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# A Comparison of Low Birth Weight Among Medicaid Patients of Public Health Departments and Other Providers of Prenatal Care in North Carolina and Kentucky

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## Synopsis .....

*Matching of Medicaid and health department patients' files to birth certificates was used as a*

*means of evaluating the effect of prenatal care given by public health departments on the birth weights of babies of women in Medicaid. Three years of live birth data from North Carolina and 2 years of birth data from Kentucky were used in the analysis.*

*After controlling for other low birth weight risk factors (including the quantity of prenatal care) with logistic regression, women in Medicaid who received prenatal care outside public health departments were found to be substantially more likely than those who received care at health departments to have low weight infants. This association was especially strong for births under 1,500 grams.*

*The authors suggest that the comprehensive prenatal care that is provided by the public health departments, which includes various nonmedical support services, may be responsible for this difference. These findings have important implications for proposed expansions of the Medicaid Program to cover more pregnant women in poverty.*

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**L**OW BIRTH WEIGHT is a serious problem in the United States, especially in the southeastern region. Much of the reduction in neonatal mortality in the last 15 years has been attributed to improving the survival of low weight babies, while efforts at preventing low weight births have been much less successful (1-4).

Strategies for reducing low birth weight infants of women in poverty are of special interest, since their rates have been particularly high and resistant to improvement. The high rate of low birth weight in the United States compared with other developed countries is due in part to high rates among indigent women in this country (5). Preterm birth prevention methods have been shown to be effective in reducing low birth weight in some settings (6-8), though some evidence indicates that such programs may be less successful among low-income women (5). Methods that work among well-educated, high-income women may not be as applicable for poor women.

For women in poverty, just increasing the quantity of prenatal care (earlier entry and more visits)

may not be sufficient to improve birth weights substantially. Several studies have suggested that provision of nutrition, education, social work, and other services in addition to obstetrical medical care is also important (9-12). These studies also suggest that such comprehensive prenatal care is more likely to occur in the public health setting. Our study uses several years of birth data for the States of North Carolina and Kentucky to examine the hypothesis that prenatal care provided in public health departments effectively reduces low birth weight among infants of women in poverty.

In the State maternal and child health programs in both North Carolina and Kentucky, contracts with local public health departments make funding contingent on the provision of a standard package of services. In addition to a broad array of prenatal medical services, a variety of ancillary services are required, including nutritional counseling, formal linkages to the Special Supplemental Food Program for Women, Infants, and Children (WIC), and other health education components. Thus, State-level funding and quality assurance

mechanisms promote a consistent level of comprehensive prenatal care among the local public health departments in each State.

## Methods

In this study, health program data files were linked to certificates of live birth to evaluate the effectiveness of prenatal care provided in public health departments. In the absence of a measure of income on the birth certificate, Medicaid-paid claims were matched to the birth records to identify a group of births to women in poverty. Records for women receiving prenatal care in health departments were then matched to the birth records. Finally, records for women who were in WIC in the prenatal period were matched to the birth certificates.

The primary comparison of the incidence of low birth weight is between women in Medicaid receiving prenatal care at public health departments and women in Medicaid receiving prenatal care from other providers (classified as such if the Medicaid birth certificates are not matched to a health department program record). Participation in WIC for these two groups is then compared. All live births to North Carolina residents for 1986 through 1988 and Kentucky births for 1985 and 1986 for which the birth certificate was matched to a Medicaid claim were included in our analyses.

In North Carolina, Medicaid claims paid for newborn hospital stays were matched to the birth records in several computerized iterations using the baby's name, hospital of birth, date of birth, sex, and county of residence. Around 98 percent of the newborn Medicaid claims for 1986 through 1988 were successfully matched to a birth record. In Kentucky, Medicaid claims paid for delivery were matched to births using the mother's social security number and then name and other variables for records not matching in the first step. A matching rate of 98 percent was achieved for the years 1985 and 1986. During these periods, the income level for Medicaid eligibility was about 40 percent of poverty in North Carolina and 27 percent of poverty in Kentucky.

In both States there is a statewide computerized client information system for public health departments that includes records for maternity care. In North Carolina, pregnancy closure records with a live birth outcome were linked to 1986 and 1987 births using mother's name, date of birth of the baby, and county of residence in two iterations. Eighty-nine percent of the health department

Table 1. Selected characteristics by race of 1986-87 North Carolina single live births to Medicaid patients by source of prenatal care<sup>1</sup>

Category	Health department Medicaid	Medicaid, not health department
Number of births:		
White .....	4,103	5,948
Black .....	7,497	11,186
Percentages for whites:		
Less than 2,500 grams ....	7.80	9.29
Less than 1,500 grams ....	0.95	1.99
Under age 18 .....	14.6	12.6
Unmarried .....	36.8	44.2
Education under 12 years..	55.4	48.6
Previous fetal death or live-born infant who died..	16.3	17.8
Prenatal care not adequate in quantity .....	40.3	40.4
In WIC Program .....	71.1	39.2
Percentages for blacks:		
Less than 2,500 grams ....	11.11	12.66
Less than 1,500 grams ....	1.70	2.57
Under age 18 .....	16.6	13.8
Unmarried .....	83.4	84.3
Education under 12 years..	42.6	40.0
Previous fetal death or live-born infant who died..	16.4	17.8
Prenatal care not adequate in quantity .....	49.5	48.1
In WIC Program .....	79.3	51.5

<sup>1</sup> Births with no prenatal care are excluded.

records for the 2 years were successfully matched using these criteria. In Kentucky, delivery records from the health department system were matched to births by social security number and then name and demographic variables, with a matching rate of about 95 percent.

Matching outcome or delivery records has the potential problem that women who begin prenatal care at the health department and then are referred to other providers for high-risk conditions could be counted in the not-health-department group because of nonmatching. In both States, however, women who are referred to other providers for high risk *medical* care but continue to receive WIC or other support services from the health department or who come to the health department for a post-partum visit or for family planning will usually have a delivery record in the health department system, especially if referral is to a tertiary hospital clinic rather than to a private physician. These women were counted in this study as health department patients.

With the use of the new birth certificate in North Carolina in 1988, records of prenatal visits to the health department could be matched directly to the birth certificates using mother's name and her date

Table 2. Selected characteristics by race of 1985–86 Kentucky single live births to Medicaid patients by source of prenatal care<sup>1</sup>

Category	Health department Medicaid	Medicaid, not health department
<b>Number of births:</b>		
White .....	4,470	15,450
Black .....	508	3,633
<b>Percentages for whites:</b>		
Less than 2,500 grams ....	6.43	8.24
Less than 1,500 grams ....	0.58	1.29
Under age 18 .....	15.7	15.9
Unmarried .....	40.1	42.9
Education under 12 years..	59.8	59.7
Previous fetal death or live-born infant who died..	15.9	17.1
Prenatal care not adequate in quantity .....	46.5	50.3
In WIC Program <sup>2</sup> .....	91.3	69.4
<b>Percentages for blacks:</b>		
Less than 2,500 grams ....	8.26	11.70
Less than 1,500 grams ....	0.98	1.87
Under age 18 .....	14.2	16.5
Unmarried .....	84.7	88.9
Education under 12 years..	40.6	43.4
Previous fetal death or live-born infant who died..	19.4	20.8
Prenatal care not adequate in quantity .....	46.0	52.4
In WIC Program <sup>2</sup> .....	93.2	62.8

<sup>1</sup> Births with no prenatal care are excluded.

<sup>2</sup> 1986 only.

of birth (month, day, year). This arrangement precludes having to rely on the baby's date of birth on potentially incomplete records of pregnancy closure to identify health department births. If a woman has just one prenatal visit in a health department, she is counted in the health department category. This procedure minimizes provider referral bias and may in fact lead to a conservative estimate of a positive effect of health department care on low birth weight. Data from the 1988 North Carolina birth cohort are compared to the earlier data for North Carolina (1986–87) and Kentucky (1985–86) as a means of validation. Beginning in October 1987, the Medicaid eligibility level in North Carolina for pregnant women was raised to 100 percent of the Federal poverty level, so some of the women in Medicaid in 1988 will have had higher incomes than those during the 1986–87 period.

In North Carolina, 90 percent of the records for women in WIC during the prenatal period were matched to a 1986–87 birth certificate using name, date of delivery, and county of residence. Some women in WIC do not return for a post-partum visit, and they were not eligible to be matched since

no date of delivery was recorded. Therefore we expect that the number of births to women in North Carolina who were in WIC shown in this study is an underestimate. In Kentucky, the social security number was available for matching WIC records to births, followed by name and demographic variables for those not matching in the first step, so that 95 percent of prenatal WIC records were matched to a birth certificate.

The incidence of low birth weight (less than 2,500 grams), very low birth weight (less than 1,500 grams), and other birth characteristics are compared for two source-of-prenatal-care groups: health department, Medicaid; and Medicaid, not health department. Further comparison of the two Medicaid groups is done using logistic regression to assess the effect of health department prenatal care on low birth weight while controlling for differences between the two groups on other risk factors for low birth weight (under age 18, unmarried, less than 12 years of education, previous fetal death or live-born infant who died, and less than adequate quantity of prenatal medical care). For the 1988 North Carolina analysis, two control variables available on the new birth certificate are added: maternal smoking and presence of medical risk factors during the pregnancy (from check boxes).

Birth weight and all of the risk factors for low birth weight used in the analysis are from data recorded on the birth certificates, while the indicators of health department and WIC program participation (yes or no) come from the matching process described previously. Quantitative adequacy of prenatal care utilization was measured using the Kessner Index (13). Only single births are included in the analysis, and births with no prenatal care are excluded since they would otherwise all be included in the not-health-department group by not matching to health department prenatal care records. Data are shown separately for whites and blacks since the proportion of infants that are black differs substantially between the two States (North Carolina: 68 percent of infants are white, 29 percent black; Kentucky: 91 percent white, 8 percent black), and since the effect of health department prenatal care may be different for the two races.

## Results

Table 1 shows that in North Carolina for 1986–87 the incidence of low birth weight and very low birth weight is substantially less for women in Medicaid receiving prenatal care at public health

departments compared with those obtaining care from other providers for both whites and blacks. For both races, the prevalence of risk factors for low birth weight is *very* similar for the two Medicaid groups. However, a much higher percent of the women in Medicaid receiving prenatal care at health departments receive WIC benefits, and this may be associated with their better birth weight outcomes.

Table 2 portrays the same indicators for Kentucky for 1985 and 1986 births combined, and the patterns are very similar. In particular, women in Medicaid who received prenatal care at public health departments had consistently better birth weight outcomes than women in Medicaid who received prenatal care from other providers. Due to the small number of black births in Kentucky, the percents for blacks in table 2 should be regarded with caution.

In table 3, which shows the 1988 birth weight results for North Carolina, the health department births are counted as those having one or more prenatal visits in a public health department (not requiring completion of a pregnancy closure record as in table 1). Also included in table 3 are data from the new birth certificate on smoking and presence of medical risk factors during the pregnancy. Patterns on the other risk factors for low birth weight shown for 1986-87 in table 1 were similar in the 1988 data. Table 3 corroborates the findings in table 1 that women in Medicaid receiving prenatal care in public health departments have better birth weight outcomes than those receiving care from other prenatal care providers. The difference between these two groups in very low birth weight (less than 1,500 grams) is less than that in table 1, especially for whites. This is consistent with the change expected as a result of reducing the problem of referral bias with the new health department-birth matching method. Values for the two Medicaid groups on smoking and medical risk factors are similar, so these factors do not appear to be confounding the results.

Table 4 displays logistic regression results, showing the relative odds of low birth weight for women in Medicaid receiving prenatal care from non-health department providers compared with those receiving prenatal care at public health departments, while controlling for the other risk factors in tables 1 and 2, except WIC. Higher participation in the WIC Program can be considered one positive aspect of the health department's prenatal care program rather than an independent "risk factor." Women receiving care outside health departments

Table 3. Selected characteristics by race of 1988 North Carolina single live births to Medicaid patients by source of prenatal care<sup>1</sup>

Category	Health department Medicaid	Medicaid, not health department
Number of births:		
White .....	4,876	3,597
Black .....	6,583	5,857
Percentages for whites:		
Less than 2,500 grams ....	7.16	8.74
Less than 1,500 grams ....	1.21	1.53
Mother smoked .....	46.0	41.8
One or more medical risk factors for this pregnancy ..	25.8	24.1
Percentages for blacks:		
Less than 2,500 grams ....	10.97	12.27
Less than 1,500 grams ....	1.79	2.43
Mother smoked .....	20.1	23.4
One or more medical risk factors for this pregnancy ..	26.3	22.9

<sup>1</sup> Births with no prenatal care are excluded.

are 1.13 to 1.37 times as likely to have an infant weighing less than 2,500 grams, and 1.42 to 2.23 times as likely to have an infant weighing less than 1,500 grams. All of these parameters except the two for Kentucky blacks have a 95 percent confidence interval with a lower limit greater than 1.00.

Table 5 shows logistic regression results for the 1988 North Carolina births to women in Medicaid, and the key results are similar to those in table 4. After the analysis is controlled for other measurable risk factors for low birth weight, women receiving prenatal care outside public health departments are significantly more likely to experience a low weight birth. The exception was white women whose infants weighed less than 1,500 grams. Thus the major findings of this paper do not appear to be due to referral of high-risk patients out of the health departments.

These findings suggest that it is the content of prenatal care provided in health departments, rather than a difference in measurable risk factors of the prenatal care recipients (including the quantity of prenatal medical care as measured by the Kessner Index), that is contributing to the better birth weight outcomes.

## Discussion

These results support earlier work suggesting that comprehensive prenatal care is effective in reducing low birth weight among women in poverty. While visits for obstetrical medical care alone may be adequate for many women with higher education

**Table 4. Estimated relative odds of low birth weight for women in Medicaid receiving prenatal care outside of public health departments, controlling for other selected low birth weight risk factors (logistic regression): single live births in North Carolina (1986–87) and Kentucky (1985–86), by race<sup>1</sup>**

State and race	Less than 2,500 grams	95 percent confidence interval limits	Less than 1,500 grams	95 percent confidence interval limits	Number
<b>North Carolina:</b>					
White .....	1.18	1.37, 1.02	1.90	2.80, 1.29	9,600
Black .....	1.13	1.24, 1.03	1.42	1.77, 1.14	17,750
<b>Kentucky:</b>					
White .....	1.26	1.45, 1.10	2.23	3.45, 1.44	18,460
Black .....	1.37	1.93, 0.97	1.63	4.08, 0.65	3,825

<sup>1</sup> Births with no prenatal care are excluded.

**Table 5. Estimated relative odds of low birth weight with presence of selected risk factors (logistic regression): 1988 single live births to Medicaid patients in North Carolina<sup>1</sup>**

Category	White				Black			
	Less than 2,500 grams	95 percent confidence interval limits	Less than 1,500 grams	95 percent confidence interval limits	Less than 2,500 grams	95 percent confidence interval limits	Less than 1,500 grams	95 percent confidence interval limits
Under age 18 .....	1.50	1.92, 1.18	1.78	3.10, 1.02	1.35	1.62, 1.13	1.45	2.19, 0.96
Unmarried .....	1.11	1.31, 0.94	1.23	1.79, 0.83	1.01	1.17, 0.87	0.81	1.10, 0.59
Education under 12 years .....	1.09	1.29, 0.91	0.82	1.24, 0.55	1.17	1.33, 1.03	0.98	1.31, 0.73
Previous fetal death or live-born infant who died .....	1.37	1.64, 1.14	1.78	2.66, 1.19	1.32	1.50, 1.16	1.77	2.32, 1.35
Prenatal care not adequate in quantity .....	1.20	1.42, 1.02	1.13	1.65, 0.78	1.12	1.26, 1.00	1.02	1.31, 0.79
Mother smoked .....	1.88	2.23, 1.59	0.89	1.31, 0.60	1.51	1.72, 1.33	1.04	1.41, 0.77
One or more medical risk factors for this pregnancy .....	2.30	2.72, 1.95	3.63	5.28, 2.50	2.19	2.46, 1.95	3.00	3.89, 2.34
Received prenatal care outside public health department .....	1.34	1.57, 1.14	1.29	1.87, 0.89	1.18	1.32, 1.05	1.44	1.85, 1.12

<sup>1</sup> Births with no prenatal care are excluded.

and income, women with fewer resources also need health education, nutritional counseling and supplementation, social work, outreach, and other non-medical ancillary services. This multidisciplinary approach is more likely to occur in public health departments in North Carolina and Kentucky than in the offices of other providers. Case management procedures to coordinate the provision of these various services are also important. In coordinating with other health and public service programs to provide these additional services, health departments rely much more than other prenatal care providers on nurses, nutritionists, educators, and other support staff. In North Carolina health departments, nurse practitioners frequently provide the basic prenatal medical services. Other studies have suggested that nurse practitioners and midwives are likely to spend more time per visit with their patients than office-based physicians, and they emphasize education, support, and patient

satisfaction (11,12). Their actions may contribute to the better birth weights among health department patients.

Previous work on this topic has been limited to a single clinic or small geographic area (9–12). This study has the advantage of being based on statewide data for several years in two different States. Only with a large number of births could we compare the incidence of very low birth weight. Although births of infants under 1,500 grams are relatively rare, they account for a large proportion of neonatal mortality and morbidity, and thus the finding of a positive effect for health department prenatal care in this category is significant. By using only Medicaid births in the health department or other provider comparison, we have in effect controlled for income differences between the two groups and thereby overcome one limitation of the study in Guilford County, NC (12).

As in any retrospective study without random

assignment to the comparison groups, there is the possibility of selection bias. In statistically controlling for other risk factors to assess the influence of health department prenatal care on birth weight of infants born to women in Medicaid, we were limited to measures available on birth certificates. Thus we could not adjust for possible differences between the two groups in other factors such as substance abuse, stress, or self-motivation. There is the possibility that medical referrals by health departments may result in some high-risk women being counted in the other Medicaid group due to lack of followup through delivery, which may have affected the results in tables 1, 2, and 4. The 1988 North Carolina data in tables 3 and 5, in which just one prenatal visit puts a birth in the health department category, do suggest that this referral bias is not a serious problem. Incomplete matching of health department records to birth records will result in some Medicaid patients of health departments being counted in the other Medicaid group. However, to the extent that prenatal care in health departments is effective in reducing low birth weight, this incomplete matching will result in the findings shown in this study understating the true difference between the two groups.

This study documents a lower incidence of low birth weight for women in Medicaid who received prenatal care at public health departments compared with those receiving care from other providers. After controlling for differences in other measurable risk factors, we have inferred that the content of prenatal care in the public health setting accounts for this difference. Further studies that actually measure the process of care are needed to determine what specific aspects of prenatal care might account for this difference.

Our findings suggest that expansions of Medicaid coverage for pregnant women should be broader than just financing more prenatal care visits. Care coordination and other ancillary services are needed to complement prenatal medical care. A comprehensive approach to prenatal care is crucial for women in poverty. But low birth weight is more than a health care issue. Substantial progress in reducing this serious and persistent problem will also require socioeconomic initiatives such as reducing poverty, improving educational levels, and increasing employment opportunities.

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