mixed mating was associated with increased risk for PTB. A study by Li et al. [16] showed that Chinese-American mothers who mated with non-Chinese fathers, whether non-Hispanic white or of another ethnic/racial group, were at higher risk for PTB than those who mated with Chinese fathers. However, Chinese-American mothers who mated with non-Hispanic white fathers had lower risk for LBW, while their counterparts who mated with fathers of other ethnic/racial groups had higher risk for LBW relative to those who mated with Chinese fathers. Another study about interethnic mating and LBW risk among Japanese-Americans found similar results to those among Chinese-Americans [17].

To our knowledge, there are no studies that have assessed the relationship between interethnic (i.e., maternal and paternal ethnic heterogeneity) mating and risk for adverse birth outcomes among Arab-Americans. Using data from the state of Michigan, the state with the largest concentration of Arab-Americans in the US, we assessed the relationship between paternal non-Arab ethnicity and risk of PTB, very PTB, and late PTB among AE mothers. As a control, we also conducted all analyses among non-Arab white mothers in Michigan during our study period.

Methods

Data

The Arab American Birth Outcome Study collected data 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 (MDCH).

Our primary outcomes of interest were PTB, very PTB, and late PTB. Infants with clinical gestational age estimates below 37 weeks were considered PTB, those with estimates below 32 weeks were considered very PTB, and those with estimates between 34 and 36 weeks were considered late PTB [18]. Birth registry data in the state of Michigan includes information about self-reported Arab ancestry, which was used to delineate AE mothers and paternal ethnicity. Other covariates collected were the following: marital status at parturition, parity, maternal age, maternal education, maternal nativity (US or foreign), and maternal smoking during pregnancy.

Paternal ethnicity was analyzed as a binary variable: Arab versus non-Arab. Parity was analyzed categorically: 0 previous, 1 previous, 2 previous, 3+ previous, or unknown previous number of births. Marital status at parturition was analyzed as a binary variable: married versus unmarried. Maternal age was analyzed as an ordinal categorical variable: <20 years, 20–25, 26–30, 31–35, 36–40, and 41+. Education was analyzed as a categorical variable: <12 years of education, general equivalency diploma (GED) or equivalent, any college, Masters degree or above, and unknown. Maternal nativity was analyzed as a binary variable: US or foreign. Maternal smoking was also analyzed as a binary variable denoting either the presence of absence of consumption at any time during pregnancy.

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

Analysis

We conducted each analysis among AE and non-Arab white mothers separately. First, we calculated univariate statistics to describe our sample. Second, we used bivariate chi-square tests to identify significant associations ($\alpha = 0.05$) between each of the covariates and outcomes of interest among AE mothers and non-Arab white mothers, as well as between each of the covariates of interest and paternal ethnicity stratified by maternal ethnicity. Third we used multivariable logistic regression models to assess the relationship between paternal non-Arab ethnicity and each outcome of interest among AE mothers. We included in our multivariable models, among both AE and non-Arab white mothers, any variables that were associated any outcome among either AE or non-Arab white mothers in bivariate analyses.

SAS 9.1 was used to carry out all statistical analyses. Statistical significance was set at the $P = 0.05$ level.

Results

We analyzed from about the births of 21,621 AE mothers and 594,431 non-Arab white mothers. Tables 1 and 2 show univariate statistics and bivariate chi-square analyses between each of our covariates and outcomes of interest among AE mothers and non-Arab white mothers, respectively. Univariate statistics showed the following: overall, the prevalence of PTB was 8.1% among AE mothers as compared to 9.4% among non-Arab white mothers. The prevalence of very PTB and late PTB among AE mothers were 1.2 and 6.5%

respectively, and 1.5 and 7.4% respectively among non-Arab white mothers. Paternal non-Arab ethnicity was recorded among 54.9% of all AE mothers in Michigan as compared to 98.5% of non-Arab white mothers. The majority of both AE mothers (55.4%) and non-Arab white mothers (51.9%) were between 20 and 30 years old. Among AE mothers, 95.9% were married while 72.3% of non-Arab white mothers were married. 72.3% of AE mothers reported that they had completed high school or above at time of birth as compared to 80.7% of non-Arab white mothers. 80.6% of AE mothers were foreign-born as compared to 7.4% of non-Arab white mothers. Among AE mothers, 3.3% smoked during pregnancy as compared to 15.8% of their non-Arab white counterparts. Among AE mothers, all covariates were significantly associated with PTB except for marital status and smoking during pregnancy. Among AE mothers, only education was associated very PTB, and paternal non-Arab ethnicity, maternal age, parity, and smoking during pregnancy were associated with late PTB in chi-square models. Among non-Arab white mothers, all covariates except paternal non-Arab ethnicity were associated each with PTB, very PTB, and late PTB.

Table 3 shows univariate statistics and bivariate chi-square analyses between each of our covariates and paternal ethnicity stratified by maternal ethnicity. Among births to AE mothers, paternal non-Arab ethnicity was significantly associated with lower parity, lower marital rates, older age, higher education, lower foreign birth rates, and higher smoking rates. Among non-Arab white mothers, paternal non-Arab ethnicity was significantly associated with lower marital rates, younger age, lower education, lower foreign birth rates, and higher smoking rates.

Table 4 shows multivariable regression models of PTB, very PTB, and late PTB among AE mothers and non-Arab white mothers separately. Among AE mothers, paternal non-Arab ethnicity was associated with higher risk for PTB (OR = 1.18, 95% CI = 1.06, 1.30), and late PTB (OR = 1.24, 95% CI = 1.10, 1.38), but not very PTB in multivariable models adjusted for all covariates. Among non-Arab white mothers, paternal non-Arab ethnicity was not associated with any outcome.

Discussion

In a study of 21,621 births to AE mothers in Michigan between 2000 and 2005, we found that paternal non-Arab ethnicity was associated with 18% greater odds of PTB and 24% greater odds of late PTB among AE mothers. Paternal non-Arab ethnicity was not associated with risk for any PTB outcome among 594,431 non-Arab white mothers. Our findings suggest that interethnic mating may be associated with increased risk for adverse birth outcomes among AE mothers. Our findings corroborate those among other groups showing increases in risk for PTB among infants born to interracial couples [12,13,16].

Our findings showed that paternal non-Arab ethnicity was associated with higher risk for late PTB, but not very PTB among AE mothers. This suggests that increases in overall PTB among AE mothers engaged in interethnic mating may be driven by increases in near-term PTB rather than earlier-term PTB.

Genetic factors have been the primary explanation posited for the association between interracial mating (black father, white mother) and risk of adverse birth outcomes [12]. This explanation has built on the well-recognized observation that black race is associated with increased risk for PTB after adjusting for potential medical, psychosocial, and behavioral confounders [19–23]. Genetic factors may also explain some of the relationship between interethnic mating and PTB observed in this analysis. However, there is an extensive literature that has shown that non-genetic factors, such as low socioeconomic status, stress, prenatal care habits, behavioral risk factors, and infection rates are important mediators of

the race-risk association in adverse birth outcomes [24–27]. This, combined with the observation that interracial/interethnic mating was associated with increased risk for adverse birth outcomes among four groups known to have better birth outcomes than African-Americans, i.e., whites [24–27], Chinese-Americans [16], Japanese-Americans [17], and now, Arab-Americans, suggests that social explanations may plausibly account for much of the association between interethnic mating and PTB risk observed in our study.

First, it has been shown that individuals in interracial/interethnic relationships have increased stress, distress, and risk for discrimination [28]. In turn, stress [29–33] and discrimination [34–37] have been shown to increase risk for adverse birth outcomes. Therefore, increased discrimination and stress associated with interethnic mating may mediate the association between interethnic mating and risk for adverse birth outcomes.

Second, there is a large literature that shows that certain cultural practices among ethnic groups may be protective against adverse birth outcomes. For example, it has been shown that Mexican-American women have favorable birth outcomes compared to other groups with similarly high risk, such as African-Americans [38–40]. In a study that assessed prenatal behavior differences between Mexican-American and African-American women, Zambrana et al., found that Mexican-Americans were less stressed, less likely to abuse substances, and more likely to have a positive attitude during pregnancy than their African-American counterparts. Upon controlling for these factors, the ethnicity-risk difference in adverse birth outcomes between Mexican-American and African-American mothers was attenuated. The authors posited that Mexican culture protects against PTB and LBW by promoting positive perinatal behaviors and a healthy maternal psychosocial status [41]. The suggestion that acculturation may increase risk for adverse birth outcomes among Hispanic groups has been supported by several other studies [42–47]. It is therefore plausible that important differences in ethnic cultural practices may exist between women involved in interethnic mating and those involved in mating within their own ethnic groups, and that these differences may mediate the association between interethnic mating and risk for adverse birth outcomes. Suggestively, we found that AE mothers engaged in interethnic mating were less likely to be married, had higher maternal ages, were more educated, were less likely to be born abroad, and were more likely to smoke than their counterparts who mated with Arab fathers. On the whole, they broke away from cultural norms relative to their counterparts, suggesting that selective differences in cultural practices between AE mothers who engaged in interethnic mating and those who did not may mediate our findings.

There are several limitations to consider when interpreting our findings. First, we used a limited covariate set. Of particular note, the only traditional socioeconomic status variable that we included was maternal education, which may be a poor predictor of SES among AE mothers because 96% of AE mothers in our analysis were married, and thus their spouses' earnings may substantially influence the families' SES independent of maternal education levels. The paucity of socioeconomic variables in our study could have allowed for residual confounding of the association between paternal non-Arab ethnicity and risk for PTB among AE mothers. 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 MDCH using the clinical estimate of gestational age. It has been shown that clinical estimates of gestational age can be inaccurate in infants with small fetal size, which is associated with maternal age, female gender, smoking, and high altitude [48–51]. It has also been shown that estimates of cigarette smoking [52,53] and maternal education [54] in birth certificate data can be unreliable. Paternal discrepancy may also be an issue. Paternal discrepancy occurs when a man who is reported to be the father of a child is not actually the father. This has been shown to occur with a median frequency of 3.7% [55]. Third, it is possible that some of our findings may be explained not by interethnic mating among AE

mothers, but by characteristics of paternal AE that are as yet unexplained. Although paternal non-Arab ethnicity was not a significant determinant of any outcome among control mothers, the near-significance of the paternal non-Arab ethnicity-PTB association among non-Arab white mothers suggests that this explanation cannot be completely excluded.

Despite the limitations, our findings have several implications for future research. First, researchers interested in this area might consider the effects of interethnic mating on risk for other adverse birth outcomes, such as perinatal or neonatal mortality, low and very low birth weight, or birth defects. Second, investigators might consider studies that empirically assess the effects of stress and discrimination among interethnic couples and their subsequent relationships with risk for adverse birth outcomes compared to couples of the same ethnicity. Third, investigators might consider studies that assess differences in degree of acculturation between mothers involved in interethnic mating and those involved in mating within their own ethnic group, as well as the relationships between acculturation and risk for adverse birth outcomes among interethnic couples. Fourth, our findings showed that interethnic mating was associated with higher risk for PTB and late PTB among Arab-Americans, a growing ethnic group. To our knowledge, there are no studies about the role of interethnic mating in determining PTB risk among Hispanic-Americans; given the size of the Hispanic-American population and the likelihood of interethnic mating in this group, studies about the birth outcomes of Hispanic interethnic couples are needed.

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Table 1

Descriptive statistics and bivariate associations between each covariate and preterm, very preterm, and late preterm birth among Arab ethnicity mothers in Michigan between 2000 and 2005

Mother/infant descriptors	Total %		Preterm		Very preterm		Late preterm	
	%	P	%	P	%	P	%	P
Total	8.1		1.2		0.69		6.5	
Paternal ethnicity		<0.01						<0.01
Non-Arab	54.9		1.2				7.1	
Arab	45.1		1.2				5.7	
Parity		<0.01			0.33			<0.01
0 Previous	34.2		1.4				6.6	
1 Previous	28.5		1.1				5.7	
2 Previous	19.2		1.1				6.0	
3 + Previous	17.4		1.1				7.6	
Unknown	0.6		0.0				12.4	
Married		0.55			0.28			0.60
Unmarried	4.1		1.6				6.9	
Married	95.9		1.2				6.4	
Maternal age		<0.01			0.21			<0.01
<20	5.6		1.4				7.1	
20-25	24.7		1.1				5.8	
26-30	30.7		1.1				5.6	
31-35	24.2		1.4				6.6	
36-40	11.8		1.1				8.2	
41+	3.0		2.0				11.1	
Education		<0.01			0.04			0.40
<11 years	23.8		1.5				6.8	
GED or equivalent	40.0		1.0				6.0	
College	21.0		1.4				6.6	
Masters or above	11.4		1.0				6.6	
Unknown	3.9		0.9				5.6	
Nativity		0.02			0.06			0.08

Mother/infant descriptors	Total %	Preterm		Very preterm		Late preterm		P
		%	P	%	P	%	P	
Foreign	80.6	7.8	1.1	6.3				
USA	19.4	8.9	1.5	7.0				
Smoking			0.20		0.36			0.05
None	96.7	8.0	1.2	6.4				
Yes	3.3	9.3	0.8	8.2				

Table 2

Descriptive statistics and bivariate associations between each covariate and preterm, very preterm, and late preterm birth among non-Arab white mothers in Michigan between 2000 and 2005

Mother/infant descriptors	Preterm		Very preterm		Late preterm	
	%	P	%	P	%	P
Total	9.4		1.5		7.4	
Paternal ethnicity		0.8		0.36		0.15
Non-Arab	1.5	9.4	1.5		7.5	
Arab	98.5	8.6	1.4		7.1	
Parity		<0.01		<0.01		<0.01
0 Previous	39.4	9.6	1.6		7.5	
1 Previous	33.5	8.5	1.3		6.9	
2 Previous	17.1	9.3	1.3		7.6	
3+ Previous	9.8	11.4	1.8		9.0	
Unknown	0.2	12.2	2.7		8.8	
Married		<0.01		<0.01		0.03
Unmarried	27.7	9.8	1.8		7.6	
Married	72.3	9.2	1.3		7.4	
Maternal age		<0.01		<0.01		<0.01
<20	8.2	9.7	1.9		7.3	
20-25	23.0	8.6	1.4		6.8	
26-30	28.9	8.8	1.3		7.1	
31-35	26.1	9.6	1.4		7.7	
36-40	11.5	10.8	1.7		8.6	
41+	2.3	12.8	2.3		9.8	
Education		<0.01		<0.01		<0.01
<11 years	17.6	9.7	1.7		7.5	
GED or equivalent	37.8	9.3	1.5		7.3	
College	29.2	9.2	1.4		7.4	
Masters or above	13.6	9.4	1.3		7.6	
Unknown	1.7	11.8	2.7		8.6	
Nativity		<0.01		<0.01		<0.01

Mother/infant descriptives	Preterm		Very preterm		Late preterm		P
	%	P	%	P	%	P	
Foreign	7.4	7.6	1.3		5.9		
USA	92.6	9.5	1.5		7.6		
Smoking				<0.01		<0.01	<0.01
None	84.2	10.5	1.4		7.3		
Yes	15.8	9.2	1.7		8.4		

Table 3

Descriptive statistics and bivariate associations between each covariate and paternal ethnicity among Arab ethnicity and non-Arab white mothers in Michigan between 2000 and 2005

Mother/infant descriptors	Arab ethnicity		Non-Arab white		P
	Paternal Arab ethnicity	Paternal non-Arab ethnicity	Paternal Arab ethnicity	Paternal non-Arab ethnicity	
Parity					0.86
0 Previous	31.9	36.1	39.4	39.4	<0.01
1 Previous	29.2	27.9	33.2	33.5	
2 Previous	19.5	18.9	17.0	17.1	
3+ Previous	19.0	16.1	10.1	9.8	
Unknown	0.3	0.9	0.3	0.2	
Married					<0.01
Unmarried	2.0	5.8	24.4	27.8	
Married	98.0	94.2	75.6	72.2	
Maternal age					<0.01
<20	5.4	5.8	7.2	8.2	
20–25	25.6	23.9	21.2	23.0	
26–30	31.5	30.1	28.4	28.9	
31–35	23.5	24.9	27.7	26.1	
36–40	11.0	12.4	12.7	11.5	
41+	3.0	3.0	2.8	2.3	
Education					<0.01
<11 years	25.0	22.7	16.5	17.6	
GED or equivalent	41.0	39.1	37.4	37.9	
College	20.8	21.2	29.8	29.2	
Masters or above	9.9	12.8	14.6	13.6	
Unknown	3.5	4.2	1.6	1.7	
Nativity					<0.01
Foreign	84.4	77.6	8.7	7.4	
USA	15.7	22.4	91.3	92.6	
Smoking					<0.01
None	97.5	96.0	85.0	84.2	0.04

Mother/infant descriptors	Arab ethnicity		Non-Arab white	
	Paternal Arab ethnicity	Paternal non-Arab ethnicity	Paternal Arab ethnicity	Paternal non-Arab ethnicity
Yes	2.5	4.0	15.0	15.8

Table 4

Multivariable models of preterm birth, very preterm birth, and late preterm birth stratified by mother's ethnicity among all births to Arab ethnicity and non-Arab white mothers in Michigan between 2000 and 2005

	<u>Arab ethnicity</u>		<u>Non-Arab white</u>	
	OR	95% CI	OR	95% CI
Preterm birth *				
Non-Arab	1.18	1.06–1.30	1.07	1.00–1.15
Arab	Reference	Reference	Reference	Reference
Very preterm birth *				
Non-Arab	0.92	0.72–1.18	1.08	0.91–1.29
Arab	Reference	Reference	Reference	Reference
Late preterm birth *				
Non-Arab	1.24	1.10–1.38	1.06	0.98–1.15
Arab	Reference	Reference	Reference	Reference

* Adjusted for parity, marital status, maternal age, education, nativity and smoking