Original Study

Predictors of Healthy Birth Outcome in Adolescents: A Positive Deviance Approach

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ABSTRACT

Study Objective: Pregnant adolescents experience elevated rates of adverse birth outcomes compared to older mothers. Positive deviance inquiry is the identification of uncommon behaviors and traits that result in better health outcomes for individuals in a population that shares similar risks. The purpose of our study was to utilize a positive deviance framework to identify sociodemographic and behavioral characteristics associated with a healthy birth outcome among adolescents.
Design: This is a retrospective cohort study design.
Setting: We performed a secondary data analysis of vital records data from the State of Louisiana between January 1, 1995 and December 31, 2007.
Participants: Data included birth certificates from 35,013 Louisiana mothers age ≤19.
Main Outcome Measure: A healthy birth was defined as having an infant of weight between 2500 g and 4000 g, delivered vaginally without induction or instrumented delivery and in the absence of pregnancy, obstetric, or neonatal complications and anomalies.
Results: Twenty-one percent of the study population was classified as positive deviants with healthy births. Multivariate log-linear regression was used to model predictors of healthy birth. Adolescents who were older, non-black, multiparous, non-smoking, married, gained a medium amount of weight, had a longer inter-pregnancy interval or received adequate prenatal care were most likely to experience a healthy pregnancy and birth. Ethnicity, alcohol use, father's information on the birth certificate and paternal characteristics did not significantly predict a positive birth outcome.
Conclusion: Characterizing positive deviant adolescents may help identify special populations for targeted intervention and important modifiable behaviors for the promotion of better birth outcomes in all young mothers.
Key Words: Pregnancy in adolescence, Birth outcomes

Introduction

Approximately 410,000 infants were born to girls aged 15-19 in the U.S. in 2009.[1] The teenage pregnancy rate in the United States remains the highest among comparably developed countries.[1,2] For decades, significant public health attention has been paid to teenage pregnancy focusing largely on pregnancy prevention and the negative consequences of early childbirth.[3] Adolescents experience higher rates of obstetric complications, low birth weight, preterm birth, and infant mortality compared to adult mothers.[4,5] Among adolescents, the youngest (those age 15 and under) have been shown to be at increased risk for intrauterine growth restriction, prematurity, still birth, and infant death compared to older adolescents.[6,7] However, mechanisms underlying the excess risk among young mothers are not well understood. It is unclear whether young age alone intrinsically places a mother and her child at risk or rather that it is a marker for high-risk circumstances.[8–13] The psychosocial context of most adolescent pregnancy is characterized by fewer educational, social, and financial resources than that of older mothers, which may modify the relationship between age and adverse obstetric outcomes.[11] Measures of socioeconomic status and adequacy of prenatal care utilization are well-established predictors of preterm birth, low birth weight, and infant mortality among adolescents.[7,14] However, it is unknown whether these factors are also inversely predictive of a healthy birth outcome.

Positive deviance refers to the notion that certain individuals within a population possess uncommon traits or behaviors that confer resilience and result in better health outcomes compared to other individuals with similar risk profiles.[15] The characterization of “positive deviant” individuals is a means of identifying efficient and effective health-promoting factors based on existing strengths within the population.[16] This positive deviance inquiry, therefore, centers on adolescents who experience a healthy pregnancy and childbirth without complication. Identifying the beneficial attributes of positive deviant adolescent mothers—as opposed to just the factors associated with adverse birth outcomes—may help determine how to promote better birth outcomes in all young mothers.

Given the historical focus on prevention of adolescent pregnancy, few studies have addressed the factors that promote a healthy birth among this maternal population.[17–19] This study examines the predictors of healthy birth among a large, diverse population of adolescent mothers and the strength of associations between various

The authors indicate no conflicts of interest.

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http://dx.doi.org/10.1016/j.jpag.2012.05.010

demographic, behavioral, and paternal involvement factors and a positive pregnancy outcome.

Materials and Methods

Subjects

Birth certificate data from Louisiana State Vital Statistics were analyzed. The study population included 35,013 adolescents age ≤19 who gave birth in the state of Louisiana between January 1, 1995, and December 31, 2007. A subgroup of adolescents meeting all of the pre-defined criteria for having experienced a healthy birth was identified from among this larger population. Women in this subgroup were flagged as positive deviants having the outcome of interest for multivariate modeling and identification of significant predictors of healthy birth.

Outcome Measurement

A healthy birth was defined as an infant born between 37 and 42 weeks gestation based on last menstrual period with weight between 2500 g and 4000 g.[20] The infant must have been delivered vaginally and without pregnancy, obstetric, or neonatal complication including birth anomalies, induced labor, cesarean section, instrumented delivery, and maternal medical risk factors. In certain instances use of interventions such as cesarean section and instrumented delivery may have been due to unpreventable conditions such as maternal body size. However, data on reason for the intervention were not available and for the purposes of this analysis we chose to define healthy birth in the most optimal terms. A sensitivity analysis utilizing a less stringent definition of a healthy birth which included births by cesarean section and induced labor was performed in order to test the robustness of our results.

Potential Predictors

Several sociodemographic and behavioral risk factors available from the birth certificates were examined in adjusted models. The youngest (age 12-14) and oldest (age 17-19) adolescents were grouped and used for comparison to each other as well as 15 and 16 year olds. All other categorical covariates were classified as follows: race (black, other); ethnicity (Hispanic, non-Hispanic); education (less than high school, high school or beyond); parity (primiparous vs multiparous); marital status (married, unmarried); prenatal care, based on the Adequacy of Prenatal Care Utilization Index[21] (inadequate, low-adequate, adequate, adequate plus derived from both week of initiation of care and adequacy of visits received once care has begun); tobacco and alcohol use during pregnancy (both yes/no); pregnancy weight gain (≤20, >20-30, >30-40, >40 lb); inter-pregnancy interval (primigravid, 7-12, 13-24, >24 mo); and urban or non-urban status (urban defined as living in a parish with a town of population greater than 100,000). Finally, paternal characteristics were also examined for potential effects on a healthy birth outcome, including father's presence (father's information on the birth certificate), age (<18, 18-22, >22 y), race (white, black, other), ethnicity (Hispanic, non-Hispanic), and education (less than high school, high school, beyond high school).

Statistical Analysis

Observations were limited to those with complete data on race, ethnicity, education, weight gain, interpregnancy interval, parity, and tobacco use, n = 30,181. Multiple log-linear models were used to investigate possible associations with healthy birth. The goal of the modeling was to identify adolescents likely to have healthy birth outcomes. Possible predictors were chosen based on the epidemiology of adverse birth outcomes in adults and adolescents. The frequency of healthy birth outcome was compared across all categories of sociodemographic and behavioral predictors. No specific causal model was assumed, but four sets of models were fitted. Initially, basic demographics were examined; next, health behavior covariates; next, paternal characteristics among those with paternal involvement. Variables significant at $\alpha = 0.10$ in the first two models were retained for subsequent models, regardless of statistical significance, to allow for comparisons of effect sizes across models. Finally, product-term Wald chi-square tests for interactions between identified predictors were performed, and after significant interactions were identified, the demographic variables that had not been retained were remodeled to determine any additional interactions. The final model was used to estimate the relative risks for healthy birth by each of the predictive categories. The modeling strategy was repeated for the sensitivity analysis utilizing a more inclusive definition of healthy birth. Analyses were performed using SAS v 9.2 (SAS Institute Inc., Cary, NC).

Results

Figure 1 depicts the process of identification of the healthy birth subgroup. Among the 35,013 adolescent women included in the study, 7,460 (21.3%) met all the criteria for a healthy birth and were classified as positive deviants and 6,585 had complete data on all potential predictors. Almost 17% (n = 2,424) of the study population was missing data on last menstrual period (LMP). Among the women whose records did contain data on LMP, approximately 17% (n = 5,557) gave birth prior to 37 weeks gestation. A large number of women meeting both the gestational age and birth weight criteria had records indicating an abnormal condition of the newborn, and/or pregnancy, obstetric, or labor complications, including those unspecified as “other” (n = 10,600).

In bivariate analysis, women experiencing a healthy birth by the study definition were more likely to be among the oldest adolescents (Table 1). A greater proportion of positive deviants were adolescents who were of race other than black, had a high school education, of Hispanic ethnicity, multiparous, received adequate prenatal care, gained a medium-high amount of gestational weight, and lived in an urban area (all $P < .05$).

In multivariable models, ethnicity, education, and marital status were all eliminated from the initial model of maternal

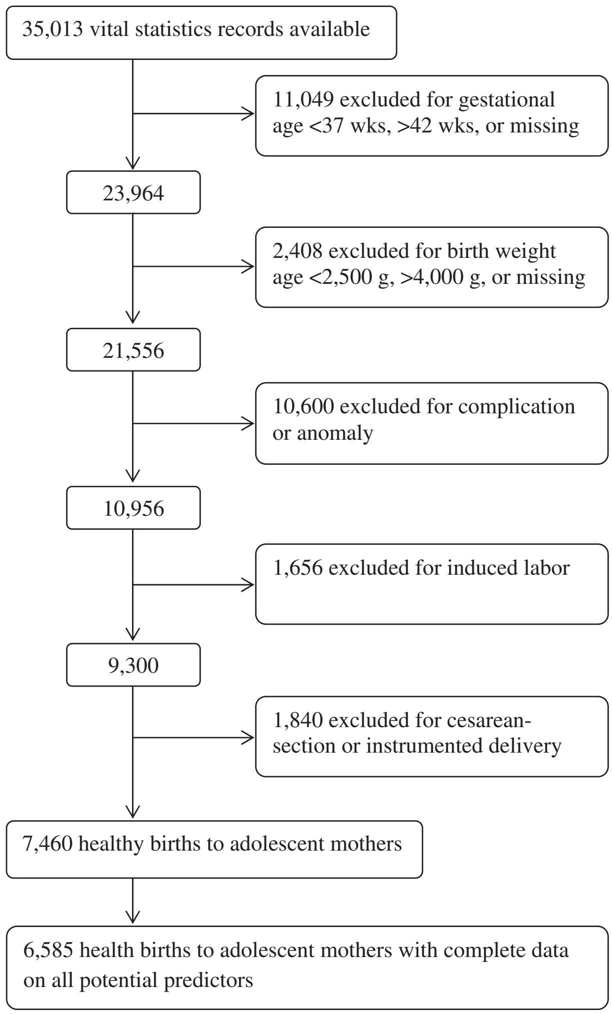

Fig. 1. Flowchart of healthy birth positive deviant identification.

demographic characteristics (Table 2; all $P > .25$). The second model included the addition of smoking, gestational weight gain, and prenatal care (alcohol use was not significantly associated), though the original associations with demographics were not changed. Finally, the addition of father's information on the birth certificate showed no effect on the healthy birth outcome (RR = 1.03; 95% CI, 0.98-1.07) nor did any of the paternal characteristics (age, education, ethnicity, race).

Tests for interaction indicated that urban/rural status was the most frequent modifier of these relationships with differential associations on the following covariates: race (P for interaction $< .01$), prenatal care ($P < .01$), gestational weight gain ($P < .05$), and education ($P < .01$). Table 3 contains relative risk estimates for healthy birth stratified by urban/rural status. Among urban adolescents, only those in the oldest age category (age 17-19) were at significantly increased probability of a healthy birth outcome, while maternal age was not a significant predictor of healthy birth among non-urban teens. While blacks in both urban and non-urban settings fared worse than women of all other races, urban black women were at especially high risk (urban RR = 0.73, 0.68, 0.79, non-urban RR = 0.90; 95% CI, 0.85-0.96). Parity was also a significant predictor of positive deviant status in both urban and non-urban teens indicating an increased likelihood of healthy birth in multiparous teens compared to primiparous, but the relationship

Table 1
Frequency, Unadjusted Relative Risk and 95% Confidence Intervals for Sociodemographic and Behavioral Predictors by Birth Outcome among Adolescents in Louisiana January 1, 1995, through December 31, 2007*

	Healthy Births (n = 6,585)		Adverse Births (n = 23,596)		Healthy vs Adverse Birth	
	n	%	n	%	RR	95% CI
Age, years‡						
17-19	5,595	22.4	19,415	77.6	Ref	
16	609	20.2	2,411	79.8	0.90	0.84, 0.97
15	269	18.2	1,213	81.9	0.81	0.73, 0.91
12-14	112	16.7	557	83.3	0.75	0.63, 0.89
Race‡						
Other	3,123	23.1	10,416	76.9	Ref	
Black	3,462	20.8	13,180	79.2	0.90	0.86, 0.94
Ethnicity†						
Non-Hispanic	6,468	21.8	23,259	78.2	Ref	
Hispanic	117	25.7	337	74.2	1.18	1.01, 1.39
Education†						
High school or beyond	2,848	22.4	9,849	77.6	Ref	
Less than high school	3,737	21.4	13,747	78.6	0.95	0.91, 0.99
Marital status						
Unmarried	5,565	21.7	20,107	78.3	Ref	
Married	1,020	22.6	3,489	77.4	1.04	0.98, 1.10
Parity‡						
Multiparous	1,524	24.3	4,750	75.7	Ref	
Primiparous	5,061	21.2	18,846	78.8	0.87	0.83, 0.92
Alcohol use						
No	6,556	21.8	23,513	78.2	Ref	
Yes	17	23.0	57	77.0	1.05	0.69, 1.60
Tobacco use						
No	5,866	21.9	20,926	78.1	Ref	
Yes	719	21.2	2,670	78.8	0.97	0.90, 1.03
Inter-pregnancy interval, months‡						
> 24	609	22.6	2,092	77.5	Ref	
13-24	986	24.3	3,075	75.7	1.08	0.99, 1.18
7-12	194	20.2	767	79.8	0.90	0.78, 1.04
Primigravid	4,796	21.4	17,664	78.7	0.95	0.88, 1.02
Prenatal care‡						
Inadequate	1,185	19.8	4,814	80.3	Ref	
Low-adequate	955	25.0	2,870	75.0	1.25	1.17, 1.36
Adequate	2,622	27.9	6,768	72.1	1.41	1.33, 1.50
Adequate plus	1,823	16.6	9,144	83.4	0.84	0.79, 0.90
Pregnancy weight gain‡						
≤20 lbs	1,646	20.7	6,296	79.3	Ref	
20-30 lb	2,146	23.5	6,972	76.5	1.14	1.07, 1.20
30-40	1,569	22.8	5,300	77.1	1.10	1.04, 1.17
> 40	1,224	19.6	5,028	80.4	0.94	0.88, 1.00
Rurality‡						
Non-urban	4,062	20.3	15,944	79.7	Ref	
Urban	2,523	24.8	7,652	75.2	1.22	1.17, 1.28
Paternal involvement						
No	2,699	21.4	9,899	78.6	Ref	
Yes	3,886	22.1	13,697	77.9	0.97	0.93, 1.01
Father's age, years						
> 22	1,411	22.1	4,942	77.8	Ref	
18-22	1,835	22.2	6,419	77.8	1.00	0.94, 1.06
< 18	203	21.1	758	78.8	0.95	0.83, 1.08
Father's race						
White	1,679	21.5	6,183	78.5	Ref	
Black	2,122	22.5	7,266	77.5	1.05	0.99, 1.11
Other	66	23.0	221	77.0	1.07	0.86, 1.33
Father's education						
Less than high school	1,504	21.7	5,422	78.3	Ref	
High school	1,920	22.3	6,693	77.7	1.03	0.97, 1.09
Beyond high school	417	22.6	1,428	77.4	1.01	0.97, 1.02
Father's ethnicity						
Non-Hispanic	3,781	22.1	13,344	77.9	Ref	
Hispanic	100	23.5	326	76.5	1.06	0.89, 1.26

* May not add to total due to missing data.
† $P < 0.05$.
‡ $P < 0.01$.

Table 2
Model Building for Predictors of Healthy Birth Outcome among Adolescents in Louisiana January 1, 1995, through December 31, 2007 (Women with complete data, N = 30,183)

Variable	Model 1: Demographics			Model 2: Add health behaviors			Model 3a: Add paternal involvement			Model 3b: Add paternal characteristics (in births with paternal involvement, n = 15,365)		
	RR	95% CI	*P*	RR	95% CI	*P*	RR	95% CI	*P*	RR	95% CI	*P*
Age, years												
12-14	Ref		<0.01	Ref		<0.01	Ref		<0.01	Ref		0.65
15	1.06	0.87, 1.30		1.07	0.88, 1.31		1.08	0.89, 1.31		0.98	0.57, 1.66	
16	1.16	0.97, 1.40		1.16	0.97, 1.40		1.17	0.97, 1.40		1.13	0.69, 1.85	
17-19	1.25	1.05, 1.48		1.23	1.03, 1.45		1.24	1.04, 1.47		1.13	0.70, 1.84	
Race												
Other	Ref		<0.01	Ref		<0.01	Ref		<0.01	Ref		<0.01
Black	0.84	0.80, 0.89		0.84	0.80, 0.88		0.84	0.80, 0.88		0.78	0.68, 0.89	
Parity												
Multiparous	Ref		<0.01	Ref		<0.01	Ref		<0.01	Ref		<0.01
Primiparous	0.75	0.66, 0.84		0.73	0.65, 0.83		0.73	0.65, 082		0.73	0.63, 0.85	
Rurality												
Rural	Ref		<0.01	Ref		<0.01	Ref		<0.01	Ref		<0.01
Urban	1.28	1.22, 1.34		1.29	1.23, 1.35		1.29	1.23, 1.35		1.39	1.30, 1.48	
Ethnicity												
Non-Hispanic	Ref		0.37									
Hispanic	1.08	0.92, 1.26										
Education												
Less than high school	Ref		0.43									
High school or beyond	0.98	0.94, 1.03										
Marital status												
Unmarried	Ref		0.40									
Married	1.03	0.96, 1.09										
Inter-pregnancy interval, months												
>24	Ref		<0.01	Ref		<0.01	Ref		<0.01	Ref		0.04
13-24	1.08	0.99, 1.18		1.08	0.99, 1.18		1.07	0.98, 1.17		1.10	0.97, 1.24	
7-12	0.94	0.81, 1.08		0.97	0.84, 1.11		0.96	0.83, 1.11		1.02	0.85, 1.23	
0 (primiparous)	1.22	1.08, 1.39		1.22	1.08, 1.39		1.22	1.07, 1.38		1.25	1.06, 1.48	
Smoking during pregnancy												
Yes				Ref		<0.01	Ref		<0.01	Ref		0.57
No				1.11	1.03, 1.19		1.11	1.23, 1.35		1.03	0.94, 1.12	
Alcohol during pregnancy												
Yes				Ref		0.51						
No				0.87	0.57, 1.31							
Gestational weight gain												
Low				Ref		<0.01	Ref		<0.01	Ref		<0.01
Medium				1.11	1.05, 1.17		1.11	1.05, 1.17		1.09	1.00, 1.18	
Medium high				1.06	1.00, 1.13		1.06	1.00, 1.13		1.03	0.94, 1.12	
High				0.91	0.85, 0.98		0.91	0.85, 0.98		0.83	0.76, 0.92	
Prenatal Care												
Inadequate				Ref		<0.01	Ref		<0.01	Ref		<0.01
Low-adequate				1.26	1.17, 1.36		1.26	1.17, 1.36		1.31	1.17, 1.47	
Adequate				1.40	1.31, 1.49		1.40	1.32, 1.49		1.40	1.27, 1.54	
Adequate-plus				0.83	0.77, 0.88		0.83	0.77, 0.89		0.84	0.77, 0.94	
Paternal involvement												
Yes							Ref		0.34			
No							1.02	0.98, 1.07				
Paternal age, years												
<18										Ref		0.76
18-22										0.98	0.85, 1.13	
>22										0.96	0.83, 1.11	
Paternal education												
Less than high school										Ref		0.48
High school										1.04	0.98, 1.11	
Beyond high school										1.01	0.91, 1.12	
Paternal ethnicity												
Non-Hispanic										Ref		0.87
Hispanic										0.98	0.81, 1.19	
Paternal race												
Black										Ref		0.33
White										1.11	0.97, 1.27	
Other										1.05	0.84, 1.32	
Model AIC	31,490.36			30,980.36			31,1028.95			15,902.21		

appeared less strongly among urban mothers (non-urban RR = 0.71; 95% CI, 0.61-0.82, urban RR = 0.77; 95% CI, 0.65-0.93). Maternal education level did predict positive deviant status, though the direction of the association was inverse for non-urban and urban teens. Non-urban teens with a higher level of education were more likely to experience a healthy birth compared to those with a lower level (RR = 1.06; 95% CI, 1.00-1.07). On the contrary, urban teens with

Table 3
Adjusted RR and 95% Confidence Intervals for Significant Predictors of Healthy Birth Stratified by Urban Status (N = 30,183)

Predictor	Non-urban			Urban			*P* for interaction
	RR	95% CI	*P* [a]	RR	95% CI	*P* [a]	
Age, yrs							0.48
12-14	Ref		0.27			0.02	
15	1.05	0.82, 1.34		1.14	0.81, 1.62		
16	1.09	0.87, 1.36		1.33	0.97, 1.83		
17-19	1.15	0.93, 1.41		1.40	1.03, 1.90		
Race							<0.01
Other	Ref		<0.01			<0.01	
Black	0.90	0.85, 0.96		0.73	0.68, 0.79		
Parity							0.54
Multiparous	Ref		<0.01			<0.01	
Primiparous	0.71	0.61, 0.82		0.77	0.65, 0.93		
Education							<0.01
Less than high school	Ref		0.04			0.01	
High school or more	1.06	1.00, 1.13		0.91	0.85, 0.98		
Marital Status							0.08
Not Married	Ref		0.82			0.05	
Married	0.99	0.92, 1.07		1.12	1.00, 1.26		
Smoking							0.61
Yes	Ref		0.06			0.06	
No	1.08	1.00, 1.18		1.14	0.99, 1.30		
Prenatal Care							<0.01
Inadequate	Ref		<0.01			<0.01	
Low-adequate	1.26	1.15, 1.38		1.24	1.09, 1.41		
Adequate	1.31	1.21, 1.42		1.54	1.39, 1.71		
Adequate-plus	0.76	0.70, 0.83		0.93	0.84, 1.04		
Gestational weight gain							0.02
Low	Ref		<0.01			<0.01	
Medium	1.07	1.00, 1.16		1.16	1.06, 1.27		
Medium-high	1.02	0.95, 1.11		1.12	1.01, 1.23		
High	0.86	0.79, 0.94		0.99	0.89, 1.10		
Inter-pregnancy interval, months							0.74
>24	Ref		0.06			0.09	
13-24	1.03	0.92, 1.15		1.14	0.99, 1.31		
1-12	0.92	0.77, 1.11		1.01	0.80, 1.29		
0 (primiparous)	1.19	1.01, 1.41		1.24	1.02, 1.51		

[a] Chi-square *P* value.

a higher level of education were 9% less likely to have a healthy birth to those with a less than high school education (RR = 0.91; 95% CI, 0.85-0.98).

All women benefited from low-adequate and adequate prenatal care compared to counterparts receiving inadequate prenatal care; teens in the highest level of care (adequate plus), however, were less likely to be positive deviants although again this relationship was not significant in the urban population (non-urban RR = 0.76; 95% CI, 0.70-0.83, urban RR = 0.93; 95% CI, 0.84-1.04). The amount of gestational weight gain associated with a positive birth outcome differed by urban status. Non-urban teens gaining a high amount of weight during pregnancy were 14% less likely to have a healthy birth compared to those gaining a low amount of weight (RR = 0.86; 95% CI, 0.79-0.94). However, in urban teens both a medium and medium-high amount of gestational weight gain were associated with an increased probability of healthy birth compared to low weight gain (medium RR = 1.16; 95% CI, 1.06-1.27, medium-high RR = 1.12; 95% CI, 1.01-1.23) while a high amount of weight gain showed no impact. Finally, compared to the longest interpregnancy interval (>24 months), shorter intervals were only marginally predictive of a healthy birth among urban and non-urban teens.

Results from the sensitivity analysis which included births by cesarean section and induced labor in the definition of a healthy birth were largely unchanged (Supplemental tables 4–6). The number of healthy births by this definition increased to 8,188. In bivariate analysis, variables previously associated with healthy birth that were no longer significant using the broader definition included interpregnancy interval and rurality. However, marital status, father's information on the birth certificate, and father's race were significant predictors in the sensitivity analysis though not in the primary analysis. Adolescents with a healthy birth by the broader definition were more likely to be married, or have father's information on the birth certificate, or have a father of black race. The only difference in modeling was the education variable, which was retained across all four models (all $P < .01$) and thus was included in the final model. Education was included in the final model in the primary analysis because of a significant interaction with rurality; however, it had previously been removed from model 1 for non-significance ($P = .43$). Effect estimates were similar in the final model of the sensitivity analysis to those of the primary analysis with a more stringent definition of healthy birth. Finally, adjusting for year of birth did not significantly change the predictors and their effect estimates in the final model. For this reason and because we were primarily interested in identifying predictors that may be relevant outside of our own data, this variable was excluded from the analysis.

Discussion

In our analysis, education, race, parity, smoking, prenatal care, gestational weight gain and inter-pregnancy interval were all associated with positive deviance: a healthy birth outcome among a high-risk maternal group. Urban status was a strong modifier of many of these associations and differentially defined the risk profiles of urban and non-urban adolescent populations. Therefore, we chose to present the results of the analyses stratified by urban status. In all models, urban residency strongly predicted increased probability of a healthy birth compared to non-urban residence. Rural-urban differences in adolescent birth outcomes have not been studied extensively in the United States: a study in Pennsylvania found the best outcomes occurred among women living in areas with a substantial work flow to an urban cluster, and worse outcomes in those living in either very urban or very rural areas,[22] and a small study in Texas found no effect of county rurality on pregnancy outcomes in teenagers.[23] Elsewhere, investigations report a similar reproductive health advantage experienced by urban adolescents;[24] the evidence is mixed as to whether this is a consequence of poor access to care in rural areas.[22,25]

The relation between education and a positive birth outcome was inverse between non-urban and urban teens in our study. Auger et al[26] found a similar interaction between maternal education and position along a rural-urban continuum; contrary to our findings, they reported a deleterious effect of higher education among women in remote or rural areas relative to metropolitan areas and an increased risk among lesser educated women in small urban areas, though without controlling for some important confounders. Possible reasons for this difference include the heterogeneity within our non-urban and urban parishes, and the fact that, given the restricted age of our study population, the range of educational achievement is inherently limited.

In both the non-urban and especially urban areas, young black women were less likely to have a healthy birth compared to adolescents of other races in our sample. While early childbearing among black women in high-poverty urban areas may help to avoid the deleterious consequences of cumulative health risks seen in black women at more advanced maternal age,[27–32] compared to young women of other races, black adolescents were still less likely to have a healthy birth in our sample. These results indicate a racial disparity beginning early in adolescence and underscore the importance of addressing health and social inequities prior to the adolescent mother's pregnancy, in her own infancy and childhood.[33,34]

Second births among adolescents have sometimes been found to be at higher risk than first births.[35,36] Interestingly, the multiparous teens in our study were more likely to experience a healthy birth outcome compared to primiparous teens. These multiparous teens may have been less stressed—having already experienced childbirth—or they may have benefitted from connections to health and social services support or behavioral counseling established during their first pregnancy. Also, primiparous babies are generally lighter than later babies, and thus at increased risk of falling in the low birthweight category.

The factors discussed above represent non-modifiable factors that may help in identifying target groups for healthy birth-promoting interventions and the effective distribution of resources to these groups. However, central to the positive deviance approach is the identification of existing and practiced behaviors that confer better health outcomes among certain individuals compared to others within a population at comparable risk. In our study, non-smoking, low-adequate or adequate prenatal care, longer inter-pregnancy intervals, and a gestational weight gain in the medium range were the significant modifiable factors exhibited by the subgroup of adolescents who experienced optimal pregnancy and birth outcomes (the positive deviants). Although pre-pregnancy weight data were unavailable, we found that adolescents who gained between 20 and 30 pounds were most likely to have a healthy birth. Gaining too much weight (>40 lbs) had a more deleterious effect than not gaining enough (under 20 lbs). The importance of counseling pregnant teens on appropriate weight gain is evident not only from its impact on a healthy birth outcome, but from the long-term effects of gestational weight gain in adolescence.[37]

Of equal interest in our analysis were the factors that did not predict positive deviant status. Self-reported alcohol use, inter-pregnancy interval, Hispanic ethnicity, marital status, father named on the birth certificate, and paternal sociodemographic characteristics showed no significant association with a healthy pregnancy outcome among positive deviant teens in both non-urban and urban populations. The impact of paternal characteristics on adolescent maternal and child health outcomes represents an understudied phenomenon. One study on paternal age and low birthweight reported a protective though non-significant effect of young age compared to older fathers.[38] A recent review concluded that there were inconsistent and insufficient associations between low birth weight and paternal age, occupational exposure, or height, and no relationship between paternal characteristics and preterm birth or small for gestational age.[39] Despite an apparent lack of direct influence on birth outcomes (both adverse and healthy), other research has demonstrated the importance of partner support on teenage mothers' educational, emotional, and economic outcomes after childbirth,[40] mother-infant interactions,[41] and parenting behaviors.[42] These outcomes were not addressed in the current study, and may represent more plausible and promising mechanisms by which young fathers beneficially impact adolescent mothers. Moreover, paternal involvement in the current study was measured only by proxy (father's information on the birth certificate) likely resulting in misclassification of some mother/father relationships.

Our study includes additional important limitations. First, birth certificates contained limited detail regarding the medical risk factors that were used to exclude individuals from the positive deviant classification. Pregnancy-induced hypertension and anemia were the most frequently named medical risk factors on the birth certificates (13%, n = 1,296 and 12%, n = 1,163 respectively); however, almost 60%

(n = 5,846) were listed only as "other." Young maternal age is not in and of itself considered an "other" complication on the birth certificate; examples of conditions likely included in the unspecified category are preterm labor, intrauterine growth restriction, previous cesarean section, steroids or glucocorticoids given prior to birth, antibiotics given during birth, chorioamnionitis, fetal distress, and previous poor outcome including stillbirth/infant death. The proportion of adolescents excluded from the positive deviant category on the basis of these individual complications is unquantifiable. Future studies will benefit from the addition of these variables to the most recently updated version of the Louisiana state birth certificates. Secondly, while the sound reliability of birth certificate data for examining population-level birth outcomes has been demonstrated, it is somewhat limited for health behavior variables in particular.[43] This may explain why alcohol use—measured by self-report and one of the least reliable variables—did not significantly predict healthy birth in our sample.[43,44]

The personal and societal consequences associated with childbearing in adolescence warrant the prioritization of teen pregnancy prevention as an important public health objective. They also necessitate the support and care of young women who do become pregnant. The application of a positive deviance approach to adolescent reproductive health is useful for identifying factors associated with a pregnancy and childbirth free of complications in a population at high-risk. We found that many but not all of the behavioral and medical risk factors that have been associated with adverse outcomes in pregnant teens are also related to a healthy birth outcome. Future research should go more in depth to identify the characteristics of positive deviant girls that enable them to give birth to healthy babies.

Acknowledgments

This work was supported by the Tulane Research Enhancement fund and the Eunice Kennedy Shriver National Institute of Child Health And Human Development (K12HD043451 to EWH and T32HD057780 to MEW). The content is solely the responsibility of the authors and does not necessarily represent the official views of the Eunice Kennedy Shriver National Institute of Child Health & Human Development or the National Institutes of Health.

Supplementary Data

Supplementary data associated with this article can be found, in the online version, at doi: 10.1016/j.jpag.2012.05.010

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