OBSTETRICS

Effects of race/ethnicity and BMI on the association between height and risk for spontaneous preterm birth

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OBJECTIVE: Short height and obesity have each been associated with increased risk for preterm birth (PTB). However, the effect of short height on PTB risk, across different race/ethnicities and body mass index (BMI) categories, has not been studied. Our objective was to determine the influence of maternal height on the risk for PTB within race/ethnic groups, BMI groups, or adjusted for weight.

STUDY DESIGN: All California singleton live births from 2007 through 2010 were included from birth certificate data (vital statistics) linked to hospital discharge data. Prepregnancy BMI (kg/m^2) was categorized as underweight (<18.5), normal (18.5-24.9), overweight (25.0-29.9), or obese (≥30.0). Maternal race/ethnicity was categorized as: non-Hispanic white, non-Hispanic black, Hispanic, and Asian. Maternal height was classified into 5 categories (shortest, short, middle, tall, tallest) based on racial/ethnic-specific height distributions, with the middle category serving as reference. Poisson regression models were used to estimate relative risks for the association between maternal height and risk of spontaneous PTB (<37 weeks and <32 weeks). Models were stratified on race/ethnicity and BMI. Generalized additive regression models were used to detect nonlinearity of the association. Covariates considered were: maternal age, weight, parity, prenatal care, education, medical payment, previous PTB, gestational and pregestational diabetes, pregestational hypertension, preeclampsia/eclampsia, and smoking.

RESULTS: Among 1,655,385 California singleton live births, 5.2% were spontaneous PTB <37 weeks. Short stature (first height category) was associated with increased risk for PTB for non-Hispanic whites and Hispanics across all BMI categories. Among obese women, tall stature (fifth category) was associated with reduced risk for spontaneous PTB for non-Hispanic whites, Asians, and Hispanics. The same pattern of association was seen for height and risk for spontaneous PTB <32 weeks. In the generalized additive regression model plots, short stature was associated with increased risk for spontaneous PTB of <32 and <37 weeks of gestation among whites and Asians. However, this association was not observed for blacks and Hispanics.

CONCLUSION: Maternal shorter height is associated with a modest increased risk for spontaneous PTB regardless of BMI. Our results suggest that PTB risk assessment should consider race/ethnicity-specific height with respect to the norm in addition to BMI assessment.

Key words: body mass index, maternal height, race/ethnicity, spontaneous preterm birth

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In the United States, 12.3% of births occur <37 weeks of gestation, with 5.4% categorized as spontaneous preterm birth (PTB) among singleton live births.[1] PTB is the primary cause of perinatal morbidity and mortality in the developed world[2] and in the United States it is associated with an annual cost >$26 billion.[3] Many maternal characteristics have been associated with PTB, including age, race/ethnicity, marital and socioeconomic status, as well as anthropometrics characteristics (weight and height).[3-6] Over the past 2 decades, there has been substantial investigation into the associations among women's prepregnancy body mass index (BMI), weight gain during pregnancy, and risk for adverse pregnancy outcomes.[6-10] Both extremes of BMI categories (underweight and obese) have been associated with increased risk of PTB.[6,9,11,12] Height, which is an indicator of the interplay between genetic and early-life factors, has been inversely associated with the risk of PTB in some but not

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TABLE 1

Demographic characteristics, 2007 through 2010 California singleton live births stratified by race/ethnicity

Variable		Non-Hispanic white	Non-Hispanic black	Asian	Hispanic
		n (%)			
Age, y	<25	102,173 (21.1)	42,069 (43.5)	16,279 (9.7)	362,847 (40.0)
	25–29	133,367 (27.6)	24,526 (25.4)	41,576 (24.8)	246,675 (27.2)
	30–34	139,551 (28.9)	17,677 (18.3)	64,033 (38.2)	182,243 (20.1)
	≥35	108,453 (22.4)	12,378 (12.8)	45,777 (27.3)	115,761 (12.8)
Prepregnancy BMI	Underweight	20,365 (4.2)	3894 (4.0)	18,044 (10.8)	225,660 (2.8)
	Normal	275,410 (57.0)	40,731 (42.1)	117,271 (69.9)	390,611 (43.0)
	Overweight	107,204 (22.2)	25,461 (26.3)	24,664 (14.7)	270,538 (29.8)
	Obese I	46,829 (9.7)	13,949 (14.4)	5983 (3.6)	139,261 (15.3)
	Obese II	21,077 (4.4)	6939 (7.2)	1336 (0.8)	52,993 (5.8)
	Obese III	12,659 (2.6)	5676 (5.9)	367 (0.2)	28,463 (3.1)
Prenatal care	Initiation in first 5 mo	460,897 (95.3)	87,991 (91.0)	160,838 (95.9)	841,902 (92.8)
	Initiation ≥6 mo/no initiation/unknown	22,647 (4.7)	8659 (9.0)	6827 (4.1)	65,624 (7.2)
Education	Some high school or less	30,130 (6.2)	16,294 (16.9)	8782 (5.2)	381,073 (42.0)
	High school diploma/GED	106,598 (22.0)	33,539 (34.7)	25,306 (15.1)	279,086 (30.8)
	Some college	137,358 (28.4)	33,295 (34.4)	30,512 (18.2)	176,530 (19.5)
	College graduate or more	209,458 (43.3)	13,522 (14.0)	103,065 (61.5)	70,837 (7.8)
Payor	Medi-Cal	112,409 (23.2)	52,074 (53.9)	34,871 (20.8)	594,620 (65.5)
	Private	351,058 (72.6)	36,630 (37.9)	122,972 (73.3)	268,971 (29.6)
	Uninsured/unknown	5245 (1.1)	1700 (1.8)	4865 (2.9)	21,472 (2.4)
	Other	14,832 (3.1)	6246 (6.5)	4957 (3.0)	22,463 (2.5)
Parity	1	218,379 (45.2)	40,759 (42.2)	80,770 (48.2)	323,233 (35.6)
	≥2	265,165 (54.8)	55,891 (57.8)	86,895 (51.8)	584,293 (64.4)
Previous PTB	No	479,798 (99.2)	95,588 (98.9)	166,962 (99.6)	903,436 (99.5)
	Yes	3746 (0.8)	1062 (1.1)	703 (0.4)	4090 (0.5)
Smoking	No/unreported	456,747 (94.5)	91,742 (94.9)	166,627 (99.4)	899,333 (99.1)
	Yes	26,797 (5.5)	4908 (5.1)	1038 (0.6)	8193 (0.9)
Pregestational hypertension, preeclampsia/eclampsia	No	457,264 (94.6)	91,291 (94.5)	148,910 (88.8)	834,417 (91.9)
	Yes	26,280 (5.4)	5359 (5.5)	18,755 (11.2)	73,109 (8.1)
Pregestational/gestational diabetes	No	451,899 (93.5)	86,251 (89.2)	161,598 (96.4)	852,987 (94.0)
	Yes	31,645 (6.5)	10,399 (10.8)	6067 (3.6)	54,539 (6.0)

BMI, body mass index; *GED*, General Educational Development; *PTB*, preterm birth.

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all studies.[13-18] Average height differs across diverse population subgroups, with non-Hispanic white or non-Hispanic black usually taller than Asian women.[19] Previous studies that examined the association between height and risk for spontaneous PTB did not stratify according to race/ethnicity. Therefore, It remained unclear whether the inverse association of height with PTB varies across different race/ethnicities. In addition, although height is a component in BMI, its