Maternal and Child Health Journal, Vol. 9, No. 2, June 2005 (© 2005)
DOI: 10.1007/s10995-005-4905-3

Timing of Enhanced Prenatal Care and Birth Outcomes in New Jersey's HealthStart Program

Nancy E. Reichman, PhD[1,3] and Julien O. Teitler, PhD[2]

Objective: This study examined the effects of prenatal care and the timing of its initiation on birth weight and gestational age outcomes among women in a state-wide Medicaid enhanced prenatal care program. *Methods*: Ordinary Least Squares and logistic regression analyses were performed using data on 88,196 births in New Jersey between 1988 and 1996. A large number of potentially confounding factors were included. *Results*: Initiating prenatal care in the first trimester was associated with a 56 g advantage in birth weight ($p = .01$) compared to no care. Initiating prenatal care in the first or second trimester was associated with a 1 day advantage in gestational age ($p = .05$). There were no significant effects of prenatal care, initiated in any trimester, on low-birth weight. Initiating care in the first versus the second trimester had no effect on the probability of delivering preterm. The findings did not vary by sociodemographic subgroup. *Conclusion*: This study provides support for claims that there is little that prenatal care can do to improve aggregate birth outcomes because most pregnancy complications are the result of behaviors and life circumstances that precede the pregnancy and are very difficult to reverse. Prenatal care, even with enhanced services, appears to offer too little, too late.

KEY WORDS: prenatal care; Medicaid; birth outcomes; low birth weight; HealthStart.

INTRODUCTION

Infants in the US are more likely to be of low-birth weight than those born in almost every other developed country (1). The main strategy used to address the problem of low-birth weight and to reduce racial disparities has been to expand prenatal care services for poor-pregnant women. Medicaid eligibility expansions and outreach to pregnant women in the late 1980s and early 1990s dramatically increased the percentages of mothers obtaining first trimester and adequate prenatal care (2–5). However, the rate of low-birth weight in the US has not declined (6).

The assumption that prenatal care can reduce aggregate rates of low-birth weight has recently been called into question (7–11). Empirical studies of the effectiveness of augmented prenatal care (12, 13) and eligibility expansion (4, 5, 14–16) under Medicaid have shown mixed results, which is not surprising given the methodological difficulties in teasing out program and selection effects and the limited control variables included in most large datasets. One of the few randomized trials revealed that although augmented (versus standard) prenatal care improved satisfaction with care and knowledge about risk conditions, it did not reduce low-birth weight among Medicaid-eligible African American women with multiple risk factors (17).

This study examined the effects of prenatal care and the timing of its initiation on birth weight and gestational age outcomes among women in a state-wide Medicaid enhanced prenatal care program. The

[1]Department of Pediatrics, Robert Wood Johnson Medical School, University of Medicine and Dentistry of New Jersey, New Jersey.
[2]School of Social Work, Columbia University, New York.
[3]Correspondences should be addressed to Nancy E. Reichman, PhD, Department of Pediatrics, Robert Wood Johnson Medical School, University of Medicine and Dentistry of New Jersey, 97 Paterson St., 4th Floor, New Brunswick, New Jersey 08903; e-mail: nancy.reichman@umdnj.edu.

key methodological issues confronting investigations of this type were addressed by using data that included a large number of potential confounding factors and focusing the analyses on a population targeted for intervention.

METHODS

Data

Data on all enrollees in HealthStart, a state-wide Medicaid prenatal care program that was inaugurated in 1988, were collected by the New Jersey State Departments of Health and Human Services. HealthStart combined comprehensive prenatal care for pregnant women on Medicaid with preventive pediatric care for children. The program, which was administered at the offices of Medicaid providers and clinics, provided not only diagnostic and medical procedures, but also a range of health support services.

To receive certification as a HealthStart prenatal provider and receive increased reimbursement, a Medicaid physician or clinic was required to provide a prescribed set of health support services that included risk assessments, health education, counseling, referrals, case coordination, and follow-up. HealthStart provided 15 prenatal care visits, compared to the 8 visits that the standard Medicaid program typically provided.

At her first visit, a woman's risk for poor-birth outcomes was assessed through maternal interview, physical examination, and records from previous providers when available. A trained case coordinator filled out a HealthStart Maternity Services Summary Data (MSSD) form for each woman who went through the program's intake process and updated the information throughout the course of the pregnancy. Quality control measures were in place to maximize accuracy of the data (18). After the birth, data on birth weight and gestational age were obtained from birth records, as was information on prenatal care use that the program may have missed.

The analyses are based on the 88,196 HealthStart mothers with single live births between 1988 and 1996 for which complete data were available on all analysis variables. This sample represents 98% of the 90,117 mothers enrolled in the program whose pregnancies resulted in single live births.

Measures

The outcomes studied were birth weight in grams, gestational age in weeks, whether the baby was low-birth weight (<2500 g), and whether the baby was born preterm (<37 weeks). The four prenatal care groups consisted of mothers who initiated care in the first, second and third trimesters of pregnancy, and not at all. The last group consists of mothers who went through the HealthStart intake process but never returned for an examination by a physician and did not go elsewhere for care. A woman was classified as initiating prenatal care in a given trimester if she obtained care at *any* provider within that trimester of her pregnancy (whether HealthStart or not). We focused on the trimester of care initiation because the data did not include the week of gestation during which prenatal care began.

The MSSD contained numerous sociodemographic, psychosocial, and medical risk factors that are associated with birth weight and gestational age (6, 7, 19–23). The following sociodemographic risk factors were included in the analyses: young and old maternal ages, black race, non-Hispanic ethnicity, being US born (versus foreign born), and being unmarried. The mother having a primary language other than English, which may be associated with access to and delivery of care, and working during the first trimester of pregnancy, which may be associated with strenuous conditions (but could also lead to increased psychological well-being or income), were included. The following psychosocial risk factors were included (all refer to just prior to or during the pregnancy): having inadequate financial resources, experiencing violence (either as perpetrator or victim), having depression or other mental health problem, experiencing homelessness or eviction, having family-related caregiving burden (other than for one's children), being involved with the criminal justice system, having inadequate housing, having an unwanted pregnancy (determined during the pregnancy rather than retrospectively after the birth), smoking cigarettes, consuming alcohol, and using illicit substances. Sixteen medical/obstetrical risk factors that are associated with birth weight and gestational age outcomes were also included. Appendix Table I provides a list of the measures included in the analyses and their distributions for the full sample of 90,117 single live births. It also indicates the proportions of mothers receiving specific types of services, although services received, except for an auxiliary analysis (discussed later) including

Table I. Pre-Existing Risk Factors and Birth Outcomes by Timing of Prenatal Care

	First trimester	Second trimester	Third trimester	No care	All mothers
Risk factors					
Non-Hispanic black (%)	31.0	37.1	43.0	41.1	35.9
Hispanic (%)	21.0	22.1	19.7	17.9	21.2
Age <20 years (%)	19.8	22.5	23.5	23.7	20.9
Married (%)	28.1	22.8	20.0	21.2	24.2
Born in US (%)	70.9	68.6	71.8	75.6	70.1
Previous low-birth weight or small-for-gestational age infant (%)	4.1	3.9	4.6	4.5	4.1
Outcomes					
Mean birth weight (grams)	3277 (588.1)	3239 (571.5)	3216 (501.0)	3190 (590.6)	3249 (573.2)
Mean gestational age (weeks)	39.0 (2.26)	39.0 (2.20)	38.9 (2.01)	38.8 (2.40)	39.0 (2.19)
Low-birth weight (%)	7.5	8.1	8.2	10	7.9
Preterm delivery (%)	8.2	8.7	10.0	10.8	8.7
N	32,615	39,538	15,393	650	88,196

Note. Standard deviations in parentheses.

receipt of benefits from the Special Supplemental Nutrition Program for Women, Infant, and Children (WIC), were not considered in this study.

Statistical Analyses

First, the bivariate associations between timing of prenatal care initiation and pre-existing risk factors were explored to assess patterns of selection into the prenatal care groups. Then, multivariate models were estimated for each of the four outcomes. Ordinary Least Squares regression was used to assess the independent associations between timing of prenatal care and both birth weight and gestational age, which were treated as continuous measures. Logistic regression was used to assess the associations between timing of prenatal care and both low-birth weight and preterm birth, which are dichotomous measures. The no-care group served as the reference group.

Control variables in the multivariate analyses included all of the sociodemographic, psychosocial and medical/obstetrical risk factors listed in Appendix Table I. The reference category for race was non-Hispanic white and for maternal age was 25 to 29 years. In addition, the size of the mother's city of residence, her county of residence, and the year of the birth were included to control for local implementation of and access to social services that could potentially affect both the timing of prenatal care and the outcomes. An indicator for female infant was also included. Additional analyses were performed to assess whether the results were robust across alternative model specifications. (for example, models that excluded behaviors and medical/obstetrical risk factors that prenatal care may have prevented).

RESULTS

The upper panel of Table I shows pre-existing maternal risk factors by timing of prenatal care initiation. Women in the no-care group were at increased risk for adverse birth outcomes compared to those who received care. They were more likely to be black, less likely to be Hispanic (a negative risk factor), more likely to be teen mothers, less likely to be married, more likely to be born in the US (native-born women have higher rates of low-birth weight than immigrant women), and more likely to have had previous low-birth weight or small-for-gestational age babies. For teen motherhood, there was a clear pattern across the four prenatal care groups; the first trimester group was at the lowest risk, followed by the second trimester group, the third trimester group, and then the no-care group. For black race, Hispanic ethnicity, non-marital birth, US-born, and previous low-birth weight or small-for-gestational-age baby, the third trimester and no-care groups were similar to one another but were both at risk compared to the first and second trimester care groups.

The lower panel of Table I presents the four outcome measures by timing of prenatal care initiation. Mean birth weight and gestational age decreased, and low-birth weight and preterm delivery increased, with later prenatal care initiation.

The multivariate results for birth weight, gestational age, low-birth weight, and preterm delivery are presented in Table II. Women who received first trimester care delivered babies 56 g heavier and had gestations 0.17 weeks longer (approximately one day), on average, than those who received no-care. An important question is whether these modest effects translated into clinically meaningful differences in outcomes. The effects on low-birth weight and preterm delivery were not statistically significant and there was no evidence (even directional) that earlier care lead to a lower probability of low-birth weight. There may have been a favorable effect of first or second trimester care on preterm delivery (the p-values were close to significant at conventional levels).

Consistent with prior research (6, 7, 20–23), the following characteristics were associated with poorer outcomes: being black, a teen mother or older mother (over age 35), born in the US, or unmarried; having an unwanted pregnancy; smoking cigarettes or using hard drugs, and having pre-existing hypertension, incompetent cervix, a previous preterm or small-for-gestational age birth, or a number of other medical risk factors.

To account for the possibility that there were differential effects for subgroups of mothers, low-birth weight and preterm delivery models were estimated for non-Hispanic whites, non-Hispanic blacks, Hispanic whites, other Hispanics, teens, mothers age 36 and over, those who smoked cigarettes, those who used hard drugs, those with genitourinary infections, and those who had sexually transmitted diseases. The results for all subgroups (not shown) were similar to those for all mothers.

Finally, we estimated a series of nested models and found that the effects of prenatal care on all four outcomes were very similar across models that controlled only for sociodemographic factors; for sociodemographic factors, city size, county of residence, and year of the birth; and for all of these plus female fetus and both medical and psychosocial risks (only the last set of results is shown, in Table II). We also estimated models that included all covariates plus whether the mother participated in WIC, a program to which HealthStart routinely referred women, but that women could have been participating in prior to enrolling in HealthStart. WIC participation was strongly associated with favorable birth weight and gestational age outcomes but did not modify the effects of prenatal care (results not shown).

DISCUSSION

The effectiveness of prenatal care in improving birth outcomes, such as low-birth weight, is difficult to ascertain. Randomized experiments that would deprive women of care would not be ethical. The alternative, epidemiological studies, face selection problems: If women with the best expected outcomes are the most likely to seek care and to do so early (*favorable selection*), the estimated effect of prenatal care could be overstated. Conversely, if women with the worst expected outcomes are the most likely to seek care and to do so early (*adverse selection*), the effect of prenatal care could be underestimated (24).

The analyses we undertook addressed selection by including a much more extensive set of control variables than prior studies and using a high-risk sample consisting exclusively of mothers on Medicaid, all of whom sought care. On the basis of the observed characteristics of mothers who initiated care in the different trimesters of pregnancy and not at all (Table I), there appeared to be favorable selection into prenatal care, even in this relatively homogeneous sample. That is, the mothers least at risk of adverse birth outcomes were the most likely to get early care. Consequently, our estimates of the effects of prenatal care are likely to be overstated.

Another important methodological challenge involves identifying the relevant target population. For example, including women who are not eligible for services could bias the estimated effects of prenatal care programs. Our study addressed this issue by using a sample of women who were enrolled in an enhanced Medicaid prenatal care program, who therefore represented an "intended to treat" population.

Finally, it is important to control for the local availability and implementation of other programs that provide services to low-income women and could potentially affect both timing of prenatal care and birth outcomes. Such services may be clustered in low-income areas. Potentially confounding effects of this type were minimized by including county fixed effects, city size, and year of birth in the analyses.

We looked within a comprehensive prenatal care program for mothers on Medicaid to determine whether that care had beneficial effects on birth weight and gestational age, and whether earlier care was associated with more favorable outcomes than later care for this group of women. We found that first trimester care had a small positive association with birth weight, but no effect on the probability of

Table II. Effects of Timing of Prenatal Care and Risk Factors on Birth Outcomes (p-values in Parentheses)

	Birth weight (grams)	Gestational age (weeks)	Low-birth weight (odds ratios)	Preterm birth (odds ratios)
First trimester care	56 (.01)	.17 (.05)	.82 (.14)	.80 (.08)
Second trimester care	38 (.08)	.15 (.08)	.86 (.25)	.84 (.17)
Third trimester care	35 (.11)	.14 (.11)	.80 (.09)	.92 (.52)
Age <15 years	−123 (.00)	−.18 (.13)	1.20 (.35)	1.43 (.04)
Age 15–17	−114 (.00)	−.17 (.00)	1.44 (.00)	1.32 (.00)
Age 18–19	−88 (.00)	−.07 (.01)	1.27 (.00)	1.16 (.00)
Age 20–24	−36 (.00)	−.01 (.75)	1.05 (.16)	1.00 (.99)
Age 30–34	−12 (.07)	−.04 (.10)	1.09 (.06)	1.08 (.07)
Age 35–39	−22 (.02)	−.16 (.00)	1.36 (.00)	1.21 (.00)
Age 40+	−84 (.00)	−.37 (.00)	1.88 (.00)	1.80 (.00)
Non Hispanic black	−184 (.00)	−.38 (.00)	1.75 (.00)	1.55 (.00)
Hispanic white	−75 (.00)	−.19 (.00)	1.16 (.01)	1.30 (.00)
Hispanic other	−91 (.00)	−.17 (.00)	1.21 (.00)	1.24 (.00)
Non-Hispanic other	−152 (.00)	−.20 (.00)	1.54 (.00)	1.30 (.00)
Worked during first trimester	26 (.00)	.09 (.00)	.91 (.00)	.88 (.00)
Born in US	−30 (.00)	−.05 (.04)	1.21 (.00)	1.14 (.00)
English not first language	−2 (.70)	.03 (.18)	.98 (.62)	.95 (.24)
Married	45 (.00)	.09 (.00)	.82 (.00)	.84 (.00)
Lived in large city	−28 (.00)	−.13 (.00)	1.15 (.00)	1.16 (.00)
Lived in medium-sized city	6 (.47)	.02 (.61)	.98 (.70)	.96 (.45)
Homelessness/eviction	−17 (.17)	−.02 (.74)	1.01 (.92)	1.02 (.77)
Substandard housing	−19 (.19)	−.04 (.46)	1.08 (.40)	1.06 (.52)
Inadequate financial resources	11 (.01)	.05 (.00)	.94 (.04)	.96 (.13)
Responsibility for caring for adult member of household	3 (.89)	−.06 (.41)	.80 (.09)	1.02 (.86)
Crime	1 (.93)	.01 (.88)	.94 (.44)	.95 (.53)
Violence	−10 (.39)	−.10 (.02)	1.14 (.06)	1.15 (.04)
Mental health problem	0 (.96)	−.02 (.64)	1.06 (.31)	1.09 (.10)
Unwanted pregnancy	−18 (.06)	−.10 (.01)	1.14 (.02)	1.18 (.00)
Smoked cigarettes	−117 (.00)	−.14 (.00)	1.41 (.00)	1.25 (.00)
Drank alcohol	−25 (.00)	−.02 (.43)	1.18 (.00)	1.04 (.35)
Drug use: marijuana only	2 (.90)	0.06 (.20)	1.04 (.59)	1.01 (.89)
Drug use: hard drugs only	−122 (.00)	−.42 (.00)	1.68 (.00)	1.56 (.00)
Drug use: marijuana and hard drugs	−88 (.00)	−.26 (.00)	1.50 (.00)	1.29 (.01)
Anemia	39 (.00)	.19 (.00)	.77 (.00)	.76 (.00)
Cardiac disease	−14 (.37)	−.12 (.04)	1.18 (.08)	1.26 (.01)
Acute or chronic lung disease	−21 (.02)	−.10 (.00)	1.05 (.38)	1.12 (.05)
Diabetes	133 (.00)	−.28 (.00)	.84 (.02)	1.38 (.00)
Genital herpes	19 (.26)	.07 (.28)	.93 (.49)	.95 (.59)
Other sexually transmitted disease	−1 (.82)	0 (.99)	1.01 (.77)	.99 (.77)
GU infection	36 (.00)	.08 (.00)	.80 (.00)	.85 (.00)
Hydramnios/oligohydramnios	−165 (.00)	−.52 (.00)	2.62 (.00)	2.01 (.00)
Hemoglobinopathy	−10 (.74)	−.06 (.64)	.96 (.82)	.99 (.97)
Hypertension, chronic	−103 (.00)	−.57 (.00)	1.52 (.00)	1.46 (.00)
Hypertension, pregnancy associated	−20 (.03)	−.19 (.00)	1.58 (.00)	1.33 (.00)
Eclampsia	−146 (.00)	−.75 (.00)	1.90 (.00)	2.33 (.00)
Incompetent cervix	−359 (.00)	−2.03 (.00)	3.64 (.00)	4.17 (.00)
Previous heavy infant (>4000 g)	256 (.00)	.13 (.02)	.69 (.00)	.86 (.10)
Previous preterm or small-for-gestational-age infant	−292 (.00)	−1.13 (.00)	2.77 (.00)	2.92 (.00)
Renal disease	−90 (.00)	−.38 (.00)	1.54 (.00)	1.71 (.00)
Rh sensitization	−2 (.91)	−.02 (.67)	.94 (.53)	.95 (.60)
Uterine bleeding	−114 (.00)	−.67 (.00)	1.85 (.00)	2.04 (.00)
Inadequate nutrition intake	−14 (.00)	0 (.95)	1.02 (.61)	.96 (.22)
Female infant	−107 (.00)	.02 (.12)	1.16 (.00)	.96 (.10)

Note. $N = 88,196$. All models control for mother's county of residence and year of the birth.

delivering a low-birth weight baby; and that first or second trimester care was associated with a 1 day advantage in gestational age, but no effect on the probability of delivering preterm. We found no sociodemographic subgroups that benefited substantially from prenatal care. Although due to data limitations we could not consider the adequacy of prenatal care received, our focus was on the timing of care initiation, which is a key component of prenatal care adequacy.

Our findings that prenatal care had modest effects at best are consistent with those from two previous studies of New Jersey's HealthStart program (12, 18). The first used linked birth and Medicaid data to compare birth outcomes of Medicaid mothers enrolled in HeathStart to those of mothers on Medicaid not in the HealthStart program; that study found that HealthStart participation was associated with reduced rates of low-birth weight among black women on Medicaid (12). However, the second study suggested that this effect may be attributable to WIC services rather than to HealthStart-specific interventions (18).

There is no question that medical care during the prenatal period can be extremely beneficial for certain mothers and their babies, and that all women, whether pregnant or not, should receive preventive and regular medical care. However, our findings suggest that providing care and services once women are pregnant is not likely to improve aggregate birth weight or gestational age outcomes. Consequently, expansions of prenatal care services are also unlikely to reduce racial disparities in these outcomes. As Alexander and Korenbrot (7) pointed out, little done during the course of standard prenatal care would be expected to improve birth outcomes for the majority of women since most medical treatable medical complications affect only a small proportion of women; the authors identified smoking cessation and nutrition enhancement as two potentially promising ways to reduce aggregate rates of low-birth weight. According to a more recent review by Lu *et al.*, (11) smoking cessation programs appear to be only modestly effective in reducing low-birth weight and preterm delivery. Two recent studies found favorable effects of participation in WIC on birth weight outcomes (25, 26).

This study has a number of strengths. The HealthStart data contain information on many more characteristics associated with birth weight and gestational age outcomes than most other datasets. Moreover, since the dataset is very large, we were able to control simultaneously for most attributes associated with differential use of prenatal care. Given that we found evidence of favorable selection into care, the very modest effects of prenatal care we found may be overstated. The findings were robust across all model specifications and subgroups. The fact that we were unable to uncover clinically relevant effects of prenatal care for any population subgroup within New Jersey suggests that the findings of this study are applicable to low-income women who seek care in the rest of the US.

The following limitations apply to this study: The analyses were based on births 8 to 14 years ago that took place in one state. The sample consisted of women eligible for Medicaid prenatal care that sought at least some care. Although studying this high-risk group reduced selection effects, the results may not be generalizable to the overall population. It is possible that infants born to more affluent women benefit more from prenatal care than those born to poor women or that prenatal care would most benefit poor mothers who never seek care.

CONCLUSION

Findings from this study provide support for claims that there is little that prenatal care can do to improve aggregate birth outcomes because most pregnancy complications are the result of behaviors and life circumstances that precede the pregnancy and are very difficult to reverse. In this sense, prenatal care, even with enhanced services, appears to offer too little, too late.

Although we found only small favorable effects of enhanced prenatal care on average, this does not mean that the HealthStart program did not help certain individuals a great deal. Nor does it mean that the program conferred no long-term benefits. It included future family planning and other psychosocial services that had the potential to impact future fertility and prenatal behaviors that we did not measure. It is also possible that the program may have improved maternal health or other aspects of infant health. In addition, it may have increased the use of pediatric care.

The findings from this study reinforce the conclusion of Lu *et al.* (11) that prenatal care, even enhanced care, is not a magic bullet that offsets a lifetime of maternal health disadvantages. Our case study of one state-wide program suggests that focusing on prenatal care services is not an effective way to reduce rates of low-birth weight. Rather, targeting

resources to women's health more generally may be a more promising approach. Augmenting preconceptional health is a potentially fruitful avenue for future intervention and research.

Appendix Table I. Characteristics of HealthStart Mothers (%)

Sociodemographics and city size	
Age	
<15	0.4
15–17	7.4
18–19	13.1
20–24	36.8
25–29	23.8
30–34	12.9
35–39	4.7
40+	1.0
Race/ethnicity	
Non-Hispanic white	27.4
Non-Hispanic black	36.0
Non-Hispanic other	3.0
Hispanic white	21.2
Hispanic other	11.9
Worked during first trimester	19.7
Born in the US	70.0
English not first language	23.1
Married during pregnancy	24.2
City size	
<50,000	52.2
50,000–74,999	8.6
75,000+	39.2
Psychosocial risk factors	
Homelessness/eviction	2.6
Substandard housing	1.7
Inadequate financial resources	34.2
Caregiving burden	1.0
Involved with criminal justice system	1.9
Violence/abuse in household	2.9
Depression/other mental health problem	4.9
Unwanted pregnancy	3.9
Smoked cigarettes	24.9
Drank alcohol	7.7
Drug use	
None	91.8
Marijuana only	2.4
Hard drugs only	4.4
Marijuana and hard drugs	1.4
Medical/obstetrical problems	
Anemia	15.0
Cardiac disease	1.5
Acute or chronic lung disease	4.2
Diabetes	3.8
Genital herpes	1.3
Other sexually transmitted diseases	12.7
Genito-Urinary infection	18.3
Hydramnios/oligohydramnios	0.8
Hemoglobinopathy	0.4
Hypertension, chronic	1.0
Hypertension, pregnancy associated	4.3
Eclampsia	0.5
Incompetent cervix	0.4
Previous infant 4000+ grams	1.8
Previous preterm or SGA infant	4.1
Renal disease	0.5
Rh sensitization	1.8
Uterine bleeding	2.3
Inadequate nutrition intake	21.4
Prenatal services received	
Nutrition	
Basic	98.2
Specialized	28.5
Extensive	4.2
WIC	81.3
Social/psychological	
Basic assessment	97.2
Specialized assessment/counseling	28.4
Other extensive/specialized service	6.1
Substance abuse	6.3
Health education	
Basic	98.2
Specialized	25.6
Childbirth	46.8
Future family planning	63.6
Smoking cessation	13.2
Home visits	
Professional (PHN, RN, MSW)	19.1
Paraprofessional (LPN, HHA, other)	4.6
Both	1.1

ACKNOWLEDGMENTS

This research was supported by grant R01-HD-35301 from the National Institute of Child Health and Human Development. The authors are grateful to the New Jersey Department of Health for providing the data used in this study.

REFERENCES

1. UNICEF (United Nations Children's Fund). *The state of the world's children 2003*. New York: Oxford University Press, 2003.
2. Kogan MD, Martin JA, Alexander GR, Kotelchuck M, Ventura SJ, Frigoletto FD. The changing pattern of prenatal care utilization in the United States, 1981–1995, using different prenatal care indices. *JAMA* 1998;279:1623–8.
3. Howell EM. The impact of the Medicaid expansions for pregnant women: A synthesis of the evidence. *Med Care Res Rev* 2001;58:3–30.
4. Currie J, Gruber J. Saving babies: The efficacy and cost of recent changes in the Medicaid eligibility of pregnant women. *J Polit Econ* 1996;104:1263–96.
5. Dubay L, Joyce T, Kaestner R, Kenney GM. Changes in prenatal care timing and low birth weight by race and socioeconomic status: Implications for the Medicaid expansions for pregnant women. *Health Serv Res* 2001;36:373–98.

6. Martin J, Hamilton B, Ventura S, Menacker F, Munson M. *Births: Final Data for 2000*, National Vital Statistics Reports 52, no. 10. Hyattsville, Maryland: National Center for Health Statistics, February 12, 2002.
7. Alexander G, Korenbrot C. The role of prenatal care in preventing low birth weight. *Future Child* 1995;5:103–20.
8. Fiscella K. Does prenatal care improve birth outcomes? A critical review. *Obstet Gynecol* 1995;85:468–79.
9. Huntington J, Connell F. For every dollar spent—the cost-savings argument for prenatal care. *N Engl J Med* 1994;331:1303–07.
10. Alexander G, Kotelchuck M. Assessing the role and effectiveness of prenatal care: History, challenges, and directions for future research. *Public Health Rep* 2001;116:306–16.
11. Lu MC, Tache V, Alexander GR, Kotelchuck M, Halfon N. Preventing low birth weight: Is prenatal care the answer? *J Matern Fet Neo Med* 2003;13:362–80.
12. Reichman NE, Florio MJ. The effects of enriched prenatal care services on Medicaid birth outcomes in New Jersey. *J Health Econ* 1996;15:455–76.
13. Joyce T. Impact of augmented prenatal care on birth outcomes of Medicaid recipients in New York City. *J Health Econ* 1999;18:31–67.
14. Piper J, Ray W, Griffin M. Effects of Medicaid eligibility expansion on prenatal care and pregnancy outcome in Tennessee. *JAMA* 1990;264:2219–23.
15. Haas JS, Udvarhelyi S, Epstein AM. The effect of health coverage for uninsured pregnant women on maternal health and the use of cesarean section. *JAMA* 1993;270:61–4.
16. Epstein A, Newhouse J. Impact of Medicaid expansion on early prenatal care and health outcomes. *Health Care Finan Rev* 1998;19:85–99.
17. Klerman LV, Ramey SL, Goldenberg RL, Marbury S, Hou J, Cliver SP. A randomized trial of augmented prenatal care for multiple-risk, Medicaid-eligible African American women. *Am J Public Health* 2001;91:105–11.
18. Reichman NE, Teitler JO. Effects of psychosocial risk factors and prenatal interventions on birth weight: Evidence from New Jersey's HealthStart Program. *Perspect Sex Reprod Health* 2003;35:130–7.
19. Mozurkewich EL, Luke B. Avni M, Wolf FM. Working conditions and adverse pregnancy outcome: A meta-analysis. *Obstet Gynecol* 2000;95:623–35.
20. Chomitz VR, Cheung LWY, Lieberman E. The role of lifestyle in preventing low birth weight. *Future Child* 1995;5:121–38.
21. Institute of Medicine, Committee to Study the Prevention of Low-Birth Weight. *Preventing low birth weight* Washington, DC: National Academy Press, 1985.
22. Nathanielsz PW. The role of basic science in preventing low-birth weight. *Future Child* 1995;5:57–70.
23. Lockwood C. Predicting premature delivery—no easy task. *N Engl J Med* 2002;346:282–84.
24. Bell JF, Zimmerman FJ. Selection bias in prenatal care use by Medicaid recipients. *Matern Child Health J* 2003;7:239–52.
25. Bitler M, Currie J. Does WIC work? The effects of WIC on pregnancy and birth outcomes. *J Policy Analy Manag* 2005;24:73–91.
26. Kowaleski-Jones L, Duncan G. Effects of participation in the WIC program on birthweight: Evidence from the National Longitudinal Survey of Youth. *Am J Public Health* 2002;92:799–803.