

A comparison of Medicaid and non-Medicaid obstetrical care in California

by Embry M. Howell, Elicia J. Herz, Ruey-Hua Wang, and Marilyn B. Hirsch

The use of prenatal care and rates of low birth weight were examined among four groups of women who delivered in California in October 1983. Medicaid paid for the deliveries of two groups, and two groups were not so covered. The analyses suggest that longer Medicaid enrollment improved the use of prenatal care. The

association between prenatal care and birth weight was less clear. For women under Medicaid, measures of infant and maternal morbidity, hospital characteristics, and Medicaid eligibility were all statistically related to charges, payments, and length of stay for the delivery hospitalization.

Introduction

Access to and quality of maternity and newborn care have been major political issues in this decade. Because of the Medicaid program's role as the main financing mechanism for the delivery of such care to low-income families, much of the debate has focused on this program. Recent legislation permits Medicaid coverage for new groups of poor pregnant women and their children. Although many policymakers seem to favor some type of expansion, there has been little information on how these expanded benefits will affect use of prenatal services, outcomes of pregnancy, or program costs.

Goals of this study

This study was designed to provide additional information on several research and policy issues relevant to recent eligibility expansions under Medicaid. Using data from one State, California, with a comprehensive Medicaid program in 1983, the initiation of prenatal care and the incidence of low birth weight were compared among four cohorts of Medicaid and non-Medicaid deliveries in October 1983. For these analyses, Medicaid mothers were divided into two groups based on length of enrollment during pregnancy. Non-Medicaid mothers were also divided into two groups based on residence in poor versus nonpoor areas. Cost analyses were performed, focusing on the effects of Medicaid maintenance assistance status on length of stay, charges, and Medicaid payments for the delivery hospitalization.

Birth outcomes and costs of care

Many studies have been conducted to identify the causes of poor birth outcomes. Risk factors include: demographic characteristics (e.g., young or old maternal age, black race, low income, unmarried status, and low educational attainment); medical risks predating pregnancy (e.g., poor obstetric history, presence of serious or chronic maternal illness); medical risks in current pregnancy (e.g., poor weight gain, short inter-pregnancy interval, fetal anomalies); behavioral and

environmental risks (e.g., smoking, poor nutritional status, substance abuse); and health care risks (e.g., inadequate prenatal care) (Institute of Medicine, 1985).

Since the introduction of formalized prenatal care services in the United States during the early 1900s, hundreds of studies have been conducted to determine the impact of these services on newborn health. In two recent comprehensive reviews of the research literature (Institute of Medicine, 1985; Office of Technology Assessment, 1988), prenatal care was judged to be effective in reducing certain problems, particularly low birth weight. In addition, the incidence of newborn deaths has been dramatically reduced since the advent of sophisticated neonatal intensive care services (Office of Technology Assessment, 1987).

Sick infants incur substantial medical care costs. From 150,000 to 200,000 newborns (4 to 6 percent of all births) are admitted to neonatal intensive care units (NICUs) annually. Low-birth-weight infants are disproportionately represented among these seriously ill newborns—at least one-half of NICU admissions are for such infants (Office of Technology Assessment, 1988).

Costs of newborn care in hospitals with NICUs are substantial. Variations in costs and length of stay are largely determined by four factors: birth weight, survival to hospital discharge, assisted ventilation and surgical intervention (Phibbs, Williams, and Phibbs, 1981; Office of Technology Assessment, 1987). In 1984, normal-birth-weight infants (> 2,500 grams) incurred average hospital-specific costs ranging from \$1,200 to \$14,600. Costs for low-birth-weight infants (\leq 2,500 grams) were much higher, from \$11,600 to \$39,400 (Office of Technology Assessment, 1987).

Impact of Medicaid

As the major public program for financing health care for the poor, Medicaid plays an important role in paying for the maternity and newborn care of low-income women and their infants. Recent legislative changes in Medicaid have allowed coverage for special categories of pregnant women (e.g., first-time pregnant women, those in two-parent families) as well as raised the income cutoff up to or beyond the official Federal poverty line.

Few studies have examined the impact of Medicaid coverage—or more generally, insurance status—on use of prenatal care and on birth outcomes. Table 1 displays

Research for this article was funded by the Health Care Financing Administration under Contract Number 500-86-0016.

Reprint requests: Embry M. Howell, Ph.D., SysteMetrics/McGraw-Hill, Inc., 4401 Connecticut Avenue, NW., Washington, D.C. 20008.

Table 1
Summary of studies assessing Medicaid's effect on use of prenatal care, newborn mortality, and birth weight

Study	Year	Location	Comparison group	Results		
				Use of prenatal care	Birth weight	Mortality
Norris and Williams, 1984	1968 and 1978	California	All non-Medicaid births	+	-	0
McCullough, 1988	1984	California	Matched non-Medicaid living in poor areas	-	+	+
Spitz et al., 1983	1976-78	Georgia	No public coverage, with less than 12 years education	NA	0	0
Buescher et al., 1987	1984	North Carolina (one county)	Special county health department program	NA	-	NA
Mullet et al., 1988	1985	Minnesota (one county hospital)	Private insurance Free clinic No insurance	- - -	- - -	NA NA NA
McDonald and Coburn, 1986	1984-86	Maine Wisconsin Texas Colorado	No insurance Private insurance	- -	NA NA	NA NA
Cooney, 1985	1981	New York City	Private insurance	-	NA	NA
Fingerhut et al., 1987	1979-83	United States	No insurance Private insurance	- -	NA NA	NA NA
U.S. General Accounting Office, 1987	1986-87	39 hospitals in 32 communities in 8 States	No insurance Private insurance	+ -	NA NA	NA NA

NOTES: + = Findings indicated participation in Medicaid was associated with better outcomes than observed in one or more comparison groups; 0 = no difference between Medicaid and non-Medicaid groups; - = findings indicated participation in Medicaid was associated with worse outcomes than observed in one or more comparison groups; and NA = no analysis of this kind reported.

SOURCE: Herz, E.: Systemetrics/McGraw-Hill, Inc., Washington, D.C., 1990.

summary information on nine studies published during the 1980s that have addressed these issues. Most of these studies used relatively recent vital records data for entire States, counties, or cities. In one study (Mullett et al., 1988), hospital medical records were examined. Another study conducted face-to-face interviews with women who had different sources of payment for maternity care (U.S. General Accounting Office, 1987). The types of comparison groups varied considerably across analyses.

Results were mixed. Among the seven studies investigating use of prenatal care, five studies found that Medicaid coverage did not improve medical care utilization during pregnancy vis-a-vis private insurance. In two studies mothers under Medicaid fared worse in terms of prenatal care patterns than those with no insurance. Three of five studies examining Medicaid's impact on birth weight found that participation in Medicaid was associated with lower birth weight than observed among selected comparison groups; two of these five studies showed no group differences or a positive impact of Medicaid on birth weight. Medicaid appeared to improve newborn mortality rates in one of three studies.

In general, the lack of a large body of data on Medicaid's effect on service use and, in particular, birth outcomes, makes conclusions tentative. State-specific variations would be expected given differences in coverage policies (McDonald and Coburn, 1986). None of the studies reviewed (Table 1) took the timing of

initial Medicaid enrollment (i.e., before or during pregnancy) into account, which may explain some of the inconsistencies in observed findings. This study was designed to provide further evidence on this issue.

Factors that influence Medicaid payments

Information is limited concerning factors that affect Medicaid expenditures for obstetrical and newborn care. Only three recent studies have been done in this area. Each study addressed different research and policy questions.

Schramm, Land, and Dutton, (1984) evaluated the cost effectiveness of prenatal care delivered under Medicaid in Missouri during the period 1981-82. Mothers with adequate prenatal care incurred average Medicaid costs of \$1,580 along with \$1,249 for their infants. In contrast, costs for mothers with inadequate prenatal care were lower (\$1,455) and only marginally higher for their infants (\$1,264). The authors concluded that increasing the level of prenatal care would not necessarily lower overall Medicaid expenditures.

A study in New York during 1984 (Fanning, Gallagher, and Zelterman, 1987) contrasted the cost to the State of a normal obstetrical episode with the cost for an infant born with severe medical problems. Normal newborns incurred costs averaging \$2,316, or one-fourth the average amount of \$8,635 observed for sick infants. Even though there were four times as many normal newborns, total expenditures were higher for infants with

severe medical problems (\$12.7 million versus \$14.2 million, respectively).

Howell and Brown (1989) conducted a descriptive analysis of the use of different types of Medicaid-financed obstetrical services and the costs of that care for mothers who delivered in October of 1983 in three States: California, Georgia, and Michigan. They found that more than one-half of total maternity and newborn expenditures through the first year of life were for the delivery hospitalization. Less than 15 percent of these expenditures were for prenatal care and more than one-half of the prenatal dollars were for nonroutine services (e.g., hospital care and radiology services).

Many factors in addition to adequacy of care, use of specific services, or severity of newborn illness may contribute to costs associated with maternity and newborn care. This article describes a multivariate analysis that identifies the relative importance of a number of factors in determining Medicaid expenditures for maternity and newborn care.

California's Medicaid program

Eligibility

In 1983, California had income standards under Aid to Families with Dependent Children (AFDC) for Medicaid eligibility that were among the highest in the Nation and which extended Medicaid coverage to most optional eligibility groups. The optional groups of pregnant women eligible to receive Medicaid coverage included pregnant women with no eligible children, pregnant women in two-parent families, pregnant women in unemployed two-parent families, and pregnant women under 21 years of age ("Ribicoff children"). Ribicoff children included those under age 21 who lived in two-parent families or children who did not otherwise meet the AFDC program definition of a "dependent" child. Women in optional coverage groups had to meet the same financial criteria as AFDC families in order to receive Medicaid coverage.

California also covered medically needy pregnant women. Medically needy enrollees could qualify for Medicaid in one of two ways: Either they met the income and assets criteria that applied to medically needy applicants or they "spent down" to medically needy income levels by deducting medical expenses from their incomes.

California's income standards were \$625 per month for a family of four receiving AFDC cash assistance and \$834 per month for medically needy families of four. The Federal poverty level was \$848 per month for a family of four in 1983 (U.S. Department of Commerce, 1985). Because of these income requirements and coverage of several optional groups, virtually all poor pregnant women in California were eligible for Medicaid in 1983.

Benefits

In terms of benefits, California's Medicaid program was quite comprehensive in 1983. In addition to required services (e.g., inpatient, outpatient, rural health clinic, laboratory and X-ray, physician, and family planning),

the program covered optional services important for prenatal and postnatal care that included dental care, prescribed drugs, emergency hospital services, and freestanding clinic care.

Reimbursement

Beginning in 1983, hospital reimbursement for inpatient services in California was based on a prospective method known as "selective contracting" (Laudicina, 1985). Under this arrangement, per diem rates were negotiated with individual hospitals in certain (largely urban) geographic regions. Except for emergency and specialized treatment, Medicaid would not pay for care provided in noncontract facilities to enrollees living in areas with contracted hospitals. More than one-half of California's hospitals and more than 75 percent of its Medicaid inpatient admissions became subject to this type of contracting. Hospitals outside contracted regions continued to be paid under the existing retrospective system with peer group ceilings.

Reimbursement for physician services for pregnant women in California took one of two forms in 1983: traditional fee-for-service reimbursement where each service was paid separately, and reimbursement using a "global fee" which included all prenatal visits, the physician's charge for delivery, and some ambulatory postnatal care. The number of prenatal visits to be covered by the global fee was unspecified. Fixed statewide physician fee schedules were set in which the physician was paid a pre-specified amount according to the procedure (or visit) code on the claim, regardless of the amount charged for the service. Hospital outpatient departments and clinics in California were also paid on a fee schedule.

Methodology

Overview

This article describes the outcomes of obstetrical care for four groups of women who delivered during October 1983 in California: short-term Medicaid enrollees, long-term Medicaid enrollees, non-Medicaid mothers who resided in low-income areas, and non-Medicaid mothers who lived in high-income areas. Multivariate logistic regression analyses were designed to identify the effects of Medicaid on initiation of prenatal care and the incidence of low birth weight, after controlling for selected demographic and maternal and child health characteristics.

This study also investigated the factors determining the cost of delivery with a special focus on the unique effects of maintenance assistance status on charges, Medicaid payments, and length of stay for the delivery hospitalization. Maintenance assistance status is of interest here because recent legislation has expanded eligibility to women other than those receiving cash assistance. Ordinary least squares regression was used to examine the effect of medically needy versus cash assistance status on costs and length of stay for delivery, controlling for hospital characteristics and maternal and infant morbidities during pregnancy and at birth.

Data and study groups

The following data sources were used in this project:

- The 1983-84 Medicaid Tape-to-Tape project—a Medicaid claims file containing prenatal, delivery, and postnatal information on Medicaid-financed births occurring in October 1983.
- The 1983-84 California Birth-Death Cohort File—linked birth and death certificates for live births, deaths among live-born infants, and fetal deaths occurring in 1983 and 1984.
- The 1980 Census ZIP Code Level File—census data on poverty status by area of residence.

Four study groups were identified using these data sources:

- Group 1—1,880 women whose deliveries were financed by Medicaid but who were enrolled in the program for 3 months or less of their pregnancies.
- Group 2—5,612 women whose deliveries were financed by Medicaid and who were enrolled in the program for 4 or more months of their pregnancies.
- Group 3—4,054 women whose deliveries were not covered by Medicaid and who were residents of low-income areas.
- Group 4—1,464 women whose deliveries were not covered by Medicaid and who were residents of high-income areas.

The study was restricted to deliveries of single, live-born infants in October 1983. Exclusions included multiple births, fetal deaths, out-of-State births, births to mothers with unknown residences, and births to mothers living in certain counties having capitated Medicaid payment systems.

The Medicaid claims file containing October 1983 deliveries was matched to the birth and death certificate data using name and date of birth. Of the original 8,194 confirmed Medicaid-financed deliveries in this data set, 7,492 records (91.4 percent) were matched.

Poverty status indicators at the census tract and ZIP code level were used to designate low- and high-income areas in the State. Low-income areas were those ranked in the top 25 percent of ZIP codes according to three poverty indexes from 1980 census data. Correspondingly, high-income areas were ranked in the bottom 25 percent of the same measures. A somewhat different approach was used in Los Angeles and Alameda counties. In these counties, because income information by census tract was unavailable, the percent of births that were covered by Medicaid was used as a poverty index. Again, the top and bottom 25 percent of tracts were identified as low- and high-income areas. Non-Medicaid mothers residing in those areas formed the two comparison groups. More detail on the methodology used to identify the study groups is contained in a separate report (Howell et al., 1990).

Findings

The findings from this study are described in four sections. First, the characteristics of the four study groups are described. Second, variations in use of prenatal care among the groups are identified. In conjunction with the prenatal care discussion, patterns of Medicaid enrollment and use of Medicaid-financed services during pregnancy are reviewed. Third, univariate and multivariate analyses examining Medicaid's impact on birth weight are

Table 2
Number of deliveries and percent distribution of selected demographic characteristics, by study group: California, October 1983

Demographic characteristic	Medicaid		Non-Medicaid	
	Group 1 Enrolled 0-3 months of pregnancy	Group 2 Enrolled 4 or more months of pregnancy	Group 3 Residents of low-income areas	Group 4 Residents of high-income areas
Total deliveries	1,880	5,612	4,054	1,464
Race and ethnicity	Percent distribution			
Hispanic	37.7	29.5	49.5	10.7
White, non-Hispanic	44.5	41.4	30.7	78.3
Black, non-Hispanic	10.8	17.8	13.3	1.5
Other, non-Hispanic	7.1	11.3	6.5	9.5
Age				
12-19 years	24.1	25.4	10.9	2.7
20-34 years	72.2	70.9	81.5	83.6
35 years or over	3.7	3.7	7.6	13.7
Marital status at delivery (Los Angeles County only)				
Married	47.4	58.5	65.2	91.8
Not married	52.6	41.6	34.8	8.2
Geographic residence				
SMSA	92.9	93.3	94.1	98.4
Non-SMSA	7.1	6.7	5.9	1.6

NOTES: SMSA is standard metropolitan statistical area. All percents are based on cases with nonmissing data. Percents may not add to 100 because of rounding.

SOURCES: (California Department of Health Services, 1983-84); (Health Care Financing Administration, 1983-84); and (U.S. Bureau of the Census, 1980.)

presented. Finally, a multivariate analysis of charges, expenditures, and length of stay for Medicaid-financed deliveries is described.

Study group characteristics

The four study groups were quite different in terms of race and ethnic composition (Table 2). The percentage of mothers who were Hispanic was highest for Group 3—non-Medicaid residents of low income areas—49.5 percent. Group 4, the non-Medicaid residents of high-income areas, were predominantly white and non-Hispanic (78.3 percent). The two Medicaid study groups had similar racial and ethnic characteristics. White women represented the largest proportion of each group (44.5 and 41.4 percent). There were more Hispanics (37.7 percent) in Group 1, the short-term Medicaid enrollees, than in Group 2, the long-term Medicaid enrollees (29.5 percent).

The Medicaid mothers were younger than the non-Medicaid mothers; about one-fourth of the Medicaid women were teenagers. Marital status could be determined from birth certificates in Los Angeles County only. Two-fifths to one-half of Medicaid mothers and about one-third of non-Medicaid residents of low-income areas in that county were unmarried, in contrast to less than one-tenth of residents of high-income areas. More than 90 percent of all four groups were residents of standard metropolitan statistical areas (SMSAs).

As shown in Table 3, eligibility characteristics differed for the two Medicaid study groups. Three maintenance assistance status groups are presented: cash assistance, medically needy, and all others. More than one-third (37.1 percent) of Group 1 members (short-term enrollees) were classified as cash assistance enrollees, compared with nearly three-fourths (71.2 percent) of Group 2 members (long-term enrollees). In California in 1983, cash assistance enrollees had family incomes that fell below the AFDC income standard set at \$625 per month for a family of four (74 percent of the Federal poverty level). Of Group 1 members, 57.7 percent were medically needy enrollees, compared with only 22.4 percent of Group 2. The 1983 medically needy income eligibility standard for a family of four in California was \$834 per month (98 percent of the Federal poverty level). Thus, enrollment patterns suggest that Group 2 women were probably poorer, on average, than members of Group 1.

Prenatal care

Descriptive analysis

Table 4 shows the patterns of initiation of prenatal care among the four study groups. Early prenatal care is defined as care initiated in the first trimester of pregnancy.¹ Short-term Medicaid enrollees were the least likely to receive early prenatal care (58.8 percent). In

¹The prenatal measure is based on self-report data on birth certificates. In 1983, California did not include number of prenatal visits on its birth certificates. Thus, it was not possible to study number of prenatal care visits.

Table 3
Number of Medicaid deliveries and percent distribution of maintenance assistance status, by study group: California, October 1983

Maintenance assistance status	Total Medicaid	Group 1	Group 2
		Enrolled 0-3 months of pregnancy	Enrolled 4 or more months of pregnancy
Total deliveries	7,492	1,880	5,612
Percent distribution			
Cash assistance ¹	62.7	37.1	71.2
Medically needy ²	31.3	57.7	22.4
All others ³	6.1	5.2	6.3

¹All categorically needy persons receiving AFDC or SSI cash assistance, most of whom were classified as AFDC adults (95.8 percent).

²All persons meeting medically needy eligibility criteria, most of whom were classified as AFDC adults (77.9 percent).

³A mix of categorically needy persons not receiving cash assistance and special optional coverage groups (i.e., refugee and State-only enrollees). Most of these mothers were classified as AFDC adults (95.8 percent).

NOTES: AFDC is Aid to Families with Dependent Children. SSI is Supplemental Security Income. Percents may not add to 100 because of rounding.

SOURCE: (Health Care Financing Administration, 1983-84.)

contrast, nearly all mothers living in high-income areas (91.7 percent) received early care. The long-term Medicaid enrollees and the non-Medicaid residents of low-income areas were similar in their receipt of early care (68.8 and 70.0 percent, respectively).

In terms of use of the Medicaid program during pregnancy, several important differences exist between Group 1 and 2 enrollees (Table 4). Most Group 1 mothers did not enroll in Medicaid until late in their pregnancies. Nearly all of these women (92.3 percent) initiated enrollment in Medicaid during their third trimester of pregnancy (61.3 percent) or at delivery (31.0 percent). In contrast, 71.4 percent of Group 2 members initiated Medicaid enrollment during their first trimester of pregnancy or were enrolled prior to conception. The remainder of Group 2 were enrolled in Medicaid by the end of their second trimester. Among those who were enrolled in Medicaid at any time during their pregnancies, the majority of both Group 1 (86.1 percent) and Group 2 (88.5 percent) remained continuously enrolled through delivery (data not shown).

Even though 71.4 percent of Group 2 mothers were enrolled in Medicaid during their first trimester of pregnancy and 68.6 percent received first trimester care according to birth records, only 46.9 percent of these women received Medicaid-covered services during this period. These data suggest that, although enrolled in Medicaid during most of their pregnancies, some of the Group 2 mothers received some prenatal care services that were not paid for by Medicaid.

An even greater discrepancy between the timing of Medicaid enrollment and initiation of prenatal care was observed for Group 1 members. Although almost no Group 1 mothers were enrolled in Medicaid during their first trimester of pregnancy (3.7 percent), 58.8 percent reported that they had received prenatal care during this trimester. In addition, very few Group 1 mothers (1.3 percent) received any services financed by Medicaid during their first trimester. These findings suggest that other financing mechanisms (e.g., private insurance,

Table 4
Number of deliveries and percent distribution of initiation of prenatal care, timing of Medicaid enrollment, and use of Medicaid-covered services prior to delivery, by study group: California, October 1983

Dependent measure	Medicaid		Non-Medicaid	
	Group 1 Enrolled 0-3 months of pregnancy	Group 2 Enrolled 4 or more months of pregnancy	Group 3 Residents of low-income areas	Group 4 Residents of high-income areas
Total deliveries	1,880	5,612	4,054	1,464
Trimester care began¹	Percent distribution			
First	58.8	68.6	70.0	91.7
Second	28.2	26.7	22.3	6.5
Third	10.2	4.0	5.9	1.5
None	2.8	0.7	1.9	0.3
Trimester enrolled in Medicaid prior to delivery¹				
First	3.7	71.4	NA	NA
Second	4.0	28.6	NA	NA
Third	61.3	0.0	NA	NA
Delivery month	31.0	0.0	NA	NA
Trimester first used any Medicaid-covered service during pregnancy				
First	1.3	46.9	NA	NA
Second	2.7	34.8	NA	NA
Third	96.0	18.2	NA	NA

¹The timing of first enrollment in Medicaid in relation to the pregnancy episode was estimated by dividing the 9 months preceding all births (in October) into 3 intervals of 3 months each (i.e., January-March = enrolled in the first trimester or enrolled prior to pregnancy; April-June = second trimester; and July-September = third trimester). Note this method is approximate because all pregnancies were not full term.

NOTES: All percents are based on cases with nonmissing data. Percents may not add to 100 because of rounding. NA is not applicable.

SOURCES: (California Department of Health Services, 1983-84); (Health Care Financing Administration, 1983-84); and (U.S. Bureau of the Census, 1980.)

out-of-pocket payments, the Maternal and Child Health Block Grant, or local funding programs) provided access to early prenatal care for many women who became enrolled in Medicaid near or at delivery.

Table 2 shows there were large differences among study groups on measures of race and ethnicity, age, and marital status—factors that are strongly related to use of prenatal care. For this reason, a multivariate analysis was used to investigate Medicaid's unique effect on initiation of prenatal care.

Multivariate analysis

Table 5 presents odds ratios derived from multiple logistic regression² assessing the probability of receiving late prenatal care (i.e., care initiated after the first trimester or no care). Mothers living in high-income areas (Group 4) served as the comparison group for all analyses (ratio value of 1.0). Other ratios represent the relative odds of receiving late prenatal care when compared with Group 4. When the 95-percent confidence interval associated with a specific odds ratio excludes 1.0, the difference between that group and Group 4 is statistically significant. Following the methodology used by Kleinman and Madans (1985), Table 5 shows the successive effects of adjusting for specific sets of independent variables on the odds ratios for each study group.

²For a discussion of multiple logistic regression techniques, see Hosmer and Lemeshow (1989).

The first row of Table 5 shows unadjusted odds ratios. For members of Groups 1, 2, and 3 the odds of receiving late care were 7.78, 5.06, and 4.75 times as great, respectively, as the odds for Group 4. Each of these odds ratios was statistically significant indicating that, relative to Group 4, every other group had increased odds of receiving late prenatal care.

Table 5 also displays estimates of the relative odds of receiving late prenatal care after adjusting for key maternal characteristics known to influence the use of prenatal care—race and ethnicity, maternal age, parity, and complications of pregnancy. The presence or absence of 16 conditions were recorded as complications of pregnancy on the California birth certificate.³ After adjusting for race and ethnicity, the relative odds of receiving late prenatal care dropped to 6.84 for Group 1, 4.47 for Group 2, and 3.94 for Group 3. Adjustments for maternal age and parity resulted in additional but smaller reductions in the relative odds, and complications of pregnancy did not substantially affect the odds ratios. After adjustments for all factors, the odds of obtaining late care among those who were enrolled in Medicaid for a short time during pregnancy (Group 1) were more than

³These conditions included: placental complications; pre-eclampsia, eclampsia, toxemia; hemoglobinopathy; urinary tract, kidney infection; anemia less than 10 mg HB; transport of mother from another hospital after onset of labor; heart disease, essential hypertension; diabetes; pulmonary; syphilis; rubella, Rh₀(D) iso-immunization; unspecified uterine bleeding not associated with labor; renal disease; previous cesarean section; and other complications of pregnancy and concurrent illnesses.

Table 5

Odds ratios for receipt of late prenatal care by study group, unadjusted and adjusted for selected maternal characteristics: California, October 1983

Predictor variable	Medicaid				Non-Medicaid		
	Group 1 ¹		Group 2 ²		Group 3 ³		Group 4 ⁴
	Odds ratio	95-percent confidence interval	Odds ratio	95-percent confidence interval	Odds ratio	95-percent confidence interval	Odds ratio
Unadjusted	7.78	6.31-9.60	5.06	4.16-6.16	4.75	3.89-5.81	1.0
Adjusted for race and ethnicity	6.84	5.52-8.46	4.47	3.66-5.46	3.94	3.21-4.84	1.0
Adjusted for race and ethnicity, maternal age, and parity	6.13	4.95-7.61	3.80	3.10-4.65	3.71	3.02-4.56	1.0
Adjusted for race and ethnicity, maternal age, parity, and complications of pregnancy	6.13	4.94-7.60	3.79	3.09-4.64	3.68	2.99-4.52	1.0

¹Enrolled 0-3 months of pregnancy.

²Enrolled 4 or more months of pregnancy.

³Residents of low-income areas.

⁴Residents of high-income areas.

NOTES: When the 95-percent confidence interval for a given odds ratio excludes 1.0, the difference between the corresponding study group and Group 4 is statistically significant at the 0.05 level or less. Deliveries with missing data were excluded.

SOURCES: (California Department of Health Services, 1983-84); (Health Care Financing Administration, 1983-84); and (U.S. Bureau of the Census, 1980.)

six times the odds for mothers who resided in high-income areas (Group 4). The odds of receiving late prenatal care for the remaining two groups—long-term Medicaid enrollees (Group 2) and non-Medicaid residents of low-income areas (Group 3)—were more than three times the odds of Group 4.

Table 6 shows the estimated coefficient for each variable from the multiple logistic regression analysis of prenatal care for the full model (i.e., based on the equation from which the odds ratios reported in the bottom row of Table 5 were drawn). A positive coefficient means the group represented by the dummy variable was more likely to get late care in comparison to the reference category. A negative coefficient describes the opposite relationship. Minority status was a significant predictor of late prenatal care, although the association was not as strong for black women as for Hispanic women and as for races other than white. Teenagers were more likely to have late prenatal care than were mothers from 20 to 34 years of age (the reference category). Older mothers did not differ significantly in their odds of receiving late care. Women having their first live birth were less likely to have late care than mothers experiencing a higher order birth. Similarly, women with complicated pregnancies were also less likely to have late care than those without such problems. Finally, the association between Medicaid enrollment and receipt of late prenatal care was positive and highly significant.

In summary, the multivariate analyses demonstrated that all of the low-income study groups had substantially increased odds of receiving late prenatal care when compared with non-Medicaid residents of high-income areas. This was especially true for short-term Medicaid enrollees (Group 1). Group 2 (long-term Medicaid enrollees) had substantially lower odds of receiving late

Table 6

Results of multivariate logistic regression on probability of late prenatal care: California, October 1983

Independent variable ¹	Coefficient	Standard error	Chi-square
Intercept	-2.395	0.101	—
Race and ethnicity			
Hispanic	***0.418	0.047	77.47
Non-Hispanic			
Black	**0.162	0.063	6.53
All other, other than white	***0.466	0.074	39.22
Maternal age			
12-19 years	***0.716	0.055	171.95
35 years or over	0.025	0.090	0.08
Parity (first live birth)	***-0.299	0.045	43.24
Complications of pregnancy (one or more)	*-0.171	0.071	5.78
Medicaid status			
Medicaid, enrolled 0-3 months of pregnancy	***1.813	0.110	271.78
Medicaid, enrolled 4 or more months of pregnancy	***1.331	0.104	165.03
Non-Medicaid, resident of low-income area	***1.303	0.105	152.54

*Statistically significant at the $p \leq 0.05$ level.

**Statistically significant at the $p \leq 0.01$ level.

***Statistically significant at the $p \leq 0.001$ level.

¹Reference categories for sets of dummy variables: race and ethnicity: white, non-Hispanic; maternal age: 20-34 years; parity: second or higher order birth; complications of pregnancy: 0; Medicaid status: non-Medicaid, resident of high-income area.

SOURCES: (California Department of Health Services, 1983-84); (Health Care Financing Administration, 1983-84); and (U.S. Bureau of the Census, 1980.)

prenatal care than did Group 1, suggesting a positive association between early Medicaid enrollment and early use of medical care during pregnancy. In general, these analyses demonstrate the importance of considering length of Medicaid enrollment in any analysis of the impact of Medicaid on prenatal care.

Delivery

Descriptive analysis

This section presents data on study group differences in delivery hospitalization (Table 7). Cesarean section delivery was more common among non-Medicaid mothers who were residents of high-income areas (Group 4) than among the other study groups. This may be due, in part, to the older age distribution, slightly higher rates of labor and delivery complications, and/or differences in health insurance coverage for Group 4 in comparison to Groups 1-3.

Infants included in this study represented first live births for 53.7 percent of short-term Medicaid enrollees, 41.8 percent of long-term Medicaid mothers, and 36.4 percent of Group 3 mothers. Like the Medicaid mothers, residents of high-income areas also had a high proportion of first live births (46.9 percent).

Ownership of the delivering hospital varied among the four groups. From 45.0 to 54.8 percent of Groups 1-3 were delivered in private, nonprofit hospitals compared with 72.6 percent of Group 4. Also, two to three times as many members of Groups 1-3 (the low-income study groups) delivered in government hospitals in comparison to Group 4 mothers.

The level of neonatal intensive care in delivery hospitals also varied by study group. Level I hospitals provide services primarily for uncomplicated maternity and newborn patients. Level II hospitals provide a full range of maternal and neonatal services for uncomplicated cases and for the majority of complicated obstetrical problems and certain neonatal illnesses. Level III hospitals provide care for normal patients but especially for all serious types of maternal-fetal and neonatal illnesses and abnormalities (Committee on Perinatal Health, 1977).

Roughly equal proportions of all four study groups (about 20 percent) were delivered in Level II hospitals. Twice as many members of Groups 1 and 3 (22 to 24 percent) gave birth in Level III facilities in comparison to Groups 2 and 4 (11 to 12 percent). Other data shown in Tables 2 and 7 do not support the conclusion that Group 1 and 3 mothers were at greater risk than the other two study groups for complications of pregnancy or labor and delivery. However, there may be other characteristics of Level III hospitals (e.g., geographic location) that influenced differential utilization by the four study groups.

Table 8 shows data on selected infant outcomes for the four study groups. Among infants of short-term Medicaid enrollees, 7.8 percent were low birth weight (under 2,500 grams) compared with 6.3 percent for infants of long-term Medicaid enrollees, 5.4 percent of infants of non-Medicaid mothers in low-income areas, and 4.2 percent of infants of non-Medicaid mothers in high-income areas. Corresponding to the findings on birth weight, residents of high-income areas were less likely to have a premature birth (< 260 days gestation) than all

Table 7

Number of deliveries and selected delivery characteristics, by study group: California, October 1983

Delivery characteristic	Medicaid		Non-Medicaid	
	Group 1	Group 2	Group 3	Group 4
	Enrolled 0-3 months of pregnancy	Enrolled 4 or more months of pregnancy	Residents of low-income areas	Residents of high-income areas
Total deliveries	1,880	5,612	4,054	1,464
	Percent			
Cesarean delivery	16.8	18.8	18.2	24.2
First live birth	53.7	41.8	36.4	46.9
One or more complications of pregnancy	9.4	10.0	8.7	10.0
One or more complications of labor and delivery	16.6	15.0	14.9	18.0
Hospital ownership	Percent distribution			
Total	100.0	100.0	100.0	100.0
Government	41.5	27.6	34.9	13.5
Private nonprofit	45.0	54.8	50.8	72.6
Private proprietary	13.1	17.0	12.7	13.0
Other, unknown, out of hospital	0.4	0.6	1.6	0.9
Hospital level of care	Percent distribution			
Total	100.0	100.0	100.0	100.0
Level I	56.5	66.6	55.2	64.1
Level II	21.0	21.8	19.0	23.4
Level III	22.1	11.1	24.4	12.0
Unknown	0.0	0.0	0.4	0.1
Not in hospital	0.4	0.6	1.2	0.5

NOTES: Hospital level of care is defined as follows: Level I, uncomplicated deliveries; Level II, majority of complicated deliveries and some neonatal complications; and Level III, all serious types of fetal and neonatal illnesses and abnormalities. All percents are based on cases with nonmissing data. Percents may not add to 100 because of rounding.

SOURCES: (California Department of Health Services, 1983-84); (Health Care Financing Administration, 1983-84); and (U.S. Bureau of the Census, 1980.)

Table 8
Number of deliveries and percent of selected birth outcomes, by study group: California, October 1983

Birth outcome	Medicaid		Non-Medicaid	
	Group 1	Group 2	Group 3	Group 4
	Enrolled 0-3 months of pregnancy	Enrolled 4 or more months of pregnancy	Residents of low-income areas	Residents of high-income areas
Total deliveries	1,880	5,612	4,054	1,464
Birth weight in grams		Percent		
Less than 2,500	7.8	6.3	5.4	4.2
Less than 1,500	1.5	0.7	0.9	0.4
1,500-2,499	6.3	5.6	4.5	3.8
Gestational age				
Under 260 days	15.1	12.0	10.3	7.0
Congenital malformations				
One or more	1.1	0.9	1.0	0.6

NOTE: All percents are based on cases with nonmissing data.

SOURCES: (California Department of Health Services, 1983-84); (Health Care Financing Administration, 1983-84); and (U.S. Bureau of the Census, 1980.)

Table 9
Number of deliveries and number of deaths per 1,000 live births, by study group: California, October 1983

Type of death	Medicaid		Non-Medicaid	
	Group 1	Group 2	Group 3	Group 4
	Enrolled 0-3 months of pregnancy	Enrolled 4 or more months of pregnancy	Residents of low-income areas	Residents of high-income areas
Total deliveries	1,880	5,612	4,054	1,464
Deaths per 1,000 live births				
Infant ¹	13.8	8.6	12.6	6.8
Neonatal ²	6.9	4.6	7.4	4.8
Postneonatal ³	6.9	3.9	5.2	2.0

¹All deaths among live-born infants occurring from 0 to 365 days of life.

²All deaths among live-born infants occurring from 0 to 28 days of life.

³All deaths among live-born infants occurring from 29 to 365 days of life.

NOTE: All rates are based on cases with nonmissing data.

SOURCES: (California Department of Health Services, 1983-84); (Health Care Financing Administration, 1983-84); and (U.S. Bureau of the Census, 1980.)

other cohorts. The highest rate of prematurity (15.1 percent) was for the short-term Medicaid enrollees. The four study groups did not differ as greatly in the percentage of infants with congenital malformations. These were reported for approximately 1 percent of infants in each of Groups 1-3 and for 0.6 percent of infants born to residents of high-income areas.

Table 9 displays data on infant deaths. Non-Medicaid mothers in high-income areas had the lowest death rates while Groups 1 and 3 experienced the highest death rates. The following multivariate outcome analysis used birth weight rather than mortality as the outcome measure because of the relatively small sample sizes that might have led to unstable mortality measures. Birth weight was chosen rather than gestational age because of the lower rates of missing data for birth weight.

Multivariate analysis

A multivariate analysis was performed to estimate Medicaid's unique effect on the rate of low birth weight, adjusting for other important factors known to influence

birth outcomes. The analysis follows the methodology described previously for analyzing receipt of late prenatal care. In addition to those variables used in the prenatal care regressions, two other control variables known to affect birth weight were included: sex of infant and complications of labor and delivery. Presence or absence of nine conditions were reported as complications of labor and delivery.⁴ As before, successive logistic regression models and adjusted odds ratios were computed for comparing Groups 1-3 to Group 4.

Table 10 shows unadjusted and adjusted odds ratios for the full State. The unadjusted relative odds of low birth weight for Group 1 (short-term Medicaid enrollees) was 1.93, for Group 2 (long-term Medicaid enrollees) the ratio was 1.53, and for Group 3 (non-Medicaid residents of low-income areas) the ratio was 1.30. The latter unadjusted odds ratio was not significantly different from

⁴These included: amnionitis, sepsis; hemorrhage associated with labor; cephalopelvic disproportion; breech or other abnormal presentation; fetal distress; maternal blood transfusion; postpartum hemorrhage; transport of infant to another hospital within 24 hours of birth; and other complications of labor and delivery.

Table 10

Odds ratios for low birth weight by study group, unadjusted and adjusted for selected maternal and infant characteristics: California, October 1983

Predictor variable	Medicaid				Non-Medicaid		
	Group 1 ¹		Group 2 ²		Group 3 ³		Group 4 ⁴
	Odds ratio	95-percent confidence interval	Odds ratio	95-percent confidence interval	Odds ratio	95-percent confidence interval	Odds ratio
Unadjusted	1.93	1.42-2.62	1.53	1.16-2.01	1.30	0.97-1.73	1.0
Adjusted for race and ethnicity	1.76	1.29-2.40	1.25	0.94-1.67	1.17	0.86-1.57	1.0
Adjusted for race and ethnicity, maternal age, parity, and sex of infant	1.69	1.23-2.32	1.25	0.93-1.67	1.17	0.87-1.59	1.0
Adjusted for race and ethnicity, maternal age, parity, sex of infant, complications of pregnancy, and labor and delivery complications	1.70	1.24-2.35	1.25	0.93-1.68	1.19	0.88-1.62	1.0

¹Enrolled 0-3 months of pregnancy.

²Enrolled 4 or more months of pregnancy.

³Residents of low-income areas.

⁴Residents of high-income areas.

NOTES: When the 95-percent confidence interval for a given odds ratio excludes 1.0, the difference between the corresponding study group and Group 4 is statistically significant at the 0.05 level or less. Deliveries with missing data were excluded.

SOURCES: (California Department of Health Services, 1983-84); (Health Care Financing Administration, 1983-84); and (U.S. Bureau of the Census, 1980.)

1.0 meaning Groups 3 and 4 did not differ in the odds of delivering a low-birth-weight infant.

Table 10 also shows the results of adjusting the odds ratios for differences in demographic characteristics and complications of pregnancy, labor, and delivery. After making all adjustments, only short-term Medicaid enrollees (Group 1) remained significantly different from the residents of high-income areas (Group 4) in their odds of delivering a low-birth-weight infant.

Medicaid eligibility determination procedures in California during 1983 may have confounded the multivariate analysis of low birth weight. Eligibility determination provisions allowed women to enroll in Medicaid after they experienced a high-cost delivery (perhaps as a result of the birth of a low-birth-weight infant), permitting retroactive coverage for the delivery and some prenatal care. These women might not have become eligible for Medicaid had they not experienced high-cost deliveries. This "selection bias" could artificially inflate the rate of low-birth-weight infants among the short-term Medicaid enrollment group (Group 1), defined as those enrolled for 0-3 months of pregnancy, because these women otherwise would have remained in the non-Medicaid, low-income group (Group 3). Such retroactive eligibility was not coded on enrollment files used for the study, so it was not possible to control for the potential bias in birth-weight differences between Groups 1 and 3.

Table 11 shows the coefficients derived from the low-birth-weight regression for the full model with all independent variables included (i.e., based on the equation from which the odds ratios reported in the bottom row of Table 10 were drawn). Here, there are fewer statistically significant coefficients than observed for the prenatal care model. The independent variables that were strongly associated with the probability of low birth weight were: black race, maternal age under 20,

Table 11

Results of multivariate logistic regression on probability of low birth weight: California, October 1983

Independent variable ¹	Coefficient	Standard error	Chi-square
Intercept	-3.468	0.150	—
Race and ethnicity			
Hispanic	-0.150	0.099	2.30
Non-Hispanic			
Black	***0.967	0.099	95.97
All other, other than white	0.132	0.146	0.82
Maternal age			
12-19 years	*0.220	0.101	4.73
35 years or over	0.148	0.160	0.85
Parity (first live birth)	0.040	0.085	0.23
Sex of infant (male)	-0.126	0.076	2.78
Complications (one or more)			
Pregnancy	**0.999	0.096	107.87
Labor and delivery	**0.793	0.087	83.19
Medicaid status			
Medicaid, enrolled 0-3 months of pregnancy	**0.533	0.164	10.57
Medicaid, enrolled 4 or more months of pregnancy	0.222	0.151	2.18
Non-Medicaid, resident of low-income area	0.177	0.156	1.29

*Statistically significant at the $p \leq 0.05$ level.

***Statistically significant at the $p \leq 0.001$ level.

¹Reference categories for sets of dummy variables: race and ethnicity: white, non-Hispanic; maternal age: 20-34 years; parity: second or higher order birth; sex of infant: female; complications of pregnancy: 0; complications of labor and delivery: 0; Medicaid status: non-Medicaid, resident of high-income area.

SOURCES: (California Department of Health Services, 1983-84); (Health Care Financing Administration, 1983-84); and (U.S. Bureau of the Census, 1980.)

Table 12

Average charges and Medicaid payments for prenatal care, delivery, and postnatal care, by birth weight: California Medicaid, October 1983

Type of service	Average charge by birth weight				Average payment by birth weight			
	Less than 2,500 grams		2,500 grams or more		Less than 2,500 grams		2,500 grams or more	
	Dollars	Percent	Dollars	Percent	Dollars	Percent	Dollars	Percent
Total	\$20,479	100.0	\$6,396	100.0	\$13,211	100.0	\$3,896	100.0
Prenatal ¹	1,223	6.0	624	9.8	874	6.6	389	10.0
Delivery	12,193	59.5	3,165	49.5	7,756	58.7	2,040	52.4
Postnatal ²	6,440	31.4	1,922	30.1	4,299	32.5	1,157	29.7
Global fee	623	3.0	684	10.7	281	2.1	309	7.9

¹Prenatal care includes all care delivered from January 1, 1983, to the date of admission for delivery (i.e., laboratory services; ambulatory care from physicians, outpatient hospital departments and clinics; inpatient care; radiology services; prescription drugs; and dental care).

²Postnatal care includes all care delivered from the discharge date of the delivery hospitalization (mother or infant, whoever was later) through October 31, 1984. This represents an approximate 12-month period following delivery. Services included in postnatal care were: laboratory services; ambulatory care from physicians, outpatient hospital departments and clinics; inpatient care; radiology services; prescription drugs; and dental care.

NOTES: All dollars represent those for mother and infant combined. All percents are based on cases with nonmissing data. Percents may not add to 100 because of rounding.

SOURCES: (California Department of Health Services, 1983-84); and (Health Care Financing Administration, 1983-84.)

complications of pregnancy, complications of labor and delivery, and short-term Medicaid enrollment.

With respect to race and ethnicity, the findings are quite interesting, particularly in comparison to the prenatal care regression results (Table 6). Black mothers were at significantly increased risk of delivering a low-birth-weight infant compared with white mothers. Hispanic mothers were somewhat, but not significantly, less likely than white mothers to have low-birth-weight infants. The prenatal care regressions showed that both black and Hispanic mothers were more likely than white mothers to have late care, with the relationship being stronger for Hispanic mothers. Overall, these findings do not suggest an association between prenatal care and low birth weight for at least one group of women, Hispanics. Similar results have been obtained in other research (Williams, Binkin, and Clingman, 1986; Remy, 1988; National Center for Health Statistics, 1984; Saunders and Zipsnis, 1988). Perhaps cultural and/or biological differences can explain these results.

Charges and Medicaid expenditures

In addition to assessing the effects of Medicaid on initiation of prenatal care and birth weight, analyses of charges and expenditures for obstetrical care were performed. No cost data were available for non-Medicaid deliveries. Univariate descriptive information is presented first, followed by the results of multivariate regression analyses.

It is important to understand the general context of Medicaid reimbursement practices during the study period. As described in the introduction, California implemented a selective contracting system for hospital reimbursement during 1983. Bids were received for fixed per diem rates and the State negotiated rates separately with each hospital. By October 1983, most areas of the State (especially urban locations) were under selective contracting, so that the majority of inpatient expenditures in this study were determined by these hospital-specific per diem rates. In hospitals with this reimbursement method, total payments for delivery hospitalizations varied in direct proportion to length of stay regardless of

diagnosis. Charges, on the other hand, would vary by factors other than length of stay, such as types of surgical procedures and level of neonatal intensive care.

Descriptive analysis

Table 12 displays data on average charges and payments for obstetrical and newborn care by birth weight for Medicaid deliveries. Charges and payments are reported for prenatal, delivery, postnatal, and global fee services. Because mothers and their infants cannot be separated in the California Medicaid claims files, all dollars represent those for the mother and infant combined. Charges and payments were higher for low-birth-weight infants (< 2,500 grams) in comparison to other newborns for prenatal, delivery, and postnatal care, but not global fees. As expected, this difference was most pronounced for the delivery hospitalization. For example, average payments for delivery were 3.8 times higher for the low-birth-weight group (\$7,756) than for all other newborns (\$2,040).

The delivery hospitalizations accounted for about 60 percent of charges and payments among low-birth-weight infants, compared with about 50 percent for all other infants. The percentage of total costs associated with prenatal care was higher for normal-weight infants than for low-birth-weight newborns.

Given the striking difference in charges and payments by birth weight and the previously observed relationship between length of Medicaid enrollment and birth weight,⁵ it is not surprising that length of Medicaid enrollment was inversely related to charges and payments. This relationship is shown in Table 13 for delivery hospitalizations. Short-term enrollees had higher average charges and payments for the delivery hospitalization than did long-term enrollees. In contrast, cash assistance mothers, although enrolled for longer periods on average during pregnancy, incurred higher average charges and payments than medically needy and other enrollees. This issue is investigated further in the multivariate analysis.

⁵Long-term Medicaid enrollees had a lower proportion of low-birth-weight births than did short-term Medicaid enrollees (Table 8).

Table 13

Average charges and Medicaid payments for delivery hospitalization, by study group and maintenance assistance status: California, October 1983

Study group and maintenance assistance status	Average charge for delivery	Average payment for delivery
Group 1 (short-term)	\$4,071	\$2,497
Group 2 (long-term)	3,671	2,399
Cash assistance ¹	3,913	2,537
Medically needy ²	3,579	2,247
All others ³	3,302	2,174

¹All categorically needy persons receiving AFDC or SSI cash assistance, most of whom were classified as AFDC adults (95.8 percent).

²All persons meeting medically needy eligibility criteria, most of whom were classified as AFDC adults (77.9 percent).

³A mix of categorically needy persons not receiving cash assistance and special optional coverage groups (i.e., refugee and State-only enrollees). Most of these mothers were classified as AFDC adults (95.8 percent).

NOTES: AFDC is Aid to Families with Dependent Children. SSI is Supplemental Security Income. Percents may not add to 100 because of rounding.

SOURCES: (Health Care Financing Administration, 1983-84.)

Multivariate analysis

Multivariate analysis was used to explore the unique effects of a variety of factors on three dependent variables: charges, Medicaid payments, and length of stay for the delivery hospitalization. The distributions of the dependent measures were skewed indicating that a number of cases had extremely high values. Thus, log-transformed dependent measures were used in ordinary least squares multiple regression analyses⁶ (Table 14).

All indexes of infant morbidity were significantly related to charges, payments, and length of stay. The strongest association was for very-low-birth-weight infants (< 1,500 grams), who stayed in the hospital substantially longer than did normal-weight newborns (≥ 2,500 grams). Similarly, payments for very-low-birth-weight infants were much greater than payments for newborns weighing 2,500 grams or more at birth. Newborns who were transferred to another hospital soon after birth and those with one or more congenital malformations incurred greater expenses and had longer lengths of stay than their healthier counterparts who had no congenital anomalies or who were not transferred.

Maternal morbidity during pregnancy and at delivery was also significantly related to charges, Medicaid payments, and length of stay. Women with labor and delivery complications, as well as those experiencing one pregnancy complication or concurrent illness stayed in the hospital longer and incurred greater charges and payments than did mothers with none of these problems. Women who delivered by cesarean section experienced longer lengths of stay, greater expenditures, and higher charges than women who had vaginal deliveries.

Mixed results were obtained for urban versus rural residence of the mother at delivery. Urban settings were

⁶The dependent measure used in an ordinary least squares regression should be normally distributed. The log transformation of a skewed dependent variable will "normalize" its distribution. See Cohen and Cohen (1983) for a discussion of log transformation and ordinary least squares regression techniques.

Table 14

Regression coefficients from multiple regression on log-transformed charges, payments, and length of stay for delivery hospitalization: California Medicaid, October 1983

Independent variable ¹	Charges	Medicaid payments	Length of stay
Infant morbidity			
Birth weight:			
Less than 1,500 grams	***1.60	***1.50	***1.05
1,500-2,499 grams	0.59	0.68	0.63
Infant transported	***0.79	***0.72	***0.28
Congenital malformations:			
1	***0.31	***0.28	**0.23
2 or more	**0.42	*0.35	0.22
Maternal morbidity			
Labor and delivery complications:			
1	***0.18	***0.15	***0.13
2 or more	***0.26	***0.20	***0.21
Pregnancy complications and concurrent illnesses:			
1	***0.13	***0.13	***0.10
2 or more	0.24	0.14	0.10
Cesarean versus vaginal delivery	***0.66	***0.58	***0.53
Urban versus rural residence of mother	***0.12	0.05	**0.08
Hospital characteristics			
Ownership:			
Government	***-0.12	0.01	***-0.06
Proprietary	0.00	***0.09	-0.03
Level of care:			
Level III	***0.25	***0.18	***0.13
Level II	***0.08	***0.24	***0.06
Maintenance assistance status			
Medically needy	***-0.07	***-0.10	***-0.05
All others	-0.04	*-0.06	-0.02
Adjusted R ²	0.3372	0.2967	0.2704

*Statistically significant at the $p < 0.05$ level.

**Statistically significant at the $p < 0.01$ level.

***Statistically significant at the $p < 0.001$ level.

¹Reference categories for sets of dummy variables: birth weight: 2,500 grams or more; labor and delivery complications: 0; pregnancy complications and concurrent illnesses: 0; congenital malformations: 0; hospital ownership: private, nonprofit; hospital level of care: Level I; and maintenance assistance status: cash assistance.

NOTE: Hospital level of care is defined as follows: Level I, uncomplicated deliveries; Level II, majority of complicated deliveries and some neonatal complications; and Level III, all serious types of fetal and neonatal illnesses and abnormalities.

SOURCES: (California Department of Health Services, 1983-84); and (Health Care Financing Administration, 1983-84).

associated with higher charges and longer lengths of stay. Despite the difference in length of stay, urban or rural status was not significantly related to Medicaid payments.

Significant variations in payments, charges, and lengths of stay were also found for hospitals with different types of ownership. Government hospitals had significantly lower charges and shorter lengths of stay for delivery than did nonprofit facilities, but Medicaid payments did not differ. The opposite pattern was observed for proprietary hospitals. For-profit institutions had significantly higher payments than nonprofit hospitals, but total charges and length of stay were similar.

Hospital level of care was also significantly related to payments, charges, and length of stay. Level of care represents the intensity of infant care services in the hospital, ranging from Level I (least intensity) to Level III (greatest intensity). As expected, Level III hospitals had higher charges and longer lengths of stay than did Level I facilities. Similar but smaller differences were also observed for Level II versus Level I facilities. In terms of payments, Level II and III facilities were more costly than Level I hospitals after controlling for maternal and infant characteristics.

Medicaid maintenance assistance status⁷ was significantly related to charges, payments, and length of stay. Medically needy enrollees had significantly lower charges and payments as well as shorter lengths of stay than did the cash assistance group, after controlling for morbidity and hospital characteristics.

Two factors may explain the lower charges, payments, and length of stay for medically needy versus cash assistance enrollees. First, 23 percent of the medically needy mothers had spend-down liability during the month of delivery. Second, 4.4 percent of this group had another form of health insurance in addition to Medicaid, compared with 1.4 percent of cash assistance enrollees (data not shown). The combination of other third-party coverage and especially out-of-pocket spend-down liability among many of the medically needy mothers would reduce the overall average Medicaid expenditures for delivery for this group in comparison to cash assistance enrollees.

In summary, the regression models shown in Table 14 account for 27 to 34 percent of the variance in the logarithmic transformation of charges, payments, and length of stay. Although these results are statistically significant, a substantial proportion of variance in each dependent measure is not explained by the model. The model may lack additional important patient, hospital, or physician characteristics that would account for the residual variance in the dependent measures.

Summary and conclusions

This study used data for California in 1983 to assess several aspects of Medicaid's financing of obstetrical care. The three primary study questions were:

- Did Medicaid coverage lead to early use of prenatal care among pregnant enrollees when compared with non-Medicaid pregnant women?
- What were the outcomes of Medicaid-financed deliveries and how did they compare with non-Medicaid deliveries?
- What were the major factors determining the charges and payments for Medicaid-financed deliveries?

Major findings and conclusions follow.

⁷Length of Medicaid enrollment was not included in these regression analyses because it was correlated with maintenance assistance status. Medically needy women had fewer months of enrollment (mean = 4.00 months), compared with cash assistance enrollees (mean = 6.81 months), and other enrollees (mean = 6.09 months).

Prenatal care and delivery outcomes

After adjusting for selected demographics and maternal health characteristics, the odds of obtaining late prenatal care among those enrolled in Medicaid for 3 months or less during pregnancy were more than six times the odds for non-Medicaid mothers who resided in high-income areas. The odds of receiving late care among both those enrolled in Medicaid for 4 or more months of pregnancy and non-Medicaid residents of low-income areas were about 3.7 times the odds for non-Medicaid women living in high-income areas. These data suggest that length of enrollment in Medicaid prior to delivery may positively influence the initiation of prenatal care, but there is much room for further improvement.

It is possible that these analyses do not control for all important differences in the study groups that affect early use of prenatal care. For example, unmeasured attitudes regarding the value of prenatal care may also account for the observed group variations in use of first trimester care (U.S. General Accounting Office, 1987; Caro, Kalmuss, and Lopez, 1988). Increased health education and outreach have been suggested as strategies to overcome attitudinal barriers to early care.

Each of the three low-income study groups had poorer birth outcomes than residents of high-income areas. However, multivariate regression analysis showed that race and complications were more important than Medicaid status in explaining the risk of low birth weight. Compared with white women, black women had significantly higher rates of low birth weight. Hispanics had relatively fewer low-birth-weight births than did white women, although the difference was not significant. Only short-term Medicaid enrollees were at significantly increased risk of having a low-birth-weight infant. The two other low-income groups (long-term Medicaid enrollees and non-Medicaid residents of low-income areas) did not differ from non-Medicaid mothers in high-income areas in their risk of having a low-birth-weight newborn, after adjustments for demographic and maternal health characteristics.

The purpose of recent Medicaid expansions has been, primarily, to improve birth outcomes for low-income women. The major way in which Medicaid expansion is expected to accomplish this goal is through more timely access to prenatal care, which is expected to help reduce the incidence of low birth weight for some newborns.

There is a lack of clear association between prenatal care and birth outcomes in the data reported here. Even though long-term Medicaid enrollees and non-Medicaid mothers living in low-income areas had four times the odds of receiving late prenatal care compared with non-Medicaid residents of high-income areas, after adjusting for demographics and maternal health characteristics these three groups did not differ in their risk of delivering a low-birth-weight infant.

Additional research is needed to directly assess this issue and to confirm whether similar results are found in other States. In particular, the preponderance of Hispanic women among California's low-income population may lead to unique findings that are not generalizable to other States.

Charges and Medicaid payments

In general, measures of infant morbidity (e.g., inadequate birth weight, transport to another hospital within 24 hours of birth, and presence of congenital anomalies) were the strongest predictors of charges and payments. Not surprisingly, birth weight was a major determinant of Medicaid expenditures: Compared with infants weighing 2,500 grams or more at birth, adjusted delivery hospitalization payments were much higher for very-low-birth-weight births (< 1,500 grams) and moderately low-birth-weight newborns (1,500-2,499 grams). Measures of maternal morbidity and hospital characteristics were also significantly related to the cost of delivery hospitalizations, including, for example, cesarean section and the available level of neonatal intensive care.

Medically needy enrollees had significantly lower charges and payments as well as shorter lengths of stay than cash assistance enrollees, after controlling for maternal and infant health status, delivery hospital characteristics, mode of delivery, and geographic residence. Average payments for medically needy mothers may have been reduced as a result of out-of-pocket spend-down liability, and, to a lesser extent, the availability of other third-party coverage.

Final comments

This study provides preliminary evidence from one State on the potential effects of recent eligibility expansions under Medicaid. In 1983 before most of the more recent changes in Medicaid eligibility were implemented, California's Medicaid program was already quite flexible and comprehensive, covering nearly all poor pregnant women in the State. The purpose of the expansions since 1986 was to extend Medicaid benefits to other poor women who were previously uninsured.

The findings presented here indicate that a longer length of enrollment in Medicaid prior to delivery may improve use of prenatal care and, to a lesser extent, birth weight. The tenuous relationship between prenatal care and birth weight shown here requires further investigation. It may be that Medicaid programs targeting enhanced prenatal services to high-risk women will be most effective in improving birth outcomes. These types of programs are being implemented in some States. The cost analyses reported in this study show that savings to the Medicaid program may be achieved if the incidence of low birth weight can be reduced.

A variety of new studies are currently under way to permit a more refined assessment of the effect of Medicaid enrollment on use of prenatal care services, rates of low birth weight, and Medicaid expenditures. Such studies will indicate whether these California findings can be generalized to other States and more recent time periods.

Acknowledgments

The authors wish to thank David Baugh, Gretchen Brown, Robert Houchens, George Wright, and Marilyn Rymer Ellwood for their helpful comments on early drafts of this article and Suzanne Dodds and Kay Miller for assistance in preparing the data files.

References

- Buescher, P., Smith, C., Holliday, J.; Levine, R., et al.: Source of prenatal care and infant birth weight: The Case of a North Carolina county. *American Journal of Obstetrics and Gynecology* 156(1):204-210, Jan. 1987.
- California Department of Health Services: Data from the California Birth-Death Cohort File, 1983-84.
- Caro, F., Kalmuss, D., and Lopez, I.: *Barriers to Prenatal Care: An Examination of Use of Prenatal Care Among Low-Income Women in New York City*. Community Service Society of New York, Department of Research Policy and Program Development. New York, 1988.
- Cohen, J., and Cohen, P.: *Applied Multiple Regression/Correlation Analysis for the Behavioral Sciences*. Hillsdale, N.J. Lawrence Erlbaum Associates, 1983.
- Committee on Perinatal Health: *Toward Improving the Outcome of Pregnancy: Recommendations for the Regional Development of Maternal and Perinatal Health Services*. White Plains, N.Y. The National Foundation March of Dimes, 1977.
- Cooney, J.: What determines the start of prenatal care? Prenatal care, insurance, and education. *Medical Care* 23(8):986-997, Aug. 1985.
- Fanning, T., Gallagher, P., and Zelterman, L.: *Assessing Medicaid Expenditures for Children at Birth and in the First Year of Life*. New York State Department of Social Services. Albany, Apr. 1987.
- Fingerhut, L., Makuc, D., and Kleinman, J.: Delayed prenatal care and place of first visit: Differences by health insurance and education. *Family Planning Perspectives* 19(5):212-214, Sept./Oct. 1987.
- Health Care Financing Administration, Office of Research and Demonstrations: Data from the Medicaid Tape-to-Tape project, 1983-84.
- Hosmer, D.W., and Lemeshow, S.: *Applied Logistic Regression*. New York. John Wiley and Sons, 1989.
- Howell, E.M., and Brown, G.A.: Prenatal, delivery, and infant care under Medicaid in three States. *Health Care Financing Review* 10(4):1-15. HCFA Pub. No. 03284. Office of Research and Demonstrations, Health Care Financing Administration. Washington. U.S. Government Printing Office, Summer 1989.
- Howell, E., Herz, E., Brown, G., and Wang, R.H.: *Outcomes and Costs of Obstetrical Care in California: A Comparison of Medicaid and Non-Medicaid Deliveries in October of 1983*. Contract No. 500-86-0016. Prepared for Health Care Financing Administration. Washington. Systemetrics/McGraw-Hill, Inc., Sept. 1990.

Institute of Medicine: *Preventing Low Birthweight*. Washington, D.C. National Academy of Sciences, 1985.

Kleinman, J., and Madans, J.: The effects of maternal smoking, physical stature, and educational attainment on the incidence of low birth weight. *American Journal of Epidemiology* 121(6):843-855, 1985.

Laudicina, S.: *A Comparative Survey of Medicaid Hospital Reimbursement Systems for Inpatient Services, State by State, 1980-1985*. The Urban Institute and the Intergovernmental Health Policy Project. Washington. George Washington University, Dec. 1985.

McCullough, J.: *Medi-Cal and Non Medi-Cal Perinatal Outcomes within California Poverty Areas, 1984*. Sacramento. California Department of Health Services, Sept. 1988.

McDonald, T., and Coburn, A.: *The Impact of Variations in AFDC and Medicaid Eligibility on Prenatal Care Utilization*. Grant No. MCJ-230506-01-1. Prepared for Department of Health and Human Services. Portland, Maine. University of Southern Maine, Dec. 1986.

Mullett, S., Leonard, B., Oberg, C., and Lia-Hoagberg, B.: A comparison of birth outcomes by payment source. *Minnesota Medicine* 72:365-369, June 1988.

National Center for Health Statistics: Advance report of the final natality statistics. U.S. *Monthly Vital Statistics Report* 33(6) Supplement. Public Health Service. Washington. U.S. Government Printing Office, Sept. 1984.

Norris, F., and Williams, R.: Perinatal outcomes among Medicaid recipients in California. *American Journal of Public Health* 74(10):1112-1118, Oct. 1984.

Office of Technology Assessment, U.S. Congress: *Neonatal Intensive Care for Low Birthweight Infants: Costs and Effectiveness*. Pub. No. OTA-HCS-38. Health Technology Case Study No. 38. Washington. U.S. Government Printing Office, Dec. 1987.

Office of Technology Assessment, U.S. Congress: *Healthy Children: Investing in the Future*. Pub. No. OTA-H-345. Washington. U.S. Government Printing Office, Feb. 1988.

Phibbs, C., Williams, R., and Phibbs, R.: Newborn risk factors and costs of neonatal intensive care. *Pediatrics* 68(3):313-321, Sept. 1981.

Remy, M.: *Perinatal Risk Factors and Low Birthweight Births Among Hispanic Women in Arizona*. Rural Health Office, Department of Family and Community Medicine, College of Medicine, University of Arizona, Feb. 1988.

Saunders, S., and Zipsnis, K.: *Arizona Perinatal Statistics: A Report on Perinatal Care, Low Birthweight and Infant Mortality*. Phoenix. Arizona Department of Health and Human Services, 1988.

Schramm, W., Land, G., and Dutton, B.: *Prenatal Care and Its Relationship to Medicaid Costs*. Grant No. 11-P-98305. Prepared for Health Care Financing Administration. Jefferson City, Mo. Missouri Division of Health, Dec. 1984.

Spitz, A., Rubin, G., McCarthy, B., et al.: The impact of publicly funded perinatal care programs on neonatal outcome, Georgia, 1976-1978. *American Journal of Obstetrics and Gynecology* 147(3):298-300, Oct. 1983.

U.S. Bureau of the Census: Data from the Census ZIP Code Level File, 1980.

U.S. Bureau of the Census: *Statistical Abstract of the United States: 1986*. 106th Edition. Washington. U.S. Government Printing Office. Dec. 1985.

U.S. General Accounting Office: *Prenatal Care: Medicaid Recipients and Uninsured Women Obtain Insufficient Care*. Report to the Congress. GAO/HRD-87-137. Washington. U.S. Government Printing Office, Sept. 1987.

Williams, R., Binkin, N., and Clingman, E.: Pregnancy outcomes among Spanish-surname women in California. *American Journal of Public Health* 76(4):387-391, Apr. 1986.