



United States  
Department of  
Agriculture

Food and  
Nutrition  
Service

Office of  
Analysis and  
Evaluation

# The Savings in Medicaid Costs for Newborns and Their Mothers from Prenatal Participation in the WIC Program

Volume 1

**Policy Information Center**

Prepared by:

**MATHEMATICA POLICY RESEARCH, INC.**

Prepared for:

U.S. Department of Agriculture  
**Food and Nutrition Service**  
**Office of Analysis and Evaluation**

October 1, 1990



United States  
Department of  
Agriculture

Food and  
Nutrition  
Service

Office of  
Analysis and  
Evaluation

A

# The Savings in Medicaid Costs for Newborns and Their Mothers from Prenatal Participation in the WIC Program

## Volume 1

Prepared by:

**MATHEMATICA POLICY RESEARCH, INC.**

Prepared for:

U.S. Department of Agriculture  
Food and Nutrition Service  
**Office of Analysis and Evaluation**

October 1, 1990

## CONTENTS

<u>Chanter</u>	<u>Page</u>
I.	INTRODUCTION ..... 1
	A. <b>RATIONALE</b> FOR THE STUDY ..... 1
	B. THE OBJECTIVES OF <b>THIS</b> STUDY ..... 2
	C. <b>BASIC STUDY DESIGN</b> ..... 3
	D. ORGANIZATION OF <b>THIS</b> REPORT ..... 5
II.	<b>DESCRIPTION</b> OF THE STUDY STATES AND THE WIC AND MEDICAID PROGRAMS ..... 7
	A <b>DESCRIPTION</b> OF THE STUDY STATES ..... 7
	B. PROGRAM BACKGROUND ..... 11
	WIC Program ..... 11
	Medicaid Program ..... 15
	The Omission of the Cost of Indigent Care Programs from the Database and the Analysis ..... 18
III.	<b>DESCRIPTION</b> OF THE DATA AND THE <b>CHARACTERISTICS</b> OF <b>WIC</b> PARTICIPANTS AND <b>NONPARTICIPANTS</b> ..... 21
	A OVERVIEW OF THE <b>WIC/MEDICAID</b> DATABASE ..... 21
	Medicaid Data ..... 21
	WIC Data ..... 23
	Vital Records ..... 24
	Combining Measures of Medicaid Costs, WIC Participation and Costs, and Maternal and Newborn Characteristics ..... 24
	B. THE CHARACTERISTICS OF WIC PARTICIPANT AND NONPARTICIPANT MEDICAID MOTHERS ..... 30
	Demographic Characteristics ..... 30
	Prenatal Care Characteristics ..... 33
	C. <b>SUMMARY</b> ..... 35
IV.	<b>THE EFFECTS</b> OF PRENATAL WIC PARTICIPATION ON MEDICAID COSTS AND BIRTH OUTCOMES ..... 37
	A METHODOLOGY ..... 37
	B. <b>THE RESULTS</b> OF THE ANALYSIS OF MEDICAID COSTS FROM BIRTH TO 60 DAYS <b>AFTER</b> BIRTH ..... 40
	C. THE RESULT'S OF THE ANALYSIS OF BIRTH OUTCOMES ..... 48

CONTENTS (continued)

<u>Chapter</u>		<u>Page</u>
V.	<b>GENERALIZATION OF THE STUDY FINDINGS</b> .....	53
	<b>A. MAJOR STUDY FINDINGS</b> .....	53
	<b>B. GENERALIZING THE STUDY RESULTS FOR 1987 MEDICAID BIRTHS</b> .....	54
	Socioeconomic and Demographic Differences .....	55
	Differences in <b>Public</b> Prenatal Care Systems for Low-Income Women ....	55
	Differences in Medicaid Policies that Affect Reimbursement .....	<b>57</b>
	<b>C. LONG-TERM STABILITY OF THE RESULTS</b> .....	59
	Changes in the WIC Program Since 1987 .....	59
	Changes in the Medicaid Program Since 1987 .....	60
	Changes in Risk Factors for <b>Adverse</b> Pregnancy Outcomes .....	63
	<b>D. -CONCLUSIONS</b> .....	63
	<b>REFERENCES</b> .....	65
	APPENDIX <b>A: ESTIMATED</b> REGRESSION COEFFICIENTS FOR MODEL TO ESTIMATE THE EFFECT OF WIC PARTICIPATION ON MEDICAID COSTS	
	APPENDIX B: ESTIMATED REGRESSION COEFFICIENTS FOR MODEL TO ESTIMATE THE <b>EFFECTS</b> OF WIC PARTICIPATION ON BIRTH-WEIGHT	

## LIST OF TABLES

<u>Table</u>		<u>Page</u>
II.1	BIRTH OUTCOMES AND <b>PERINATAL RISK</b> FACTORS: U.S. <b>AND</b> STUDY STATES .....	9
II.2	THE CHARACTERISTICS OF THE WIC PROGRAM IN THE STUDY STATES .....*	14
III.1	NUMBER OF MEDICAID MOTHERS AND NEWBORNS .....	27
III.2	DESCRIPTIVE DATA ON MEDICAID BIRTHS: NUMBER OF BIRTHS, AVERAGE MEDICAID COSTS, AND BIRTHWEIGHT ....	28
III.3	DEMOGRAPHIC <b>CHARACTERISTICS</b> OF MEDICAID MOTHERS .....	31
<b>III.4</b>	<b>PRENATAL CARE CHARACTERISTICS</b> OF MEDICAID MOTHERS .....	<b>34</b>
IV.1	<b>SAVINGS</b> IN MEDICAID COSTS <b>FROM</b> BIRTH TO 60 DAYS <b>AFTER BIRTH ASSOCIATED</b> WITH PRENATAL PARTICIPATION IN THE WIC PROGRAM.....	43
IV.2	<b>ESTIMATED</b> BENEFIT-COST RATIOS .....	45
IV.3	SAVINGS IN MEDICAID COSTS FROM BIRTH TO <b>60</b> DAYS <b>AFTER BIRTH</b> : EFFECT'S OF PRENATAL <b>WIC</b> PARTICIPATION AND THE ADEQUACY OF PRENATAL CARE .....	47
<b>IV.4</b>	<b>ESTIMATED EFFECTS</b> OF WIC <b>PARTICIPATION</b> ON <b>BIRTH-</b> <b>WEIGHT</b> AND GESTATIONAL AGE .....	<b>50</b>



## LIST OF FIGURES

<u>Figure</u>		<u>Page</u>
IV.1	PREDICTED MEDICAID COSTS FROM BIRTH TO 60 DAYS AFTER BIRTH, NEWBORNS AND MOTHERS .....	41
Iv.2	PREDICTED MEDICAID COSTS FROM BIRTH TO 60 DAYS AFTER BIRTH, NEWBORNS .....	42



## ACKNOWLEDGMENTS

This report was prepared by **Mathematica** Policy Research, Inc., under contract number 53-3 198-8-63 from the U.S. Department of Agriculture, Food and Nutrition Service, Office of Analysis and Evaluation.

The report represents a team effort in which many individuals made key contributions. We gratefully acknowledge the assistance of the following programmers who contributed their enormous expertise and hard work to constructing the complex database for the analysis: Dan Buckley, Robert Cohen, Lauren **Haworth**, Ann Huff, John Mamer, Josh **Rozen**, and Paula Wolk. The members of the advisory panel for the study--David Baugh, David Guilkey, Ian Hill, Anne **Koontz**, and Wayne Schramm--provided valuable comments on the database design, analysis, and preliminary results. Florida, **Minnesota**, North Carolina, South Carolina, and Texas **WIC**, Medicaid, Vital Records, and Health Statistics staff provided basic data extracts, program information, and **assistance in the** planning and data collection stages of the study. We would also like to **recognize** the substantial assistance and encouragement provided by **Marian** Lewin, formerly of the Food and Nutrition Service, and by Jay Hirschman, Jan **Lilja**, Christy Schmidt, Ron Vogel, and Fran **Zorn** of the Food and Nutrition **Service**, and David **Baugh**, Gretchen Brown, Deidra Abbott, and Marilyn Hirsch of the Health Care Financing Administration.

The authors acknowledge their intellectual debt to the previous work of Wayne Schramm and his colleagues at the Missouri Center for Health Statistics, who linked databases and compared costs for the **WIC** and Medicaid programs, and to the work of Ian Hill and his colleagues at the National Governors' Association, who tracked and assessed the numerous recent Medicaid expansions for pregnant women and children.

The authors would also like to thank several individuals from **Mathematica** Policy Research who made important contributions both to the study and this report: Harold **Beebout**, John Burghardt, Cindy Castro, Thomas Good, Debra Jones; and Barbara Prince.

**Barbara Devaney**  
Linda Bilheimer  
Jennifer **Schore**



**THE SAVINGS IN MEDICAID COSTS  
FOR NEWBORNS AND THEIR MOTHERS  
FROM PRENATAL PARTICIPATION IN THE WIC PROGRAM**

**EXECUTIVE SUMMARY**

This study is mandated by the Commodity Distribution Reform Act and WIC Amendments of 1987 (Public Law 100-237) and the Joint Resolution Continuing Appropriation for Fiscal Year 1988 (Public Law 100-202). Its primary objective is to determine the savings in Medicaid costs for newborns and their mothers during the first 60 days after birth from participating in the Special Supplemental Food Program for Women, Infants, and Children (WIC) during pregnancy. The prenatal component of the WIC program provides food supplementation, nutrition education, and health-care and social services referrals to low-income pregnant women, the primary goal of which is to improve their nutritional status. To the extent that improved nutritional status leads to more favorable birth outcomes, then lower Medicaid expenditures and indigent care costs after birth may offset the costs of providing prenatal WIC benefits.

A secondary objective of this study is to examine the effects of prenatal participation in the WIC program on two important birth outcomes--birthweight and gestational age. This analysis complements the analysis of Medicaid costs, in that the savings in Medicaid costs can be interpreted within the context of the effects of WIC participation on birth outcomes.

Specifically, the analysis conducted for this study addressed the following questions:

- What are the savings in Medicaid costs for newborns and their mothers during the **first** 60 days after birth **from** participating in the WIC program during pregnancy?
- **Are** the savings in Medicaid costs that are due to prenatal WIC participation greater or less than the costs of providing WIC benefits to pregnant women?
- Does prenatal WIC participation affect such birth outcomes as birthweight and gestational age?

DESCRIPTION  
OF THE STUDY  
STATES

The study entailed analyses of the relationship between Medicaid costs and prenatal WIC participation in each of **five** states-Florida, Minnesota, North Carolina, South Carolina, and Texas. The study period included **all** Medicaid births in 1987 for Florida, Minnesota, North Carolina, and South Carolina and all Medicaid births from January through June 1988 in Texas. These five states accounted for nearly 105,000 Medicaid births. The proportion of these births to WIC participants varied considerably across the study states, ranging from nearly one-half of the Medicaid

births in Texas to almost three-quarters of the Medicaid births in South Carolina.

The **five** study states exhibited some striking contrasts in birth outcomes and **perinatal** risk factors. Minnesota had a lower proportion of **low-income** women than the other study states and had birth outcomes that were more favorable than **those** of the other study states. Both its infant mortality rate and percentage of low-birthweight infants (birthweight of less than 2,500 grams, or 5.5 pounds) were the lowest of the five states and were lower than the rate for the nation as a whole. In contrast, all of the **three** Southeastern states--Florida, North Carolina, and South Carolina--had infant mortality rates that were higher than the national average. Texas is an extremely large state, accounting for roughly 8 percent of **all** U.S. births. In 1987, its infant mortality rate was below the U.S. average, although a relatively high proportion of women received inadequate levels of prenatal care.

#### PROGRAM BACKGROUND

Authorized by Congress in 1972, the **WIC** program provides nutritional risk assessments, food supplementation, nutrition education, and health and social **service** referrals to low-income pregnant and postpartum women and their infants, and children up to age five. The program, which is federally funded and administered by state and local agencies, has become one of the largest public health programs for low-income pregnant women and children. Nationwide, the WIC program has grown from a \$750 million program that **served** 2 million women and children in 1980 to an estimated \$2.1 billion program that serves 4.5 million women and children in 1990. During fiscal year 1987, the WIC program in the **five** study states ranged from an approximately \$26 million program that served an average of 56,000 persons per month in Minnesota to a \$112 million program that served 226,000 persons per month in Texas.

Medicaid **is** a joint federal and state program that reimburses the covered medicalcare costs of low-income persons. Authorized under Title XIX of the Social Security Act, Medicaid has become **the** nation's primary medical-reimbursement program for low-income individuals. For many years, the income eligibility for Medicaid was linked to the AFDC income eligibility standards, which were low enough that many women below the poverty level were not poor enough to **qualify** for Medicaid. In 1987, the poverty income threshold was \$9,056 for a family of three, and, for the **five** study states, **the** Medicaid income eligibility standards for pregnant women and children ranged **from** 33 percent of the poverty level in Texas to 88 percent of the poverty level in **Minnesota**. In Florida, North Carolina, and South **Carolina**, income eligibility levels were between 40 and 50 percent of the poverty level for most of the study period. Thus,

the household incomes of the Medicaid mothers and newborns considered in this study were very low, and considerably lower than the **WIC** income eligibility limit of 185 percent of poverty. Since 1987, Medicaid has increased the income eligibility standards for pregnant women and children. **Currently**, states are required to expand Medicaid coverage to pregnant women and children whose incomes are below 133 percent of poverty and have the option to provide coverage up to 185 percent of the federal poverty level.

**THE  
CHARACTER-  
ISTICS OF WIC  
PARTICIPANTS  
AND NONPARTI-  
CIPANTS**

The basic analytic approach to measuring the savings in Medicaid costs from prenatal participation in the WIC program was to compare the Medicaid costs of WIC participants with the Medicaid costs of a group of women who did not participate in the WIC program (nonparticipants). However, because WIC participants may differ from nonparticipants in terms of other factors that **also influence** Medicaid costs, it was necessary to identify and adjust for these **differences** in order to obtain accurate estimates of **the** effects of prenatal **WIC** participants. Thus, an important component of the analysis was a descriptive analysis of the demographic and prenatal care characteristics of Medicaid mothers who are **WIC** participants and those who are nonparticipants. **WIC** participants are **defined** as women who redeemed any food instruments during the nine months prior to birth or, if no redemption data are available, who had a **WIC** certification date during the nine months prior to birth.

Differences in the adequacy of prenatal care for WIC participants and nonparticipants were large and consistent across the study states. In all five states, Medicaid mothers who did not participate in the **WIC** program were two to three times as likely to have received inadequate prenatal care as WIC participants, where inadequate prenatal care is defined as 4 or fewer prenatal care visits. Overall, 9.6 percent of **WIC** participants received inadequate levels of prenatal care, in contrast to 22.4 percent of nonparticipants. **WIC** participants in all five states also had an average of one to two more prenatal visits. The average number of prenatal care visits ranged from 8.9 to 11.2 for **WIC** participants and from 7.1 to 9.2 for nonparticipants. These **findings** have important implications for the analysis of Medicaid cost savings, since it is important that the effects of prenatal WIC participation be isolated from the effects of prenatal care on Medicaid costs.

In contrast to the striking differences in the adequacy of prenatal care, the **differences** in the demographic characteristics of **WIC** participants and nonparticipants in any given state were generally quite small.

**THE EFFECT OF  
PRENATAL WIC  
PARTICIPATION  
ON MEDICAID  
COSTS**

Prenatal WIC participation was associated with substantial savings in Medicaid costs for newborns and their mothers during the first 60 days after birth. When newborn and maternal Medicaid costs were able to be separated, the estimated savings in newborn Medicaid costs associated with prenatal WIC participation were even greater than the estimated savings in combined newborn and maternal Medicaid costs.

- Average Medicaid costs from birth to 60 days after birth ranged from \$2,433 in South Carolina (hospital costs only) to \$3,822 in Minnesota. Average Medicaid costs for newborns only from birth to 60 days after birth were available only for North Carolina and Texas and were \$1,733 and \$1,867, respectively.
- Estimated reductions in Medicaid costs for newborns and their mothers during the **first** 60 days after birth associated **with** prenatal participation in the WIC program ranged from **\$277** in Minnesota to \$598 in North Carolina, with intermediate values of \$347, \$493, and \$565 in Florida, Texas, and South Carolina, respectively.
- Estimated savings in newborn Medicaid costs from birth through 60 days associated with prenatal WIC participation were \$744 in North Carolina and \$573 in Texas.

Estimated savings in Medicaid costs were combined with data on the costs of the WIC program to determine benefit-cost estimates for the prenatal component of the WIC program. **All** benefit-cost estimates were greater **than** one, indicating that the benefits of prenatal **WIC** participation (estimated Medicaid savings) exceeded the costs of providing prenatal WIC benefits. For newborns and mothers, these estimates ranged from 1.77 in Florida to 3.13 in North Carolina, with values of 1.83 for Minnesota and 2.44 for both South Carolina and Texas. For newborns only, the benefit-cost estimates were 3.90 in North Carolina and 2.84 in Texas. Thus, for every dollar spent on the prenatal WIC program, the associated savings in Medicaid costs during the **first** 60 days after birth ranged from \$1.77 to \$3.13 for newborns and mothers and from \$2.84 to \$3.90 for **newborns** only,

Two points must be considered when these **findings** are interpreted. First, the estimated savings in Medicaid costs **from** birth to 60 days after birth associated with prenatal **WIC** participation are independent of the effects of prenatal care on Medicaid costs. **The** analytical results also show that considerable Medicaid cost savings during the 60day period after birth are associated with receiving adequate or intermediate levels of prenatal care.

- For newborns and mothers, the estimated savings in Medicaid costs during the first 60 days after birth associated with receiving adequate or intermediate levels of prenatal care were \$267 in Florida, \$362 in Texas, \$623 in South Carolina (hospital costs only), \$415 in North Carolina, and \$1,005 in Minnesota.
- For newborns only, the estimated reductions in Medicaid costs during the **60-day** period after birth associated with receiving adequate or intermediate levels of prenatal care were \$610 in Texas and \$593 in North Carolina.

The second important point is that the estimated savings in Medicaid costs associated with prenatal **WIC** participation are not independent of any unmeasured characteristics that also may affect pregnancy outcomes and maternal and newborn Medicaid costs. WIC participants are a **self-selected** group of women who may choose to participate in the WIC program for underlying reasons that might also influence pregnancy outcomes and Medicaid costs even in the absence of the **WIC** program. For example, some pregnant women may not participate in the **WIC** program because they lack access to public programs that provide health care and other services, which may independently affect pregnancy outcomes. Thus, the estimated savings in Medicaid costs related to prenatal WIC participation may overestimate the true savings since, relative to nonparticipants, **WIC** participants would have lower Medicaid costs in the absence of the WIC program. The problem introduced by self-selection is rendered less severe by the fact that (1) the adequacy of prenatal care is also likely to be related to any such underlying differences between WIC participants and nonparticipants, and (2) the analysis was able to adjust the estimated savings in Medicaid costs associated with prenatal WIC participation for the adequacy of prenatal care. However, the potential implications of the self-selection issue should be kept in mind when the study results are interpreted and generalized.

#### THE EFFECT OF PRENATAL WIC PARTICIPATION ON **BIRTH** OUTCOMES

In all five study states, prenatal WIC participation by Medicaid recipients was associated with increased birthweight, and the estimated increase in birthweight was greatest for births occurring before 37 weeks gestation.

- The average increase in birthweight related to prenatal **WIC** participation by Medicaid recipients ranged from 51 grams in Minnesota to 73 and 77 grams in Florida and Texas, respectively, to 113 and 117 grams in South Carolina and North Carolina, respectively.

- For Medicaid births occurring before 37 weeks gestation, the average increase in birthweight associated with prenatal **WIC** participation ranged from 138 grams in Minnesota to **259** grams--approximately half a pound--in South Carolina.
- Prenatal **WIC** participation by Medicaid recipients was also associated with a lower incidence of preterm births and a longer gestational age.

GENERAL-  
IZATION OF  
THE STUDY  
FINDINGS

The results of the study indicate that prenatal participation in the **WIC** program improves birth outcomes and generates savings in Medicaid costs. Two important questions concerning the study results are:

1. What inferences can be drawn **from** these state-specific results about the nation as a whole?
2. How stable are these conclusions over time?

The following socioeconomic differences among Medicaid-eligible pregnant women and differences among the state Medicaid programs are particularly important for addressing these two questions:

- At the time of the study, Medicaid income eligibility ceilings ranged **from** 33 percent of the poverty level in Texas to 88 percent in Minnesota; the other three states had income eligibility ceilings between 40 percent and 50 percent of the poverty level. In 1987, the federal poverty income threshold was \$9,056 for a family of three. If prenatal **WIC** participation is more beneficial for lower-income women, the variation across states in the Medicaid eligibility ceilings would result in larger effects of prenatal **WIC** participation in states with lower Medicaid eligibility ceilings and smaller effects in states with higher ceilings.
- The Medicaid income eligibility standards have increased considerably since 1987. If prenatal **WIC** participation is more beneficial for **lower-**income women, then the benefits of prenatal **WIC** participation observed in 1987 may be greater than what would be observed under the current Medicaid income eligibility standards for pregnant women, which range from 133 to 185 percent of the federal poverty level.
- In 1987, both Florida and Texas imposed inpatient hospital service limits that may have restricted the amounts that Medicaid reimbursed

for high-cost newborns. **The** other three states did not impose inpatient hospital service limits. These **limitations** on Medicaid reimbursements could have the effect of reducing the savings in Medicaid costs in Florida and Texas relative to the other study states and would reduce the savings in Medicaid **costs** in other states with **relevant** reimbursement limitations. Since 1987, however, those restrictions on Medicaid reimbursements in Florida and Texas have been relaxed considerably, which could have the effect of increasing the potential for savings in Medicaid costs in these two states.

- Among the five study states, only South Carolina did not have a medically needy spend-down program at the time of the study. **Spend-down** eligibility is a vehicle by which high-coat newborns can become eligible for Medicaid due to their medical expenses. The absence of the program could have the effect of reducing the apparent benefits of WIC participation in South Carolina and in other states without medically needy programs if the spend-down eligibility category included a greater proportion of nonparticipants in the WIC program than did other Medicaid eligibility categories.

The fact that the benefits of **WIC** program participation were so clearly demonstrated in all the study states, despite their population and program differences, suggests that a nationwide study of all 1987 Medicaid births would show similar outcomes for **WIC** program participants and **benefit-cost** ratios greater than one in the large majority of states.

Recent expansions and program enhancements in the Medicaid and the **WIC** programs, as well **as** the growing problem of substance abuse among pregnant women, may also affect the long-term stability of the study results. Higher Medicaid **income-eligibility** ceilings for pregnant women, in conjunction with increased coordination between the Medicaid and the **WIC** programs, mean that a higher-income group of women are likely to participate in the **WIC** program. At **the** same time, aggressive outreach and improved eligibility procedures may bring a higher-risk group of pregnant women into both the Medicaid and the **WIC** programs. The net effects of these enrollment changes on estimates of WIC benefits is uncertain.

## L INTRODUCTION

**The** Commodity Distribution Reform Act and **WIC** Amendments of 1987 (Public Law **100-237**) and the Joint Resolution Continuing Appropriation for Fiscal Year 1988 (Public Law **100-202**) mandated a study to examine **the** relationship between prenatal participation in the Special Supplemental Food Program for Women, Infants, and Children (WIC) and Medicaid costs for **mothers** and newborns **from** birth to **60** days after birth. This report **presents** the results of the study and consists of two volumes. This **first** volume summarizes and **discusses** the basic **findings** of the study and **describes** the WIC and Medicaid programs. The second volume provides a more **in-depth discussion** of the methodological approach underlying the study and the results of the analysis.

### A RATIONALE FOR THE STUDY

Low birthweight and infant mortality are major public health concerns in the United States. **The** high social and economic **costs** associated with low birthweight are now widely recognized, and public policy has endeavored to prevent low birthweight by enhancing **access** to prenatal care, **particularly** among **low-income women**. **The** high **costs** of caring for infants with low birthweight **impose** a large **financial** burden on the **Medicaid** program, the nation's primary program providing reimbursement for health care services to low-income women and their children. During **1984-85**, approximately 17 percent of total U.S. births were financed by Medicaid, and up to 41 percent of Medicaid expenditures for delivery were for high-cost deliveries (Alan **Guttmacher** Institute, **1987**; Howell and Brown, 1989). **In** recent **years**, the Federal government has expanded the Medicaid program **specifically** to improve access to prenatal and neonatal care for poor women **and** their children.

At the **same** time, evidence that good **prenatal** nutrition improves **birth** outcomes has prompted increased expenditures under the WIC program, which was authorized by Congress in 1972 to provide nutritional risk assessments, food **assistance**, nutrition education, and health and social service referrals to low-income pregnant and postpartum women and their infants, and children up to age **five**. The major goal of the prenatal nutrition supplementation and education provided under the WIC program is to improve the nutritional status of low-income pregnant women. The program, which **is** federally funded and administered by state and local agencies, has become a major component of the maternal and **child** health **services** delivered at the state and local levels. Nationwide, **the WIC program has grown from a \$750 million program that served 2**

**million** women and children in 1980 to a **\$2.1 billion** program that **serves** an estimated 4.5 million women and children in 1990.

Since both the WIC and Medicaid programs serve low-income **pregnant** women, an important issue **is** the extent to which prenatal participation in the WIC program **affects** the **subsequent** health- **costs** of **Medicaid-**eligible women and their **newborns**. In particular, if WIC participation during **pregnancy** improves pregnancy **outcomes**, then lower Medicaid expenditures and state indigent care expenditures in the neonatal period and later in life may **offset** the **costs** of the WIC program. To examine this **issue** further, **Congress directed** the **Secretary** of Agriculture in 1987 to undertake a study to **assess** the savings in Medicaid and state indigent care costs for women and their newborns during the **first** 60 days after birth that are due to the mother's prenatal participation in the WIC program **This** report presents the **findings** of this study.

## **B. THE OBJECTIVES OF THIS STUDY**

**As mandated, the primary objective of this study is to determine the** extent to which the participation of pregnant **women** in the WIC program **affects Medicaid and indigent care costs from birth to 60 days after birth.** The study entailed **analyses** of the relationship between Medicaid **costs** and WIC participation in each of **five** states-Florida, Minnesota, North **Carolina**, South Carolina, and Texas.<sup>1</sup> A secondary objective of this study is to examine the effects of prenatal WIC participation on birth outcomes, including birthweight and gestational age. This analysis of birth outcomes is important for two reasons. **First, savings** in Medicaid costs can be interpreted within the context of the effects of **WIC** participation on birth outcomes. Second, WIC participation may have **effects** on birth outcomes that may not adequately be **reflected** by the estimated savings in Medicaid **costs**. That **is**, to the extent that **WIC** participation improves birth outcomes by drawing individuals into the **health care system**, this increased demand for health care may at **least partially offset** any savings in **Medicaid costs** due to better birth **outcomes**.

---

<sup>1</sup>**As discussed in** Chapter II of this **volume, examining** state indigent care **costs** was not feasible in **this** study.

Specifically, the analysis **addressed the** following questions:

- What are the savings in Medicaid costs for mothers and their newborns from birth to 60 days after birth due to the mothers' participation in the **WIC** program during their prenatal period?
- Are the **savings** in Medicaid costs that are due to prenatal WIC participation greater or **less** than the costs incurred by the **WIC** program to provide its services, including the costs of nutrition **supplementation, administration,** and nutrition education?
- Does prenatal WIC participation by Medicaid recipients **affect** such birth outcomes as **birthweight** and **gestational** age?

### C. BASIC STUDY DESIGN

**The analysis of the effects** of prenatal WIC participation on Medicaid costs **from** birth to 60 days after birth included **three** key components:

1. **Combining** information on Medicaid **costs,** WIC participation and costs, and birth **outcomes** for each of the study states
2. **Assessing** the savings in Medicaid costs by comparing Medicaid costs for WIC participants **with the** Medicaid costs for nonparticipants based on statistical analysis to adjust for **differences** in costs attributable to other factors
3. Interpreting the study **findings** and their implications for the states not **included** in the study and for **recent** changes in the WIC and Medicaid programs and target populations

**The first** component pertains to the data used in **the** analysis. In each of **the five** study **states,** the database for **the** analysis was **constructed from three** separate state data **files:** (1) Medicaid **files,** which provided Medicaid cost and **eligibility** data on newborns and **their** mothers; (2) Vital Records **files** (birth, infant death, and *fetal death files*), which provided data on maternal **characteristics, birthweight** and other newborn characteristics, **prenatal care,** and infant and fetal deaths; and (3) **WIC** program **files, from** which **the** Medicaid mothers were **identified** as either

WIC participants or nonparticipants and which provided WIC cost data on the participants. These three data **files** were linked to create a database with Medicaid birth records in a given time period that included data on Medicaid costs, WIC participation status and costs, birthweight and other pregnancy outcomes, and maternal characteristics, such as age, race, birth parity, education, marital status, prenatal **care**, and previous obstetrical history. The time period was 1987 for **Florida**, Minnesota, North Carolina, and South **Carolina** and the **first** six months of 1988 for **Texas**. **The WIC/Medicaid** data are descii in Chapter III of this volume and in more detail in the forthcoming Volume 2 of this report.

**The second** analytic component **entailed** developing an accurate measure of the Medicaid costs that WIC participants would have incurred had they not participated in **WIC**. **This analytical** component was not **straightforward, because**, in addition to WIC participation, WIC participants and nonparticipants may **differ** in terms of other **characteristics** that **affect perinatal outcomes** and Medicaid costs. **These** factors include demographic and prenatal care **characteristics**, all of which **vary across individuals and across the study states**. **Chapter IV** of this volume contains a brief summary of the methodological approach to this study and Volume 2 **will describe** the methodological approach in greater **depth**.

The third analytic component entailed using the results of the analysis to draw inferences about the WIC and Medicaid programs. **The** analysis yielded **findings** on the cost-effectiveness of prenatal WIC participation in four states during 1987 and during the **first** six months of 1988 for **Texas**.<sup>\*</sup> **These findings** differ among the study states, because their demographic compositions and institutional structures **differ** and because they face **different** problems in ensuring that low-income pregnant women and children have access to care In addition, the WIC and Medicaid programs have changed since the study period. It is important that these factors be considered when the **findings** are interpreted, in order to assess their implications for the WIC and Medicaid programs.

---

<sup>2</sup>**The five states were selected** on the basis of an extensive feasibility study that encompassed site visits to seven possible participant states and a thorough review of their programs and data systems. Based on this review, **five** of the seven states in the **feasibility study** were selected to participate.

#### D. ORGANIZATION OF THIS **REPORT**

This volume includes **five** chapters and two appendices. Chapter II provides background information on the states included in the study and on the **WIC** and Medicaid programs **in** those states. Chapter **III** **describes** the data **used** in the analysis and presents descriptive data on the Medicaid births in each of the study states. The main analytical Wings are presented in Chapter IV, and Chapter V **discusses** the implications of the study **findings** for the national WIC and Medicaid **programs**. Appendixes A and B contain tables with **detailed** analytical results.



## II DESCRIPTION OF THE STUDY STATES AND THE WIC AND MEDICAID PROGRAMS

Background information on the study, states and on the WIC and Medicaid programs is important for interpreting and generalizing the **findings** of the study, which are **presented** in the subsequent chapters of this report. Section A of this chapter **describes** the **perinatal** and **sociodemographic** characteristics of the five study states, and Section B **provides** background information on the WIC and Medicaid programs.

### A DESCRIPTION OF THE STUDY STATES

Five states were selected for **this** study--Florida, Minnesota, North Carolina, South Carolina, and Texas. Several factors were considered in **the final selection of the study states**. **They include:**

- **The geographical distribution of the study states.** The study states were selected in part to ensure a representative **geographic distribution**. The North Central, **Southeastern**, and Southwestern regions of the country are represented by the five states selected, although three of **the five states** are **from** the southeast.
- **Large urban areas.** Three of **the five** states **selected** (Florida, **Minnesota**, and **Texas**) have **large** urban areas, which is useful for drawing conclusions about the **effectiveness** of the WIC program in other states with large urban **areas**.
- **Perinatal outcomes.** It was desirable that the study states **exhibit** variation in birth outcomes and **perinatal risk factors** to facilitate determining whether the cost-effectiveness of the WIC program depends on the extent to which the target population exhibits adverse **birth outcomes**. The perinatal outcomes for the study states range **from** some **less** favorable outcomes for South Carolina to some very favorable **outcomes** for Minnesota.
- **Minority representation.** Given the **ethnic diversity** of the target population, it was desirable that the study **states exhibit** a broad **representation** of minorities. Four of the **five** states (the exception is **Minnesota**) have large minority populations, and both Florida and Texas have a large Hispanic population. In addition, Minnesota provides information on the effects of prenatal WIC participation in states with a predominantly white population.

- **WIC participation rate.** Variation in the penetration of the WIC program among eligible pregnant women is important for assessing the effects of prenatal WIC participation in states whose availability and accessibility of WIC services differ. For the five states in this study, the percentage of Medicaid births occurring to WIC participants ranged from a low of 47.8 percent in Texas to a high of 73.4 percent in South Carolina, with intermediate values of 57.6 percent, 68.8 percent, and 68.7 percent in Florida, Minnesota, and North Carolina, respectively.

Although only five states participated in the WIC/Medicaid study, the selected states accounted for 18 percent of all U.S. births in 1987. Overall, some striking contrasts in birth outcomes and perinatal risk factors exist among the five study states. As shown in Table II.1, Minnesota contains a lower proportion of low-income women and exhibits birth outcomes that are more favorable than those of the other study states. Both its infant mortality rate and percentage of low birthweight infants are the lowest of the five states and are lower than the rates for the nation as a whole. In contrast all of the three Southeastern states-- North Carolina, South Carolina, and Florida--have infant mortality rates greater than the national average, with South Carolina having the highest rate of the five study states. Texas is an extremely large state, accounting for roughly 8 percent of all U.S. births. Its infant mortality rate is below the U.S. average, although the percentage receiving late or no prenatal care is considerably higher than the national average and is the highest of the five study states.

Table II.1 presents information on three key perinatal risk factors: the poverty status of women of childbearing age, births to teenagers, and inadequate prenatal care. The following summarizes the differences in these risk factors among the study states:

- **The poverty status of women of childbearing age.** Minnesota has a considerably lower percentage of low-income women of childbearing age than do the other four states, and the contrast is even more marked for the proportion of women below 185 percent of the poverty level. At the other end of the spectrum, South Carolina has the highest percentage of low-income women of childbearing age. In comparison with national data, the proportion of low-income women of childbearing age in North Carolina in 1984-1986 is very

**TABLE II.1**

**BIRTH OUTCOMES AND PERINATAL RISK FACTORS: U.S. AND STUDY STATES**

	<b>U.S.</b>	<b>Florida</b>	<b>Minnesota</b>	<b>North Carolina</b>	<b>South Carolina</b>	<b>Texas</b>
<b>Total Births, 1987</b>	<b>3,809,394</b>	<b>175,144</b>	<b>65,173</b>	<b>93,501</b>	<b>52,801</b>	<b>301,962</b>
<b>Infant Mortality Rate, 1987<sup>a</sup></b>	<b>10.1</b>	<b>10.6</b>	<b>8.7</b>	<b>11.9</b>	<b>12.7</b>	<b>9.1</b>
<b>Percent Low Birthweight, 1987<sup>b</sup></b>	<b>6.9</b>	<b>7.7</b>	<b>5.0</b>	<b>7.9</b>	<b>8.6</b>	<b>6.9</b>
<b>Percent of women Ages 15-44 Below Poverty Thresholds, 1984-86</b>						
<b>&lt; 100%</b>	<b>15.2</b>	<b>15.4</b>	<b>11.4</b>	<b>14.0</b>	<b>17.3</b>	<b>15.2</b>
<b>&lt; 150%</b>	<b>24.3</b>	<b>26.8</b>	<b>19.4</b>	<b>24.2</b>	<b>29.4</b>	<b>25.5</b>
<b>&lt; 185%</b>	<b>31.0</b>	<b>34.4</b>	<b>25.0</b>	<b>32.3</b>	<b>37.6</b>	<b>33.1</b>
<b>Percent of Births to Teenagers, 1986</b>	<b>12.6</b>	<b>13.8</b>	<b>7.3</b>	<b>15.9</b>	<b>16.6</b>	<b>15.2</b>
<b>Percent of Births to Women Receiving Late or No Prenatal Care, 1986</b>	<b>6.0</b>	<b>8.6</b>	<b>3.8</b>	<b>4.6</b>	<b>8.1</b>	<b>11.5</b>

**SOURCES:** National Center for Health Statistics (1988 ad 1989), Newacheck (1988), ad Hughes et al. (1989).

<sup>a</sup>Number of infant deaths per 1,000 live births.

<sup>b</sup>Birthweight of less than 2,500 grams.

**close to the 1986** national average, while the proportion for Minnesota is considerably below the national average, and the proportions for the other three states exceed the national average.

- **Births to teenagers.** In all four Southern states, the percentage of **births to teenagers** is high relative to the nation as a whole, while a very low percentage of **births occurs** to teenagers in Minnesota. The contrast between the percentage of births to teenagers in Minnesota and the four Southern states is **striking**.
- **Inadequate prenatal care.** In 1986, the percentage of births to women receiving late prenatal care (prenatal care during the third trimester only) or no prenatal care was high in **Florida**, South Carolina, and Texas relative to Minnesota and North Carolina and relative to the nation as a whole. In **contrast**, the percentage with late or no prenatal care was lower in both Minnesota and North Carolina than the U.S. average.

For the most part, these data on perinatal risk **factors** are consistent with the birthoutcome of the live study **states**. In particular, **Minnesota** has both very favorable birth outcomes and lower risk factors for adverse perinatal outcomes relative to the other four **states**, while South Carolina shows the highest levels of risk for two of the three perinatal risk factors and the highest rates of infant mortality and low birthweight

The inclusion of Florida and Texas, both of which have a large Hispanic population, raises some very interesting issues. The observed relationship between prenatal care utilization and birthweight is weaker in states with high proportions of Hispanic and Native American births (Hughes et al., 1989). In general, Hispanic women have lower rates of prenatal care utilization than non-Hispanic women, but also appear to be at lower risk for having low-birthweight infants. It is possible that cultural factors **influence their use** of prenatal care **and affect their birth outcomes**. **Thus, in analyses of the effects of prenatal WIC participation on Medicaid costs and birth outcomes, the effects of variations in race and ethnicity must be accounted for.\***

---

\*Florida **and** Texas are the only **two** of the **five** study states for which data on Hispanic ethnicity are available. **However**, the number of Hispanic **births in the other three states is very small**.

## B. PROGRAM BACKGROUND

The descriptions of the WIC and Medicaid programs in this section provide background information for the analytical **findings** presented in the following chapters. The discussion focuses primarily on the important features of program operations. A broader discussion of WIC, Medicaid, and other indigent care programs for low-income pregnant women and their newborns is contained in another report **from** this study, "Description of State Programs" (**Bilheimer**, 1990).

### WIC Program

The WIC program was authorized **by** Congress in 1972 to provide nutritional screen& food assistance, nutrition education, and health care **referrals to** low-income pregnant women, **breastfeeding** women, postpartum women, **infants**, and children up to age **five** who are at nutritional risk **The** major goal of the prenatal component of the WIC program is to improve the nutritional status of low-income pregnant **women**. In most **states**, the WIC program has become one of the largest and most important public health programs for low-income pregnant women and **infants**, but both the extent to which the WIC program is integrated with other maternal and child health services and the proportion of eligible women and **infants** who participate vary considerably **across** the **states**.

Program eligibility depends on both income level and evidence of nutritional risk **States** have the option of **setting 'income** eligibility between 100 and **185** percent of the **federal poverty** level, provided that income eligibility is no lower than that for **free** or reduced-price health **services**. Nearly all states have set income eligibility at **185** percent of the poverty level. Nutritional **risks** include both medical risks, such as anemia, extremes of leanness or obesity, **maternal age**, or poor pregnancy history, and dietary **risks** due to **poor dietary patterns**.

The **WIC** program is administered nationally by the Food and Nutrition Service (**FNS**) of the U.S. **Department** of Agriculture (USDA) and at the **state** level by a designated state **agency**, usually the state department of **health**.<sup>2</sup> Congress sets funding annually, and the available funds are allocated to the states on the basis of an allocation formula that takes into

---

<sup>2</sup>The **WIC** program is administered by the Departments of Health in all of the study states.

account the number and percentage of eligible women and children being **served**, among other measures.

The WIC program is not an entitlement program, and states may not have **sufficient** funds to **serve** all eligible persons who apply for the program. Federal regulations thus **require** that the states establish a nutritional-risk priority system to ensure that scarce program resources are allocated fairly and reach those who need them the **most**. Priorities I to III are based on nutritional risk established through documented nutritionally related medical conditions, and priorities IV and V are based on nutritional risk **defined** in terms of inadequate dietary patterns. Priority VI includes postpartum **women at nutritional risk, although some states** may classify **some postpartum** women at priority **III**, IV, or V. At their option, states may define a priority VII, which includes previously **certified WIC** participants **whose** nutritional status might **regress** if they can no longer receive supplemental foods. Pregnant women at nutritional risk as demonstrated by documented **medical conditions receive the highest** priority (priority I), while pregnant **women** at nutritional risk due to inadequate dietary patterns are priority IV. During **1987**, all **five** of the study states **served** priorities I through IV, and all except Minnesota served priorities I through VI.

At the state level, the WIC agency enters into contracts with local agencies to administer the program. WIC agencies are usually within local departments of health, community health **centers**, or other local public health care providers. The WIC agency is sometimes a community-based organization or **hospital**. States establish both rules for allocating the state's funds to local agencies and guidelines within which the local agencies must administer the WIC program.

**Since the majority** of WIC providers are local public health clinics, WIC **services have become** an integral part of prenatal care provided to **low-income** women by public **clinics**. In terms of aggregate expenditures, WIC has become a major component of maternal and child health services at the state and local levels, having grown **from** a \$256 million program that **served 848,000** women and children in **1977** to a \$21 billion program that **serves** an estimated **4.5** million women and children in 1990.

The organization of program operations at the local level varies greatly, but for pregnant women it works approximately as **follows**. When a woman **learns** about the program and **applies** to the program at the **WIC** office, she **is** screened to determine whether she meets the income

criterion and one or more of the risk criteria required for **eligibility**. If she is eligible, she receives a nutrition education session and a food instrument for the purchase of a food package **from** a participating vendor. Usually (though not always), application, **eligibility** determination, service receipt, and health care referrals all occur in the initial visit. **In** subsequent months, the participant will then return to the **WIC** office periodically **in** order to pick up her WIC food instrument and receive nutrition education **services**. The **frequency** of food instrument pick-up **varies from** once every month to once every three months (at which time food instruments for three months are picked up). Participants are eligible for **WIC** benefits through **the end** of the pregnancy and up to six weeks postpartum. **The mother may then be recertified as a breastfeeding** mother, or in some instances as a postpartum participant, in which case she will continue to receive WIC **services** for an additional period of time.

**The WIC programs in the five study states vary greatly in terms of their** total budgets, the total number of persons **served**, and the distribution of the caseload across the eligibility categories. As shown in Table II.2, WIC grants in the **five** states ranged **from approximately** \$26 million in Minnesota to \$112 million in **Texas** in **fiscal** year 1987, with intermediate figures of \$36 million, \$49 million, and \$58 million in South Carolina, North Carolina, and **Florida, respectively**.

**Differences** in aggregate expenditures are reflected in **differences** in the total number of persons served by the **WIC** program. In 1987, the average number of **persons served per** month ranged **from** 56,000 in Minnesota to 226,000 in Texas. Data on the proportion of WIC participants who are pregnant women do not **exist** for all the study states, but information is available on the proportion of participants who are **women**. These proportions appear to vary considerably, ranging **from** 15.6 percent in Minnesota to 263 percent in **Florida**. In the other three states, the proportion of participants who are women varies **from** 21 percent to **23 percent**. **Thus, in terms of case mix, the Minnesota WIC program has** a lower proportion of women and a higher proportion of infants and children than do the WIC programs of the other **states**, while Florida has a higher proportion of women than the other states.

**In** contrast to the variation in the size of the program **across** the study states, the availability and **accessibility** of WIC services vary somewhat less, although some **differences** do **exist**.

TABLE 11.2

## THE CHARACTERISTICS OF THE WIC PROGRAM IN THE STUDY STATES

	Florida	Minnesota	North Carolina	South Carolina	Texas
<b>Size of the Program</b>					
Total Budget FY 1987 (\$ million)	57.8	25.6	49.0	36.2	112.4
Average Monthly WIC Participants, 1987					
Total	117,600	56,300	106,400	73,500	226,300
Women	31,000	8,800	22,000	16,600	51,600
<b>Availability and Accessibility of WIC Services</b>					
WIC Program Statewide	Yes	Yes	Yes	Yes	Yes (Effective April 1990. In 1988, 34 counties were unserved.)
Income Eligibility Criteria	185% of poverty (State- wide, as of July 1988. Previously, 15 counties were below 185% of poverty. Most used 150%.)	185% of poverty (State- wide)	125% - 185% of poverty	185% of poverty (State- wide)	185% of poverty (State- wide)
Waiting Lists	No	Yes (Efforts made to ensure that pregnant women are not placed on waiting list.)	No (But pregnant women experience delays due to constraints in the public prenatal care system.)	Yes (Only with State approval. No waiting lists for Priorities I, II, and III.)	No (But waits for appointments do occur.)

SOURCES: Information collected from site visits, state documents, and interviews with state staff, and data from the Food and Nutrition Service, U.S. Department of Agriculture.

- **Service proximity.** Texas is the only one of the **five** states that did not have a statewide WIC program during the study period; in 1988, **34 counties** out of a total of 254 were unserved. The number of unserved counties in Texas has steadily declined, and the last **unserved** county received WIC **services** in 1990. To facilitate access, all of the states use food **instrument** pick-up **sites** in addition to **certification** sites.
- **Income eligibility.** Income **eligibility standards** are relatively uniform **across the five states.** **Nearly all WIC programs in all five states are** using the **185 percent** of poverty income criterion, although, in 1987, a few locations in Texas, Florida, and North Carolina may have used a lower income **eligibility** criterion.
- **Waiting lists.** Strategies for **maintaining waiting** lists differ among the **states,** but it is clear that some states face more of a caseload management problem than do others and did so in 1987 as well. In **Minnesota,** waiting lists and caseload management are important tools in program operations and serve to identify excess demand for the **WIC program.** **The other study states made efforts to minimize the** use of waiting lists. While all states **affirm** that every **effort** is made to ensure that priority I pregnant women are not placed on waiting **lists,** the **reality may vary by state.** In particular, pregnant women may experience delays in enrolling in the WIC program due to constraints on public maternity care or waits for initial WIC appointments.

### Medicaid Program

**Authorized** under Title **XIX** of the Social Security **Act,** Medicaid is a joint federal and state program that reimburses the covered medical-care costs of **low-income** persons. It is the largest program providing reimbursement for health care services to the poor, but by no means are all low-income persons **eligible.** Eligibility **depends** on categorical status in addition to income, and states have considerable discretion in determining income eligibility ceilings. In **addition,** while a core group of **services** is federally mandated, states can choose to offer a wide range of optional services and can also impose service limits on both mandated and optional **services.**

For many **years,** Medicaid **eligibility** for low-income pregnant women and **children** was linked to **eligibility** for Aid to Families with Dependent Children (**AFDC**). This link **effectively** excluded low-income pregnant women in two-parent households and low-income women in their first pregnancy, although some states opted to cover some of these women.

In addition, AFDC income eligibility standards in some states were so low that many women below the poverty level were not poor enough to qualify for Medicaid. **This** problem was **particularly** severe in the South; in 1987, seven Southern states had AFDC payment standards below 30 percent of the federal poverty level (Hughes et al., 1988), which was \$9,056 for a family of three. **States** have the option of **establishing** medically needy programs, which have a higher income **ceiling**, but **they** are not to exceed 133 percent of the AFDC payment standard. Under a medically needy program, low-income women with high **obstetrical** and neonatal costs could “spenddown” and become Medicaid-eligible, although **they** were ineligible for Medicaid during their pregnancies.

The **growing awareness** of the **cost-effectiveness** of prenatal care in the early **1980s** occurred amid growing concerns about the rising costs of maternity care and the inadequate **financing** of **maternity** care. **Access** problems were **particularly** severe for Low-income pregnant women and infants, many of whom lacked **any** form of **health** insurance coverage. In response to these concerns, Congress authorized a **series** of expansions of the Medicaid program to pregnant women and infants. **The** mandates of the Deficit Reduction Act of **1984** and the **Consolidated** Budget Reconciliation Act of **1985** effectively eliminated the Medicaid categorical eligibility requirement that linked **Medicaid eligibility** to AFDC eligibility and required that **states** provide Medicaid coverage of prenatal, delivery, **and postpartum services to all income-eligible** women regardless of their family structure. **Subsequent initiatives** in the **Omnibus** Budget Reconciliation Acts of **1986** and **1987** (OBRA-86 and **OBRA-87**) and the Medicare Catastrophic Act of **1988** have **progressively** expanded Medicaid income **eligibility** to pregnant women and children. Legislation under OBRA-86, which became effective during **1987**, **permitted** states to extend coverage to pregnant women and newborns in families whose incomes **were** up to 100 percent of the federal poverty level, and permitted them to waive the assets test for **eligibility**. OBRA-87 expanded this option by allowing **states** to cover pregnant women and infants up to 185 percent of the federal **poverty level**. All states **were required** by **July** 1990 to provide Medicaid coverage to pregnant women and infants below 100 percent of the federal poverty level. **Finally**, under the Omnibus Budget Reconciliation Act of **1989**, states are mandated to expand Medicaid coverage to all pregnant women and children under age **six** whose incomes are below 133 percent of the poverty level.

The **OBRA-86** expansions to **100** percent of the poverty level were not implemented in any of the study states until October **1987**, towards the

end of the time period for this study. Thus, for most of 1987, pregnant women and children were potentially eligible for Medicaid in one of the following three groups:

- **AFDC recipients** who were "categorically" eligible for Medicaid because they received cash assistance under the Aid to Families with Dependent Children Program. In addition, some former AFDC recipients who became ineligible for AFDC payments remained eligible for Medicaid.
- **Pregnant women and children** who resided in households which met the income and resource requirements of AFDC eligibility, but who were not eligible for AFDC because the state did not provide AFDC benefits to pregnant women without other children (AFDC coverage which is at the state's option) or the child did not meet the definition of "dependent" (that is, both parents were in the home). Women were eligible from the point at which pregnancy was medically established, and birth-related services were covered through 60 days postpartum. Newborn children were covered for one year, provided that the mother was eligible for and receiving Medicaid at birth and provided that the mother remained eligible and the child resided with the mother.
- **Medically needy individuals in families with children whose income and/or resources were above the limits established for AFDC eligibility but still needed medical assistance in the state's view.** The state set income limits for the medically needy program that did not exceed 133 and 1/3 percent of the benefits paid to an AFDC case with no other income. A medically needy program was provided at the state's option; however, if the state had a medically needy program, it had to serve pregnant women and children, as defined above. All states in the study except South Carolina had a medically needy program in 1987.

In October 1987, Florida, North Carolina, and South Carolina implemented Medicaid coverage of women and infants in families whose incomes were up to 100 percent of poverty; in September 1988, Texas did also. In July 1987, Minnesota raised the Medicaid income threshold for its medically needy program to 88 percent of poverty; in October 1988, it raised its Medicaid income levels for pregnant women to 185 percent of poverty.

In terms of the services covered by Medicaid no major service limitations existed that would have **affected** normal maternal and newborn care. However, some states imposed restrictions that may have limited Medicaid reimbursement for **high-cost** newborns. In South Carolina, Medicaid allowed a maximum of 18 ambulatory visits-including physicians' visits-a year; however, according to state Medicaid program staff, this restriction probably did not **affect** most maternal and infant care. In contrast, Texas and **Florida** imposed **service** limits during the study year that may have limited the number of days reimbursed by Medicaid for **high-cost** newborns. During the study period, the Texas Medicaid program paid for a maximum of 30 inpatient hospital days per spell of illness, and required a **60-day** break before another reimbursable spell of illness. **In** addition, it **imposed** a \$50,000 expenditure cap. The cap was subsequently raised to **\$200,000** in November 1988, with the other service restrictions remaining unchanged **Florida** imposed **restrictions** on both physician visits and inpatient days in **1987. Medicaid** recipients were allowed only one physician inpatient hospital visit per day (although other physician **services** in the hospital could be billed) and a maximum of 45 inpatient days per **fiscal** year. **These** limitations **were** changed effective July 1989. In particular, Florida eliminated limits on hospital days for children younger than age one.

The Omission of  
the Cost of  
Indigent Care  
Programs from the  
Database and the  
Analysis

The Congressional mandate for this study requested an assessment of the savings in both Medicaid and indigent care costs for newborns due to prenatal WIC participation. However, determining indigent care costs for pregnant women and newborns is **difficult**, since many of these costs are borne by the private sector and are seldom documented. This problem is particularly true with delivery and newborn services, for which states have **traditionally** provided relatively little funding other than through Medicaid, thus forcing hospitals to bear the brunt **of** uncompensated care costs.

**This study does not directly** examine the effects of prenatal WIC participation on indigent care costs. Three main reasons explain the omission of indigent care costs from the analysis. **First** and foremost is that the available data on state indigent care programs are limited. All Study **states** operate programs to **serve** the needs of low-income pregnant women, and **these** programs are **discussed** in detail in another report **from** this study, "Description of State Programs" (**Bilheimer**, 1990). However, **these** programs often do not maintain individual-level data **files** on **services** received and costs **incurred**. In particular, a major source of concern is the high level of uncompensated hospital care for maternity and newborn care, and it is not possible to obtain individual-level data on

uncompensated hospital care within the context of this study. **In** order to be applicable to this study on the **cost-effectiveness** of the WIC program, a health care service or reimbursement program must have had data **files** on individuals that could be **linked** to **WIC** program **records**.

A second reason for omitting indigent care costs **from** the analysis is that many programs which serve low-income pregnant women provide **only** prenatal **care** to participants, and do not cover labor and delivery **costs**. **Thus**, even for those programs for which **individual-level** program data systems are maintained at the state level, **information** is not available on the **primary outcome** variable for the **analysis--indigent** care costs for **labor** and delivery and **during** the 60day period after bii

A third reason for omitting state indigent **care** costs **from** the study is that some of the state programs that provide **financial** assistance at and after birth exist precisely because of problems related to the pregnancy and birth. For example, in many states, Programs for Children with Special Health Needs reimburse providers for **services** rendered to children born with serious **health** needs. **Thus**, in order to be a participant in such a **program**, the newborn is by **definition** a high-coat birth, **and** it is of little interest to examine the **effects** of the WIC program on program costs. If any analysis of such programs were to be undertaken, it **would likely** focus on the effect of the **WIC** program on the likelihood of receiving any benefits at **all**, rather than on the coats received once in the **program**.



### III. DESCRIPTION OF THE DATA AND THE CHARACTERISTICS OF WIC PARTICIPANTS AND NONPARTICIPANTS

One of the key analytic challenges in **assessing the savings** in Medicaid **costs** from prenatal **WIC** participation was to construct an analysis database that contained information on Medicaid costs **from birth to 60 days after birth** and on WIC participation. **This chapter provides** an overview of the data used to examine the relationship between Medicaid costs and prenatal WIC participation. The **first** section **describes** the **WIC/Medicaid** database, and the **second** section provides descriptive **profiles** of **WIC** participants and nonparticipants in each of the **five** study **states**.

#### A OVERVIEW OF THE WIC/MEDICAID DATABASE

**The database designed** for this study **serves** bur major purposes: (1) to **identify the** newborns of mothers who **receive** Medicaid, and women with Medicaid **claims** for labor and **delivery** in a **specified** time period, (2) to provide information on Medicaid **costs from birth to 60 days after birth**, (3) to determine whether the mother participated in the WIC program while she was **pregnant**, and (4) to **provide descriptive** information on the characteristic8 of **WIC** participants and nonparticipants. The data **sources include** the Medicaid paid claims and **eligibility files**, the WIC program **files**, and the **Vital Records files**. **Each of these is discussed in turn**, followed by a brief discussion of how the data were combined for **analytical purposes**.<sup>1</sup>

#### Medicaid Data

Medicaid **eligibility** and paid claims **files** served two purposes: (1) to **identify** Medicaid-covered births, and (2) to provide data on Medicaid costs for the analysis. **The analysis sample includes all Medicaid-covered births that occurred** in 1987 in Florida, Minnesota, North Carolina and South **Carolina**, and those in the **first** six months of 1988 in Texas. Women and newborns who **participate in** health maintenance organizations (**HMOs**) were not **included** in the **analysis**,<sup>2</sup> since Medicaid

---

<sup>1</sup>Volume 2 of this **report will** contain a more detailed description of the state data systems used to construct the database.

<sup>2</sup>The exclusion of HMO enrollees **from** the study **affects** only the analysis for Florida and Minnesota, since no HMO participation by Medicaid recipients **occurs** in North Carolina, South **Carolina**, or Texas. The percentage of **all Medicaid** recipients **enrolled** in prepaid **health plans** in 1987 was approximately 5 percent **in** Florida and 9 percent in **Minnesota**.

pays a flat monthly **capitation** fee to **HMOs** that **covers all acute-care services** for enrollees, rather than a fee based **on** individual **services** rendered. Thus, while **WIC** participation may influence the cost of providing birth-related care to an HMO enrollee, it will not have any short-term effect on the cost of such care to Medicaid. Therefore, prenatal WIC participation will not **affect** Medicaid costs for HMO enrollees.

The choice of 1987 as the study period represents a balance between the competing objectives of (1) selecting the most recent year **possible** in order to observe a period when at least some of the **recently** enacted Medicaid expansions were in effect and (2) selecting a period of time by which all Medicaid claims for the study subjects were fully **processed** and **finalized** in time to construct the data file and perform the analysis for this study, which was **mid-1989**. The year **1987** was selected as a study period that would **maximize** the availability of a complete claims history for each birth in the study sample.

**Texas is the sole exception to using calendar year 1987. In Texas, the study is based on all Medicaid births that occurred during the period from January 1988 through June 1988, since the data necessary to identify WIC prenatal participants were not available for births in an earlier period. While the risk of missing Medicaid claims that were not finalized by the date on which the extract was created is somewhat greater, Texas appears to process most claims relatively promptly. Furthermore, because the Texas Medicaid program paid for just 30 days of inpatient services during that period, the risk of missing long-term hospitalizations by using the later period is much lower in Texas than it would be in many other states.**

As mandated, the Medicaid costs **examined** in this study include reimbursements **from** birth to **60 days** after birth. Although constructed for the database, prenatal Medicaid costs were not included in the analysis summarized in this **report**. In addition, because of the widespread use of **global** billing by physicians for comprehensive prenatal care and delivery services combined, all physician claims for prenatal care and delivery were included in **the** prenatal period. For **services that started** within the **60-day** period after birth but extended **beyond** the 60day period, the

Medicaid reimbursements were prorated according to the proportion of the service period that occurred within the **60-day postpartum period**.<sup>3</sup>

### WIC Data

Data from the states' WIC data systems were used to determine whether a mother identified by the Medicaid files was receiving WIC benefits while she was pregnant. In this study, a woman was considered a prenatal WIC participant if she redeemed any food instrument during the nine months prior to birth or, for states that did not provide redemption data, if she had a WIC certification date sometime during the nine months prior to birth. Alternative definitions of prenatal WIC participation that account for the point in a woman's pregnancy at which she was certified for the WIC program were also considered, and results based on these alternative **definitions** will be discussed in Volume 2 of this report.

The cost of providing the WIC food packages to pregnant women was also derived from the WIC files. WIC program costs are equal to the cost of the food packages provided to each participant plus an estimate of the administrative and nutrition education expenses per participant. However, the type of data on food package costs varied across the states. Florida, Minnesota, and North Carolina provided data on the actual value of food instruments redeemed during pregnancy for each of the prenatal **WIC** participants. In these three states, the estimate of the food supplement for each prenatal WIC participant was obtained from summing the values of the redeemed food instruments from the pregnancy certification date to six weeks after the birth of the child.

South Carolina provided data only on the number of food instruments issued during pregnancy and up to 6 weeks postpartum, and Texas provided data only on the date of certification for each pregnant women, from which the months of prenatal WIC participation was estimated. Thus, for both South Carolina and Texas, the cost of the **WIC** food supplements was estimated on the basis of the months of participation during pregnancy multiplied by (1) the average value of the monthly food package (available from state data) and (2) the average proportion of food instruments that are redeemed (from state data).

---

<sup>3</sup>Volume 2 of this report will present findings from an analysis in which the total reimbursements for Medicaid claims that extend beyond the 60-day period after birth are included in the Medicaid cost variable, rather than being prorated.

The estimate of **total** WIC costs per prenatal WIC participant entailed adding an adjustment for administrative and nutrition education expenses to the costs of the WIC food supplements. This adjustment was obtained from state data on total WIC food costs and total administrative and nutrition education costs. **The** ratio of administrative and nutrition education expenses to total WIC food costs was multiplied by the average food supplement cost per prenatal participant to calculate estimated administrative and nutrition education expenses per participant. Total WIC costs per prenatal WIC participant were the sum of the food package costs and administrative and nutrition education **expenses**.<sup>4</sup>

### Vital Records

Vital Records data **files** provided information on the characteristics of Medicaid mothers and newborns. These data **files** are maintained at the state level by Bureaus of Vital Records, which are **responsible** for overseeing the collection of information on births, deaths, marriages, and divorces. The following data were available from the Vital Records **files**:

- Data on the sex, number, duration of gestation, and birthweight of newborns
- Data on the age, race, **ethnicity**, education, and marital status of mothers
- Data on the number of previous live births, number of previous pregnancy terminations, and indicators of prenatal care

### Combining Measures of Medicaid Costs, WIC Participation and Costs, and Maternal and Newborn Characteristics

To conduct the analysis of the Medicaid cost savings due to WIC participation, the data on Medicaid costs, WIC participation and costs, the characteristics of Medicaid mothers, and birth outcomes were combined for each Medicaid-covered birth. Specifically, for each Medicaid birth in the study period, the analysis file contained the following information: the Medicaid costs of the newborn, the Medicaid costs of the mother, the birth outcomes (birthweight and gestational age) of the newborn, the demographic and prenatal care characteristics of mothers, whether **the**

---

<sup>4</sup>The measure of WIC costs includes federal costs only and does not include any in-kind or other subsidies to the WIC program provided by the states.

mother participated in the WIC program during pregnancy, and either the months of participation or the value of redeemed food **instruments**.<sup>5</sup>

This brief description of combining the data on Medicaid costs, WIC participation and costs, and maternal and newborn characteristics **camouflages** the actual complexity of the **file construction process**. Variations in the data **systems across** the states and the sheer volume of records that were **processed** (for **example, millions** of Medicaid claims) represent one level of complexity. **In addition**, the **identifying** information on individuals from the various **state data files** made it **difficult** to determine unambiguously whether, for example, a **person** on the Medicaid **file was the same** individual **as** the one who appeared on the **Vital Records file**. Due to the lack of **unambiguous identifying** data, multiple iterations of the **file construction process** were necessary.

**The** ability to combine the **measures of Medicaid costs**, WC participation, and mother and newborn **characteristics** for each birth depended on both the **effectiveness** of the linking algorithms and a number of other factors. In particular, valid **circumstances exist** under which some data were missing yet the Medicaid birth was **still** retained for **the** study. **Most notably**, data on WIC **costs** were **not** available for those Medicaid births to women who **were not WIC** participants. Newborn Medicaid costs were missing if the newborn did not have its Medicaid eligibility established separately from the mother. **The** mother's Medicaid costs were missing if **only** the newborn was **Medicaid-eligible**.

However, some incomplete records were dropped **from the analysis** sample. **Out-of-state** births and adoptions may mean that birth **certificates** were not available, and data entry **errors** may have **resulted** in unmatched Medicaidbirths. **In general, Medicaid records that were not linked to the vital records birth file** were **omitted from the analysis** due to the absence of important maternal information and newborn characteristics **from the birth certificates**. Descriptive **analyses** of the Medicaid bii that could not be linked **successfully** to the Vital Records **files** were conducted and the Wings did not indicate any **systematic difference** in average Medicaid costs between **analysis file observations** (those linked to the Vital Records birth **file**) and those observations excluded **from the final analysis file**.

---

<sup>5</sup>Volume 2 of this report will describe in detail the process by which the Medicaid, WIC, and Vital Records data were linked.

Table **III.1** presents some summary data on the number of Medicaid mothers and newborns in each of the **five** study states. Florida and Texas had the largest number of Medicaid mothers and **newborns**, while **Minnesota** and South Carolina had the **smallest**.<sup>6</sup> With the exception of South Carolina, the Medicaid mothers who were included in the **final** analysis ranged **from** nearly 94 percent to 97 percent of **all** Medicaid mothers, while the Medicaid newborns included in the **final** analysis were between 97 and 98 percent of all Medicaid newborns. The percentages for South Carolina were lower than for the other states for two reasons: (1) birth **certificates** for **out-of-state** residents who gave birth in South Carolina were not available, so that Medicaid births to out-of-state residents could not be matched to a birth **record**; and (2) less identifying information from the Medicaid **files** was available in South Carolina relative to the other four **states**.

**Overall**, the **WIC/Medicaid analysis database** includes nearly **105,000** Medicaid **births**.<sup>7</sup> The proportion of these births **occurring** to WIC participants varied considerably **across** the study states, ranging **from** nearly **one-half of the Medicaid births in Texas** to **almost** threequarters of the Medicaid births in South **Carolina**. (See Table **III.2**.) Average Medicaid costs **from** birth to 60 days after birth for newborns were available only for North Carolina and Texas, and were similar in

---

<sup>6</sup>The number of Medicaid mothers and newborns **from** Florida was greater than **from** Texas because the study period in **Texas** was only six months. On an annual basis, Texas had the greatest number of Medicaid **births** of the study **states**.

<sup>7</sup>Medicaid births include **all** birth events. Birth events are **defined** as one of the following three **possibilities**: (1) a Medicaid mother/newborn pair matched to a newborn birth **certificate**; (2) a Medicaid newborn (no Medicaid mother identified) matched to a **newborn** birth **certificate**; and (3) a Medicaid mother (no Medicaid newborn **identified**) matched to a newborn birth **certificate**.

TABLE III.1

NUMBER OF MEDICAID **MOTHERS** AND NEWBORNS

	<b>Florida</b>	<b>Minnesota</b>	<b>North Carolina</b>	<b>South Carolina</b>	<b>Texas</b>
<b>All Medicaid Mothers</b>	<b>32,967</b>	10,842	19,721	11,671	24,475
<b>Medicaid Mothers Included in the Analysis<sup>a</sup></b>	<b>32,033</b>	<b>10,450</b>	<b>18,501</b>	10,462	23,534
<b>Percent of All Medicaid Mothers</b>	97.1 %	<b>96.4 %</b>	93.8%	89.6 %	<b>96.2 %</b>
<b>All Medicaid Newborns</b>	<b>26,662</b>	<b>10,313</b>	14,450	<b>12,781</b>	25,767
<b>Medicaid Newborns Included in the Analysis<sup>a</sup></b>	<b>25,873</b>	10,153	<b>18,091</b>	<b>11,358</b>	<b>25,097</b>
<b>Percent of AU Medicaid Newborns</b>	97.0 %	<b>98.5 %</b>	98.1%	88.9%	97.4 %

**SOURCE:** WIC/Medicaid database for Florida, Minnesota, North Carolina, South Carolina, and Texas.

<sup>a</sup>Observations included in the analysis are those Medicaid mothers or newborns that were matched with a Vital Records birth certificate.

TABLE IIL2

**DESCRIPTIVE DATA ON MEDICAID BIRTHS: NUMBER OF BIRTHS,  
AVERAGE MEDICAID COSTS, AND BIRTHWEIGHT**

	Florida	Minnesota	North Carolina	South Carolina	Texas
Medicaid Births	<b>35,558</b>	<b>11,592</b>	20,441	11,641	<b>25,472</b>
To WIC Participants	20,476	<b>7,977</b>	14,039	<b>8,543</b>	<b>12,180</b>
To Nonparticipants	15,082	<b>3,615</b>	<b>6,402</b>	<b>3,098</b>	<b>13,292</b>
<b>Percent WIC Participants</b>	<b>57.6 %</b>	<b>68.8%</b>	<b>68.7%</b>	<b>73.4 %</b>	<b>47.8 %</b>
Average Medicaid Costs <sup>a</sup>					
<b>Newborns</b>	<b>n.a.</b>	<b>n.a.</b>	\$1,733	<b>n.a.</b>	\$1,867
<b>Newborns and Mothers</b>	<b>\$2,569</b>	<b>\$3,822</b>	\$2743	<b>\$2,433<sup>b</sup></b>	\$3,248
Average Birthweight (grams)	<b>3,181</b>	<b>3,295</b>	<b>3,143</b>	<b>3,103</b>	<b>3,191</b>
<b>Percent Low Birthweight<sup>c</sup></b>	<b>11.7 %</b>	<b>8.6 %</b>	<b>12.8 %</b>	<b>12.9 %</b>	<b>10.7 %</b>

**SOURCE:** WIC/Medicaid database for Florida, Minnesota, North Carolina, South Carolina, and Texas.

**NOTE:** Medicaid births include all Medicaid mothers and newborns that were matched with a Vital Records birth certificate.

- I.&xks Medicaid costs from birth to 60 days after bii Bii with costs  $\leq$  \$200 are excluded.

<sup>b</sup>Includes hospital costs only.

<sup>c</sup>Birthweight of less than 2,500 grams (5.5 pounds).

magnitude (\$1,733 and \$1,967, **respectively**).<sup>8</sup> In contrast, the average Medicaid costs for mothers and newborns showed greater variation across the states, ranging from a low of \$2,433 in South Carolina (hospital costs only) to \$3,822 in Minnesota. Birth outcome data indicate that the average birthweight of Medicaid newborns in the study states was around seven pounds (3,190 grams), and approximately 11.5 percent of the Medicaid newborns **were low birthweight** (a **birthweight** of less than **2,500** grams, or **5.5** pounds). The average birthweight of Medicaid newborns ranged **from** 3,103 grams (6.83 pounds) in South Carolina to 3,295 grams (**7.25** pounds) in Minnesota. The percentage of low birthweight newborns was highest in **North** Carolina and South Carolina (128 and 129 percent, **respectively**) and lowest in **Minnesota** (8.6 percent).

**For the purposes of this study, it is important to realize that the study population consisted of a very low-income group of women and that the socioeconomic characteristics of the study populations in five states were not comparable during the study period. At the two extremes, Minnesota was covering pregnant women whose incomes were up to 88 percent of the poverty level (\$7,969 for a family of three), whereas Texas was covering only pregnant women whose incomes were up to 33 percent of the poverty level (\$2,988 for a family of three). In Florida, North Carolina, and South Carolina, income eligibility changed from below 50 percent of the poverty level in the first quarters of the study year to 100 percent of the poverty level in the last quarter of the year. However, because eligibility expansions typically require a considerable start-up period, the full impact of this change may not have been felt until 1988. Thus, the Medicaid mothers and newborns in this study were very poor with incomes well below the WIC income eligibility limit of 185 percent of poverty. The differences in Medicaid income eligibility across the states during the study period may have a significant effect on the study findings and must be considered when the implications of the analysis**

---

<sup>8</sup>North Carolina and Texas were the only two study states in which newborns automatically received their own Medicaid number, and claims for all newborns appeared under their own number. In the remaining study states, claims for normal healthy newborns often appeared under the claims for the mother, and it was not possible to distinguish the newborn's Medicaid costs from the mother's Medicaid costs. In addition, in South Carolina, it was not possible to separate physician claims for the prenatal period from claims for the 60-day postpartum period; thus, only hospital costs are considered in South Carolina.

findings are assessed within the context of current **income** eligibility standards.

## B. THE CHARACTERISTICS OF WIC PARTICIPANT AND NONPARTICIPANT MEDICAID MOTHERS

The major analytic challenge to this study was to develop an accurate measure of the Medicaid costs that would have been incurred by WIC participants had they not participated in the WIC program. To meet this challenge, the data **described** above were used to compare the Medicaid costs of WIC participants with those of nonparticipants. However, WIC participants may differ **from** nonparticipants in terms of other factors that may also influence Medicaid costs, and it is necessary to identify and adjust for these differences in order to obtain an accurate estimate of the effects of prenatal WIC participation. This section presents descriptive data on the available demographic and prenatal care characteristics of **Medicaid-eligible** WIC participants and nonparticipants.

### Demographic Characteristics

The age distribution of **Medicaid-eligible** WIC participants and nonparticipants in the Eve study states did not **differ** greatly. As shown in Table III.3, mean age of the women in the study varied from 22 in North Carolina and South Carolina to 24 in Minnesota, with approximately two-thirds or more of the women in all states between the ages of 20 and 34. Minnesota had the smallest proportion of women under 18 (8 percent of both Medicaid-eligible **WIC** participants and nonparticipants), while other states had higher proportions of these younger women (between 10 and 15 percent).

The racial composition of Medicaid-eligible WIC participants and nonparticipants varied somewhat within states, perhaps reflecting differences in WIC outreach or racial/cultural preferences for the use of health care and publicly funded **health-care** programs. White women consistently comprised a smaller proportion of WIC participants than nonparticipants. This difference was particularly pronounced in North Carolina and Texas. In North Carolina, white women comprised **40** percent of nonparticipants but only 35 percent of WIC participants, while in Texas white women comprised 28 **percent** of nonparticipants and 17 percent of WIC participants. Even in Minnesota, in which the majority of both WIC participants and nonparticipants were white, **80** percent of nonparticipants and 74 percent of WIC participants were white.

TABLE III.3

## DEMOGRAPHIC CHARACTERISTICS OF MEDICAID MOTHERS

	Florida		Minnesota		North Carolina		South Carolina		Texas	
	WIC Participants	Non-Participants								
Mean Age (years)	22.9	23.1	23.6	23.3	22.1	22.5	22.2	22.5	22.9	22.7
Age										
Less than 18	13.3 %	10.2 %	7.7 %	7.5 %	15.1 %	11.4 %	13.2 %	13.0 %	12.0 %	10.4 %
18 to 19	16.8	16.7	16.7	17.6	19.4	18.5	20.4	18.2	17.9	20.0
20 to 34	66.6	70.0	71.4	71.0	63.4	67.4	64.2	66.1	66.4	66.1
35 or older	3.4	3.0	4.2	3.9	2.1	2.7	2.3	2.7	3.8	3.5
Race <sup>a</sup>										
White	42.9 %	44.5 %	74.0 %	80.2 %	35.3 %	40.3 %	25.3 %	27.5 %	17.1 %	28.3 %
Black	47.9	45.0	9.5	9.1	64.7	59.7	74.7	72.5	27.0	28.5
Hispanic	8.5	9.9	--	--	--	--	--	--	52.1	37.1
Native American	--	--	7.1	7.0	--	--	--	--	--	--
Asian	--	--	9.0	3.0	--	--	--	--	--	--
Unknown	.7	.7	.4	.7	--	--	--	--	3.9	6.1
Marital Status										
Married	34.5 %	35.8 %	54.7 %	62.9 %	32.1 %	31.4 %	29.7 %	30.6 %	50.4 %	44.9 %
Unmarried	65.5	64.2	45.3	37.1	67.8	68.6	70.3	69.4	49.6	55.1
Mean Years of Education	11.0	11.2	11.4	11.8	11.1	11.3	11.1	11.2	n.a.	n.a.
Education										
Less than 9 years	8.6 %	7.2 %	4.8 %	2.6 %	7.4 %	5.6 %	7.6 %	6.5 %	n.a.	n.a.
9-11 years	39.5	37.8	27.6	25.1	39.4	37.2	38.2	38.4		
12 years	41.3	41.9	43.1	44.4	42.5	43.2	44.0	42.2		
13 or more years	10.3	12.5	14.3	17.4	10.4	13.8	9.8	12.1		
Unknown	.4	.6	10.3	10.5	.2	.2	.4	.9		
Number of Medicaid Births	20,476	15,082	7,977	3,615	14,039	6,402	8,543	3,098	12,180	13,292
Percent of Total	57.6	42.4	68.8	31.2	68.7	31.3	73.4	26.6	47.8	52.2

SOURCE: WIC/Medicaid database for Florida, Minnesota, North Carolina, South Carolina and Texas.

<sup>a</sup>Racial breakdowns of samples differed across states. In North Carolina and South Carolina, a very small number of women classified neither as white nor black are included with the black women. In Texas, "white" means "white, nonspanish," "black" means "black, nonspanish" and "Hispanic" is predominantly Mexican.

The racial composition of the Medicaid populations varied considerably across the study states. Minnesota had the greatest proportion of white women and roughly equal proportions of black, Native **American, and** Asian women (though 9 percent **of WIC** participants were Asian, compared with 3 percent nonparticipants). Texas contained a smaller proportion of white women and a higher proportion of Hispanic women (**primarily** Mexican), particularly among WIC participants (52 percent of participants versus 37 percent of nonparticipants were Hispanic). In Texas, black women comprised just over a quarter of **WIC** participants and nonparticipants: 27 percent and 29 percent, respectively. In Florida, equal proportions of WIC participants and nonparticipants were either white or black (approximately 45 percent) and the remaining 10 percent of each group were Hispanic North Carolina and South **Carolina were** predominantly black. In North Carolina, 65 percent of the WIC participants were black compared with 60 percent of nonparticipants, while in South Carolina 75 percent **of WIC participants were** black, compared with 73 percent of **nonparticipants**.

Some **differences** in the marital status of WIC participants and nonparticipants were also **observed** in **Minnesota** and Texas, but not in Florida, North Carolina, or South Carolina. In **Minnesota**, 55 percent of **WIC** participants and 63 percent of nonparticipants were married, while in Texas 50 percent of **WIC** participants and 45 percent of nonparticipants were **married**. However, in Florida, North Carolina, and South Carolina, approximately **one-third** of both **WIC** participants and nonparticipants were **married**.

In the four states for which information on the educational level of the mother was available **from** birth **certificates** (every state but Texas), the average number of years of school completed was 11. However, in each state, a larger proportion of WIC participants than nonparticipants had not reached high school, and a smaller proportion of WIC participants than nonparticipants had an education beyond high **school**.

### Prenatal Care Characteristics

In contrast to fairly minor differences in demographic characteristics, differences in the **adequacy** of prenatal care for **WIC** program participants and nonparticipants are more **striking**.<sup>9</sup> In all **five** states, Medicaid mothers who did not participate in the **WIC** program were approximately two to three times as likely to have received inadequate prenatal care as **WIC** participants. (See Table 311.4.) Overall, 9.6 percent of the **WIC** participants in the five study **states** received inadequate levels of prenatal care, in contrast to **22.4** percent of nonparticipants. **WIC** participants in all five states also had, on average, one to **two** more prenatal visits than nonparticipants. The number of prenatal care visits ranged from 8.9 to 11.2 for **WC** participants as compared with from **7.1** to 9.2 for nonparticipants. **WIC** participants were also more likely to have had any prenatal care than nonparticipants. **These** findings are not surprising since access to prenatal care for low-income women and **WIC** program participation are linked in many states. However, this **finding** has important implications for the analysis of Medicaid cost savings since it is important to distinguish between the effects of **WIC** participations and the effects of the adequacy of prenatal care on Medicaid costs.

Large differences in the **adequacy** of prenatal care are also observed across the study states. Medicaid births to **WIC** participants receiving inadequate care ranged from roughly **5** percent in North Carolina to **14** percent in Texas, **and** births to nonparticipants receiving inadequate care ranged from nearly 15 percent in Minnesota to **28** percent in South Carolina. Both North Carolina and Minnesota had relatively high proportions of Medicaid mothers receiving adequate prenatal care and low

---

<sup>9</sup>The **adequacy** of prenatal care was measured with a **modified Kessner** Index used by the National Center for Health Statistics. The **Kessner** Index combines information on the timing of entry into prenatal care with the number of visits recorded and the length of the **pregnancy** gestation. Thus, for **example**, for a full-term pregnancy, adequate prenatal care is defined as nine or more visits, with the **first** visit occurring during the first trimester of pregnancy, and inadequate care is **defined** as four or fewer visits. Intermediate care for a full-term pregnancy encompasses all levels of prenatal care in between the two extremes. Adequate prenatal care for preterm births (births of less than 37 weeks of gestational age) requires a decreasing number of visits as the length of **the gestation decreases**.

**TABLE III.4**  
**PRENATAL CARE CHARACTERISTICS OF MEDICAID MOTHERS**

	Florida		Minnesota		North Carolina		South Carolina		Texas	
	WIC Participants	Non-Participants								
<b>Keener Index<sup>a</sup></b>										
Adequate	40.1 %	32.5 %	42.9 %	36.1 %	51.9 %	40.3 %	33.7 %	25.4 %	34.8 %	26.9 %
Intermediate	47.9	41.2	35.5	32.8	41.0	38.7	51.0	44.2	42.8	40.5
Inadequate	9.1	22.6	7.8	14.6	4.9	18.2	13.6	28.0	14.2	25.0
Unknown	3.0	3.7	13.8	16.6	2.1	2.8	1.6	2.4	8.1	7.7
<b>Mean Number of Prenatal Visits</b>	10.3	8.3	9.8	8.7	11.2	9.2	8.9	7.1	9.1	7.7
<b>Prenatal Visits</b>										
No visits	1.7 %	11.1 %	.9 %	4.3 %	0.5 %	8.4 %	1.3 %	10.2 %	3.2 %	9.3 %
1-2 visits	2.5	5.4	1.9	4.2	1.4	5.6	4.0	8.4	4.2	7.1
3-6 visits	14.7	17.4	14.3	16.1	11.1	15.3	22.6	26.5	20.8	24.1
7-10 visits	39.7	36.3	33.1	30.0	27.6	24.9	37.7	30.5	35.5	30.8
11-12 visits	15.5	12.1	19.6	16.7	26.8	22.3	17.0	12.0	14.5	11.7
13 visits or more	24.9	16.6	17.2	13.1	32.4	23.1	16.3	10.9	18.0	13.3
Unknown	1.0	1.2	13.0	15.6	0.2	0.4	1.1	1.6	4.4	3.8
<b>Number of Medicaid Births</b>	20,476	15,082	7,977	3,615	14,039	6,402	8,543	3,098	12,180	13,292
<b>Percent of Total</b>	57.6	42.4	68.8	31.2	68.7	31.3	73.4	26.6	47.8	52.2

**SOURCE:** WIC/Medicaid database for Florida, Minnesota, North Carolina, South Carolina and Texas.

<sup>a</sup>The Keener Index, as modified by the National Center for Health Statistics, combines information on the timing of entry into prenatal care with the number of visits recorded and the length of the pregnancy gestation. Thus, for example, for a full-term pregnancy, adequate prenatal care is defined as nine or more visits, with the first visit occurring during the first trimester of pregnancy, and inadequate care is defined as four or fewer visits. Intermediate care for a full-term pregnancy encompasses all levels of prenatal care in between the two extremes. Adequate prenatal care for preterm births (births of less than 37 weeks of gestational age) requires a decreasing number of visits as the length of gestation decreases.

proportions **receiving inadequate** care, while the opposite is true for South Carolina and Texas.<sup>10</sup>

### C. SUMMARY

The data used for the analysis of the savings in Medicaid costs from birth to 60 days after birth resulting from prenatal **WIC** participation includes almost 105,000 Medicaid births, representing all Medicaid-covered births in 1987 in Florida, Minnesota, North Carolina, and South Carolina and in the **first** six months of 1988 in Texas. The percentage of these births that were to women who participated in the WIC program during pregnancy ranged from 47.8 percent in Texas to 73.4 percent in South Carolina, with intermediate values for Florida, Minnesota, and North Carolina.

The demographic characteristics of Medicaid mothers varied considerably across the **five** study states, but the differences between **WIC** participants and nonparticipants in any particular state were less marked. The most striking differences arise between Minnesota and the other four states; Minnesota contained a significantly lower percentage of young teenage Medicaid mothers and much higher percentages of married and white Medicaid mothers than the other four states. Texas and Florida were the only **two** study states with significant Hispanic populations, but the proportion of Hispanic mothers in Texas was much greater than in Florida. Within any particular state, **Medicaid-eligible WIC** participants and nonparticipants generally had similar age, educational, and **marital-**status characteristics (with some small exceptions), but racial and ethnic differences occurred in Minnesota and Texas. In Minnesota, **Medicaid-**eligible **WIC** participants included a greater proportion of Asians than did nonparticipants. In Texas, Medicaid-eligible WIC participants were considerably more likely to be Hispanic than were nonparticipants.

In all five **states**, Medicaid-eligible WIC participants were noticeably more likely than nonparticipants to have received **adequate** prenatal care and **less** likely to have received inadequate prenatal care. This finding has important implications for analyzing the relationship between Medicaid costs and prenatal **WIC** participation. That is, since both the adequacy of

---

<sup>10</sup>**Due** to the relatively high proportion of Medicaid mothers in Minnesota for whom the **adequacy** of prenatal care was unknown, the Minnesota data should be interpreted carefully.

prenatal care and prenatal **WIC** participation may influence Medicaid **costs**, it is critical to be able to isolate the savings in Medicaid **costs** due to prenatal **WIC** participation **from** the savings attributable to the adequacy of prenatal care.

#### IV. THE EFFECTS OF PRENATAL WIC PARTICIPATION ON MEDICAID COSTS AND BIRTH OUTCOMES

This chapter provides estimates of the effects of prenatal **WIC** participation on the savings in Medicaid costs from birth to 60 days after birth and on birth outcome measures. It begins with a brief discussion of the methodology and continues with a discussion of the main results of the analysis. Based on the Medicaid cost savings associated with prenatal **WIC** participation and data on **WIC** costs, benefit-cost ratios are presented to show the estimated savings in Medicaid costs per dollar spent on the prenatal component of the **WIC** program.

The results of the analysis show considerable Medicaid cost savings for prenatal **WIC** participants. For newborns and mothers, the estimated savings in Medicaid reimbursements from birth to 60 days after birth range from \$277 in Minnesota to \$598 in North Carolina. The associated benefit-cost ratios range from 1.77 in Florida to 3.13 in North Carolina, indicating that for every dollar spent on the prenatal **WIC** program, the associated **savings** in Medicaid costs for newborns and mothers during the **first 60** days after birth are between \$1.77 (Florida) and \$3.13 (North Carolina). For newborns only, the estimated savings in Medicaid costs **from** birth through 60 days are \$744 in North Carolina and \$573 in Texas, with associated benefit-cost ratios of 3.99 and 2.84, respectively.

The savings in Medicaid costs due to prenatal **WIC** participation are supported by the findings from the analysis of birth outcomes. Increased newborn birthweight is associated with prenatal **WIC** participation by Medicaid recipients in all five states, with estimates ranging from an increase in birthweight of 51 grams in Minnesota to 117 grams in North Carolina. The probabilities of having a low-birthweight newborn or a preterm birth are also lower for Medicaid-eligible **WIC** participants than for nonparticipants.

##### A METHODOLOGY

Data **from** the constructed WE/Medicaid databases in Florida, Minnesota, North Carolina, South Carolina, and Texas were used to assess the savings in Medicaid costs from birth to 60 days after birth and to examine differences in birth outcomes due to prenatal participation in the **WIC** program. These databases include all Medicaid-covered births in 1987 (the **first** six months of 1988 in Texas) and contain information on Medicaid costs, **WIC** participation and costs, birthweight and other measures of pregnancy outcomes, the adequacy of prenatal care, and

maternal demographic characteristics, such as age, race, education, marital status, and number of previous live births and pregnancy terminations.

The basic analytic approach for measuring the savings in Medicaid costs and **differences** in birth outcomes attributable to the **WIC** program was to compare the Medicaid costs and birth outcomes of WIC participants with the Medicaid costs and birth outcomes of a comparison group. The comparison group used in this study consists of a group of Medicaid mothers, and their newborns, who did not participate in the WIC program during their pregnancy (nonparticipants).<sup>7</sup> Such a comparison group was critical for providing information on what the Medicaid costs and birth outcomes for **WIC** participants would have been had the **WIC** program not existed.

One potential problem with this comparison-group approach is that both the observed and the unobserved characteristics of WIC participants may differ from those of comparison women who do not participate in the **WIC** program. Thus, the key analytic issue in assessing the savings in Medicaid costs is how to isolate the effects of prenatal **WIC** participation on Medicaid **costs** from the effects of other characteristics.

The methodological approach of this study was to use multiple regression analysis to control for the measured differences between **WIC** participants and nonparticipants. Regression analysis provided estimates of the effects of the **WIC** program that are independent of other measured characteristics that also affect savings in Medicaid **costs** for mothers and newborns. For example, if Medicaid reimbursements from birth to 60 days after birth were lower for women who received adequate prenatal care, and if WIC participants were more likely than nonparticipants to receive adequate prenatal care, then a simple comparison of Medicaid

---

<sup>7</sup>This approach was used by Wayne Schramm at the Missouri Center for Health Statistics to estimate **the** effects of prenatal participation in the MC program on Medicaid costs in Missouri (**Schramm, 1985, 1986, and 1989**). **Schramm** estimated benefit-cost ratios for prenatal **WIC** participation in the state of Missouri at three points in time--1980, 1982, and 1985-86. **In** all three studies, the results indicated that significant savings in Medicaid **costs** were associated with prenatal WIC participation, although all the estimated benefit-cost ratios were less than 1.0, suggesting that the estimated savings in Medicaid costs in Missouri were less than the **costs** of providing prenatal WIC benefits.

reimbursements for **WIC** participants with those for nonparticipants would overstate the true effect of **WIC** participation, since some of the difference can be attributed to the adequacy of prenatal care. However, multiple regression analysis provides estimates of the relationship between Medicaid reimbursements and **WIC** participation that isolate the effects of **WIC** participation from the effects of adequate prenatal care.<sup>2</sup> The fact that multiple regression analysis can adjust for measured differences in individual characteristics, thereby more closely identifying the actual effects of prenatal **WIC** participation, makes it a powerful analysis tool.

However, estimating the effects of the **WIC** program can be complicated considerably if unobserved or unmeasured differences between **WIC** participants and nonparticipants also influence pregnancy outcomes and Medicaid costs. For example, relative to other eligible women who do not participate in the **WIC** program, **WIC** participants may have a better understanding of the availability of and types of benefits provided by the social service delivery system. Such differences might lead to favorable pregnancy outcomes, and thus to lower Medicaid costs, even in the absence of the **WIC** program. Because this type of difference is largely unmeasured, particularly with the type of data available for this study, it is very difficult to isolate the effects of **WIC** participation from those of pre-existing differences on Medicaid costs. This issue will be discussed in detail in Volume 2 of this report.

The statistical analysis of the savings in Medicaid costs focused on maternal and newborn reimbursements from birth to 60 days after birth. In addition to prenatal **WIC** participation, the following characteristics were assumed to be important predictors of Medicaid cost savings: the sex of the newborn, multiple births, mother's age, mother's race/ethnicity, the adequacy of prenatal care, marital status, the number of previous live births, the number of previous pregnancy terminations, mother's

---

<sup>2</sup>This is true only if prenatal participation and the adequacy of prenatal care are not perfectly correlated. If prenatal **WIC** participants and women who receive adequate prenatal care are the exact same group of women, then perfect multicollinearity exists and multiple regression analysis is not able to separate the effects of the adequacy of prenatal care and prenatal **WIC** participation. In this study, although prenatal adequacy and prenatal **WIC** participation are correlated, the correlation is not perfect (the correlation coefficients range from .13 to .16) and perfect or severe multicollinearity is not a problem.

education, and whether the county of residence is urban or rural. Descriptive data on most of these characteristics were presented and discussed earlier in Chapter III.

## B. **THE RESULTS OF THE ANALYSIS OF MEDICAID COSTS FROM BIRTH TO 60 DAYS AFTER BIRTH**

The principal finding from the analysis of Medicaid costs is that prenatal **WIC** participation is associated with substantial savings in Medicaid costs during the first 60 days after birth. In all **five** states, average predicted Medicaid costs from birth to 60 days after birth for women who did not participate in the **WIC** program exceeded predicted Medicaid costs for women who did participate, as shown in Figures IV.1 and IV.2.<sup>3</sup> The difference between the predicted Medicaid costs with and without the **WIC** program are the regression estimates of the Medicaid cost savings, which are presented in Table IV.1.<sup>4</sup> Prenatal participation in the **WIC** program is associated with reductions in Medicaid costs for mothers and newborns combined that ranged from \$277 in Minnesota to \$598 in North Carolina, with intermediate values of \$347, \$493, and \$565 for Florida, Texas, and South Carolina (**hospital** costs only), respectively.

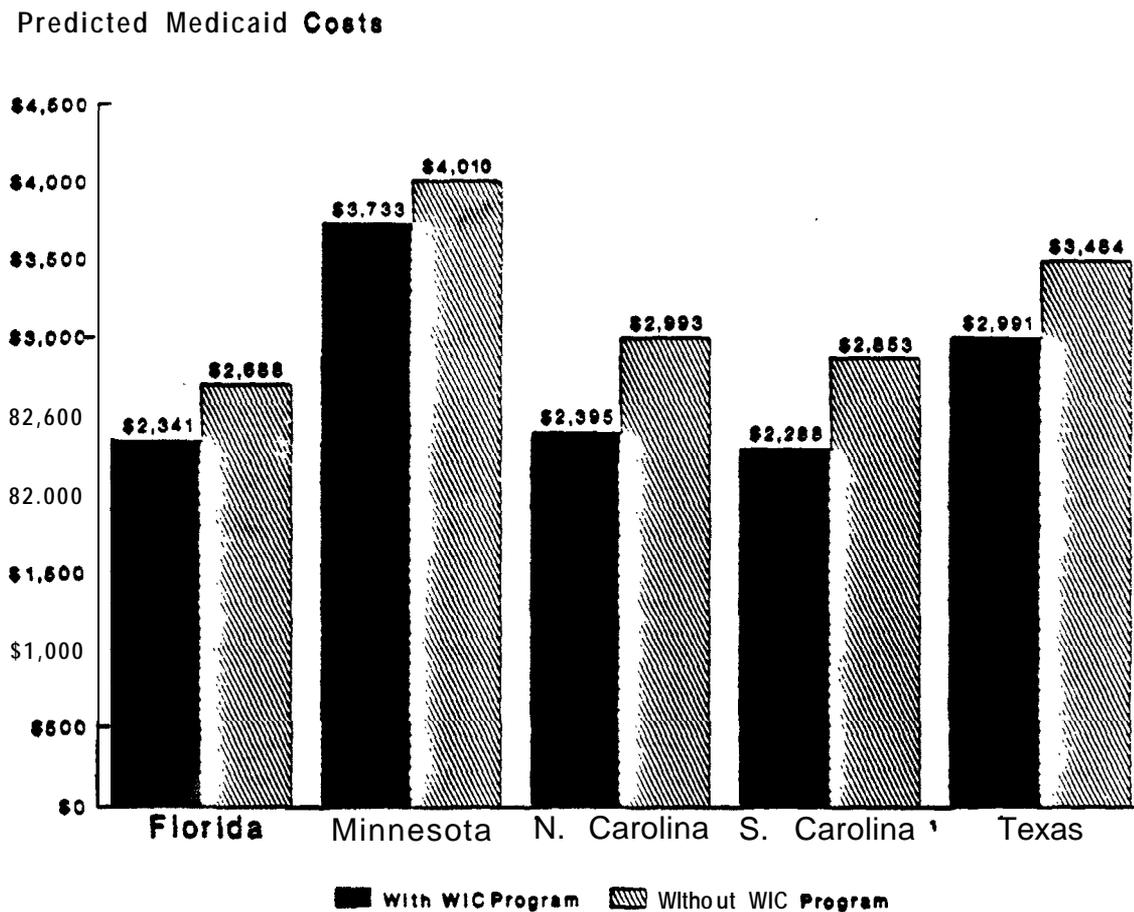
In North Carolina and Texas (the only two states in which maternal and newborn Medicaid costs could be separated), the estimated savings in newborn Medicaid costs due to prenatal **WIC** participation were even greater than the estimated savings in combined maternal and newborn Medicaid costs. Specifically, estimated savings in newborn Medicaid costs from birth through 60 days were **\$744** in North Carolina and **\$573** in

---

<sup>3</sup>**Predicted** Medicaid costs are the regression-adjusted mean values of Medicaid costs under two scenarios: (1) all births were to **WIC** participants; and (2) **all** births were to nonparticipants.

<sup>4</sup>Complete sets of regression estimates of the determinants of Medicaid costs, including the effects of the individual characteristics described above, are presented in Appendix Tables A1 through A.5. With the exception of the estimates for Minnesota, all the estimates presented in Table IV.1 differ statistically from **zero** at the **.01** level of significance (two-tailed test), and the estimate for Minnesota differs statistically from **zero** at the **.07** level of significance (two-tailed test) and is statistically greater than zero at the **.03** level of significance (one-tailed test).

**FIGURE IV.1**  
**PREDICTED MEDICAID COSTS FROM**  
**BIRTH TO 60 DAYS AFTER BIRTH,**  
**NEWBORNS AND MOTHERS**



1 Medicaid costs refer to hospital costs only

**FIGURE IV.2**  
**PREDICTED MEDICAID COSTS**  
**FROM BIRTH TO 60 DAYS AFTER BIRTH,**  
**NEWBORNS**

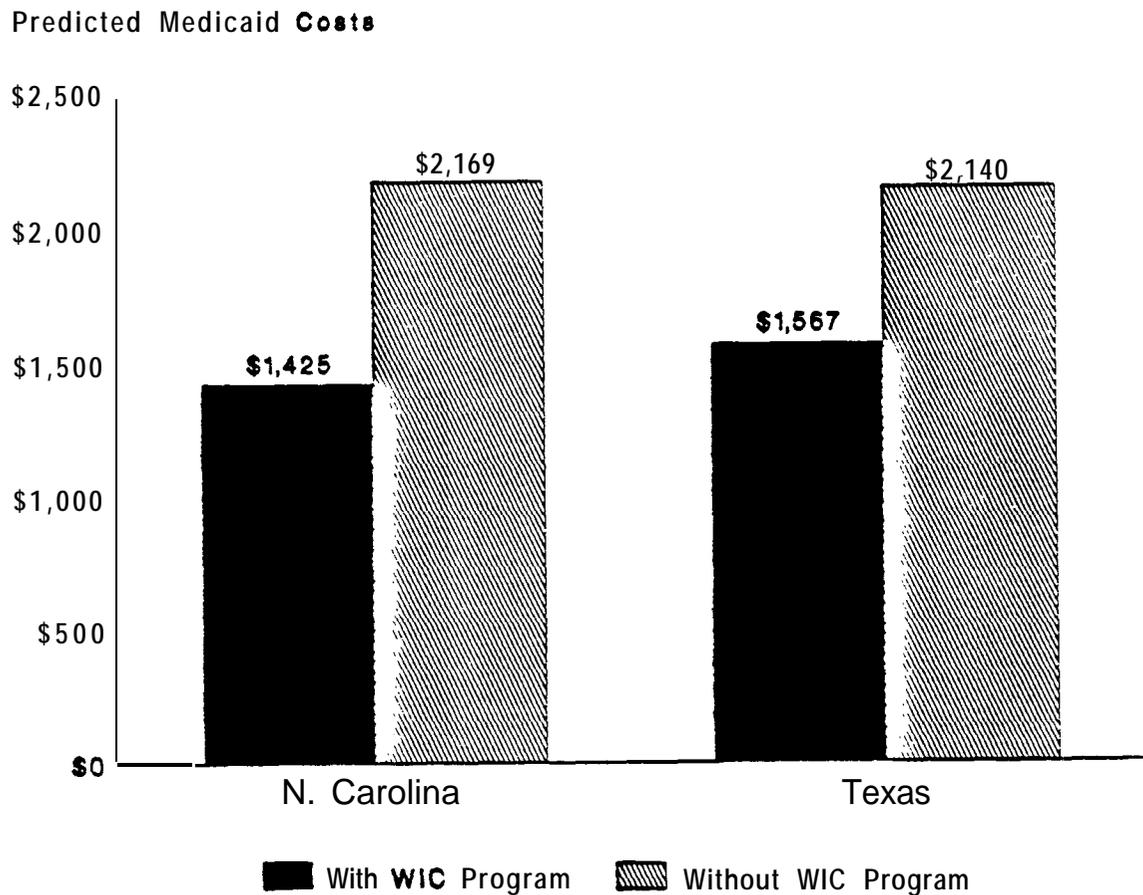


TABLE IV.1

SAVINGS IN MEDICAID COSTS FROM BIRTH TO 60 DAYS AFTER BIRTH ASSOCIATED WITH PRENATAL PARTICIPATION IN THE WIC PROGRAM

	Average Medicaid Costs		Estimated Savings in Medicaid Costs <sup>a</sup>
	With WIC Program	Without WIC Program	
Florida Newborns and Mothers	<b>\$2,341</b>	<b>\$2,688</b>	<b>\$347</b>
<b>Minnesota</b> Newborns and Mothers	\$3,733	\$4,010	\$277
<b>North Carolina</b> Newborns Newborns and Mothers	31,425 <b>\$2,395</b>	<b>\$2,169</b> <b>\$2,993</b>	<b>\$744</b> \$598
<b>South Carolina<sup>b</sup></b> Newborns and Mothers	<b>\$2,288</b>	<b>\$2,853</b>	<b>\$565</b>
<b>Texas</b> Newborns Newborns and Mothers	<b>\$1,567</b> <b>\$2,991</b>	<b>\$2,140</b> <b>\$3,484</b>	\$573 <b>\$493</b>

SOURCE: WIC/Medicaid database for Florida, Minnesota, North Carolina, South Carolina, and Texas.

NOTE: Medicaid costs are from birth to 60 days after birth. Complete sets of regression estimates are presented in Appendix A and in Volume 2 of this report.

<sup>a</sup>All estimated savings in Medicaid costs are statistically significant at the .01 level (two-tailed test), except in Minnesota where the estimate is statistically significant at the .07 level (two-tailed test) and at the .03 level (one-tailed test).

<sup>b</sup>Medicaid costs refer to hospital costs only.

Texas. This finding reflects two phenomena: (1) high health care costs after birth are usually associated with **high-cost** newborns rather than mothers; and (2) some very high-cost newborns, whose mothers were not Medicaid-eligible during pregnancy, become eligible for Medicaid due to their high costs.

The benefit-cost ratios presented in Table IV.2 show the **estimated** savings in Medicaid costs per dollar of **WIC** program costs—the **cost** of the **WIC** supplemental food benefits plus an adjustment for administrative and nutrition education expenses. (See Chapter **III** for a discussion of **WIC** program costs.) All benefit-cost estimates are greater than one, suggesting that the **WIC** program is cost-effective, with the benefits of prenatal **WIC** participation (that is, savings in Medicaid costs from birth to 60 days after birth) exceeding the costs of providing benefits. For newborns and mothers, these estimates vary across states, ranging from 1.77 in Florida to 3.13 in North Carolina, with values of 1.83 for Minnesota and 2.44 for both South Carolina and Texas. For newborns only, the benefit-cost estimates are 3.90 in North Carolina and 2.84 in Texas. Thus, for every dollar spent on the prenatal **WIC** program, the associated savings in Medicaid costs during the first 60 days after birth range from \$1.77 to \$3.13 for newborns and mothers and from \$2.84 to \$3.90 for newborns only?

---

‘These benefit-cost ratios are larger than those obtained by Schramm for the state of Missouri (1985, 1986, and 1989). Among others, one important difference between this study and the studies by Schramm is the definition of Medicaid costs **from** birth to 60 days after birth. The definition in this study includes reimbursements for all Medicaid claims with a **start** date of service at or before 60 days after birth, and claims that extend beyond the **60-day** postpartum period are prorated according to the proportion of the claim period that **falls** within the **60-day** postpartum period. The definition used in the Schramm studies includes **reimbursements** for all Medicaid **claims** with an **end** date of service at or before the cutoff date (30 days in 1980, and 45 days in 1982 and 198586). Thus, the definition of Medicaid costs in this study is more inclusive and includes higher-cost births, particularly those with claims that extend beyond the postpartum period. Yet a third definition of Medicaid costs from birth through 60 days, and one that will be discussed in Volume 2, includes all costs (i.e., no prorating) for claims with a **start** date of service within 60 days of birth. Thus, the definition used **for the analysis** results presented in this **volume** is in the middle between the more **inclusive** and less exclusive of the possible definitions of Medicaid **costs** from birth through 60 days.

TABLE IV.2

## ESTIMATED BENEFIT-COST RATIOS

	Estimated Savings in Medicaid Costs <sup>a,b</sup>	Estimated Prenatal WIC Costs per Participant	Estimated Benefit-Cost Ratios <sup>b</sup>
<b>Florida</b>			
Newborns and Mothers	\$347	\$196	1.77
<b>Minnesota</b>			
Newborns and Mothers	\$277	\$151	1.83
<b>North Carolina</b>			
Newborns	\$744	\$191	3.90
Newborns and Mothers	\$598	\$191	3.13
<b>South Carolina<sup>c</sup></b>			
Newborns and Mothers	\$565	\$232	2.44
<b>Texas</b>			
Newborns	\$573	\$202	2.84
Newborns and Mothers	\$493	\$202	2.44

SOURCE **WIC/Medicaid** database for Florida, Minnesota, **North Carolina**, **South Carolina**, and **Texas**.

<sup>a</sup>Medicaid costs are **from** birth to 60 days after birth.

<sup>b</sup>All estimates are statistically **significant** at the .01 level (two-tailed test), **except in Minnesota** where the estimate is statistically **significant** at the .07 level (two-tailed test) and at the .03 level (one-tailed test).

<sup>c</sup>Medicaid costs refer to hospital costs only.

Two points must be considered when these results are interpreted. First, the estimated savings in Medicaid costs from birth to 60 days after birth that are associated with prenatal WIC participation are independent of the effects of prenatal care on Medicaid costs. Table IV.3 presents estimates of the separate effects of prenatal WIC participation and the adequacy of prenatal care on the savings in Medicaid costs from birth to 60 days after birth. These estimates indicate that considerable Medicaid cost savings during the 60-day postpartum period were associated with adequate or intermediate levels of prenatal care, ranging from \$267 for newborns and mothers in Florida to \$1,005 for newborns and mothers in Minnesota. Thus, for Medicaid-eligible women who both participate in the WIC program during pregnancy and receive adequate or intermediate levels of prenatal care, the associated savings in Medicaid costs are substantial.

The second important point is that the estimated savings in Medicaid costs associated with prenatal WIC participation are not independent of any unmeasured or unobserved differences between WIC participants and nonparticipants that may also influence birth outcomes and Medicaid costs. WIC participants are a self-selected group of women who may choose to participate in the WIC program for underlying reasons that may independently lead to lower Medicaid costs. For example, some pregnant women may not participate in the WIC program because they lack access to public health programs, which, may affect pregnancy outcomes. Thus, the estimated savings in Medicaid costs related to WIC participation may overestimate the true savings, since, relative to nonparticipants, WIC participants would have lower Medicaid costs even in the absence of the WIC program.<sup>6</sup> The problem introduced by self-selection is rendered less severe by the fact that (1) the adequacy of prenatal care is also likely to be related to any such underlying differences between WIC participants and nonparticipants, and (2) the analysis was able to adjust the estimated savings in Medicaid costs associated with prenatal participation for the adequacy of care. However, the potential implications of the self-selection issue should be kept in mind when the study results are interpreted and generalized.

---

<sup>6</sup>Conversely, if the WIC program were successful at reaching high-risk, low-income pregnant women, WIC participants may be more likely to have higher-cost pregnancy outcomes than nonparticipants, and the estimated savings presented in this chapter would underestimate the true savings associated with prenatal WIC participation.

TABLE IV.3

SAVINGS IN MEDICAID COSTS FROM BIRTH TO  
60 DAYS **AFTER** BIRTH: EFFECTS OF PRENATAL WIC  
PARTICIPATION AND THE ADEQUACY OF PRENATAL CARE

	Prenatal WIC Participation	Prenatal Care Was Intermediate or <b>Adequate</b> <sup>a</sup>
Florida Newborns and <b>Mothers</b>	\$347	\$267
<b>Minnesota</b> Newborns and Mothers	\$277	<b>\$1,005</b>
North Carolina Newborns Newborns and Mothers	\$744 \$598	\$593 <b>\$415</b>
<b>South</b> Carolina Newborns and Mothers	<b>\$565</b>	\$623
Texas Newborns Newborns and Mothers	\$573 \$493	<b>\$610</b> \$362

SOURCE: **WIC/Medicaid** database for Florida, Minnesota, North Carolina, and Texas.

NOTE: Complete sets of regression estimates are presented in Appendix A and in Volume 2 of this report. All estimated effects of prenatal care are statistically significant at the **.01** level. With the exception of Minnesota, the estimated effects of prenatal WIC participation are statistically significant at the **.01** level (two-tailed test). In Minnesota, the estimated effect of prenatal WIC participation is statistically significant at **the .07** level (two-tailed test) and at the **.03** level (one-tailed test).

**\*These** estimates are derived from a comparison of regression-adjusted mean values of Medicaid costs for intermediate or adequate levels of prenatal care with regression-adjusted mean values of Medicaid costs for inadequate levels of prenatal care.

Other unmeasured differences between WIC participants and nonparticipants may also influence the study findings. One issue considered in the analysis concerns the timing of enrollment in the WIC program. For the results presented in this report, a woman is considered a prenatal WIC participant if she redeemed any food instruments during the nine months prior to birth, or, for states with no redemption data, if she had a certification date for the WIC program sometime during the nine months prior to birth. Thus, WIC participants include some women who enrolled very early during pregnancy and some women who enrolled very late during pregnancy. For the very late WIC enrollees (e.g., after 36 weeks gestation) there is the potential for an overstatement of the effects of WIC participation due to the fact that Medicaid costs for these late WIC enrollees with longer gestational ages are **being** compared to costs for nonparticipants, some of whom had preterm births and did not have the opportunity to enroll later as prenatal WIC participants. At the opposite end of the spectrum, early WIC enrollees (e.g., enrollment in the first trimester) may well include higher risk pregnancies that have higher Medicaid costs.<sup>7</sup> Thus, for early WIC enrollees, there is the potential for an understatement of the effects of WIC participation, since Medicaid **costs** for the higher-risk early enrollees are also being compared to nonparticipants who, as a group, are likely to have lower-risk pregnancies. Both of these issues are discussed in the forthcoming Volume 2 of this report.

### C. THE RESULTS OF THE ANALYSIS OF BIRTH OUTCOMES

An analysis of the effects of prenatal WIC participation on birth outcomes is important for understanding the possible sources of the Medicaid cost savings discussed earlier. This section presents the results of an analysis of the effects of prenatal WIC participation on four measures of birth outcomes: birthweight, the incidence of low birthweight, gestational age, and the incidence of preterm births.

---

<sup>7</sup>Although the data available for this study do not allow a thorough analysis of why this is true, discussions with state staff and analyses of early WIC enrollees suggest that they exhibit the highest risk factors for poor pregnancy outcomes. In addition, the WIC program actively targets early prenatal enrollment by high-risk **women**.

Prenatal WIC participation by Medicaid recipients is consistently associated with increased birthweight and a lower incidence of low birthweight (births of infants who weigh less than 2,500 grams, or 5.5 pounds), as shown in Table IV.4. The average increase in birthweight ranged from 51 grams in Minnesota to 73 and 77 grams in Florida and Texas, to 113 and 117 grams in South Carolina and North Carolina, respectively. Similarly, the reduction in the percentage of women who gave birth to low-birthweight newborns ranged from 2 percentage points in Minnesota to 5 percentage points in North Carolina and South Carolina. (From 10 to 17 percent of nonparticipating Medicaid women gave birth to low-birthweight babies.)

However, the most dramatic increase in birthweight for prenatal WIC participants relative to nonparticipants occurred with the newborns of the subsample of Medicaid women who had preterm births--births of infants whose gestational age was less than 37 weeks. The average increase in birthweight for this subsample ranged from 138 grams in Minnesota to 259 grams--approximately half a pound--in South Carolina, with intermediate increases of 150, 165, and 238 grams in Florida, Texas, and North Carolina, respectively. Thus, increases in birthweight for preterm births to Medicaid-eligible WIC participants relative to nonparticipants were on the order of 6 to 11 percent, compared with 2 to 4 percent for all births. Consequently, increases in birthweight for full-term births were relatively small--under 50 grams--in all five states.

In general, the pattern of the estimated effects of prenatal WIC participation on birthweight are consistent with the explanation that relatively heavier babies have relatively lower-cost births. The smallest effects on birthweight and Medicaid costs were observed in Minnesota, while the largest effects for birthweight and costs were observed in North Carolina and South Carolina.

Prenatal WIC participation by Medicaid recipients is also associated with a lower incidence of preterm births and a longer gestational age. The reduction in the percentage of women with preterm births ranged from 2 percentage points in Minnesota to 6 percentage points in South Carolina. Medicaid-eligible prenatal WIC participants also had longer gestations than nonparticipants, ranging from between .2 weeks and .8 weeks longer for Minnesota and North Carolina, respectively, with intermediate estimates of .4 weeks for Florida and Texas, and .6 weeks for South Carolina. These estimated gestational age effects should be interpreted

TABLE IV.4  
ESTIMATED EFFECTS OF WIC PARTICIPATION ON BIRTHWEIGHT AND GESTATIONAL AGE

	Birthweight				Gestational Age	
	Birthweight (grams) <sup>a</sup>			Incidence of Low Birthweight (%) <sup>b</sup>	Gestational Age (weeks) <sup>a</sup>	Incidence of Preterm Births (%) <sup>b,c</sup>
	All Births	Preterm Births	Full-Term Births			
<b>Florida</b>						
With WIC Program	3,225	2,602	3,313	9.5	39.6	11.8
Without WIC Program	3,152	2,452	3,284	12.8	39.2	15.3
Estimated Effect of WIC Participation	73	150	29	-3.3	.4	-3.5
<b>Minnesota</b>						
With WIC Program	3,312	2,342	3,398	7.8	39.3	10.4
Without WIC Program	3,261	2,204	3,382	10.0	39.1	12.7
Estimated Effect of WIC Participation	51	138	16	-2.2	.2	-2.3
<b>North Carolina</b>						
With WIC Program	3,179	2,669	3,276	11.1	39.6	13.2
Without WIC Program	3,062	2,430	3,234	16.2	38.8	18.6
Estimated Effect of WIC Participation	117	238	42	-5.1	.8	-5.4
<b>South Carolina</b>						
With WIC Program	3,134	2,602	3,222	11.7	39.3	13.9
Without WIC Program	3,021	2,343	3,192	16.8	38.7	20.2
Estimated Effect of WIC Participation	113	259	30	-5.1	.6	-6.3
<b>Texas</b>						
With WIC Program	3,231	2,834	3,308	8.8	39.5	11.5
Without WIC Program	3,154	2,669	3,283	12.2	39.1	15.7
Estimated Effect of WIC Participation	77	165	25	-3.4	.4	-4.2

SOURCE: WIC/Medicaid database for Florida, Minnesota, North Carolina, South Carolina, and Texas.

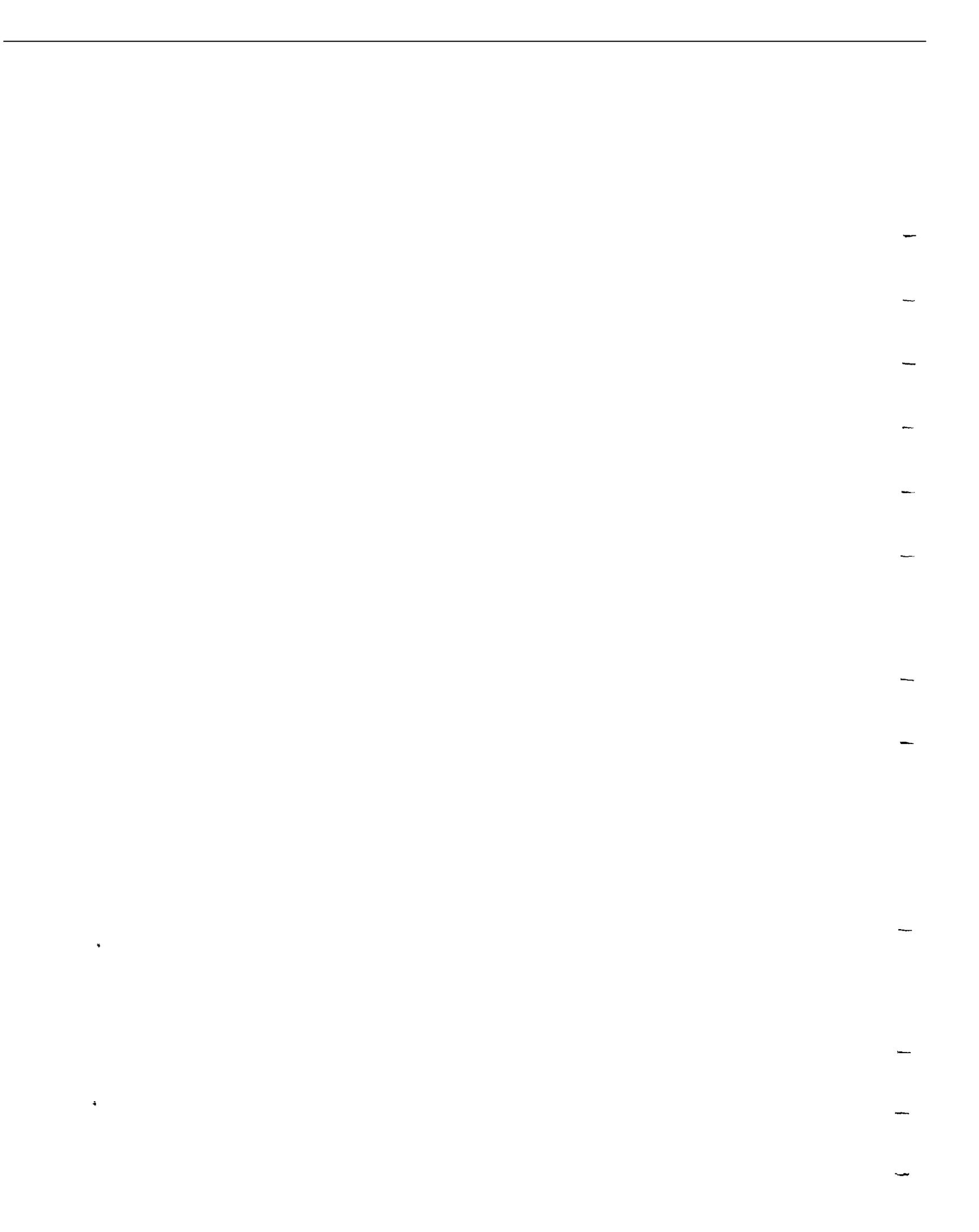
NOTE: Complete sets of regression estimates are presented in Appendix B and in Volume 2 of this report. All estimated effects are statistically significant at the .01 level, except the effect on birthweight for full-term births in Minnesota.

<sup>a</sup>Estimated with OLS regression.

<sup>b</sup>Estimated with probit analysis.

<sup>c</sup>Preterm births are those with a gestational age of less than 37 weeks.

with some caution, however, given the issue discussed previously concerning early and **late** enrollees in the WIC program. In particular, some **WIC** participants enroll very late during pregnancy, and the **gestational** age of the newborns of these late **enrollees** would have been relatively **high** even had they not enrolled in the WC program.



## V. GENERALIZATION OF THE STUDY FINDINGS

The results of this study indicate that prenatal participation in the WIC program by Medicaid recipients improves birth outcomes and leads to savings in Medicaid costs. However, given that the study is limited to five states and is based on 1987 birth cohorts, two important questions must still be resolved:

1. What inferences can be drawn from these state-specific results about the nation as a whole?
2. How stable are these conclusions over time?

Analyzing the reasons for the different results in the five study states can shed light on the **first** question. In addition to variations in the **accessibility** and effectiveness of the WIC program, differences in birth outcomes and health care costs are due to differences in (1) the characteristics of the Medicaid population, and (2) program policies that affect Medicaid reimbursement amounts. **These** same factors affect the extent to which the results of the study can be generalized. In addition, major changes in both the WIC and the Medicaid programs have occurred since 1987, and the increase of **substance** abuse is changing the nature of perinatal risk factors. Consequently, the same study conducted with a 1990 Medicaid birth cohort might generate different findings.

This chapter explores the **generalizability** of the study results. Section A summarizes the major **findings** presented in earlier chapters. Section B discusses the feasibility of generalizing the results for all 1987 Medicaid births, building on the insights gained **from** studying the reasons for different outcomes in the study states. Section C reviews the programmatic and risk-factor changes that may affect the long-term stability of the results. The conclusions of the chapter are summarized in Section D.

### A MAJOR STUDY FINDINGS

The findings of the study in all five states indicate that prenatal participation in the WC program by Medicaid recipients is associated with higher birthweights, longer gestational ages, and reduced maternal and newborn Medicaid costs in the **60-day** postpartum period. These results occur after the effects of sociodemographic characteristics and the

adequacy of prenatal care on birth outcomes and Medicaid costs are adjusted for. However, not all the differences between participants and nonparticipants that may affect birth outcomes and costs can be assessed. **In** particular, the factors that affect (1) a pregnant woman's decision to seek prenatal care and/or to participate in the **WIC** program, and (2) her ability to obtain this care, have not **been** directly measured.

Full-term birthweight **differences** between Medicaid-eligible **WIC** participants and nonparticipants were observed **in** all states, but were much **smaller** in magnitude than the overall birthweight differences. The study **findings** suggest that prenatal **WIC** participation by Medicaid recipients has (1) a larger effect on the birthweights of **preterm** infants than on full-term infants, and (2) leads to lower prematurity rates. Medicaid costs for mothers and newborns were also lower for **WIC** participants than for nonparticipants, and benefit-cost ratios were greater **than** one in all five study states. **In** the two states in which mothers' and newborns' costs could be separated, the estimated **cost** savings for newborns alone were greater than the cost savings for mothers and newborns.

**While** the results from all five states led to the same overall conclusions, significant differences in the magnitude of the measured differences arose. The estimated effects of **WIC** participation by Medicaid recipients on birthweight and **gestational** age were greatest in North Carolina and South Carolina and least in Minnesota. These **results** are also reflected in the estimated savings in Medicaid costs, although, unlike birth outcomes, Medicaid cost savings are not directly comparable across states. In the study, costs are defined in terms of Medicaid-reimbursed amounts, which may vary dramatically across **states** because state program policies differ. Major differences in the estimated benefit-cost ratios also exist; the ratio is the highest in North Carolina and the lowest in Minnesota and Florida. Again, however, interstate comparisons of benefit-cost ratios should be made very cautiously, since program policies and the characteristics of the **WIC** and Medicaid populations affect both the measured benefits and the costs of **WIC** participation regardless of changes in birth outcomes.

## B. GENERALIZING THE STUDY **RESULTS** FOR 1987 MEDICAID **BIRTHS**

Three factors contribute to the estimated differences in the impacts of the **WIC** program in the study states: (1) socioeconomic and demographic differences among Medicaid-eligible pregnant women; (2) differences in public prenatal care systems for low-income women; and (3) differences in Medicaid program policies that **affect** reimbursement amounts. These factors also affect **the** extent to which **the** study findings can be generalized to **all** 1987 Medicaid births. In this section, the insights from studying the **possible** causes of outcome differences **in** the five study states are used to assess the feasibility of generalizing the results of the study.

Socioeconomic  
and Demographic  
Differences

In 1987, the characteristics of the **Medicaid-eligible** populations differed considerably across the five study states. Medicaid-eligible pregnant women in Minnesota were predominantly white and married, were somewhat older, and appeared to be less disadvantaged than those in the other four states. In addition to maternal age, marital status, and racial/ethnic differences, the Medicaid populations in the study states were not comparable socioeconomically. In **1987**, the poverty income threshold for a family of three was \$9,056; the Medicaid income eligibility thresholds ranged from 33 percent of the poverty level in Texas to 88 percent of the **poverty** level in Minnesota. The other three states had income eligibility thresholds between 40 and **50** percent of the poverty level. A priori, one would expect that the benefits of program participation would be greatest among the most severely disadvantaged women. This expectation is consistent with the apparently smaller program impact in Minnesota.

Socioeconomic and demographic differences among Medicaid populations affect the extent to which the study findings can be generalized. **The** results from the five states suggest that the effects of prenatal participation in the **WIC** program are more pronounced in **socioeconomically** disadvantaged states with relatively large black populations and in states with relatively low Medicaid income eligibility thresholds. However, the lack of a large, urban, industrial state in the study limits the conclusions that can be drawn about the impacts of the program in states with large, predominantly urban, minority populations. It is not clear whether the same benefits would be seen among inner-city minority populations.

Differences in  
Public Prenatal  
Care Systems for  
Low-Income  
Women

**The** use of prenatal care by low-income women **often** depends on the availability and **accessibility** of public prenatal care. **The** accessibility of public prenatal care may also affect participation in the **WIC** program. Public prenatal care providers--such as local health departments--typically also provide **WIC services**, thus facilitating the referral of pregnant women to **WIC** services. (All of the study states reported experiencing difficulties in getting private physicians to refer pregnant women to the **WIC** program.) Conversely, if a referral from a prenatal care provider is required for **WIC** participation, bottlenecks in the public prenatal care system may impede **WIC** participation.

---

As described here, the availability and accessibility of public prenatal care differed considerably across the five study states, as did the linkages between **WIC** services and prenatal care.

- In Florida, North Carolina, and South Carolina, local health departments are generally direct providers of prenatal **care** and **WIC services**. Both Florida and South Carolina have subsidized prenatal care available in almost every county. However, North Carolina has been facing growing problems with the withdrawal of physicians from public health clinics. In July **1988**, **12** North Carolina counties had no public prenatal care available. According to state staff, constraints on public prenatal care in North Carolina meant that pregnant women experienced delays in enrolling in the **WIC** program.
- In contrast to the other three southern states, a mixed health-care delivery system for low-income pregnant women exists in Texas. In the more populous counties, local health departments provide prenatal care. In smaller counties, either prenatal care services are administered and funded by the State Health Department, or the State may contract with private providers in **these** counties. Despite these efforts, the Texas Department of Health identified 55 counties **that** were in **need** of prenatal care services, although, **by 1988**, **the** state-funded Maternal Improvement Health Insurance Act (**MIHIA**) program was providing prenatal care in 36 of these counties. **WIC services** in Texas are also available from a range of different providers, including local health departments, Community Action Program (CAP) agencies, Migrant Health Centers, nonprofit health centers, and freestanding **WIC** centers. As with prenatal care, however, Texas had a number of unserved counties during the study period. Thirteen percent (34 out of **254** counties) were not served by the **WIC** program during the study period. Texas achieved state-wide **WIC** services in 1990.
- The public health philosophy of Minnesota differs from that of the other four **states** in the study, and **is** not strongly oriented towards **the** direct provision of services. **Consequently**, with the exception of Migrant Health Centers and a few clinics in the Twin Cities, prenatal care and **WIC** services are provided separately in Minnesota; **WIC** services are provided largely by the public sector, and prenatal care is provided by private physicians.

Given these variations in the availability and accessibility of prenatal care, one would expect that (1) rates of inadequate prenatal care among Medicaid mothers would be higher in North Carolina and Texas, and that (2) **WIC** participation rates would be lower in Texas and Minnesota. However, North Carolina had the lowest overall rate of inadequate prenatal care and, at the high end of the scale, South Carolina and Texas exhibited little difference. As expected, Texas had the lowest rate of **WIC** participation among Medicaid mothers, but Minnesota's **WIC** participation rate was the second highest among the study states. These findings are difficult to interpret, given what is known about the effects of availability and accessibility on program participation. Thus, the **results** for the five states included in this study do not provide solid evidence on how the generalizability of the study **findings** is affected by the differences in the health care delivery systems for low-income women.

Differences in  
Medicaid Policies  
that Affect  
Reimbursement

In this study, maternal and newborn **costs** are defined as the amounts that Medicaid reimbursed for **mothers** and infants **from** birth to **60** days after birth. However, Medicaid reimbursement amounts may not reflect either (1) the real costs of care or (2) the relative costs of mothers and newborns in different states, since state Medicaid program policies have critical effects on the reimbursement amounts. Lower **Medicaid**-reimbursed amounts do not necessarily mean that overall costs were lower. Medicaid policies that restrict reimbursement amounts may force other indigent care programs and public hospitals to pick up the excess costs of low-income women and newborns. Unfortunately, other indigent care costs could not be included in this study. Consequently, the limitations of the cost measurement should be kept in mind when the results of the study are interpreted and generalized.

The following factors affect Medicaid reimbursement amounts for mothers and newborns in the **first 60** days of life:

- **Service** limits. For cost-containment purposes, many states limit the number of inpatient hospital days and/or physician visits that will be paid by Medicaid. In 1987, both Florida and Texas had Medicaid inpatient hospital service limits that may have restricted the amount that Medicaid reimbursed for high-cost newborns. The effect of these **limits** would be to underestimate the costs of care and to lower the benefit-cost ratios in the two states.

- **Hospital reimbursement methods.** Medicaid programs typically use one of five basic hospital reimbursement methods: retrospective cost-based systems, diagnosis-related groups (**DRGs**), hospital-specific prospective flat rates, budgeted systems, or negotiated rates. **Each** of these systems provide different cost-containment incentives. Among the five study states, Minnesota, South Carolina, and Texas used **DRGs**, and Florida and North Carolina used prospective hospital-specific per diem rates. Under a DRG system, the same amount is paid for all patients in a particular DRG, regardless of the length of stay. (However, in both South Carolina and Texas, newborn care could be reimbursed on a per-diem **basis**, which probably tempered the impact of **DRGs**.) Under hospital-specific per diem-rates, the amount reimbursed varies according to length of stay and is also **affected** by the historical costs of the individual hospital, since these factors are used to determine the prospective rate. The latter is an important consideration when the costs of mothers and newborns are reviewed, **since** Medicaid deliveries and newborn care **frequently** occur in relatively high-cost public and university hospitals.
- **Spend-down eligibility.** All states must include certain population groups in their Medicaid programs, but coverage of other groups is optional. In particular, states have the option of establishing a medically needy program. The program allows Medicaid coverage for persons in the same categories as Medicaid participants whose income is slightly above the Medicaid income-eligibility ceiling. It also allows people to become eligible for Medicaid if high medical expenses reduce their income to the Medicaid eligibility level. **Spend-down** eligibility is a vehicle by which high-cost newborns become eligible for Medicaid, due to their medical expenses. In states without spend-down programs, the **costs** for the care of these **newborns** may be picked up by other indigent health care programs or be absorbed by hospitals. Among the study states, South Carolina did not have a **spenddown** program at the time of the study, which could have reduced the apparent benefits of **WIC** participation in South Carolina if the spenddown eligibility category included a greater proportion of nonparticipants in the WC program.

**The** large variations in cost savings among the study **states** partially reflect the different Medicaid **eligibility** and reimbursement policies and their interactive effects. Nationwide, Medicaid program policies vary greatly and profoundly affect the capacity to generalize the results of the study

for 1987 Medicaid births. Thus, for example, in 1987, 7 states and the District of Columbia reimbursed hospitals using a retrospective cost-based system, 14 states used **DRGs**, 21 states used hospital-specific flat rates based on historical costs, 4 states used budgeted rates, and 3 states use negotiated rates. In addition, 14 states did not have medically needy programs, and 15 states (in 1986) imposed limitations on inpatient hospital patient days (Congressional Research **Service**, 1988). Wide variations in the amounts paid by Medicaid for different **services** also occurred that were not necessarily closely related to differences in health-care costs. For example, the Medicaid reimbursement for a global fee for a delivery in 1986 ranged from \$214 in New Hampshire to \$1,508 in Massachusetts. The corresponding ratios of Medicaid-reimbursed amounts to prevailing community charges ranged from 18 percent in Florida to 74 percent in Nevada (Lewis-Idema, 1988). Given program variations that affect reimbursed amounts regardless of differences in underlying health-care costs, the concept of a single benefit-cost ratio expressing Medicaid savings as a function of **WIC** costs makes sense only at the state level. A range of benefit-cost ratios exists nationwide, reflecting different program policies in addition to real differences in outcomes.

### C. LONG-TERM STABILITY OF THE RESULTS OF THE STUDY

Since the analysis period of the **WIC/Medicaid study (1987)**, major changes have occurred in the WIC and the Medicaid programs and in the environments in which these programs are operating. Thus, at issue is the long-term stability of the study results. Specifically, if the study were repeated using 1990 Medicaid births, would the same associations between **WIC** participation and birth outcomes and the same range of benefit-cost ratios be observed? This question is addressed here, focusing on three specific issues: (1) changes in the **WIC** program; (2) changes in the Medicaid program; and (3) changes in risk factors for adverse pregnancy outcomes.

#### Changes in the WIC Program Since 87

Significant expansions in **the** WIC program have occurred in all states since 1987. The Commodity Distribution Reform Act and WIC Amendments of 1987 mandated that states adopt a variety of **cost-**containment initiatives, including infant formula rebates. States were required to contract with one (or more) infant formula manufacturers and

receive rebates on retail purchases of infant formula by **WIC** participants. These rebates have generated considerable cost savings, which have allowed states to expand the number of program participants without increases in federal funding. Consequently, the number of pregnant women participating in the **WIC** program has increased almost 22 percent nationally (from **486,900** to 593,000) between 1987 and 1989. The increase in prenatal **WIC** participation was due both to cost containment measures and to appropriations increases during that period. The experience of any particular state is also a function of (1) the proportion of eligible pregnant women already participating, and (2) the extent of outreach and program coordination efforts.

**In** addition, Public Law 101-147 and the Child Nutrition and **WIC** Amendments of 1989 include an adjunctive income eligibility requirement. Women, infants, and children at nutritional risk who are certified for Food Stamps or Medicaid must now be deemed to meet the income eligibility criterion for the **WIC** program automatically. This legislation also requires certain referrals from the **WIC** program to Medicaid. The net effect of these legislative changes is likely to increase the proportion of Medicaid births to **WIC** participants.

The effect of the program expansions on birth outcomes and Medicaid costs depends on the extent to which the **WIC** program expansions target and reach women who are at higher-risk than those previously enrolled. Reaching higher-risk women could lead to higher rates of adverse pregnancy outcomes, and higher Medicaid costs among **WIC** participants than previously, since **WIC** participants would include a larger proportion of high-risk women. If, on the other hand, program expansions lead to a larger proportion of low-risk women among **WIC** participants, then rates of adverse pregnancy outcomes may decline among **WIC** participants. Consequently, an evaluation of the impact of the **WIC** expansions requires tracking the changing risk characteristics of prenatal **WIC** participants, to ascertain whether changes in birth outcomes and costs reflect changes in risk characteristics or changes in the effectiveness of the program.

Changes in the  
Medicaid Program  
Since 87

Since 1987, Medicaid program eligibility has continually been expanded to pregnant women and infants, and major enhancements have been made to the program to improve both access to care and the quality of care. So profound and complex have these changes been that making simple inferences about their impact **on WIC benefit-cost** studies is difficult. These problems are compounded by the variation in initiatives and the

pace at which they are being introduced in different states. The changes that have occurred fall into four broad categories: (1) income eligibility expansions and initiatives to streamline eligibility determination; (2) other program enhancements to improve the quality of care for pregnant women; (3) coordination between the **WIC** and Medicaid programs; and (4) higher reimbursement rates for obstetrical care. Each of these issues is reviewed briefly here.

**Income Eligibility Expansions and Initiatives to Streamline Eligibility Determinations.** Under the Omnibus Budget **Reconciliation Act** of 1989, states are mandated by Congress to expand Medicaid coverage to all pregnant women, infants, and children under age six whose incomes are below 133 percent of the poverty level. States have had the option of providing Medicaid coverage to pregnant women and infants below 185 percent of poverty since 1988, and several states have expanded to this income level. In addition, states have the option of waiving the asset test for pregnant women, granting continuous eligibility for pregnant women for up to 60 days postpartum, and allowing certain primary care providers to grant short-term Medicaid presumptive **eligibility** to pregnant women.

These changes have had several effects. If prenatal **WIC** participation is more beneficial for low-income women, enrolling a higher-income group of pregnant women in the Medicaid program may have the effect of lowering the estimated benefits of **WIC** participation. Conversely, streamlining and simplifying Medicaid eligibility processes may enable states to enroll a new group of poor, high-risk women in the Medicaid program, those for whom the regular eligibility processes are too complex and arduous. This change could have the effect of increasing the estimated benefits of **WIC** participation. Third, many pregnant women in the “near-poor” income categories, who previously became **Medicaid-eligible** only by spending down **when** they or their infants incurred high costs, may now be Medicaid-eligible throughout their pregnancies. The effects of this change on the estimates of **WIC** benefits are uncertain.

**Other Medicaid Program Enhancements for Pregnant Women.** In addition to eligibility enhancements, states also have the option of initiating a variety of Medicaid program enhancements for pregnant women, including enriched prenatal care, targeted outreach, and care coordination. The intent of **these** initiatives is to provide high-quality prenatal care to all Medicaid-eligible pregnant women, especially those at high risk of adverse pregnancy outcomes

Coordination between the WIC and Medicaid Programs. Of particular importance for enhancing the quality of care for low-income pregnant women is the recent Congressional mandate that requires coordination between the Medicaid and the WIC programs. The mandate requires that states notify all Medicaid beneficiaries who are pregnant, postpartum, or breastfeeding women, or children younger than five, of the availability of WIC benefits. Women, infants, and children at nutritional risk who are certified for food stamps or Medicaid must now automatically be deemed to meet the income test to qualify for the WIC program. In addition, nutrition education for pregnant women can now be reimbursed by Medicaid as part of a package of enriched prenatal care in addition to the nutrition education provided through the WIC program.’

Some of these initiatives are so recent that it is difficult to assess their implications for benefit-cost studies of the WIC program. However, it is clear that the proportion of pregnant women enrolled in the Medicaid program who are also participating in the WIC program is likely to increase in the future. Furthermore, the distinction between WIC program services and Medicaid-reimbursed services will become increasingly blurred as nutrition screening and counseling become part of the regular prenatal care package reimbursed by Medicaid.

Higher Reimbursement Rates for Obstetrical Care. In many states, Medicaid eligibility and program expansions have been accompanied by enhanced reimbursement rates for providers of obstetrical services. The purpose of the higher fees is to increase participation rates of providers and to encourage providers both to accept high-risk pregnant women and to ensure that they provide the women with the appropriate level of care. If these initiatives prove successful, prenatal care costs for Medicaid mothers should increase, but the costs associated with adverse pregnancy outcomes should decline.

---

<sup>1</sup>Hill and Bennett (1990) cite the example of Utah, which has introduced a two-step benefit for Medicaid-eligible pregnant women. All Medicaid-eligible pregnant women are referred to the WIC program for initial evaluation and counseling. Women with more complex nutritional and medical needs can then receive further Medicaid-reimbursed education, counseling, and monitoring.

Changes in Risk  
Factors for  
Adverse  
Pregnancy  
Outcomes

In its landmark 1985 study Preventing Low Birthweight, the Institute of Medicine identified the principal risk factors for adverse pregnancy outcomes, which included medical risks in the current pregnancy, behavioral and environmental risks, health-care risks, demographic factors, and medical risks predating the pregnancy. The recent expansions of the WIC and the Medicaid programs are intended to address some of the specific risks included within these categories, such as poor weight gain during pregnancy, poor nutrition, and absent or inadequate prenatal care. However, many other risks remain, and **some** behavioral risks appear to be increasing.

In particular, the increase in alcohol and drug abuse among pregnant women--especially cocaine and crack--has become a major public health policy problem. While much of the information on this issue has been anecdotal, recent studies suggest that the number of newborns exposed to drugs is increasing dramatically and that low-birthweight rates are thus rising (Joyce, 1990; U.S. General Accounting Office, 1990; Public Health Foundation, 1990). The costs of newborn care are increasing correspondingly; the U.S. General Accounting Office (1990) has estimated that hospital charges for drug-exposed infants were up to four times greater than for infants with no evidence of drug exposure. If recent trends continue and pregnancy outcomes deteriorate, the costs of newborn care will rise.

The WIC and the Medicaid programs will play essential roles in addressing these increasing behavioral risks. WIC nutritional assessments, counseling, and education, in conjunction with enhanced Medicaid prenatal care benefits, are critically important for women who are at risk of using drugs and alcohol during pregnancy. Indeed, recent legislation has recognized the importance of the WIC program to address the need for drug-use referrals and education.

#### D. CONCLUSIONS

Wide variations in **WIC** and Medicaid program policies and in the sociodemographic characteristics of Medicaid mothers across the country make generalizing the **WIC/Medicaid** study results extremely difficult. These problems are compounded by the exclusion of other indigent care costs from the study, which means that only a partial picture of the **health-care** costs of low-income women and newborns is available. Nonetheless, the fact that the benefits of **WIC** prenatal participation by Medicaid

recipients were so clearly demonstrated in all five study states, with all their population and program differences, suggests that a nationwide study of the effects of **WIC** prenatal participation among **all** Medicaid mothers in 1987 would show (1) better birth outcomes for **WIC** participants, and (2) **benefit-cost** ratios for the **WIC** program that are greater than one.

In the future, a variety of forces will affect the benefits **of** prenatal participation by Medicaid participants in the **WIC** program. **The** Medicaid program expansions are allowing a higher-income group of pregnant women to enroll in Medicaid. Due to the increased coordination between the **WIC** and the Medicaid programs, more pregnant women with incomes above the poverty level, who may be at lower nutritional risk are likely **to** participate in the **WIC** program. Conversely, aggressive outreach and improved eligibility **procedures** may bring a higher-risk group of pregnant women into the Medicaid and the **WIC** programs. The net effect of these enrollment changes on estimates of **WIC** benefits is uncertain. Clearly, however, the development of outreach, referral, and care coordination programs **will** bring more pregnant women into both the **WIC** and the Medicaid programs, and the service populations of the two programs will merge.

## REFERENCES

- Alan Guttmacher Institute. The Financing of Maternity Care in the United States. New York: Alan Guttmacher Institute, 1987.
- Bilheimer, Linda.** "Report on Description of State Programs: Study of Savings in Medicaid and Indigent Care for Newborns from Participation in the WIC Program." Princeton, NJ: Mathematica Policy Research, April 1990.
- Congressional Research Service, U.S. Congress. Medicaid Source Book: Backmound Data and Analysis, Washington, D.C.: U.S. Government Printing Office, November, 1988.
- Hill, Ian T.** and Trude Bennett. Enhancing the Scope of Prenatal Services. Washington, D.C.: National Governors' Association, 1990.
- Howell, Embry,** and Gretchen Brown. "Prenatal, Delivery, and Infant Care Under Medicaid in Three States." Health Care Financing Review, vol. 10, no. 4, Summer 1989, pp. 1-15,
- Hughes, Dana, Kay Johnson, Sara Rosenbaum, T. Simons and E. Butler. The Health of America's Children: Maternal and Child Data Book Washington, D.C., Children's Defense Fund, 1988.
- Hughes, Dana, Kay Johnson, Sarah Rosenbaum, and Joseph Liu. The Health of America's Children: Maternal and Child Health Data Book Washington, D.C., Children's Defense Fund, 1989.
- Institute of Medicine. Preventing Low Birthweight. Washington, D.C.: National Academy Press, 1985.
- Joyce, **Theodore.** "The Dramatic Increase in the Rate of Low Birthweight in New York City." American Journal of Public Health, vol. 80, no. 6, June 1990.
- Lewis-Idema, Deborah.** Increasing Provider Participation. Washington, DC.: National Governors' Association, 1988.
- National Center for Health Statistics. "Advance Report of Final Mortality Statistics, 1986." Monthly vital Statistics Report vol. 37, no. 6, Supplement, DHHS Pub. No. (PHS) 88-1120. Public Health Service. Hyatt&e, MD, September 1988.
- \_\_\_\_\_. "Advance Report of Final Natality Statistics, 1987." Monthly Vital Statistics Report. vol. 38, no. 3, Supplement. Public Health Service. Hyattsville, MD: 1989.
- Newacheck, Paul.** Estimating Medicaid-Eligible Pregnant Women and Children Living Below 185% of Poverty. Washington, D.C.: National Governor's Association, 1988.
- Public Health Foundation. Public Health Macroview. vol.3, no.1, January/February 1990.

Schramm, Wayne. "WIC Prenatal Participation and its Relationship to Newborn Medicaid Costs in Missouri: A Cost/Benefit Analysis." American Journal of Public Health, vol. 75, no. 8, August 1985.

\_\_\_\_\_. "Prenatal Participation in WIC Related to Medicaid Costs for Missouri Newborns: 1982 Update." Public Health Reports, vol. 101, no. 6, November-December 1986.

\_\_\_\_\_. "WIC Prenatal Participation: CM/Benefit Analysis for Missouri 198546." Paper presented at the American Public Health Association Meeting, October 1989.

U.S. General Accounting Office. Drug-Exposed Infants: A Generation at Risk GAO/HRD-90-138. Washington, D.C.: June 1990.

APPENDIX A

ESTIMATED REGRESSION **COEFFICIENTS** FOR MODEL **TO ESTIMATE**  
THE EFFECT OF WIC **PARTICIPATION** ON MEDICAID **COSTS** (DOLLARS)

1  
1  
1  
1  
1  
1  
1

TABLE A1

ESTIMATED REGRESSION COEFFICIENTS FOR MODEL TO ESTIMATE  
 THE EFFECT OF **WIC** PARTICIPATION ON MEDICAID **COSTS**:  
 FLORIDA BIRTH TO 60 DAYS **AFTER** BIRTH  
 (Standard Errors in Parentheses)

Explanatory Variables	Coefficients (\$): Newborns and Mothers
Intercept	2,101 ** (134)
Prenatal WIC Participation	-347 ** (48)
<b>Newborn Characteristics</b>	
Male <sup>a</sup>	113 * (46)
Multiple birth	7,626 ** (197)
<b>Mother Characteristics</b>	
Age 18-19	123 (89)
Age 20-34	146 (84)
Age 35 and over	797 ** (162)
Black	399 ** (54)
Hispanic	226 ** (86)
<b>Other<sup>b</sup></b>	-351 (278)
Not married	20 (53)
<b>Kessner</b> Index intermediate	-105 * (51)
<b>Kessner</b> Index inadequate	210 ** (73)

TABLE A1 (continued)

Explanatory Variables	Coefficients (\$): Newborns and Mothers
<b>Mother Characteristics (continued)</b>	
<b>Kessner</b> Index missing	511 ** (134)
Previous live births (number)	-41 (20)
Education < 9 years	8 (113)
Education 9-11 years	50 (83)
Education 12 years	47 (78)
Urban	117 (69)
Prenatal Care from Public Health Clinic	-203 ** (69)
<b>R<sup>2</sup></b> <b>Sample Size</b>	.052 30,968

SOURCE: Florida WIC/Medicaid birth event analysis file.

NOTE: The unit of observation is the birth event. Observations with Medicaid costs from birth to 60 days after birth  $\leq$  \$200 are excluded.

● (\*\*): Significant at the .05 (.01) level, two-tailed test.

<sup>a</sup>In the case of multiple births, the binary “Male” is coded one if at least one of the newborns was a male.

<sup>b</sup>Other includes Native American and Asian.

TABLE A2

**ESTIMATED REGRESSION COEFFICIENTS FOR MODEL TO ESTIMATE  
THE EFFECT OF WIC PARTICIPATION ON MEDICAID COSTS:  
MINNESOTA, BIRTH TO 60 DAYS AFTER BIRTH**  
(Standard Errors in Parentheses)

Explanatory Variables	Coefficients (\$): Newborns and Mothers
Intercept	2,710 ** (383)
<b>Prenatal WIC Participation</b>	-277 (154)
<b>Newborn Characteristics</b>	
Male <sup>a</sup>	210 (138)
Multiple birth	11,007 ** (603)
<b>Mother Characteristics</b>	
Age 18-19	-499 (315)
Age 20-34	-249 (301)
Age 35 and over	-155 (490)
Black	1,090 ** (250)
American Indian	-18 (274)
Asian	-787 ** (334)
Not married	80 (156)
<b>Kessner Index intermediate</b>	390 * (161)
Kessner Index inadequate	1,184 ** (254)

TABLE A.2 (continued)

Explanatory Variables	Coefficients (\$): Newborns and Mothers
<b>Mother Characteristics (continued)</b>	
Kessner Index missing	1,663 ** (225)
Previous live births (number)	-155 * (60)
Pregnancy Terminations $\leq$ 20 weeks	316 ** (95)
Pregnancy Terminations of $>20$ weeks	484 (433)
Education $<$ 9 years	691 (425)
Education 9-11 years	496 * (236)
Education 12 years	72 (208)
Education missing	376 (312)
Urban	952 ** (154)
R <sup>2</sup>	.049
Sample Size	10,441

SOURCE: Minnesota WIC/Medicaid birth event analysis file.

NOTE: The unit of observation is the birth event. Observations with Medicaid costs from birth to 60 days after birth  $\leq$  \$200 are excluded.

\*(\*\*): Significant at the .05 (.01) level two-tailed test.

\*In the case of multiple births, the binary "Male" is coded one if at least one of the newborns was a male.

TABLE A3

ESTIMATED REGRESSION COEFFICIENTS FOR MODEL TO ESTIMATE  
THE EFFECT OF WIC PARTICIPATION ON MEDICAID COSTS:  
NORTH CAROLINA, BIRTH TO 60 DAYS **AFTER BIRTH**  
(Standard Errors in Parentheses)

Explanatory Variables	Coefficients (\$): Newborns	Coefficients (\$): Newborns and Mothers
Intercept	2,204 ** (171)	2,699 ** (176)
Prenatal WIC Participation	-744 ** (71)	-598 ** (73)
<b>Newborn Characteristics</b>		
Male <sup>a</sup>	79 (63)	99 (64)
Multiple birth	8,578 ** (1,107)	8,001 ** (1,167)
<b>Mother Characteristics</b>		
Age 18-19	-114 (118)	9 (120)
Age 20-34	-97 (115)	112 (117)
Age 35 and over	306 (245)	699 ** (251)
Nonwhite	227 . * (76)	378 . * (77)
Not married	-178 * (79)	-148 (81)
<b>Kessner</b> Index intermediate	342 . * (68)	289 ** (6%)
<b>Kessner</b> Index inadequate	743 ** (127)	542 . ' (128)
<b>Kessner</b> Index missing	1,230 . * (180)	1,252 ** (184)
Previous live births (number)	-121 ** (32)	-162 . * (33)

TABLE A3 (continued)

Explanatory Variables	Coefficients (\$): Newborns	Coefficients (\$): Newborns and Mothers
<b>Mother Characteristics (continued)</b>		
Pregnancy terminations of >20 weeks	205 ** (57)	224 ** (58)
Education <9 years	288 (166)	428 * (169)
Education 9-11 years	27 (113)	40 (116)
Education 12 years	-12 (104)	-12 (107)
Education Missing	-46 (855)	-183 (846)
Urban	145 * (63)	220 ** (65)
R <sup>2</sup>	.020	.015
Sample Size	16,078	17,135

SOURCE: North Carolina WIC/Medicaid birth event analysis file.

NOTE: The unit of observation is the birth event. Observations with Medicaid costs from birth to 60 days after birth  $\leq$  \$200 are excluded.

● (\*\*): Significant at the .05 (.01) level, two-tailed test.

\*In the case of multiple births, the binary "Male" is coded one if at least one of the newborns was a male.

TABLE A4

ESTIMATED REGRESSION COEFFICIENTS FOR MODEL TO ESTIMATE  
**THE EFFECT OF WIC PARTICIPATION ON MEDICAID COSTS: SOUTH CAROLINA**  
 (Standard Errors in Parentheses)

Explanatory Variables	Coefficients (\$): Newborns and Mothers	
	Hospital Reimbursements, Birth to 60 Days after Birth	Total Reimbursements, Prenatal and Birth to 60 Days after Birth
<b>Intercept</b>	2,828 ** (277)	3,867 ** (368)
<b>Prenatal WIC Participation</b>	-565 ** (110)	-710 ** (146)
<b>Newborn Characteristics</b>		
Male*	139 (94)	165 (125)
Multiple birth	6,729 ** (415)	8,391 ** (549)
<b>Mother Characteristics</b>		
Age 18-19	-296 (179)	-251 (237)
Age 20-34	-279 (162)	-230 (215)
Age 35 and over	530 (344)	884 (458)
Nonwhite	33 (120)	-8 (159)
Not married	-86 (114)	-29 (151)
<b>Kessner Index intermediate</b>	0 (108)	-155 (144)
<b>Kessner Index inadequate</b>	623 • * (144)	516 ** (192)

TABLE A4 (continued)

Explanatory Variables	Coefficients (\$): Newborns and Mothers	
	Hospital Reimbursements, Birth to <b>60</b> Days after Birth	Total Reimbursements, Prenatal and Birth to <b>60</b> Days after Birth
Motber <b>Characteristics (continued)</b>		
<b>Kessner</b> Index missing	<b>685</b> (362)	<b>801</b> (481)
Education < 9 years	<b>229</b> (242)	529 (322)
Education 9-11 years	<b>102</b> (172)	<b>160</b> (229)
Education 12 years	<b>-62</b> (164)	-104 (218)
Education missing	1,726 ** (654)	2,158 • (866)
Urban	<b>81</b> (96)	<b>-49</b> (127)
<b>R<sup>2</sup></b>	<b>.031</b>	.a27
Sample Size	10,879	10,978

SOURCE: South Carolina **WIC/Medicaid** birth event anal@ file.

NOTE: The unit of observation is the birth event. Observations with Medicaid **costs** from birth to 60 days after birth  $\leq$  \$200 are excluded.

• (\*\*): **Significant** at the .05 (.01) level, two-tailed test.

\*In the case of multiple births, the binary “Male” is coded one if at least one of the newborns was a male.

**TABLE A.5**

ESTIMATED REGRESSION COEFFICIENTS FOR MODEL TO **ESTIMATE**  
 THE EFFECT OF **WIC PARTICIPATION** ON MEDICAID COSTS:  
**TEXAS, BIRTH TO 60 DAYS AFTER BIRTH**  
 (Standard **Errors** in Parentheses)

Explanatory Variables	Coefficients (\$): Newborns	Coefficients (\$): Newborns and Mothers
Intercept	2168 ** (154)	3572 ** (151)
Prenatal WIC Participation	-573 ** (75)	-493 ** (74)
<b>Newborn Characteristics</b>		
Male <sup>a</sup>	153 * (74)	223 ** (72)
Multiple birth	8538 ** (297)	9428 ** (305)
<b>Mother Characteristics</b>		
Age 18-19	-194 (138)	-238 (135)
Age 20-34	-92 (125)	0 (123)
Age 35 and over	711 ** (243)	844 ** (238)
Black, <b>nonspanish</b>	-226 . (101)	-176 (100)
Mexican	-45 (92)	-319 . * (91)
Other Hispanic	6 (226)	313 (213)
Not married	-229 .' (79)	-100 (78)
<b>Kessner Index</b> intermediate	-19 (87)	-123 (85)

TABLE AS (continued)

Explanatory Variables	Coefficients (\$): Newborns	Coefficients (\$): Newborns and Mothers
<b>Mother Characteristics (continued)</b>		
Kessner Index inadequate	599 ** (108)	292 ** (106)
Kessner Index missing	672 ** (146)	654 ** (144)
Previous live births (number)	-115 ** (30)	-128 ** (29)
Pregnancy terminations of >20 weeks	495 ** (153)	678 ** (153)
R <sup>2</sup>	.046	.045
Sample Size	21,081	23,787

SOURCE: Texas WE/Medicaid birth event analysis file.

NOTE: The unit of observation is the birth event Observations with Medicaid costs from birth to 60 days after birth  $\leq$ \$200 are excluded.

• (\*\*): Significant at the .05 (.01) level, two-tailed test.

\*In the case of multiple births, the binary "Male" is coded one if at least one of the newborns was a male.

APPENDIX B

**ESTIMATED** REGRESSION COEFFICIENTS FOR MODEL **TO** ESTIMATE  
THE EFFECTS OF WIC PARTICIPATION ON **BIRTHWEIGHT** (GRAMS)



TABLE B.1

ESTIMATED REGRESSION COEFFICIENTS FOR MODEL TO ESTIMATE  
THE EFFECTS OF WIC PARTICIPATION ON BIRTHWEIGHT: FLORIDA  
(Standard Errors in Parentheses)

Explanatory Variables	Coefficients (grams): Total Sample	Coefficients (grams): Gestational Age < 37 Weeks	Coefficients (grams): Gestational Age ≥ 37 Weeks
Intercept	3,308 ** (19)	2,569 ** (73)	3,412 ** (18)
Prenatal WIC Participation	73 ** (7)	150 ** (26)	29 ** (6)
<b>Newborn Characteristics</b>			
Male	128 ** (7)	65 ** (25)	142 ** (6)
Multiple birth	-983 ** (23)	-791 ** (48)	-745 ** (25)
<b>Mother Characteristics</b>			
Age 18-19	12 (13)	14 (46)	-12 (12)
Age 20-34	-12 (12)	-48 (44)	-37 ** (11)
Age 35 and over	-73 ** (24)	-178 * (82)	-63 ** (22)
Black	-189 ** (8)	-54 (31)	-151 ** (7)
Hispanic	7 (13)	98 (54)	1 (11)
Other <sup>b</sup>	-117 ** (40)	197 (136)	-107 ** (37)
Not married	-57 ** (8)	10 (31)	-55 ** (7)
Kessner Index immediate	-11 (7)	53 (29)	-19 ** (7)
Kessner Index inadequate	-195 ** (11)	-92 ** (35)	-148 ** (10)
Kessner bda missing	-129 ** (20)	-237 * (111)	-80 * (31)
Previous live births (number)	14 ** (3)	29 ** (10)	17 ** (3)
Education < 9 years	-53 ** (17)	0 (63)	-60 ** (15)
Education 9-11 years	-64 ** (12)	-33 (46)	-70 ** (11)
Education 12 years	-19 (11)	-19 (43)	-22 * (10)

TABLE B.1 (continued)

Explanatory Variables	Coefficients (grams): Total Sample	Coefficients (grams): Gestational Age < 37 Weeks	Coefficients (grams): Gestational Age ≥ 37 Weeks
<b>Mother Characteristics (continued)</b>			
Urban	-14 (10)	-75 (38)	-8 (9)
Prenatal Care from Public Health Clinic	24 * (10)	86 * (39)	2 (9)
R <sup>2</sup>	.11	.08	.09
Sample Size	31,732	4,093	26,795

SOURCE: Florida WIC/Medicaid newborn analysis file.

NOTE: The unit of observation is the newborn.

\*(\*\*) : Significant at the .05 (.01 level)

TABLE B.2

**ESTIMATED REGRESSION COEFFICIENTS FOR MODEL TO ESTIMATE  
THE EFFECTS OF WIC PARTICIPATION ON BIRTHWEIGHT: MINNESOTA**  
(Standard Errors in Parentheses)

Explanatory Variables	Coefficients (grams): Total Sample	Coefficients (grams): Gestational Age < 37 Weeks	Coefficients (grams): Gestational Age ≥ 37 Weeks
Intercept	3,370 ** (30)	2,183 ** (123)	3,492 ** (26)
Prenatal WIC Participation	51 ** (12)	138 ** (49)	16 (11)
<b>Newborn Characteristics</b>			
Male	122 ** (11)	-8 (48)	132 ** (10)
Multiple birth	-921 ** (34)	-255 ** (73)	-761 ** (38)
<b>Mother Characteristics</b>			
Age 18-19	-1 (24)	108 (97)	-41 (22)
Age 20-34	-22 (23)	54 (90)	-65 ** (21)
Age 35 and over	-42 (38)	330 * (147)	-94 ** (34)
Black	-218 ** (20)	-123 (72)	-187 ** (18)
American Indian	129 ** (22)	129 (116)	93 ** (19)
Hispanic	-146 ** (27)	210 (115)	-189 ** (24)
Not married	39 ** (12)	30 (54)	40 ** (11)
Kessner Index intermediate	-55 ** (13)	31 (60)	-52 ** (11)
Kessner Index inadequate	238 ** (20)	61 (72)	-165 ** (18)
Kessner Index missing	-146 ** (18)	-128 (73)	-90 ** (18)
Previous live births (number)	40 ** (5)	52 ** (20)	35 ** (4)
Education < 9 years	-143 ** (34)	-37 (134)	-121 ** (30)
Education 9-11 years	-155 ** (19)	-126 (83)	-149 ** (16)
Education 12 years	-84 ** (16)	-14 (75)	-84 ** (14)
Education Missing	-129 ** (24)	-223 * (106)	-134 ** (23)

TABLE B.2 (continued)

Explanatory Variables	Coefficients (grams): Total Sample	Coefficients (grams): Gestational Age < 37 Weeks	Coefficients (grams): Gestational Age ≥ 37 Weeks
<b>Mother Characteristics (continued)</b>			
Urban	-3 (12)	50 (55)	-5 (11)
Pregnancy Terminations ≤ 20 weeks	-31 ** (8)	-135 ** (31)	-8 (7)
Pregnancy Terminations of > 20 weeks	-88 * (35)	-115 (120)	-60 (31)
R <sup>2</sup>	.118	.079	.103
Sample Size	11,547	973	10,022

SOURCE: Minnesota WIC/Medicaid newborn analysis file.

NOTE The unit of observation is the newborn.

\*(\*\*): Significant at the .05 (.01 level)

TABLE B.3

ESTIMATED REGRESSION COEFFICIENTS FOR MODEL TO ESTIMATE  
THE EFFECTS OF WIC PARTICIPATION ON BIRTHWEIGHT: NORTH CAROLINA  
(Standard Errors in Parentheses)

Explanatory Variables	Coefficients (grams): Total Sample	Coefficients (grams): Gestational Age < 37 Weeks	Coefficients (grams): Gestational Age ≥ 37 Weeks
Intercept	3,272 ** (24)	2,197 ** (81)	3,398 ** (21)
Prenatal WIC Participation	117 ** (10)	238 ** (29)	42 ** (9)
<b>Newborn Characteristics</b>			
Male	112 ** (9)	90 ** (28)	125 ** (8)
Multiple birth	-994 ** (27)	-776 ** (53)	-788 ** (31)
<b>Mother Characteristics</b>			
Age 18-19	9 (16)	34 (50)	-20 (15)
Age 20-34	-12 (16)	3 (48)	-36 * (15)
Age 35 and over	-39 (34)	-39 (102)	-27 (31)
Nonwhite	-174 ** (10)	-61 (35)	-146 .' (9)
Not married	-6 (11)	51 (37)	-16 (10)
Kessner Index intermediate	-117 ** (9)	107 . * (36)	-47 .' (8)
Kessner Index inadequate	-243 ** (17)	27 (52)	-169 . * (16)
Kessner Index missing	-218 ** (25)	503 . * (45)	-116 (80)
Previous Live Birth (number)	40 ** (4)	58 ** (13)	31 . * (4)
Pregnancy Terminations (number)	-50 ** (8)	-143 .' (25)	-21 . * (7)
Education <9 years	-138 ** (23)	117 (72)	-152 ** (21)
Education 9-11 years	-94 ** (16)	119 . (54)	-113 .' (14)
Education 12 years	-39 ** (15)	108 . (50)	-46 . * (13)

TABLE B3 (continued)

Explanatory Variables	Coefficients (grams): Total Sample	Coefficients (grams): Gestational Age < 37 Weeks	Coefficients (grams): Gestational Age ≥ 37 weeks
<b>Mother Characteristics (continued)</b>			
Education Missing	-41 (116)	-339 (342)	57 (106)
Urban	-20 * (9)	-68 * (28)	-13 (8)
R <sup>2</sup>	.109	.123	.081
Sample Size	20,688	3,625	17,063

SOURCE: North Carolina WIC/Medicaid newborn analysis file.

NOTE: The unit of observation is the newborn.

\*(\*\*): Significant at the .05 (.01 level)