Maternal Age and Birth Outcomes: Data from New Jersey

By Nancy E. Reichman and Deanna L. Pagnini

The effects of maternal age on low birth weight, newborns' hospital costs and infant mortality were estimated based on individual 1989 and 1990 vital statistics records from New Jersey that were linked with uniform billing hospital discharge records. Results of multivariate analyses show a U-shaped relationship between maternal age and low birth weight among whites, with the youngest (younger than 15) and oldest (aged 40 and older) mothers being at higher risk than 25–29-year-olds; older teenagers were not at any significantly increased risk. Among blacks, however, 15–19-year-olds faced significantly lower risks of delivering low-birth-weight babies than did black women aged 25–29. Both black and white mothers in their 30s were significantly more likely to deliver a low-birth-weight baby than women aged 25–29 of the same race. The multivariate analysis also showed that newborn hospitalization costs increased with maternal age among both blacks and whites. The seemingly poorer birth outcomes of teenage mothers appear to result largely from their adverse socioeconomic circumstances, not from young maternal age per se.

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Teenage pregnancy and childbearing have become pressing social concerns in the United States, where approximately one million teenagers become pregnant each year, and half that number give birth.[1] An enormous quantity of research has shown that teenage childbearing is linked to a host of negative social, economic and medical consequences for both mother and child. There is a great deal of debate, however, about whether these consequences are due to maternal age per se, or whether they are caused by the adverse economic and social circumstances of teenagers who become mothers.[2]

Research has documented that teenage mothers are at high risk for poor birth outcomes: Babies born to teenagers are more likely than those born to women in their 20s to be born early, to weigh less than 2,500 g at birth or to die before age one. Further research suggests that these risks vary by age even among teenage mothers, with those younger than 15 having the worst outcomes.[3]

Some of the explanations proposed for these adverse birth outcomes are biological—i.e., that a pregnant teenager who is still growing may be competing for nutrients with the fetus, or that pregnancy within two years after menarche increases the risk of preterm delivery.[4] Psychological factors may also be involved, since many adolescent pregnancies are unplanned, unwanted or discovered late;[5] a pregnant teenager may lack the emotional maturity to take responsibility for a pregnancy even after she has decided to carry it to term. And part of the explanation may simply reflect selection bias, since teenagers who become mothers are more likely than others to be poor, to be undereducated or to live in areas with limited access to resources and services.[6]

Teenagers are not the only age-group at high risk for poor birth outcomes, but they have received the most public attention. Although a constellation of risk factors for adverse birth outcomes applies to teenage mothers, once the effects of these risk factors are controlled for, early childbearing may actually improve infant health in some cases (particularly among blacks).[7]

On the other end of the age spectrum, while women who give birth relatively late in their reproductive lives have fewer socioeconomic disadvantages than teenagers, they nonetheless share increased risks for poor birth outcomes. Delayed childbearing poses its own biological risks, such as an increased likelihood of medical conditions such as hypertension and diabetes.[8] In addition, women aged 35 and older, like teenagers, have higher rates of unintended pregnancy than do women in their 20s and early 30s.[9] And risks for poor birth outcomes increase further with age, with those older than 40 being at greater risk than 35–39-year-olds.[10]

The research on the relationship between maternal age and birth outcome has left important gaps, however. Aggregation has masked important within-group differences at both ends of the reproductive-age spectrum. For example, research that groups teenagers at ages 13 or 14 through 17[11] may mask variation within this disparate category of adolescents. Other recent studies that analyzed the effects of young maternal age tended to compare teenagers to women in their 20s only, and either ignored older women or grouped them all together.[12] In addition, little research has been conducted on births to older mothers, even though such births are becoming increasingly common.

Thus, to assess the true effects of maternal age, researchers need an inclusive set of narrowly defined age-groups spanning all reproductive ages across a number of outcomes. In this article, we use a unique linked data set of births in 1989 and 1990 among New Jersey women to analyze the effects of maternal age on low birth weight, infant mortality and newborn hospitalization costs.

We compared the birth outcomes of teenage mothers in three distinct age-groups—those younger than 15, 15–17-year-olds and 18–19-year-olds. The youngest adolescents are most likely to be at risk, both biologically and socially, for poor birth outcomes.[13] In contrast, while technically teenagers (although no longer minors), the 18–19-year-olds might be closer to adults than to adolescents, since they may be working or in college; moreover, compared with younger teenagers, older adolescents are more likely to be married and to have a wanted pregnancy. For these reasons, we expect that 18–19-year-olds would have better birth outcomes than younger adolescents.

We compared the birth outcomes among each adolescent group with those of older women to answer the following questions: Do teenagers fare the worst in

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all birth outcomes among all age-groups? Are all teenagers at the same risk, or do older adolescents have better outcomes than younger ones? How important is maternal age once other important characteristics are controlled? And do the patterns differ between blacks and whites?

Data and Methods

The data used in this analysis come from individual vital statistics records for 1989 and 1990 births and deaths; these were linked with uniform billing hospital discharge records. The data, provided by the New Jersey Department of Health, are for all singleton, in-state live births to New Jersey residents over the period. Insurance status and newborn costs were recorded on the hospital discharge records, infant mortality was recorded on death certificates, and all other individual-level measures were recorded on birth certificates. Several of these birth certificate measures, such as smoking and alcohol usage, were self-reported, while others, such as birth weight, were recorded by clinicians. Prenatal care data gathered from the birth certificates were taken directly from prenatal care records when available, or from the mothers' self-reports.

Our cost measure was the amount charged on the uniform bill by the hospital in which the infant was born.* The reported charges are based on the projected costs for direct services rendered to an individual (such as room and board, x-rays and medications), as well as the indirect (overhead) costs of providing these medical services.

We analyzed the data separately by race, since black and white women exhibit different patterns in birth outcomes by age;[14] women of other races were excluded from the analysis. In addition to the three adolescent age-groups, we created four distinct groups of older women spanning five years each, and a fifth comprised of women aged 40 and older, for an overall total of eight age-groups.

Table 1. Percentage distribution of 1989 and 1990 births among New Jersey women, and 1990 birthrates for New Jersey and the United States, all by maternal age, according to race

Maternal age	% distribution of NJ births		Birthrate (per 1,000)			
			New Jersey		United States	
	White	Black	White	Black	White	Black
<15	0.1	0.7	0.4	0.7	2.1	4.9
15–17	1.9	8.5	14.6	29.5	67.3	82.3
18–19	4.1	12.4	44.7	78.0	132.5	152.9
20–24	17.9	30.4	69.5	109.8	133.9	160.2
25–29	34.2	26.2	108.5	120.7	108.1	115.5
30–34	30.2	15.8	93.0	81.7	67.9	68.7
35–39	10.2	5.2	35.6	31.5	25.4	28.1
≥40	1.4	0.9	5.3†	5.7†	4.6†	5.8†
Total	100.0	100.0	na	na	na	na

†Birthrate per 1,000 40–44-year-olds. Notes: For percentage distribution of NJ births, N=162,329 births to white women and N=41,772 births to black women. na=not applicable.

Since low birth weight and infant mortality are defined as dichotomous variables, we used logistic regression for these estimates. For hospital costs, however, we conducted an ordinary least-squares regression using the natural logarithm of costs, since the logged costs yield a better model fit than do the charges themselves.

We ran three sets of models separately for each race, predicting the effect of maternal age (relative to the reference group—25–29-year-olds) on each outcome. The first was unadjusted and presents the gross effects of age. The second controlled for medical and behavioral risk factors only, incorporating measures of prenatal care use, reproductive history, behavioral risk factors such as smoking and alcohol use, and the woman's health status.† The final model added further socioeconomic controls, including education, insurance status, marital status and city size,‡ as well as dummy variables for the woman's county of residence. Comparing the chi-square statistics (and degrees of freedom) across the models shows whether adding each set of variables significantly increased the fit of the model.

To incorporate the independent variables, we relied on a model that has been widely applied in the analysis of infant health and birth outcomes, referred to as an "infant health production function."[15] Low birth weight, infant mortality and newborn costs were all considered birth outcomes that reflect the joint product of several "inputs," which we classified for the purposes of this study as maternal age, medical factors and socioeconomic factors.

We expected that such characteristics as single marital status, a low level of education and lack of private insurance would result in poorer outcomes at all ages. We also expected that smoking and alcohol use, late prenatal care and the presence of hypertension or diabetes would similarly indicate poorer outcomes. Although the effects of reproductive history (i.e., parity, prior loss of a child and having had a pregnancy termination) are ambiguous in the aggregate, research linking these factors to birth outcomes suggests that they should be included as control variables.

Results

Overall, very few of the more than 204,000 singleton births to New Jersey whites and blacks in 1989 and 1990 were to mothers younger than 15 (Table 1). Black women

Table 2. Percentage of newborns with low birth weight, percentage dying within one year of birth and mean newborn hospitalization costs, all according to maternal race and age, New Jersey, 1989 and 1990

Age	N	% low birth weight	% dying within year	Mean hospitalization costs
WHITE				
All women	**162,329**	**4.2**	**0.5**	**$1,157**
<15	156	15.4	1.3	2,093
15–17	3,064	8.6	1.1	1,441
18–19	6,639	7.1	0.9	1,281
20–24	29,064	4.9	0.7	1,166
25–29	55,530	3.6	0.4	1,112
30–34	48,980	3.7	0.4	1,120
35–39	16,627	4.2	0.4	1,235
≥40	2,269	6.1	0.6	1,551
BLACK				
All women	**41,772**	**11.6**	**1.5**	**$1,926**
<15	288	12.5	2.4	1,764
15–17	3,534	11.5	1.5	1,761
18–19	5,179	11.5	1.6	1,800
20–24	12,691	11.4	1.6	1,934
25–29	10,958	11.6	1.4	1,963
30–34	6,583	12.0	1.4	1,998
35–39	2,173	11.4	1.5	2,008
≥40	366	11.5	1.6	2,277

Notes: Differences by maternal age are significant at p=.0001 (chi-square test) for low birth weight and for mean hospitalization costs (F-test) among both whites and blacks. Age differences in infant mortality rates were not significant—p=.3411 among whites and p=.8222 among blacks (chi-square test).

*We used this measure rather than the actual payment, since New Jersey operated under a Disease Related Group system between 1985 and 1992, in which patients were charged a set of fees associated with their diagnosis; therefore, the "actual payments" for that period represented the average cost of treating a given diagnosis, and not the value of resources utilized in the care of individual patients. Thus, reported charges are likely to be a more accurate measure of the true cost of hospitalization than are actual payments.

†The dichotomous medical variables, coded 1 if the variable was present and 0 if it was not, were: mother smoked cigarettes at any time during the pregnancy; mother drank at any time during the pregnancy; mother had had a live birth within the preceding 20 months; newborn was female; mother was diagnosed as diabetic; mother developed pregnancy-related hypertension; mother had had at least one induced or spontaneous abortion; newborn was a first birth; mother had had a liveborn child who later died; and mother began prenatal care in the first trimester.

‡The dichotomous social and economic variables, coded 1 if the variable was present and 0 if it was not, were: mother had age-appropriate education (within one year of the appropriate grade for age among teenagers and completion of at least high school among older women); mother was covered by Medicaid (versus having private insurance); mother was uninsured (versus private insurance); mother was married at the time of the birth; and the birth occurred in 1990. For city size, we used two dichotomous variables that compared large and mid-sized cities to smaller ones (75,000 inhabitants or more vs. fewer than 50,000, and 50,000–74,999 vs. fewer than 50,000).

Table 3. Logistic regression coefficients indicating effect of maternal age on the likelihood of low birth weight, by race, according to adjustment for variables

Variable	White			Black		
	Unadjusted	Adjusted for medical controls	Adjusted for medical and socio-economic controls†	Unadjusted	Adjusted for medical controls	Adjusted for medical and socio-economic controls†
Age						
<15	1.57***	1.20***	0.78**	0.09	0.10	–0.04
15–17	0.91***	0.58***	0.23**	–0.01	–0.02	–0.16*
18–19	0.70***	0.32***	0.01	–0.01	–0.04	–0.21**
20–24	0.32***	0.16***	0.01	–0.02	–0.03	–0.12*
30–34	0.01	0.11**	0.16***	0.04	0.10	0.16**
35–39	0.16***	0.29***	0.34***	–0.02	0.13	0.21*
≥40	0.55***	0.66***	0.67***	0.02	0.15	0.21
Smoked during pregnancy	na	0.71***	0.68***	na	0.64***	0.54***
Used alcohol during pregnancy	na	0.04	0.03	na	0.53***	0.48***
Had recent live birth	na	0.20***	0.21***	na	0.30***	0.30***
Female baby	na	0.21***	0.21***	na	0.22***	0.22***
Mother diabetic	na	0.05	0.03	na	–0.22	–0.20
Pregnancy-related hypertension	na	1.23***	1.24***	na	0.90***	0.92***
Had prior abortion or miscarriage	na	0.12***	0.12***	na	0.14***	0.15***
First birth	na	0.41***	0.46***	na	0.22***	0.23***
Had child who died	na	0.55***	0.51***	na	0.49***	0.47***
Obtained prenatal care in first trimester	na	–0.35***	–0.18***	na	–0.31***	–0.24***
Age-appropriate education	na	na	–0.16***	na	na	–0.21***
Insurance						
Medicaid	na	na	0.21***	na	na	0.12*
Uninsured	na	na	0.23***	na	na	0.22***
Married at birth	na	na	–0.24***	na	na	–0.33***
Baby born in 1990	na	na	0.01	na	na	–0.01
City size						
≥75,000	na	na	0.29***	na	na	0.07
50,000–74,999	na	na	0.15**	na	na	0.02
Intercept	–3.28***	–3.54***	–3.43***	–2.03***	–2.45***	–2.57***
Model fit (χ^2)	393.4	1,491.9	1,878.9	1.88	784.3	978.4
df	7	17	44	7	17	44
N	162,112	145,038	145,019	41,713	35,699	35,696

*p<.05. **p<.01. ***p<.001. †Also includes controls for county of residence. Notes: In this and subsequent tables, reference category for maternal age is 25–29-year-olds. Reference category for Medicaid and uninsured is privately insured; and reference category for city size is 50,000 residents. Ns differ slightly throughout the tables bacause of missing values. na=not applicable.

were more likely than white women to have given birth as teenagers (22% vs. 6%); conversely, whites were more likely than blacks to have given birth at age 30 and older (42% vs. 22%). Overall, New Jersey birthrates for both races and for all age-groups were systematically lower than comparable U.S. rates, with one exception: Rates among white women in their 30s were higher in New Jersey than in the country as a whole.

The birth-weight data displayed in Table 2 (page 269) indicate that except for the youngest mothers (those younger than 15), the percentage of babies weighing less than 2,500 g among black teenagers was similar to that among older black mothers. White teenagers, however, had a markedly higher incidence of low birth weight than did older white mothers. Moreover, 15% of babies born to the youngest white adolescents were of low birth weight, a rate that was almost three percentage points higher than that among the youngest black infants. In contrast, the incidence of low birth weight among babies born to whites older than 19 was less than half that among all black women, and the differences between age-groups were statistically significant for both blacks and whites (p=.0001).

The percentage of infants who died within one year of birth decreased slightly with maternal age among whites, but was relatively low overall. There was no statistically significant association between maternal age and infant mortality among whites (p=.341). Among black infants, the pattern of mortality by maternal age was more complex, and the likelihood of dying was higher than that among whites at all ages. However, although babies born to black mothers younger than 15 were the most likely to die, there was no systematic relationship between maternal age and infant mortality among blacks (p=.822).

Finally, mean newborn hospitalization costs increased with age among blacks, but not among whites. Newborn costs for babies born to white mothers younger than 15 were higher than those among any age-group in either race, with one exception—the newborns of black women aged 40 and older. Otherwise, costs for white newborns were consistently lower than those for black newborns. Among whites, infants born to women younger than 18 and to those aged 40 and older had the highest mean costs, while costs were lowest for the infants of 20–34-year-olds. Among blacks, however, newborn hospitalization costs were lowest among infants born to teenage mothers. Differences in newborn costs by maternal age were statistically significant for both races (p=.0001).

Thus, the data in Table 2 indicate that regardless of their race, the youngest mothers had the worst birth outcomes. Among whites, teenagers clearly had poorer outcomes than women in their late 30s and older; among blacks, however, the relationship was not as clear-cut.

Table 3 shows the age coefficients from the logistic regressions on low birth weight. (These coefficients represent the increase or decrease in the log odds of low birth weight.) Among whites, the unadjusted estimates indicate that teenagers are at highest risk of having a low-birth-weight baby, and the youngest teenagers present the highest risk overall—white mothers younger than 15 had a 1.57 increase in the log odds that their babies would be born weighing less than 2,500 g, compared with mothers aged 25–29.*

Once the medical and behavioral variables are added, however, the relationships change. White mothers older than 40 face the second-highest risk of having a low-birth-weight baby, after the youngest teenagers. The addition of socioeconomic variables further reduces the apparent disadvantages of young maternal age among whites, as the coefficients for low birth weight among teenagers decline with the inclusion of each set of variables. In the partially adjusted model, white mothers younger than 15 are the most likely to have a low-birth-weight baby relative to 25–29-year-olds, followed by mothers in their 40s, and then by 15–17-year-olds. In the fully controlled model, white 18–19-year-olds and 20–24-year-olds are no longer at a significantly increased risk for a low-birth-

*Exponentiating these log odds produces the odds ratios for a particular outcome. In this instance, white mothers younger than 15 would be 4.8 times more likely than those aged 25–29 to have a low-birth-weight baby (odds ratio of 4.8, since $e^{1.57}$= 4.8).

weight delivery, and the effects among those younger than 15 and aged 15–17 are greatly reduced.

The pattern is different for black women, for whom maternal age has no significant impact on the likelihood of low birth weight in the unadjusted and partially adjusted analyses. Once the full set of socioeconomic variables is added, however, black 15–19-year-olds are significantly less likely than 25–29-year-olds to deliver a low-birth-weight baby. Thus, black teenage mothers appear to have a birth-weight advantage over black women in their 20s that is masked by the socioeconomic risks they face. And, like white women in their 30s, once confounding variables are controlled for, black women in their 30s have a higher risk of low-birth-weight delivery than those aged 25–29.

The multivariate results for low birth weight differed somewhat from the descriptive results. For example, while the descriptive analysis showed that whites in each adolescent age-group were at significantly increased risk for low birth weight compared with white 25–29-year-olds, 18–19-year-olds were no longer at an increased risk once the full set of controls was introduced. Further, while the descriptive analysis indicated that white women in their 30s were not at an increased risk relative to 25–29-year-olds, their risk did increase with the introduction of controls. For black women, the increased risk for low birth weight among teenagers younger than 15 found in the descriptive analysis was no longer significant in the multivariate analysis.

According to the fully adjusted model displayed in Table 4, infants born to all teenagers except those younger than 15 had lower hospital costs than those born to 25–29-year-olds, regardless of race. In contrast, infants born to women aged 30 and older had progressively higher hospitalization costs than did those born to 25–29-year-olds. Moreover, newborn hospitalization costs were highest for the babies of the oldest mothers (aged 40 and older).*

While this age pattern was the same among blacks both before and after controls were introduced, the age effects among whites were more sensitive to adjustment. For example, among whites, observed risk factors other than very young age must have affected newborn hospitalization costs, since costs for infants born to those younger than 15 were no longer statistically different from those for infants born to 25–29-year-olds once all medical, behavioral and socioeconomic risk factors were controlled for; there was no similar change in significance after adjustment among blacks.

Table 4. Ordinary least-squares regression coefficients indicating effect of maternal age on newborn hospitalization costs, by race, according to adjustment for variables

Variable	White			Black		
	Unadjusted	Adjusted for medical controls	Adjusted for medical and socio-economic controls†	Unadjusted	Adjusted for medical controls	Adjusted for medical and socio-economic controls†
Age						
<15	0.21***	0.16**	0.09	–0.04	–0.07	–0.08
15–17	0.02	–0.06***	–0.12***	–0.08***	–0.11***	–0.14***
18–19	–0.02*	–0.07***	–0.11***	–0.07***	–0.10***	–0.14***
20–24	–0.01**	–0.04***	–0.06***	–0.05***	–0.05***	–0.08***
30–34	0.02***	0.03***	0.04***	0.04*	0.04**	0.06***
35–39	0.06***	0.09***	0.09***	0.08***	0.11***	0.13***
≥40	0.15***	0.18***	0.17***	0.19***	0.22***	0.22***
Smoked during pregnancy	na	–0.01*	–0.00	na	0.09***	0.06***
Used alcohol during pregnancy	na	0.04***	–0.02	na	0.28***	0.27***
Had recent live birth	na	0.02**	0.02**	na	0.07***	0.06***
Female baby	na	–0.10***	–0.10***	na	–0.08***	–0.08***
Mother diabetic	na	0.17***	0.16***	na	0.23***	0.22***
Pregnancy-related hypertension	na	0.29***	0.29***	na	0.38***	0.39***
Had prior abortion or miscarriage	na	0.00	0.01*	na	0.08***	0.07***
First birth	na	0.12***	0.12***	na	0.10***	0.07***
Had child who died	na	0.13***	0.13***	na	0.10***	0.12***
Obtained prenatal care in first trimester	na	–0.05***	–0.03***	na	–0.11***	–0.09***
Age-appropriate education	na	na	0.01*	na	na	–0.06***
Insurance						
Medicaid	na	na	0.04***	na	na	0.04**
Uninsured	na	na	–0.01	na	na	0.11***
Married at birth	na	na	–0.04***	na	na	–0.09***
Baby born in 1990	na	na	0.12***	na	na	0.14***
City size						
≥75,000	na	na	0.11***	na	na	0.12***
50,000–74,999	na	na	0.10***	na	na	0.04*
Intercept	6.64***	6.66***	6.62***	6.88***	6.86***	6.83***
Model fit (F)	37.81	181.2	257.5	17.15	63.5	76.6
R^2	0.00	0.02	0.07	0.00	0.03	0.09
N	160,060	143,250	143,231	40,941	35,097	35,094

*p<0.05. **p<0.01. ***p<0.001. †Also includes controls for county of residence.

For the risk of infant mortality, the data in Table 2 indicated that the risk of an infant death decreased with maternal age among white women but was largely constant among blacks (except for the youngest teenagers). This pattern persisted in the multivariate analyses among blacks (Table 5, page 272), except that the babies of women younger than 15 appeared to be no longer at a significantly increased risk compared with those born to 25–29-year-olds. Among white women, the unadjusted and partially adjusted analyses indicated that mothers aged 15–24 were at an increased risk, but this association lost almost all statistical significance once the full set of socioeconomic factors was introduced. These results must be interpreted cautiously, however, because infant deaths are rare, even in a population-based study covering two years. For the results to be reliable, analyses of infant mortality would need to be replicated with a larger sample.

Discussion and Conclusion

Our results demonstrate that definitions of age categories, comparison groups, specific birth outcomes and mediating factors complicate the relationship between maternal age and birth outcomes. Among whites, the descriptive results are consistent with the commonly held perception that babies born to teenage mothers are at higher health risk and have higher hospitalization costs than do babies born to women in their 20s. However, once white teenage mothers are compared with white mothers of all ages (including those in their 30s and those aged 40 and older), teenagers are no longer the sole group at risk of poor birth outcomes and high costs.

The results from the multivariate regressions among whites indicate that teenagers younger than 15 have the highest risk of delivering a low-birth-weight in-

*For example, the highest age coefficient, 0.22 among blacks, indicates that costs for the newborns of women aged 40 and older were approximately 25% higher than those for infants born to 25–29-year-olds, as $e^{0.22} = 1.25$.

Table 5. Logistic regression coefficients indicating effect of maternal age on likelihood of infant death, by race, according to adjustment for variables

Variable	White			Black		
	Unadjusted	Adjusted for medical controls	Adjusted for medical and socio-economic controls†	Unadjusted	Adjusted for medical controls	Adjusted for medical and socio-economic controls†
Age						
<15	1.10	0.71	0.14	0.59	0.65	0.42
15–17	0.92***	1.01***	0.50*	0.09	0.19	–0.02
18–19	0.78***	0.64***	0.21	0.18	0.09	–0.13
20–24	0.47***	0.41***	0.19	0.18	0.15	0.02
30–34	.01	0.07	0.14	0.05	0.04	0.13
35–39	–0.01	0.04	0.11	0.07	0.11	0.23
≥40	0.43	0.39	0.43	0.18	–0.16	–0.06
Smoked during pregnancy	na	0.44***	0.36***	na	0.17	0.04
Used alcohol during pregnancy	na	0.07	0.08	na	0.69***	0.62***
Had recent live birth	na	0.18	0.20	na	0.28	0.26
Female baby	na	–0.25**	–0.25**	na	0.00	0.01
Mother diabetic	na	0.09	0.06	na	–0.18	–0.18
Pregnancy-related hypertension	na	0.36	0.36	na	0.01	0.01
Had prior abortion or miscarriage	na	0.35***	0.34***	na	0.29**	0.29**
First birth	na	0.18*	0.23**	na	0.10	0.14
Had child who died	na	1.11***	1.05***	na	0.83***	0.81***
Obtained prenatal care in first trimester	na	–0.04	0.20	na	–0.24*	–0.10
Age-appropriate education	na	na	–0.15	na	na	–0.25*
Insurance						
Medicaid	na	na	0.18	na	na	0.21
Uninsured	na	na	0.42***	na	na	0.52***
Married at birth	na	na	–0.50***	na	na	–0.39**
Baby born in 1990	na	na	0.06	na	na	–0.10
City size						
≥75,000	na	na	0.18	na	na	0.39*
50,000–74,999	na	na	0.22	na	na	0.46*
Intercept	–5.44***	–5.52***	–5.40***	–4.28***	–4.56***	–4.37***
Model fit (χ^2)	67.8	129.5	209.6	5.09	71.5	127.7
df	7	17	44	7	17	42
N	162,329	145,202	145,183	41,772	35,735	35,732

*p<0.05. **p<0.01. ***p<0.001. †Also includes controls for county of residence.

fant relative to 25–29-year-olds, closely followed by mothers 40 and older, and then by those aged 35–39. However, the newborns of white teenagers have lower hospitalization costs than those born to older women and do not appear to have higher rates of mortality. The story for blacks is somewhat different: Both the marginal distributions and multivariate results show little systematic association between maternal age and birth outcome.

According to our multivariate analysis, many teenage mothers appear not to be at any increased risk for adverse birth outcomes above and beyond that posed by the observed factors that we included as controls. Unobserved determinants of low birth weight, infant mortality and hospitalization costs, however, might be correlated with prenatal care, smoking or alcohol usage. To the extent that this is the case, the coefficients for these variables would be biased.[16] However, when we ran these analyses and excluded prenatal care, smoking and alcohol (not shown), the results changed very little for blacks and not at all for whites. We decided to include these variables in the birth outcome models, since they represent behaviors that are potentially modifiable through public policy; however, more research is needed to assess the validity of these estimates.

Although teenagers generally initiate prenatal care later than do older mothers, older adolescents (18–19-year-olds), regardless of race, are at no significantly increased risk for low birth weight or infant mortality relative to 25–29-year-olds of the same race. Black teenage mothers aged 15–19 have a significantly reduced risk of delivering a low-birth-weight baby relative to 25–29-year-olds. The multivariate analysis indicated that for both blacks and whites, babies born to 15–19-year-olds have lower newborn hospitalization costs than do those born to older mothers of the same race.

Poorer outcomes observed among teenagers are largely explained by the adverse socioeconomic circumstances that these mothers face, and not by young maternal age per se. The effects that remain after observed medical, behavioral and social risk factors are controlled reflect mainly unobserved health and social factors. Among white teenagers, those younger than 15 have the most unexplained risk. While Geronimus and Korenman found that mothers aged 17 and younger were not at any increased risk compared to 18–19-year-olds after family background characteristics were controlled, they did not specifically analyze teenagers younger than age 15.[17] Similarly, whereas Strobino and colleagues found that the teenagers aged 14–17 had no birth-weight disadvantage relative to 23–25-year-olds, creating a single age-category of 14–17-year-olds may have masked important differences within this group.[18]

On the other hand, Fraser and colleagues found that babies born to teenagers younger than 17 faced an increased risk of low birth weight, even when the sample was limited to married teenagers who had received adequate prenatal care and had age-appropriate educational levels.[19] Finally, Satin and colleagues[20] also found that the very youngest adolescents (those aged 11–15) were at elevated risk of adverse pregnancy outcomes, but those aged 16–19 were not, once numerous confounding factors were controlled for. Collectively, the evidence suggests that young teenagers face greater risk for adverse outcomes than do older teenagers, and that at least some of this association is due to biological immaturity.[21]

The results from our study support findings by Geronimus[22] and others that the relationship between maternal age and birth outcomes differs dramatically by race. The multivariate results indicate that black teenagers have less of a risk of delivering a low-birth-weight baby than do older black women with the same medical, behavioral and socioeconomic characteristics. A similar pattern of increasing risk of infant mortality with maternal age was attributed to the general worsening of black women's health over their reproductive years.[23] This research suggested that black women's health may deteriorate more quickly than whites', resulting in distinctly different patterns in infant mortality by maternal age.

Although black teenagers in our sample had a lower risk of delivering a low-birth-weight baby than did 25–29-year-old blacks, rates of low birth weight among 25–29-year-olds were more than three times higher among blacks than whites. Outcomes were dramatically worse for blacks than for whites among all age-

(continued on page 295)

Maternal Age and Birth Outcomes...

(continued from page 272)

groups except the youngest teenagers, which suggests that race may be more important than maternal age in explaining birth outcomes. More research is needed to understand the sources of these racial disparities, some of which may be due to differences in the characteristics of neighborhoods and communities in which the mothers reside.[24]

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