Placental Abruption Among Singleton and Twin Births in the United States: Risk Factor Profiles

Cande V. Ananth PhD, MPH

John Smulian MD, MPH
Lehigh Valley Health Network, john.smulian@lvhn.org

Kitaw Demissie MD, PhD

Anthony M. Vintzileos MD

Robert A. Knuppel MD, MPH

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Placental Abruption among Singleton and Twin Births in the United States: Risk Factor Profiles

Cande V. Ananth,[1] John C. Smulian,[2] Kitaw Demissie,[3] Anthony M. Vintzileos,[2] and Robert A. Knuppel[2]

The authors performed a population-based epidemiologic study to evaluate and contrast risk factor profiles for placental abruption among singleton and twin gestations. Data were derived from linked US birth/infant death files for 1995 and 1996, comprising 7,465,858 singleton births and 193,266 twin births. The authors also evaluated effect modification between smoking and hypertension and the effect of a dose-response relation with number of cigarettes smoked daily on abruption risk. Abruption was recorded in 5.9 per 1,000 singleton births and 12.2 per 1,000 twin births. Risk factors for abruption among singleton and twin births, respectively, included preterm premature rupture of membranes (adjusted relative risks (RRs) = 4.89 and 2.01), eclampsia (RRs = 3.58 and 1.67), anemia (RRs = 2.23 and 2.33), hydramnios (RRs = 2.04 and 1.66), renal disorders (RRs = 1.54 and 2.56), and intrapartum fever (>100°F) (RRs = 1.17 and 1.69). Chronic hypertension (RR = 2.38) and pregnancy-induced hypertension (RR = 2.34) were risk factors for abruption in singleton births but not in twin births. Number of cigarettes smoked daily demonstrated a dose-response trend for abruption risk in singletons and twins. Abruption was more likely to occur among smokers with chronic hypertension (RRs = 4.66 and 3.15) and eclampsia (RRs = 6.28 and 5.08). The authors conclude that abruption is twice as likely to occur in twins as in singletons with differing risk factor profiles. This suggests that abruption in twins may result from different pathophysiologic processes. *Am J Epidemiol* 2001;153:771–8.

abruptio placentae; pregnancy; risk factors; twins

Placental abruption, defined as premature separation of the placenta from the uterine wall prior to delivery, is an uncommon but serious obstetric complication (1). As a major cause of third trimester bleeding, it is responsible for up to one fourth of all perinatal deaths (2–4). This is due, at least in part, to the excessively high rates of prematurity, fetal growth restriction, and stillbirth that accompany abruption (5–9). The etiology of abruption is speculative and perhaps multifactorial, but a number of risk factors have been identified. These include advanced maternal age, multiparity, cigarette smoking, drug use, uterine decompression, a short umbilical cord, prolonged premature rupture of membranes (PROM), chorioamnionitis, folate deficiency, chronic hypertension, preeclampsia, and prior abruption (10–16).

The risk of developing placental abruption is higher among twin births than among singleton births (1). However, surprisingly little is known about the risk factors for abruption in twin births. In comparison with singleton pregnancies, twin pregnancies have increased incidences of preeclampsia, prematurity, growth restriction, and perinatal mortality. The etiologies of these complications in twin births may differ from those in singleton births. Therefore, we examined risk factors for placental abruption among twin births in the United States for the 1995 and 1996 cohorts and compared the risk factor profiles with those of singleton pregnancies for the same period.

MATERIALS AND METHODS

Cohort composition

We used US national linked birth/infant death data files for 1995 and 1996. These data are assembled by the National Center for Health Statistics under a cooperative agreement with all US states and the District of Columbia. These natality and mortality data files, produced annually, include statistical data from birth and infant death certificates (up to age 1 year) that are provided to the National Center for Health Statistics by the individual states under

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Abbreviation: PROM, premature rupture of membranes.

[1] Division of Epidemiology and Biostatistics, Department of Obstetrics, Gynecology, and Reproductive Sciences, Robert Wood Johnson Medical School/Saint Peter's University Hospital, University of Medicine and Dentistry of New Jersey (UMDNJ), New Brunswick, NJ.

[2] Division of Maternal-Fetal Medicine, Department of Obstetrics, Gynecology, and Reproductive Sciences, Robert Wood Johnson Medical School/Saint Peter's University Hospital, UMDNJ, New Brunswick, NJ.

[3] Department of Environmental and Community Medicine, Robert Wood Johnson Medical School, UMDNJ, New Brunswick, NJ.

Correspondence to Dr. Cande V. Ananth, Department of Obstetrics, Gynecology, and Reproductive Sciences, Robert Wood Johnson Medical School, 125 Paterson Street, New Brunswick, NJ 08901-1977 (e-mail: ananthcv@epi.umdnj.edu).

the Vital Statistics Cooperative Program (17). These data conform to uniform coding specifications and have passed rigorous quality checks. The data have been edited and reviewed, and they form the basis for official US birth and death statistics.

In this database, placental abruption was defined as the complete or partial separation of the placenta prior to delivery. The attendant usually makes a clinical diagnosis of this condition at the time of delivery; however, an unknown number of the reported cases may have been identified by antenatal ultrasound. The diagnosis of abruption, as well as medical complications and obstetric procedures performed during pregnancy, is recorded on current US birth certificates using a check-box format (18). Assignment of gestational age in these data was based predominantly on the date of the last menstrual period. In approximately 5 percent of the births, the date/month of the last menstrual period was missing; therefore, it was imputed (19). For a small fraction of births, an inconsistent gestational age was replaced with a clinical estimate. The replacements with clinical estimates and the gestational age imputations were all performed by the National Center for Health Statistics.

During the years 1995 and 1996, there were 7,721,604 singleton births that resulted in live birth or fetal death. We excluded 181,009 births with missing data on gestational age or a gestational age of <20 completed weeks, as well as 74,737 births with missing data on placental abruption. These exclusions left us with 7,465,858 singleton births for analysis. Similarly, there were 204,717 twin births during the same years that resulted in live birth or fetal death. Of these, we excluded those with missing data on gestational age or a gestational age at delivery of <20 weeks (n = 8,887). We also excluded births with missing data on placental abruption (n = 2,564). This left us with 193,266 twin births for analysis.

Covariates

The vital statistics data contained information on several sociodemographic factors, medical complications, and procedures performed during pregnancy. Sociodemographic and obstetric risk factors for abruption included maternal age (coded in 5-year intervals as <20, 20–24, 25–29, 30–34, and 35–49 years and examined as a continuous variable), gravidity (1, 2, and ≥3), maternal race (Caucasian, Black, and other race/ethnicity), marital status (married or unmarried), cigarette smoking (smoker or nonsmoker), average number of cigarettes smoked daily during pregnancy, and alcohol use during pregnancy.

Medical complications of pregnancy included anemia (hemoglobin level <10.0 g/dl or hematocrit <30 percent), intrapartum fever (>100°F), hypertensive disorders (chronic hypertension, pregnancy-induced hypertension, and eclampsia), diabetes (gestational and preexisting), hydramnios, renal disease, and preterm PROM. Preterm PROM was defined as all pregnancies in which membranes had been ruptured for over 12 hours and those in which delivery occurred before 37 completed weeks of gestation.

Statistical analysis

We computed risks of abruption in the presence and absence of the risk factors and derived unadjusted relative risks with 95 percent confidence intervals. Adjusted odds ratios were derived from multivariable logistic regression models. Since the odds ratio is not a good approximator of the relative risk when the incidence of the outcome in the presence of a risk factor is high, we transformed the adjusted odds ratios to relative risks (20).

The choice of risk factors for inclusion in the regression model was based on the results of the univariable analysis. Because of the size of the data set, especially for singleton pregnancies, small differences between incidences of abruption for the presence versus absence of a risk factor resulted in statistically significant predictors in the regression model. Therefore, we chose predictors for inclusion in the model if the unadjusted relative risk was above 1.5 or below 0.75. Moreover, since this was a population-based study, we were less motivated to base the importance of risk factors purely on statistical significance. We instead present 95 percent confidence intervals for effect measures (relative risks) that should be interpreted as means of assessing the precision of the estimates. We also calculated adjusted population attributable risks to assess the quantitative impact of each of the risk factors on abruption (21).

We modeled the average number of cigarettes smoked daily as a continuous variable. To avoid having to make assumptions about the effect of the shape of the distribution of number of cigarettes smoked on abruption risk, we modeled this covariate using restricted cubic splines (22). Cubic splines are nonparametric smoothing procedures that offer great flexibility in modeling and do not impose any restriction on the shape of their distribution. Splines are based on choosing cutpoints of the covariate by assigning knots, the locations for which are derived empirically. We determined the number of knots by comparing nested models with several different knots using the deviance statistic based on the likelihood ratio test. The most parsimonious model was retained.

RESULTS

Placental abruption was recorded in 5.9 per 1,000 (n = 44,032) singleton births and 12.2 per 1,000 (n = 2,358) twin births. In both the singleton and twin cohorts, fetal deaths were more common in the abruption group; among surviving babies, a greater proportion weighed less and were delivered early in the abruption compared with the nonabruption group (table 1). Women with abruption were more than twice as likely to have cesarean deliveries.

Analysis of maternal characteristics in twin pregnancies indicated a 23 percent increase in the frequency of abruption among older women (aged 35–49 years), whereas among singleton pregnancies, a 37 percent increase was apparent for the same age group in comparison with women aged 25–29 years (table 2). Similarly, multigravid women were more likely to develop abruption than primigravid women in both the singleton and twin cohorts. Incidences

TABLE 1. Perinatal outcomes and delivery characteristics in relation to placental abruption among singleton and twin births, United States, 1995 and 1996

	Singleton births		Twin births	
	No. of births	% with abruption	No. of births	% with abruption
Total	7,465,858	0.59	193,266	1.22
Pregnancy outcome				
Fetal death	31,196	10.68	2,065	6.49
Livebirth	7,434,662	0.55	191,201	1.16
Birth weight (g)				
500–999	40,789	8.65	7,888	5.39
1,000–1,499	43,120	8.37	10,702	3.10
1,500–1,999	83,136	5.72	25,832	1.99
2,000–2,499	291,307	2.35	57,907	1.02
≥2,500	7,004,251	0.31	90,631	0.53
Gestational age (weeks)				
20–27	44,700	8.43	7,611	5.19
28–31	78,675	5.79	13,231	3.59
32–33	92,779	3.90	16,274	2.21
34–36	523,217	1.75	65,037	1.01
≥37	6,726,487	0.34	91,113	0.52
Infant gender				
Female	3,642,784	0.55	96,643	1.18
Male	3,823,074	0.63	96,623	1.26
Mode of delivery				
Cesarean	1,472,478	1.71	82,708	1.72
Vaginal	5,969,454	0.34	109,736	0.84

of abruption were similar for Blacks and Caucasians among twin pregnancies, but Blacks were at increased risk for abruption in singleton pregnancies. Both cigarette smoking and alcohol use during pregnancy conferred an increased risk for abruption.

Several medical and obstetric complications of pregnancy were associated with abruption risk in both singleton and twin births (table 3). These included eclampsia, preterm PROM, maternal anemia, intrapartum fever, hydramnios, and renal disease. In contrast, neither chronic hypertension nor pregnancy-induced hypertension was associated with risk for abruption in twin pregnancies, but both factors were risk factors in singleton pregnancies.

We fitted multivariable logistic regression models to identify and evaluate the independent contributions of risk factors for abruption, separately for singleton and twin births (table 4). Preterm PROM, eclampsia, anemia, hydramnios, smoking, renal disorders, and intrapartum fever were associated with increased risk for abruption in both singleton and twin births. However, chronic hypertension and pregnancy-induced hypertension were not associated with abruption risk in the twin cohort but were strong risk factors in the singleton cohort. Number of cigarettes smoked per day was modeled using cubic splines with knots at 0, 1, 5, 10, and 25 for singleton births and at 0, 1, 5, and 10 for twin births. Risk of abruption increased steeply up to about five cigarettes per day for both singleton and twin births, implying a strong dose effect (figure 1). However, the increase in risk plateaued for twin births beyond five cigarettes per day (adjusted relative risk = 1.7) while continuing to rise for singleton pregnancies.

Risks of abruption among singleton and twin births were evaluated in relation to maternal age (<20, 20–24, 25–29, 30–34, and 35–49 years) and gravidity (gravida 1, 2, and ≥3). For this analysis, primigravid women aged 25–29 years served as the universal referent, and all other age × gravidity cross-classifications were compared with this referent category (table 5). Analysis of singleton births indicated that abruption risk increased steadily with increasing gravidity for all age strata. Women in the highest age × gravidity classification (gravida ≥3 and age 35–49 years) were found to have a 1.8-fold increase in abruption risk. Among twin births, no specific age or gravidity effects were apparent, although multigravid women (gravida ≥3) aged 35–49 years were at 52 percent increased risk for abruption.

A strong joint effect of hypertensive disorders and cigarette smoking on the risk of abruption was noted. Among singleton births, the incidence of abruption was substantially elevated for smokers with any form of hypertension as compared with normotensive women who did not smoke (table 6). Among twin births, smokers with chronic hypertension and smokers who developed eclampsia had increased risks for abruption. These analyses indicate that the effects of smoking and hypertension do not act independently on abruption risk but rather behave synergistically on the additive scale.

TABLE 2. Maternal characteristics associated with placental abruption among singleton and twin births, United States, 1995 and 1996

Maternal characteristic	Singleton births				Twin births			
	No. of births	Placental abruption			No. of births	Placental abruption		
		%	Unadjusted RR*	95% CI*		%	Unadjusted RR	95% CI
Maternal age (years)								
<20	983,988	0.58	1.07	1.04, 1.11	14,135	1.17	1.03	0.87, 1.23
20–24	1,841,807	0.56	1.04	1.01, 1.06	37,499	1.21	1.06	0.94, 1.20
25–29	2,047,145	0.54	1.00†		52,981	1.14	1.00	
30–34	1,715,459	0.60	1.10	1.07, 1.13	55,538	1.20	1.06	0.96, 1.18
35–49	877,453	0.74	1.37	1.33, 1.41	28,060	1.41	1.23	1.09, 1.39
Gravidity								
1	2,522,536	0.50	1.00†		31,726	1.06	1.00†	
2	2,165,988	0.53	1.06	1.03, 1.08	57,165	1.07	1.01	0.88, 1.15
≥3	2,721,115	0.72	1.44	1.41, 1.47	102,897	1.34	1.27	1.13, 1.43
Maternal race								
Caucasian	5,934,905	0.57	1.00†		152,811	1.22	1.00†	
Black	1,147,942	0.74	1.30	1.23, 1.34	33,334	1.28	1.05	0.93, 1.16
Other	383,011	0.52	0.91	0.83, 1.00	7,121	0.86	0.70	0.52, 0.89
Marital status								
Unmarried	2,410,822	0.67	1.27	1.25, 1.30	54,126	1.32	1.15	1.05, 1.27
Married	5,043,478	0.53	1.00†		138,412	1.15	1.00†	
Smoking								
Smoker	823,245	1.09	2.00	1.95, 2.05	19,319	1.96	1.72	1.54, 1.92
Nonsmoker	5,136,710	0.54	1.00†		136,479	1.14	1.00†	
Alcohol use								
Yes	93,945	1.40	2.29	2.17, 2.42	1,985	1.96	1.57	1.15, 2.15
No	6,269,521	0.61	1.00†		164,587	1.25	1.00†	

* RR, relative risk; CI, confidence interval.
† Referent.

DISCUSSION

Despite the fact that this analysis was based on a large number of US pregnancies for both singleton and twin cohorts, some limitations of this study merit attention. The incidence of abruption among singleton pregnancies is usually reported to range from 0.7 percent to 1.0 percent (23, 24), while among twin births it ranges from 1 percent to 2 percent (1). Placental abruption, in these national data files, was recorded in 0.58 percent of singleton births and 1.22 percent of twin births. Although a diagnosis of severe abruption is seldom missed, misclassification of abruption, if any, would probably have occurred for milder forms of this condition. Second, our study did not take into account at least three important risk factors for abruption: parity, chorioamnionitis, and cocaine use. Since information on these factors is currently not available in US vital statistics data, we used gravidity and intrapartum fever (>100°F) as proxies for parity and chorioamnionitis, respectively. However, there were no reliable data available to use as a proxy for cocaine use in these data files. Finally, our analysis did not adjust for the presence of intracluster correlation due to twinning. The national database, unfortunately, does not distinguish between twins from the same pregnancy. Failure to account for intracluster correlation probably results in biased variances of the effect measure (i.e., relative risks), although the relative risks themselves may be unaffected (25). Therefore, results of analyses pertaining to the twin cohort must be interpreted cautiously.

Obvious strengths of this study include the population-based nature of the data and the fact that the analysis was based on all registered US pregnancies that ended after 20 weeks, regardless of outcome. In addition, risk factors for abruption in twin pregnancies, to our knowledge, have not been reported, which makes this study particularly important. The comparison of risk factor profiles for abruption among singleton and twin births in comparable cohorts and a comparable time period (1995 and 1996) should have minimized the influence of biases that might have affected the results. Our data allowed us to carefully examine dose-response patterns of abruption risk in relation to number of cigarettes smoked daily, using flexible smoothing methods. Finally, because of the large size of the data set, we were able to evaluate effect modifications of several risk factors for abruption.

Placental abruption was twice as likely to occur in twin pregnancies as in singleton pregnancies. Although this phenomenon has been recognized (1), previous investigators

TABLE 3. Maternal complications of pregnancy associated with placental abruption among singleton and twin births, United States, 1995 and 1996

Maternal complication	Singleton births				Twin births			
	No. of births	Placental abruption			No. of births	Placental abruption		
		%	Unadjusted RR*	95% CI*		%	Unadjusted RR	95% CI
Hypertension								
Normotensive	7,110,353	0.55	1.00†		174,114	1.20	1.00†	
Chronic hypertension	48,892	1.51	2.73	2.54, 2.94	1,692	1.42	1.17	0.78, 1.74
Pregnancy-induced hypertension	245,750	1.29	2.34	2.25, 2.42	14,158	1.23	1.00	0.87, 1.18
Eclampsia	25,482	2.12	3.84	3.53, 4.18	2,065	2.13	1.76	1.31, 2.37
Preterm premature rupture of membranes								
Present	74,199	3.11	5.50	5.28, 5.74	10,280	2.46	2.14	1.88, 2.43
Absent	7,391,659	0.56	1.00†		182,986	1.14	1.00†	
Maternal anemia								
Present	147,437	1.40	2.45	2.35, 2.56	6,055	2.96	2.54	2.19, 2.96
Absent	7,283,040	0.57	1.00†		185,974	1.16	1.00†	
Intrapartum fever								
Present	120,906	0.77	1.30	1.22, 1.39	2,649	2.45	2.04	1.60, 2.60
Absent	7,344,952	0.59	1.00†		190,617	1.20	1.00†	
Hydramnios								
Present	88,128	1.46	2.52	2.39, 2.67	3,483	2.21	1.84	1.47, 2.31
Absent	7,342,349	0.58	1.00†		185,645	1.22	1.00†	
Renal disease								
Present	19,646	1.19	2.02	1.78, 2.30	567	3.70	3.06	2.01, 4.67
Absent	7,351,539	0.59	1.00†		189,862	1.19	1.00†	
Diabetes mellitus								
Present	190,101	0.71	1.22	1.15, 1.28	6,384	1.27	1.04	0.84, 1.30
Absent	7,240,376	0.58	1.00†		185,645	1.22	1.00†	

* RR, relative risk; CI, confidence interval.
† Referent.

have not attempted to speculate on the reasons for this finding. Surprisingly, the risks of abruption among twin births according to various risk factors (tables 2 and 3) did not indicate obvious patterns that might help to explain the twofold increased incidence. We believe that placental underperfusion in twin pregnancies due to smoking and

TABLE 4. Adjusted relative risks* and population attributable risks associated with risk factors for placental abruption among singleton and twin births, United States, 1995 and 1996

Risk factor	Singleton births			Twin births		
	RR†	95% CI†	PAR† (%)	RR	95% CI	PAR (%)
Preterm premature rupture of membranes	4.89	4.69, 5.10	2.7	2.01	1.76, 2.29	2.8
Eclampsia	3.58	3.29, 3.90	1.0	1.67	1.24, 2.25	0.8
Chronic hypertension	2.38	2.21, 2.56	1.0			
Pregnancy-induced hypertension	2.34	2.25, 2.42	4.2			
Maternal anemia	2.23	2.13, 2.33	2.6	2.33	2.00, 2.72	4.2
Hydramnios	2.04	1.93, 2.15	1.5	1.66	1.32, 2.08	1.4
Cigarette smoking	1.97	1.92, 2.02	11.5	1.69	1.50, 1.89	7.3
Alcohol use	1.57	1.49, 1.67	1.3	1.19	0.87, 1.64	0.3
Renal disorders	1.54	1.35, 1.75	0.3	2.56	1.66, 3.91	0.5
Intrapartum fever (>100°F)	1.17	1.10, 1.25	0.4	1.69	1.31, 2.18	1.3

* The adjusted relative risks were derived from multivariable logistic regression models, with further adjustment for maternal age and gravidity.
† RR, relative risk; CI, confidence interval; PAR, population attributable risk.

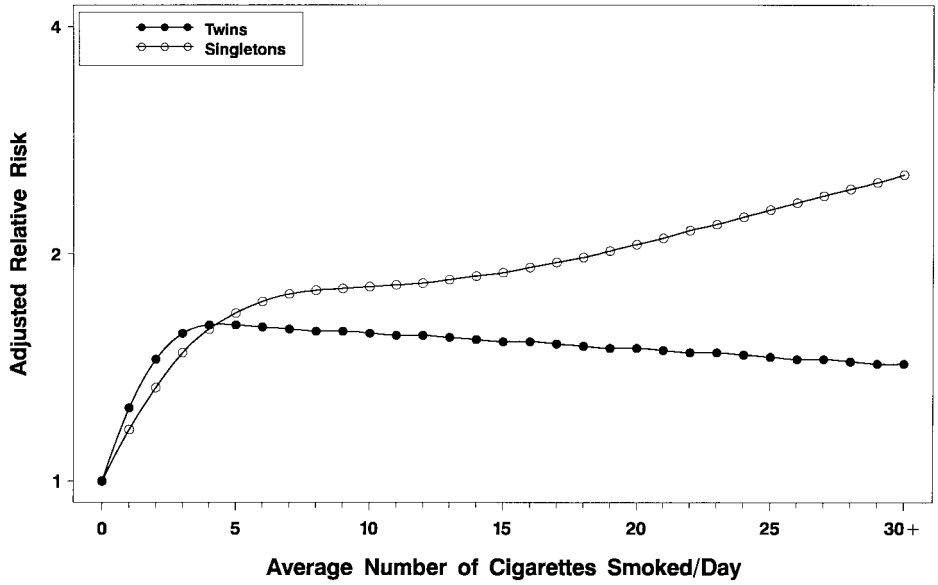

FIGURE 1. Associations between placental abruption and average number of cigarettes smoked per day among singleton and twin births, United States, 1995 and 1996.

increased incidences of pregnancy-induced hypertension and eclampsia may also account for some of the increased incidence in twin births. Nevertheless, these speculations suggest that abruption in twin pregnancies may result from different underlying pathologic processes in comparison with singleton pregnancies.

We previously noted the presence of a dose-response relation between average number of cigarettes smoked per day and the risk of abruption in singleton births (10). Results from the present study not only corroborate these findings for singleton pregnancies but extend them to twin births as well. With the exception of two studies (14, 26), most studies have considered smoking and hypertensive disorders to be independent risk factors for abruption. Cigarette smoking has been shown to be protective against preeclampsia and pregnancy-induced hypertension because of nicotine's effects on prostaglandin synthesis (27) or because of the potentially hypotensive

TABLE 5. Influence of maternal age and gravidity on adjusted relative risks* of placental abruption among singleton and twin births, United States, 1995 and 1996

Type of pregnancy and maternal age (years)	Gravidity					
	1		2		≥3	
	RR†	95% CI†	RR	95% CI	RR	95% CI
Singleton births						
<20	1.21	1.15, 1.27	1.53	1.43, 1.63	1.85	1.68, 2.03
20–24	1.11	1.06, 1.17	1.23	1.16, 1.29	1.67	1.59, 1.76
25–29	1.00‡		1.13	1.07, 1.19	1.60	1.53, 1.67
30–34	1.14	1.08, 1.21	1.22	1.16, 1.29	1.60	1.53, 1.68
35–49	1.37	1.27, 1.48	1.44	1.35, 1.54	1.82	1.74, 1.92
Twin births						
<20	1.23	0.88, 1.72	1.08	0.78, 1.50	1.31	0.90, 1.91
20–24	0.86	0.62, 1.21	1.18	0.90, 1.55	1.36	1.06, 1.74
25–29	1.00‡		1.08	0.83, 1.40	1.25	0.99, 1.59
30–34	1.16	0.86, 1.57	0.93	0.71, 1.22	1.39	1.10, 1.76
35–49	1.13	0.78, 1.63	1.25	0.93, 1.68	1.52	1.19, 1.94

* Relative risks were adjusted for anemia, intrapartum fever, renal disorders, preterm premature rupture of membranes, eclampsia, and hydramnios for both singleton births and twin births. In the singleton analysis, relative risks were further adjusted for chronic hypertension, pregnancy-induced hypertension, and alcohol use.

† RR, relative risk; CI, confidence interval.

‡ Referent.

TABLE 6. Influence of cigarette smoking and hypertensive disorders on adjusted relative risks* of placental abruption among singleton and twin births, United States, 1995 and 1996

Cigarette smoking and hypertension status	Singleton births		Twin births	
	RR†	95% CI†	RR	95% CI
Nonsmoker				
Normotensive	1.00‡		1.00‡	
Chronic hypertension	2.29	2.09, 2.51	1.10	0.68, 1.77
Pregnancy-induced hypertension	2.13	2.21, 2.42	0.95	0.79, 1.16
Eclampsia	3.60	3.27, 3.98	1.46	1.02, 2.08
Smoker				
Normotensive	1.96	1.96, 2.01	1.67	1.48, 1.89
Chronic hypertension	4.66	3.97, 5.48	3.15	1.47, 6.75
Pregnancy-induced hypertension	3.79	3.45, 4.17	1.27	0.75, 2.08
Eclampsia	6.28	5.10, 7.72	5.08	2.58, 9.98

* Relative risks were adjusted for anemia, intrapartum fever, renal disorders, preterm premature rupture of membranes, eclampsia, and hydramnios for both singleton births and twin births. In the singleton analysis, relative risks were further adjusted for chronic hypertension, pregnancy-induced hypertension, and alcohol use.
† RR, relative risk; CI, confidence interval.
‡ Referent.

effect of thiocyanate contained in tobacco smoke (28). However, both smoking and hypertensive disorders are established risk factors for placental abruption. A meta-analysis based on over 1.3 million singleton pregnancies concluded that smoking was associated with a 1.9-fold (95 percent confidence interval: 1.8, 2.0) increased risk for abruption (29). Furthermore, in the presence of smoking, the risk of abruption was dramatically increased with coexistent chronic hypertension or preeclampsia. Results from the present study corroborate those of the meta-analysis (29).

Our population attributable risks for abruption risk factors in singleton and twin births (table 4) indicated that cigarette smoking during pregnancy had the greatest effect (11.5 percent for singletons and 7.3 percent for twins). Smoking is potentially "preventable." The attributable risks imply that if all women were to quit smoking during pregnancy, 11.5 percent and 7.3 percent of abruptions in singleton and twin pregnancies, respectively, would potentially be preventable. These findings are modest and offer great scope for public health interventions, specifically those targeted toward encouraging pregnant women to stop smoking. The two other risk factors for abruption based on attributable risks included pregnancy-induced hypertension and preterm PROM for singleton pregnancies and preterm PROM and anemia for twin pregnancies. Women diagnosed with any of these conditions during pregnancy should be monitored carefully.

Results of this study suggest that risk factor profiles for placental abruption are different among singleton births and twin births. Furthermore, abruption appears more frequently in twin births than in singleton births, without any obvious patterns. A better understanding of the factors that predispose women to the development of placental abruption in both singleton and twin pregnancies might be helpful in developing effective prevention strategies.

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