Impact of Medicaid Managed Care, Race/Ethnicity, and Rural/Urban Residence on Potentially Avoidable Maternity Complications: A Five-State Multi-level Analysis

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Executive Summary

BACKGROUND AND OVERVIEW

Complications of pregnancy affect the lives of many women and infants. Previous research has suggested that some pregnancy complications affecting mothers during delivery hospitalizations may also be associated with inadequate prenatal care. Prior research has also found that African Americans are at higher risk of pregnancy-related complications than are non-Hispanic whites (hereafter whites), and that women receiving Medicaid benefits are at higher risk of pregnancy-related complications than those with private insurance. Previous work has yielded mixed findings about pregnancy outcomes by area of residence, and for women enrolled in Medicaid managed care (MMC) and Medicaid fee-for-service (MFFS).

This study examines pregnancy-related complications using Potentially Avoidable Maternity Complications (PAMCs) as an indicator of access. PAMCs were defined by an inter-disciplinary team of experts on access to health services and health disparities. They are an indicator of access to prenatal care of reasonable quality, and of the healthy behaviors during pregnancy that should be promoted by successful prenatal care. The indicator is designed for use with large hospital discharge datasets.

The study analyzes pregnancy complication risks among women receiving Medicaid in two ways. First, we examine a large geographically diverse sample of women, using a sample of hospital discharge data from the Nationwide Inpatient Sample (NIS), part of the Healthcare Cost and Utilization Project (HCUP) of the Agency for Healthcare Research and Quality (AHRQ). The NIS provides inpatient hospital discharge data for 20% of U.S. community hospitals, from 28 participating states. This portion of the analysis focuses on the interaction between rural and urban hospital location, and mothers' race or ethnicity. Location is based on the delivery hospital; the NIS does not contain geographic residence information. Non MSA hospitals were defined to be rural. Next, the study examines the association of PAMC risks with:

- MMC versus MFFS
- County level MMC
- Mothers' race or ethnicity
- Rural or urban location.

This portion of the analysis uses data from California, Florida, Maryland, New York, and South Carolina. All data, except for those representing South Carolina, were from the Statewide Inpatient Databases (SIDs). The SIDs, also part of HCUP at AHRQ, provides 100% of inpatient hospital discharges in participating states. South Carolina data were obtained from the South Carolina Department of Health and Environmental Control. These states were selected because the data include payer information, which allows us to distinguish, among women receiving Medicaid, those who were enrolled in MMC and those who received care through MFFS, as well as race and ethnicity. The state level analysis includes two populous states, California and New York. These states include sizable groups of racially and ethnically diverse women, and include rural and urban areas.

In all state-level analyses, rural counties were defined as those with no more than 20,000 residents, not adjacent to metropolitan areas. In Florida, New York, and South Carolina, rural was defined by the mothers' area of residence. In Maryland, where individuals' residence

counties were not known, rural was defined by the county of the delivery hospitalization. In the California data, neither patient nor hospital location was available.

KEY NATIONAL FINDINGS

- Mothers delivering in rural hospitals had lower PAMC risks than those with urban deliveries (adjusted odds ratio, OR, 0.78, CI 0.62-0.99). This was the expected finding, because mothers with high PAMC risks are likely to be directed to urban hospitals.
- In rural hospitals, African American women had greater PAMC risks than white women (adjusted OR 1.72, CI 1.26-2.36). This suggests notable prenatal care access barriers for rural African Americans.
- In urban hospitals, adjusted PAMC risks were substantially lower for Hispanics and Asians than for whites (OR .51, CI 0.43-0.61, OR 0.32, CI 0.18-0.55, respectively).

KEY STATE-LEVEL FINDINGS

Rural/Urban Differences:

- There were no notable PAMC risk differences between residents of rural and urban areas.

Medicaid Managed Care (MMC) and MMC Penetration:

- In no instance was MMC associated with higher PAMC risk.
- In Maryland and New York, MMC reduced PAMC risks:
  - Women in MMC had lower PAMC risk than women in MFFS (adjusted OR=0.44, CI 0.39-0.50 for Maryland; adjusted OR=0.77, CI 0.67-0.89 for New York).
  - Greater MMC penetration was associated with reduced PAMC risk for women enrolled in MMC: for each 1% penetration increase, PAMC risks were reduced by 0.83% in Maryland, and by 1.07% in New York.

Race and Ethnicity:

- For African Americans, adjusted PAMC risks were higher than for whites in four of the five states: California (OR 1.20, CI 1.07-1.35), Florida (OR 1.14, CI 1.07-1.22), Maryland (1.23, CI 1.09-1.39), and New York (OR 1.68, CI 1.48-1.92).
- For Hispanics, adjusted PAMC risks were notably lower than for whites in three states: California (OR 0.43, CI 0.43-0.51), Florida (OR 0.71, CI 0.64-0.78), and Maryland (0.40, CI 0.31-0.51).

- For Asians, adjusted PAMC risks were substantially lower than for whites in the four states with a sufficient number of Asian mothers: California (OR 0.55, CI 0.46-0.66), Florida (0.39, CI 0.17-0.87), Maryland (OR 0.51, CI 0.30-0.85), and New York (0.57, CI 0.43-0.77).

- South Carolina data provided rich information about individual characteristics. African Americans in South Carolina were much more likely than whites to be unmarried, disabled, living in poverty, to have diabetes or hypertension, and to live in a rural area. After controlling for these and other risk factors, the adjusted odds of a PAMC did not differ between African Americans and whites. Nonetheless, because of their greater prevalence of notable risk factors, African American South Carolinians are at much higher risk of pregnancy complications than are women in other groups. The greater prevalence of PAMC risk factors among African Americans in South Carolina suggests that unadjusted results provide the more reasonable foundation for policy development.

POLICY RECOMMENDATIONS (SEE DISCUSSION IN CHAPTER 5)

Our results support the following recommendations:

- The Secretary of the Department of Health and Human Services (The Secretary) should direct the Centers for Medicare and Medicaid Services (CMS) to encourage the enrollment of pregnant Medicaid beneficiaries into managed care. Managed care should include outreach, case management, management of major chronic diseases, and special focus on risk factors among women in vulnerable groups and their providers, including: cultural competency of prenatal care providers; case management and other forms of support; transportation to prenatal care providers; health care home visits; and, faith-based interventions focused on healthy lifestyles.

- The Secretary should direct CMS to monitor Medicaid deliveries in MMC and MFFS, to identify contractors who do not appear to be referring appropriately. Policymakers and practitioners should develop guidelines for practitioners in rural areas that will improve rates of referral to urban hospitals for women with high PAMC risks. Practitioners should be monitored and potential sanctions developed.

- The Secretary should direct the Health Resources Services Administration to expand Healthy Start in rural areas. Currently only about 10% of Healthy Start programs are in rural areas. Greater access to Healthy Start, particularly for vulnerable women, may reduce pregnancy complications.

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RECOMMENDATIONS FOR FURTHER RESEARCH

- Conduct additional state-level analyses of the impact of MMC penetration on pregnancy complications, using the PAMC indicator.
- Evaluate outcomes of expanding access for at-risk mothers to Healthy Start, Community Health Centers, and other innovative initiatives using the PAMC indicator.
- Perform further analyses of race and ethnicity and PAMC risks, focusing on specific subgroups among Hispanic and Asian women, e.g., Cuban Americans, Mexican Americans, Japanese Americans, and Chinese Americans. Another analysis should examine PAMC risks for American Indians. Studies such as these can help to identify groups that might particularly benefit from expanded prenatal care outreach.
- Conduct quantitative analyses of state and county level Medicaid programs, to examine possible differential selection processes between women in MMC and MFFS.
- Develop guidelines to help rural providers direct women at high risk of pregnancy complications to urban hospitals, which are better equipped to manage complications.

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CHAPTER 1

Introduction

Medicaid has undergone substantial changes in its coverage for poor and near poor pregnant women over the past two decades, to expand coverage for women in these groups. By the mid 1990s, the proportion of births covered by Medicaid was nearly 40% (Currie & Grogger, 2002). During the past decade, many states expanded enrollment of Medicaid beneficiaries into Medicaid managed care, in large part to control rapidly rising Medicaid costs. As a result, Medicaid managed care (MMC) has grown to be the primary form of service delivery within Medicaid: 57% of Medicaid recipients were enrolled in MMC in 2001, up from 10% in 1991 (Centers for Medicare and Medicaid Services, 2002). Effects of the introduction of MMC on pregnancy outcomes are unclear. Managed care may enhance care coordination, improving access and quality, particularly for minorities (Murray & Bernfield, 1988). However, managed care potentially provides incentives for under-provision of services (Kreiger, Connell, Frederick A, & LoGerfo, 1992). As MMC gains experience and increases penetration in local areas, outcomes may improve.

Knowledge about effects of MMC for pregnant women can help national and state policy makers enhance Medicaid's performance. If it can be shown that access is greater for MMC enrollees than for Medicaid fee-for-service (MFFS) enrollees, and further that access among MMC enrollees is greater in areas with greater MMC penetration, this would support promoting MMC enrollment. It would particularly support promoting MMC in rural areas, as MMC penetration tends to be notably lower in rural areas than in urban areas (Felt-Lisk, Silberman, Hoag, & Slifkin, 1999). Use of MMC is also often regarded as a supply side policy strategy to increase Medicaid's cost-effectiveness (Gruber, 1997). Thus, MMC offers the potential of positive impacts on both outcomes and costs.

Disparities in Pregnancy Outcomes

Access to prenatal and primary care varies among groups of pregnant women distinguished by area of residence or the location of their delivery hospitals, by race or ethnicity, and by enrollment in MMC or MFFS. A detailed literature review is provided in Appendix C.

- Relatively few studies have examined associations between race and ethnicity and area of residence or delivery. Clarke et al. (1995) used data from 1988, in a primarily descriptive analysis, and found that African Americans in non-metropolitan areas were more likely to have inadequate prenatal care than were whites or Hispanics. Using the same data source and outcome indicator, Miller et al. (1996) found that women in rural areas were more likely to have inadequate prenatal care, controlling for other factors, regardless of their risks. A bivariate analysis by Clarke and Coward (1991) found that infant death risks were higher for rural residents. However, these differences were not found in multivariate analyses.
- Most studies find that African American women receive significantly less prenatal care than white women, and are more likely to have maternity-related complications

(Alexander & Cornely, 1987; Bennett et al., 1998; Brown, 1989; Clarke et al, 1995; LaVeist et al., 1995; Miller et al., 1996; Saftlas, Lawson, & Atrash, 1994). Notably poorer outcomes have been found for African Americans even after controlling for insurance status (Barfield et al., 1996; Haas et al., 1993). Some researchers attribute this result, in part, to disadvantage across the life course for women in minority groups, as well as stress associated with discrimination (Dole et al., 2004; Lu & Halfon, 2003).

- Findings for Hispanic women are mixed. Hispanic women in various subgroups (e.g., Cuban Americans, Mexican Americans) differ substantially in social and economic characteristics, and in other risk factors for prenatal care (Albrecht & Miller, 1996; Balcazar, Cole, & Hartner, 1992). Cuban Americans, for example, have more prenatal care, and are at lower risk of pregnancy-related morbidity, compared with other Hispanics (Albrecht & Miller).
- Less research has examined pregnancy-related outcomes for Asian Americans. Researchers have found substantial heterogeneity in this group, with Chinese and Japanese American women having better pregnancy outcomes than other Asian Americans, such as those in Filipino and Hawaiian groups (Le, Kiely, & Schoendorf, 1996; Singh & Yu, 1993, 1994).

Effects of Medicaid Managed Care Expansions

The Medicaid eligibility expansions during the past two decades increased access to prenatal care for underserved populations. The effect of the expansions on birth outcomes, as measured by low birth weight (LBW) and rates of preterm birth, is weak (Howell, 2001). MMC has grown during the same period. Studies of the effects of MMC have mixed results:

- Some studies have found no outcome differences (Carey, Weis, & Homer, 1991; Conover, Rankin, & Sloan, 2001; Ray, Gigante, Mitchel, & Hickson, 1998).
- Using 1987-1992 data, Tai-Seale, LosSasso, Freund, and Gerber (2001) found that MMC in California was associated with less care and shorter delivery stays.
- Other studies have found that women enrolled in MMC were more likely to receive prenatal care and/or had better outcomes than those in MFFS (Laditka, Laditka, Mastanduno, Lauria, & Foster, 2003; Laditka, Laditka, & Bennett, 2004; Levinson & Ullman, 1998; Schulman, Sheriff, & Momany, 1997).
- A recent study found that MMC was associated with positive effects for some women, and negative effects for others (Howell, Dubay, Kenney, & Sommers, 2004).

Purpose of This Report

This report examines:

- Pregnancy-related complications among women receiving Medicaid benefits.
- Outcomes by rural or urban areas of residence, or by delivery hospital location.
- Outcome differences associated with race or ethnicity.

This report also examines differences in access to care for pregnant women enrolled in MMC and MFFS. The analysis uses Potentially Avoidable Maternity Complications (PAMCs) as an indicator of access to prenatal care. PAMCs are a set of pregnancy-related complications defined by an inter-disciplinary team of experts on access to health services and health disparities (Laditka, Laditka, Bennett, & Probst, In Press). PAMCs are an indicator of access to prenatal care of reasonable quality, and of the healthy behaviors during pregnancy that should be promoted by successful prenatal care. The indicator assumes that timely access to primary and prenatal health care can reduce risks of pregnancy complications. Conceptually, PAMCs range from patient behaviors that providers should identify and attempt to change, such as drug, alcohol or tobacco use, to medical conditions that should be detected and treated, such as urinary tract infections leading to pyelonephritis. The PAMC indicator was designed for use with large hospital discharge datasets.

Hospital discharge information in this report comes from several data sources: (1) the year 2000 Nationwide Inpatient Sample (NIS), a large geographically diverse national dataset; (2) the State Inpatient Databases (SIDs), for the year 2000, for California, Florida, Maryland, and New York; and (3) The South Carolina Department of Health and Environmental Control, for year 2000 South Carolina data. These five states were selected because the data include payer information. This information permits us to distinguish, among women receiving Medicaid, those who were enrolled in MMC and those who received care through MFFS, as well as race and ethnicity. The state level analysis includes two populous states, California and New York. The five states include sizable groups of racially and ethnically diverse women, and include rural and urban areas.

Appendices of this report include delivery PAMC categories and definitions (appendix A), methods, data sources, and detailed tables (appendix B), a literature review on pregnancy outcomes and Medicaid (appendix C), and a discussion guide used for conversations with public officials knowledgeable about Medicaid enrollment of pregnant women in the states studied in this project (appendix D). Public officials were interviewed as a first step to understand possible selection bias regarding enrollment into MMC. The report addresses four key questions:

- How do PAMC risks differ among women receiving Medicaid and residing in rural areas, compared with those in urban areas, and among Medicaid-insured women with deliveries in rural hospitals compared with urban hospitals?
- Does PAMC risk differ among women enrolled in MMC and those enrolled in MFFS?
- Do PAMC risks differ for women in MMC depending on county MMC penetration?
- How do PAMC risks differ across racial and ethnic groups?

~ Potentially Avoidable Maternity Complications (PAMCs) ~

PAMCs are an indicator of access to prenatal care of reasonable quality. PAMCs are a set of pregnancy-related complications defined by an inter-disciplinary team of experts on access to health services and health disparities. PAMCs were defined for antepartum, delivery, and postpartum hospitalizations. This study focuses on delivery PAMCs. The PAMC indicator was designed for use with large hospital discharge datasets. The PAMC indicator development team was led by Sarah B. Laditka, Ph.D., and included James N. Laditka, D.A., Ph.D., M.P.A., Melanie Mastanduno, R.N., M.P.H., Michele Lauria, M.D., M.S., and Tina Foster, M.D., M.P.H., M.S.

CHAPTER 2

Potentially Avoidable Maternity Complication Risks Among Medicaid-insured Deliveries: National Estimates of Prevalence and Contributing Factors

~ Summary ~

Overall, PAMC risks were lower for women with deliveries in rural hospitals. However, compared with all other race and ethnicity groups, African Americans delivering in rural hospitals had higher PAMC risks. This suggests prenatal care access barriers for rural African American women. In urban hospitals, PAMC risks did not differ between African Americans and whites, and were substantially lower for Hispanics and Asians. Rural African American women at high risk of complications may not be adequately referred to deliver in urban hospitals, which are usually better equipped to address their greater risks. If lower risk white women from rural counties seek care in urban hospitals, this would also contribute to these results.

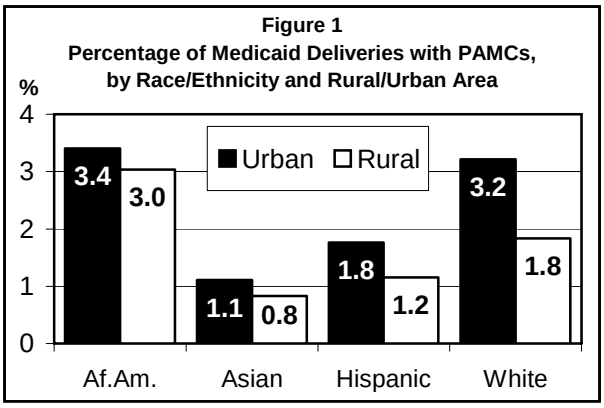
In the first stage of the analysis, we used a large and geographically diverse hospital discharge dataset, the year 2000 Nationwide Inpatient Sample (NIS), to identify PAMC risks among Medicaid beneficiaries. We did so to place our state analyses in a national context, by estimating Medicaid PAMC prevalence across all race and ethnicity groups, and for both rural and urban locations. The NIS does not allow us to distinguish between Medicaid beneficiaries enrolled in Medicaid managed care (MMC) or Medicaid fee for service (MFFS). We examine differences between women enrolled in MMC and MFFS in the state-level analyses, presented in Chapter 4. In addition, the NIS only provides location information for hospitals. In Chapter 4, we address this limitation in state level analysis of Florida, New York, and South Carolina. From this point forward, all references to women and/or mothers refer to those whose delivery hospitalizations were covered by Medicaid.

~ Data and Sampling ~

We used the 2000 Nationwide Inpatient Sample (NIS), hospital discharge data from the Health Care Cost and Utilization Project. The NIS is a 20% sample of community hospitals in 28 states. To approximate population risks, the NIS was restricted to delivery hospitalizations. Location is based on the delivery hospital; the NIS does not contain geographic residence information. Non MSA hospitals were defined to be rural. Separate estimates were developed for African Americans, non Hispanic whites (hereafter whites), Hispanic, and Asian or Pacific Islanders (hereafter Asian).

PAMC Prevalence among Women Receiving Medicaid

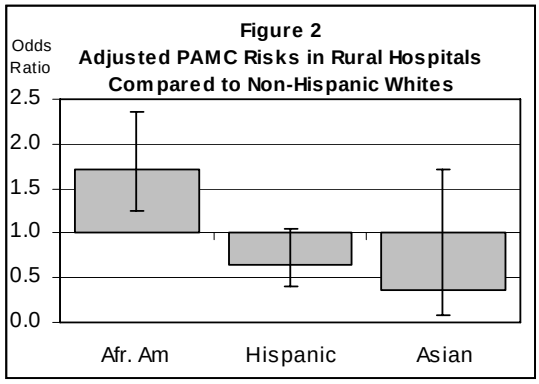
Fewer than one in five deliveries took place at rural hospitals (16.9%, Table B-1). Across all Medicaid deliveries, women who delivered in rural hospitals were at lower risk of a PAMC than those in urban hospitals (1.9% compared with 2.6%).



We examined PAMC risks among women distinguished by race or ethnicity, by location of hospital delivery (Figure 1). The prevalence of PAMCs was greatest for African Americans with deliveries in urban hospitals, followed by whites with deliveries in urban hospitals. Among deliveries in rural hospitals, the prevalence of PAMCs was greatest for African Americans, followed by whites, Hispanics, and Asians.

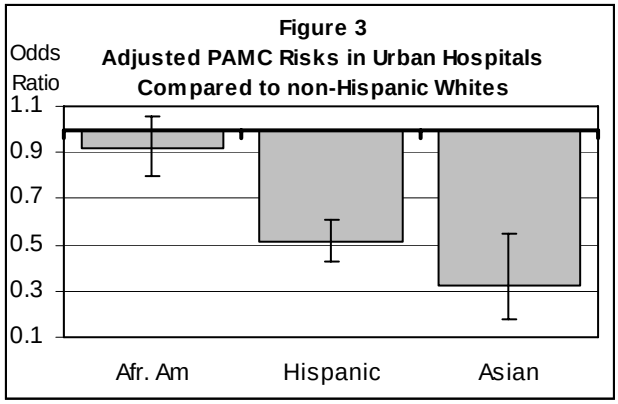
Adjusted PAMC Risks

To ascertain factors contributing to overall PAMC risk, we used multivariate logistic regression. Results were first obtained for deliveries in all hospitals, allowing a rural-urban comparison (Table B-7). With patient and hospital characteristics held equal, PAMC risks remained lower for women delivering in rural hospitals than for those delivering in urban hospitals (odds ratio, OR, 0.78, CI 0.62-0.99; p<.05).



We next examined adjusted PAMC risks for women with deliveries in rural hospitals, controlling for other individual, hospital, and area factors (Figure 2 and Table B-8). The comparison category for race and ethnicity in all instances is whites. African Americans were more likely to have a PAMC (OR 1.72, Figure 2). PAMC risks were not greater for Hispanics or Asians (Figure 2). Also of interest are the higher risks associated with two comorbidities for women delivering in rural hospitals: asthma (OR 2.12, CI 1.13-3.96), and obesity (OR 1.98, CI 1.21-3.24) (Table B-8).

Adjusted risks for women with deliveries in urban hospitals are shown in Figure 3 and Table B-9. With hospital factors and patient demographic and clinical characteristics held equal, PAMC risks were not elevated for African Americans compared to whites, and were lower among Hispanics and Asians (OR 0.51, OR 0.32, respectively, Figure 3 and Table B-9). In



urban hospitals, risks were higher for women with either of two comorbidities, asthma (OR 1.77, CI 1.50-2.08), and hypertension (OR 1.79, CI 1.37-2.33) (Table B-9).

Summary

Overall, PAMC risks were lower for women with deliveries in rural hospitals. Compared with white women, African American women delivering in rural hospitals had notably higher PAMC risks. This suggests that rural African American women face prenatal care access barriers. In urban hospitals, PAMC risks did not differ between African Americans and whites. In urban hospitals, PAMC risks were substantially lower for Hispanics and Asians than for whites. Taken together, the results suggest a process whereby rural African American Medicaid beneficiaries with high-risk pregnancies may not be adequately encouraged to deliver in urban hospitals. If lower risk white women from rural areas commonly seek care in urban hospitals, this could also contribute to these results.

CHAPTER 3

Potentially Avoidable Maternity Complication Risks Among Medicaid Deliveries: Medicaid Enrollment Trends in the U.S. and in Five Individual States

~ Summary ~

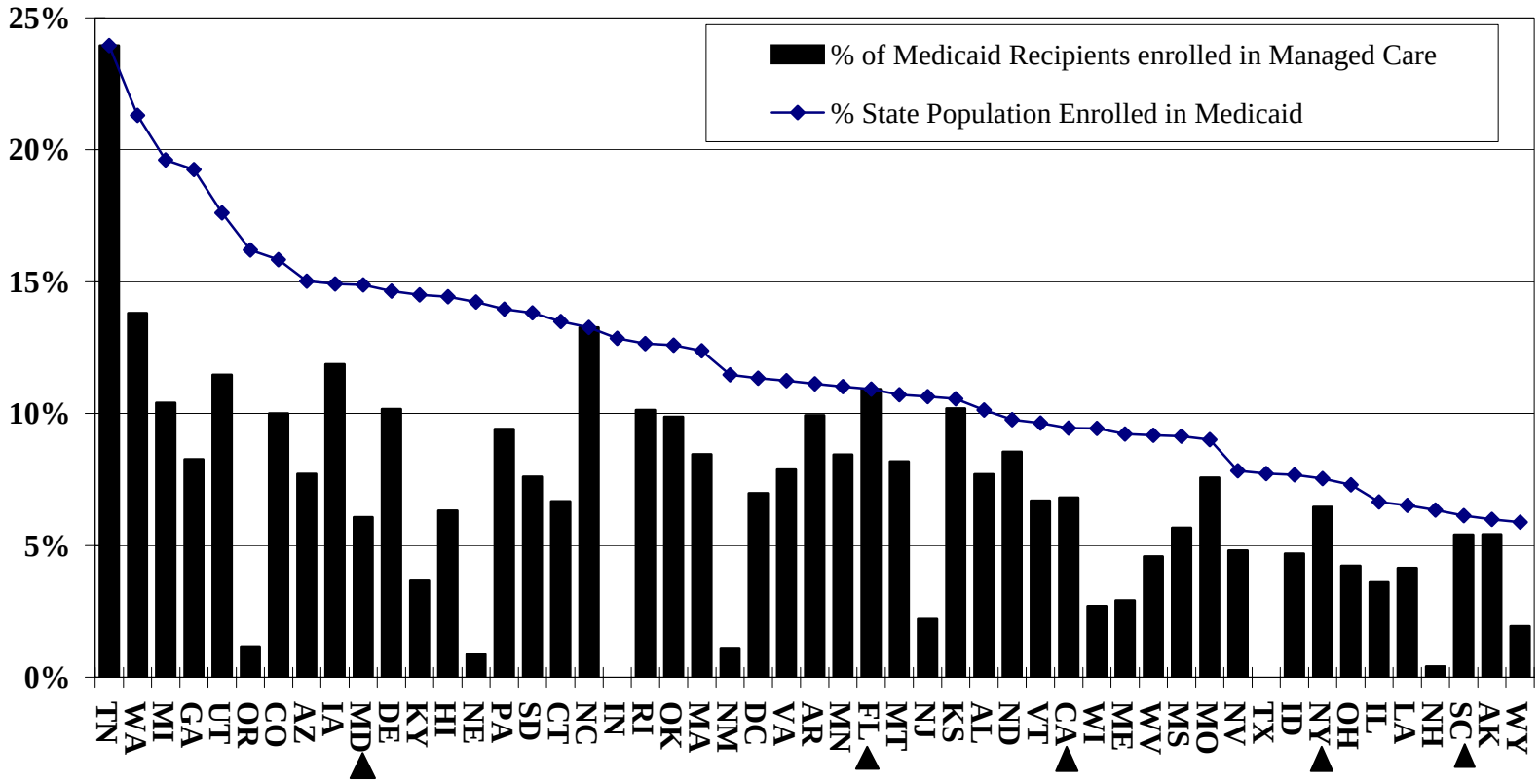
There was a large variation in Medicaid and Medicaid managed care (MMC) enrollment across the five states studied. There was no relationship between the level of a state's managed care penetration for the population in general and MMC penetration. Of the five states in our study, California, Florida, and Maryland enrolled more than half of Medicaid recipients in some type of MMC; in New York and South Carolina, a much smaller percentage of Medicaid recipients were enrolled in MMC. In discussions with five public officials knowledgeable about MMC in three of the studied states, providers stated that MMC plans could not use incentives to attract healthier women. Providers in two of these states thought that women in MFFS were in worse health than those in MMC. We emphasize that the interviews with public officials report the *opinions* of state officials who are speaking about mechanisms in place to prevent bias. These reported opinions should be carefully distinguished from objective outcomes that would indicate whether state mechanisms successfully avoid bias.

National Enrollment Trends in Medicaid and Medicaid Managed Care

To provide a policy context for the analysis of Medicaid managed care and access to prenatal care, in this chapter we provide an overview of Medicaid and MMC enrollment trends in the U.S. and in the five states studied. There is a large variation in Medicaid and MMC enrollment across states (Figure 4). For example, 23% of Tennessee's residents were enrolled in Medicaid, and all of these individuals were enrolled in managed care (TennCare). In contrast, in Wyoming, only 6% of residents were enrolled in Medicaid, with less than half of enrollees in MMC (Figure 4).

In the majority of instances, there is no apparent relationship between the level of a state's managed care penetration for the population in general and its MMC penetration (Figure 5). That is, many states have low overall managed care enrollment, but high MMC penetration (e.g., Florida, Georgia, and Michigan). Such states appear to have made a policy judgment that individuals in Medicaid require a different approach to medical care services than others in the general population. This information does not reveal, however, whether the different approach is intended primarily to reduce Medicaid costs, or to improve beneficiaries' health care outcomes, or both.

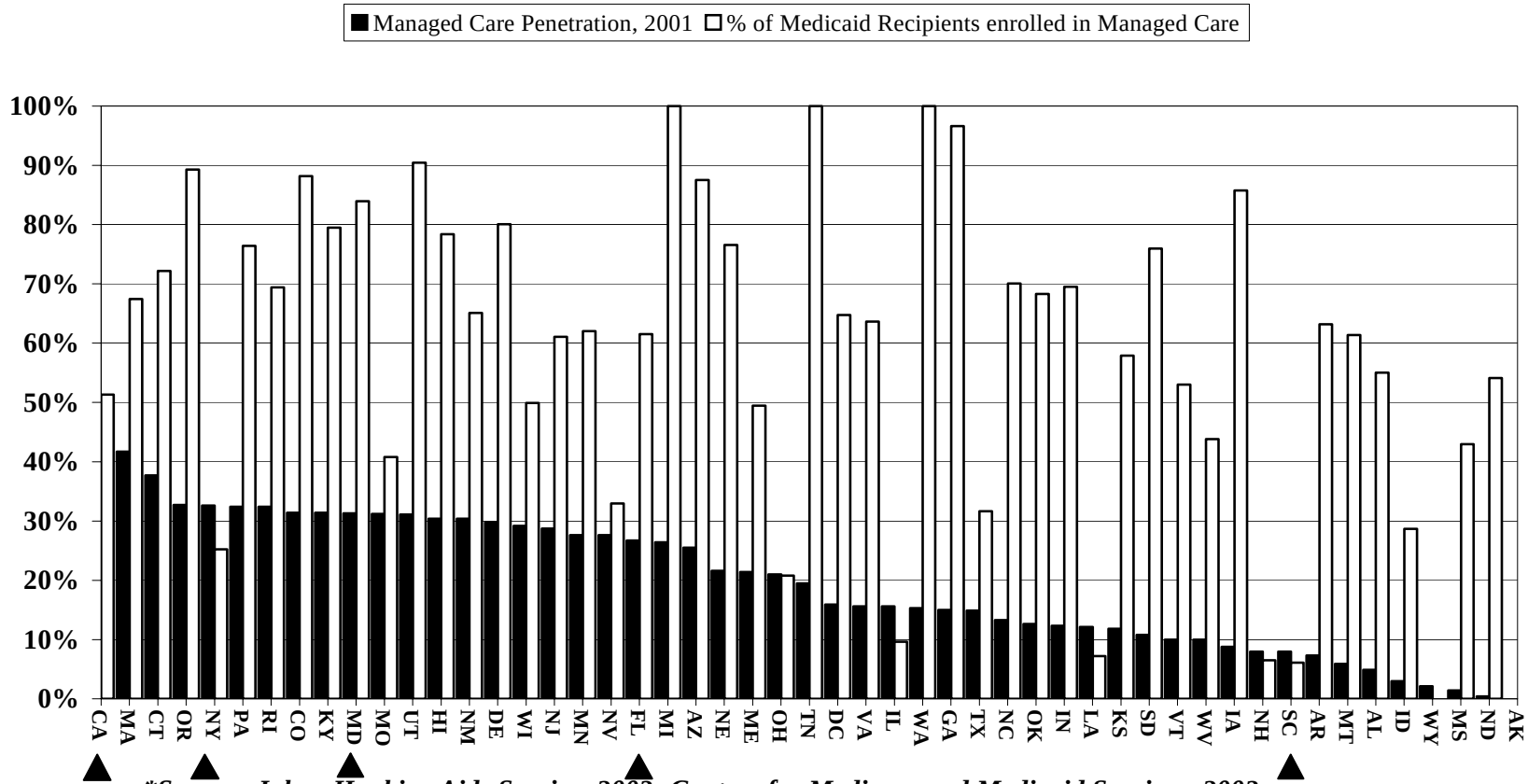
Figure 4
Medicaid Enrollment and the Percentage of Medicaid Beneficiaries in Managed Care, by State, 2000



Source: Johns Hopkins Aids Service, 2003; Centers for Medicare and Medicaid Services, 2002

▲ *Indicates states analyzed in this report*

Figure 5
State Managed Care Penetration and Percentage of Medicaid Beneficiaries Enrolled in Medicaid Managed Care, 2000



Source: Johns Hopkins Aids Service, 2003; Centers for Medicare and Medicaid Services, 2002

▲ *Indicates states analyzed in this report*

Enrollment Comparisons across the States in This Study

Given the large degree of variation among states, analyses based on national data can often conceal important differences in outcomes and quality for pregnant women receiving Medicaid benefits. Managed care enrollment characteristics among the five states included in our analysis are presented in Table 1. This summary shows:

- The percentage of *all state residents* enrolled in any form of managed care (row 1) ranged from 8.0% in South Carolina to 50.7% in California.
- The proportion of all state residents enrolled in Medicaid (row 2) ranged from 9% in Maryland to 15% in California.
- California, Florida, and Maryland enrolled more than half of Medicaid recipients in some type of managed care plan, while New York and South Carolina enrolled proportionately fewer Medicaid recipients (row 3).

Table 1. Comparison of Enrollment Characteristics among Five States

Enrollment Characteristic	California	Florida	Maryland	New York	South Carolina
Percentage of Residents Enrolled in Managed Care	50.7	26.7	30.3	32.6	8.0
Percentage of Residents Enrolled in Medicaid	15.0	11.3	9.0	14.5	14.2
Percentage of Medicaid Recipients Enrolled in Medicaid Managed Care	51.3	61.5	84.0	25.2	6.1

***Sources: Johns Hopkins Aids Service, 2003; Centers for Medicare and Medicaid Services, 2002**

To provide additional policy context for the MMC analysis, Medicaid and MMC enrollment are reviewed in the sections that follow, together with an overview of benefits provided to pregnant women covered by Medicaid. Further, as a first step to understand possible selection bias regarding enrollment into MMC, we spoke with a total of five public officials in charge of administering MMC in California, Maryland, and New York. A discussion guide for our telephone interviews is shown in appendix D. In South Carolina, very few women were enrolled in MMC in the year 2000 (less than 70); thus, we did not speak with a public official in South Carolina. (Florida public officials declined to speak with us, and did not return our phone calls.)

Although these interviews are a useful first step toward understanding differential selection processes between women enrolled in MMC and MFFS, we acknowledge that the responses we obtained may be biased. Such bias may be likely, because having no selection bias is often an explicit state goal. Thus, state officials responsible for the Medicaid program may not want to admit, even to themselves, that selection bias exists. It is also possible that all mechanisms in place to avoid selection bias are not working well, and that state officials are unaware of this shortcoming. Therefore, we emphasize that we are reporting the *opinions* of state officials who are speaking about mechanisms in place to prevent bias. These reported

opinions should be carefully distinguished from objective outcomes that would indicate whether state mechanisms successfully avoid bias.

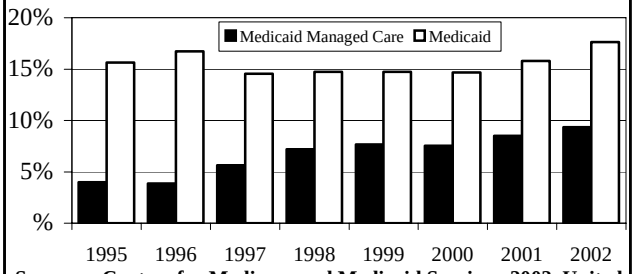
Characteristics of Medicaid, Medicaid Managed Care, and Medicaid Pregnancy Care in Studied States

California

California first authorized the provision of managed care within its Medi-Cal (i.e., Medicaid) program in 1972. Enrollment into Medicaid managed care grew slowly until the early 1990s. At that time, faced with rising medical care costs, California substantially increased enrollment of Medi-Cal recipients into managed care. Enrollment increased to 51.3% of Medicaid recipients in 2000, more than twice the enrollment in 1996 (Medi-Cal Policy Institute, 2000). In 2000, over five million California residents were enrolled in Medi-Cal (Centers for Medicare and Medicaid Services, 2002).

Medi-Cal enrollment and Medi-Cal recipients enrolled in managed care, both as a percent of the state's population for 1995-2002 are shown in Figure 6. As Figure 6 shows, enrollment in Medi-Cal as a percentage of the state population declined slightly in 1997, and remained flat through 2000. Enrollment increased in 2001 and 2002. Enrollment in Med-Cal managed care grew steadily from 1995-1998, was flat in 1999 and 2000, and grew again in 2001 and 2001. Managed care has steadily grown as a percentage of Medicaid recipients, from about 4% in 1995 to 53.0% in 2002.

Figure 6
Enrollment in Medicaid and Medicaid Managed Care, Percent of State Population, California, 1995-2002.



Sources: Centers for Medicare and Medicaid Services, 2002, United States Census Bureau, 2003

Pregnant women are eligible for additional services and have different eligibility requirements than other Medi-Cal beneficiaries. The Presumptive Eligibility for Pregnant Women Program allows pregnant women to utilize Medi-Cal services for up to 90 days while their eligibility for Medi-Cal is being determined (California Department of Health Services, 2003). The Access for Infants and Mothers (AIM) Program extends Medi-Cal benefits to uninsured mothers with incomes that exceed the eligibility criterion. This program covers antepartum, delivery, and postpartum care (California Department of Health Services, 2003).

In California, 28% of deliveries in our sample were covered by a Medicaid managed care plan. Because the California data did not provide individual or hospital level identifiers, we were not able to identify either patients' residence counties or the counties in which their delivery hospitals were located. We spoke with two public officials in California, an official in the Maternal Child Health Bureau, and an official in the Medi-Cal Managed Care Division. These officials indicated that about 85% of women receiving Medicaid are enrolled in the first trimester, about 10% in the second, and about 5% in an antepartum or delivery hospitalization. Officials commented that MMC is required to offer a comprehensive perinatal services program

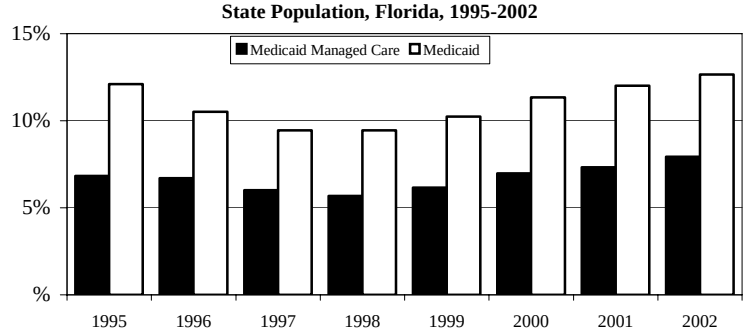
(CPSP), which provides nutritional and psychosocial counseling, health education, and general prenatal care. In contrast, MFFS is not required to offer CPSP. Both officials commented that MMC enrollment is well controlled through regulation, and that enrollment practices do not differ notably among various MMC plans. Further, all MMC plans contain the same required assessments, and offer the same types of care. The Medi-Cal managed care official commented that there were no incentives to encourage MMC plans to recruit healthier women. She commented that she believed women in MFFS were generally in worse health, and tended to subsequently enroll in MMC plans.

Florida

Florida requires all Medicaid recipients to enroll in a managed care plan unless they are covered by Medicare or reside in a nursing home. As is the case with most states having mandatory enrollment requirements, however, implementation of the requirement is not yet universal. In 2000, 61.5% of all Medicaid recipients were in managed care, about 2 million residents, compared to 60.0% in 1998 and only 37.3% in 1995 (Centers for Medicare and Medicaid Services, 2002). The state has also encouraged increased provider participation in Medicaid managed care by raising its reimbursement rates (Marquis & Long, 2002).

Medicaid enrollment and Medicaid recipients enrolled in managed care are shown in Figure 7, both as a percent of Florida's population for 1995-2002. As Figure 7 shows, enrollment in Medicaid as a percent of the state's population declined slightly in 1997 and 1998, with enrollment increases since 1999. Enrollment in MMC also declined slightly during these years, with enrollment increases since 1999. In 2002, 62.7% of Medicaid beneficiaries were enrolled in managed care. This percentage includes all Medicaid beneficiaries, however. Thus, in addition to pregnant women, it includes all adult Medicaid beneficiaries, including older individuals, and also children. It may not represent the proportion of pregnancies in MMC.

Figure 7
Enrollment in Medicaid and Medicaid Managed Care, Percent of State Population, Florida, 1995-2002



Sources: Centers for Medicare and Medicaid Services, 2002, United States Census Bureau, 2003

Eligibility for pregnant women depends on their income level and number of children. Typically, pregnant women with incomes less than 185% of the poverty level are eligible for services. Covered services include physician visits, hospital delivery, licensed midwives, and family planning. Pregnant women may also be covered under the Presumptively Eligible Pregnant Women Program. This Program allows pregnant women to utilize Medicaid services while eligibility is being determined (Agency For Health Care Administration, 2003). In Florida, 14.6% of deliveries in our sample were covered by a MMC plan. About 6% of women enrolled in MMC resided in rural areas; about 15% of women enrolled in MMC resided in urban areas.

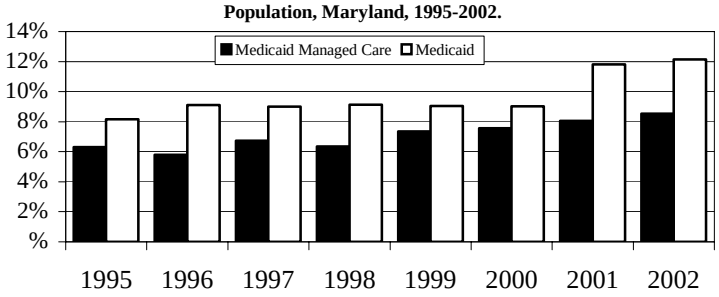
Maryland

Maryland faced high unemployment rates and budget crises due to a national economic recession in the early 1990s. The struggle to balance the state budget and to decrease expenses to meet reduced revenues placed considerable strain on many state programs. This applied particularly strongly to Medicaid, which had experienced rapid enrollment growth due to unemployment and expanded eligibility criteria. To manage costs, the state turned to managed care in its Medicaid program in the mid 1990s (Oliver, 1998).

In 1997, Maryland instituted HealthChoice, its Medicaid managed care program. The state made enrollment mandatory for eligible individuals. About 85% of Medicaid beneficiaries in Maryland are eligible for HealthChoice. Those eligible for the program include pregnant women (Maryland Department of Health and Mental Hygiene, 2002). Individuals enrolled in HealthChoice have the same benefits as those enrolled in Medicaid fee-for-service, but may be offered additional services by their managed care providers, such as dental services (Maryland Department of Health and Mental Hygiene, 2002).

Figure 8 displays Medicaid enrollment and Medicaid recipients enrolled in managed care, both as a percentage of Maryland's population for 1995-2002. Medicaid enrollment as a percentage of the state population was stable from 1995-2000, with a sizable increase in enrollment in 2001. Enrollment in MMC has increased steadily since 1999. In 1995, approximately 77% of all Medicaid recipients were enrolled in managed care. In 2000, Maryland had over 477,000 residents enrolled in Medicaid, with 84% of those in managed care (Centers for Medicare and Medicaid Services, 2002).

Figure 8
Enrollment in Medicaid and Medicaid Managed Care, Percent of State Population, Maryland, 1995-2002.



Sources: Centers for Medicare and Medicaid Services, 2002, United States Census Bureau, 2003

Pregnant women and children are eligible for services through the Maryland Children's Health Program (MCHP) as well as HealthChoice. Pregnant women of any age who have incomes below 200% of the federal poverty level are eligible for this program, even if they have another form of health insurance in addition to Medicaid (Maryland Department of Health and Mental Hygiene, 2002). Services covered include prenatal care, hospital delivery, physician visits, dental and vision care, and family planning (Maryland Department of Health and Mental Hygiene, 2002).

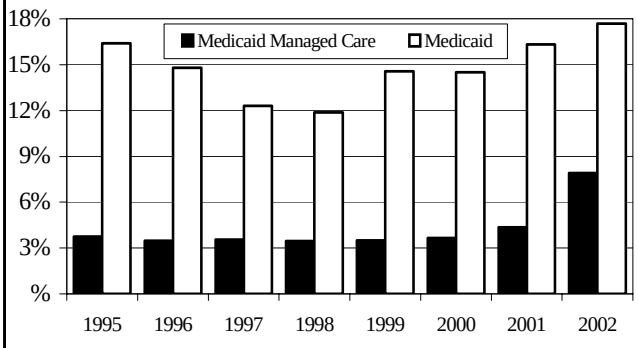
In Maryland, 77.5% of deliveries in our sample were covered by MMC. Of women enrolled in MMC in our sample, 87% had a delivery in a rural hospital; about 77% had a delivery in an urban hospital. We spoke with one public official in Maryland, affiliated with the University of Maryland. He did not have statistics available about percentages of women enrolled by pregnancy trimester. He stated that MMC is mandatory except in cases of new immigration, and other "late presenters." MMC plans offer comprehensive coverage for pregnant women. Services available to pregnant women are similar for MMC plans and MFFS. In response to our question about enrollment practice differences among MMC plans, he

commented that MMC plans are not allowed to conduct direct marketing, and differ in relative size. He stated that MMC plans are required to provide the same level of care to pregnant women, commenting that they are subject to strict government regulation. He stated that there are no incentives to encourage MMC providers to recruit or select healthier women, indicating that selection is well regulated. Finally, he commented that he believed MFFS clients would tend to be in worse health, as they present later in pregnancy, and usually without any prior prenatal care.

New York

Enrollment in Medicaid managed care began slowly in New York State. Several factors account for relatively low Medicaid managed care enrollment, including low provider reimbursement rates and many rural areas in central and upstate New York. In 1988, only 60,000 recipients were enrolled; by 1991, the number had only risen to 75,000, out of a total 1991 Medicaid caseload of 2,241,000. In 1995, New York State enacted a plan that required enrollment in managed care plans for a majority of Medicaid recipients (Sparer & Brown, 1999). The percentage of Medicaid recipients enrolled in Medicaid managed care increased from less than 20% in 1995 to nearly 30% in 1998 (Centers for Medicare and Medicaid Services, 2002). In 2000, more than 3 million New York State residents were enrolled in Medicaid; 25.2% of them in managed care (Centers for Medicare and Medicaid Services, 2002). By 2002, the percentage of Medicaid beneficiaries enrolled in managed care had risen to 44.6%.

Figure 9
Enrollment in Medicaid and Medicaid Managed Care, Percent of State Population, New York, 1995-2002.



Sources: Centers for Medicare and Medicaid Services, 2002, United States Census Bureau, 2003

Medicaid enrollment and Medicaid recipients enrolled in managed care, both as a percent of New York's population, for 1995-2002, are displayed in Figure 9. As shown in Figure 9, Medicaid enrollment followed major economic trends of the 1990s, declining in 1996 and 1997, and increasing beginning in 1999. MMC enrollment was stable at about 4% of the state's population from 1995-2000, with enrollment increases in 2001 and 2002.

Pregnant women are eligible for additional services through the New York Prenatal Care Assistance Program (PCAP). In areas without a participating PCAP clinic, the Medicaid Obstetrical and Maternal Services (MOMS) Program provides additional services to pregnant women (New York State Department of Health, 2003). Pregnant women of any age with incomes below 200% of the federal poverty level are eligible for the PCAP or the MOMS program at no cost (New York State Department of Health, 2003). Services covered under these programs include prenatal care, hospital delivery, and physician visits for mothers during their pregnancy and up to two months after birth (New York State Department of Health, 2003).

In New York, 16.2% of deliveries in our sample were covered by MMC. Of women covered by MMC in our sample, about 13% resided in a rural area and about 16% resided in an

urban area. We spoke with two officials in New York, one affiliated with the state Bureau of Women's Health, the other with the state's Division of Family Health. Both officials indicated that:

- They did not have statistics available about the timing of Medicaid enrollment by pregnancy trimester;
- Basic features of MMC include assessment, case management, and identification of special cases, e.g., women with certain chronic illnesses;
- MMC is more highly regulated than MFFS;
- MMC has higher overall quality and provides better access to specialty care;
- Enrollment procedures are standardized; i.e., do not differ among MMC plans, and are closely regulated;
- MMC plans differ in types of care provided, e.g., optional dental, routine visits, transportation;
- There were no incentives that encourage MMC providers to recruit or select healthier women;
- State regulations do not allow marketing;
- They believed that there is no difference in the health status of women enrolled in MMC versus MFFS, and;
- Women can choose between enrolling in MMC and MFFS.

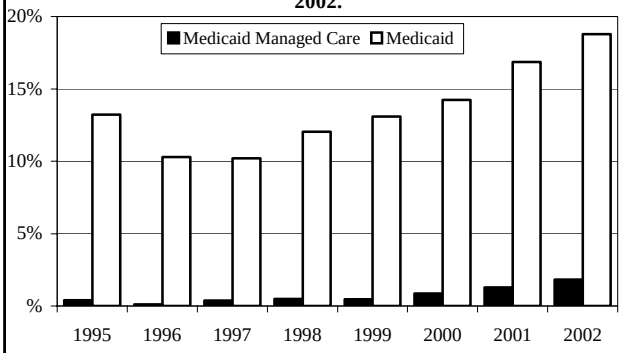
One official stated, "many MMC plan names are well-recognized and sought after by clients." One stated that New York used a "maternity kick payment," which is a separate amount paid to MMC plans for every pregnant woman enrolled.

South Carolina

Medicaid managed care began in 1996 in South Carolina, with the Physician Enhanced Program (PEP). Studies have shown that MMC has saved South Carolina anywhere from 2% to 7% per member, encouraging the state to increase enrollment (South Carolina Department of Health and Human Services, 2003). The number enrolled in MMC increased by more than 500% from 1999 to 2002, with 10,000 more expected to enroll for 2003 (South Carolina Department of Health and Human Services, 2003). In 2000, South Carolina had approximately 570,000 residents enrolled in Medicaid; 6.1% of these were enrolled in managed care (Centers for Medicare and Medicaid Services, 2002). Again, however, this represents all Medicaid recipients, including children, older adults, and adults of middle ages who are not experiencing pregnancies. It does not necessarily indicate the proportion of pregnant women enrolled in MMC.

Figure 10 displays Medicaid enrollment and Medicaid recipients enrolled in managed care, both as a percent of South Carolina's population for 1995-2002. Medicaid enrollment as a percent of the state's population declined in 1996, with steady enrollment increases since 1997. Enrollment in Medicaid managed care was low throughout this period, with increases in managed care enrollment in 2001 and 2002.

Figure 10
Enrollment in Medicaid and Medicaid Managed Care, Percent of State Population, South Carolina, 1995-2002.



Sources: Centers for Medicare and Medicaid Services, 2002, United States Census Bureau, 2003

Pregnant women and children in South Carolina are eligible for services up to 185% of the federal poverty level, even if they have another form of health insurance in addition to Medicaid (South Carolina Department of Health and Human Services, 2003). Services covered include prenatal care, hospital delivery, physician visits, vision and dental care, and family planning (South Carolina Department of Health and Human Services, 2003).

In South Carolina, only 68 deliveries covered by Medicaid were in a MMC plan. Because of the extremely low MMC coverage of pregnancies in South Carolina, we were not able to examine effects of MMC penetration or compare PAMC risks between women in South Carolina enrolled in MMC versus MFFS.

CHAPTER 4

Potentially Avoidable Maternity Complication Risks Among Medicaid-insured Deliveries: Case Studies of Prevalence and Contributing Factors in Five States

~ Summary ~

Across five geographically and racially diverse states, there were no substantial differences in PAMC risks by rural or urban status for Medicaid-insured mothers. In no instance was MMC associated with higher PAMC risks. In Maryland and New York, mothers enrolled in MMC had lower PAMC risks than those enrolled in MFFS. In these same two states, higher MMC penetration was associated with lower PAMC risks among women enrolled in MMC. Compared to whites, PAMC risks were generally lower for Hispanics and Asians, and higher for African Americans.

In South Carolina, after controlling for a wide variety of risk factors, PAMC risks did not differ between African American and white mothers. However, in this instance unadjusted risks provide a better foundation for policy development. This is so because the prevalence of a wide-array of risk factors is substantially greater for African Americans than for whites in South Carolina. African Americans are more likely to: be single; live in poverty; live in a rural area; be age 17 or younger; have anemia, diabetes, or hypertension, and; be obese. These are all factors that contribute notably to PAMC risk. Thus, in South Carolina, and possibly in similar states, the greater unadjusted risks of African Americans best show where prenatal care policies can be most efficiently targeted.

Estimates of PAMC prevalence and risks were developed for women receiving Medicaid in California, Florida, Maryland, New York and South Carolina. In all states, race and ethnicity and rural and urban comparisons were examined. We were able to analyze the impact of Medicaid managed care (MMC) versus Medicaid fee-for-service (MFFS) enrollment at the state level in California, Florida, Maryland, and New York. South Carolina had too few MMC deliveries for study. In Florida, Maryland, and New York the associations of MMC penetration and PAMC risk were also investigated.

~ Data and Sampling ~

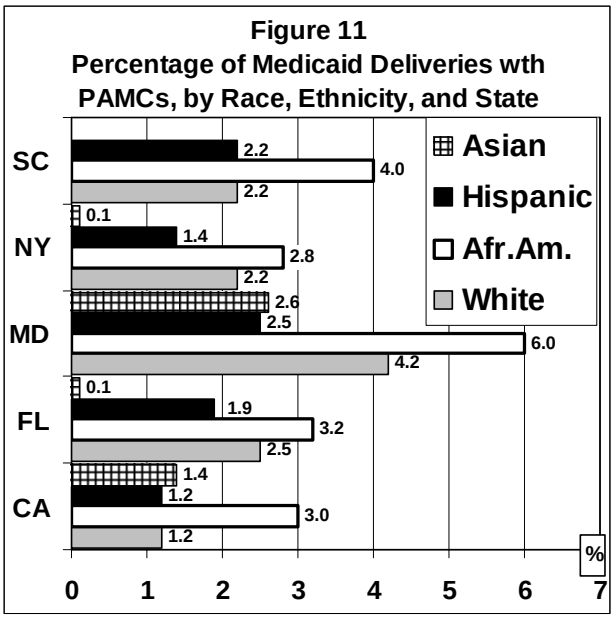
Data for California, Florida, Maryland, and New York were from the year 2000 Statewide Inpatient Dataset (SID), from the Health Care Cost and Utilization Project. The SID is a 100% sample of hospitals available for selected U.S. states. For South Carolina, data were obtained from The South Carolina Department of Health and Environmental Control for the year 2000. All state-level datasets were restricted to delivery hospitalizations. Because almost all births occur in hospitals, this restriction approximates population risks.

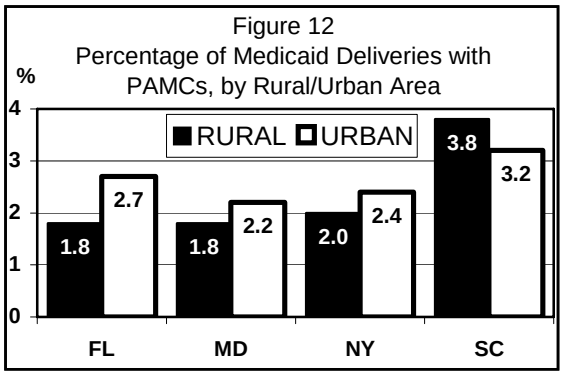
In all state-level analyses, rural counties were defined as those with no more than 20,000 residents, not adjacent to metropolitan areas. Location is based on the county of residence for women in Florida, New York and South Carolina. In Maryland, location is based on the county of the delivery hospital. For California, no hospital or patient level identifiers were provided; thus, the California analysis is limited to the state level.

Separate estimates were developed for African American, white, Hispanic, and Asian women.

PAMC Risks among Medicaid-insured Women

Figure 11 shows the proportion of women with PAMCs, by race and ethnicity, for the five states examined. In all states, African Americans had a higher percentage of deliveries with a PAMC than whites; however, the percentage ranged from 2.8% in New York through 6.0% in Maryland. The percentage of deliveries with a PAMC was similar or somewhat lower for Hispanics than whites. In Florida and New York, Asian women had very low percentages of deliveries with PAMCs. In California, the percentage of deliveries with PAMCs among Asian women was higher than Hispanics or whites. We note that California has the highest percentage of Asian women of all states studied. Maryland had the highest percentage of African American women of all states studied.



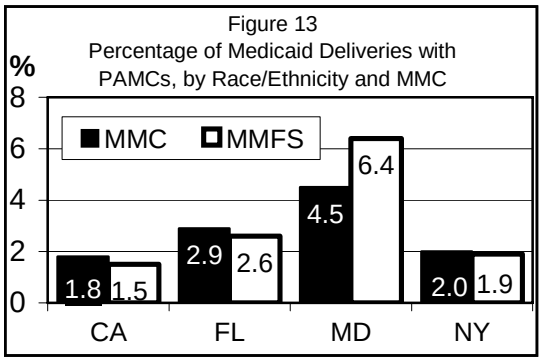


PAMC rates by rural and urban areas are shown in Figure 12. Generally, rural or urban differences in PAMC risks were not substantial: In Florida, Maryland, and New York, women in rural areas had lower PAMC risks (Figure 12). In South Carolina, women living in rural areas had greater

PAMC risks (Figure 12).

Figure 13 shows the proportion of mothers with PAMCs by type of Medicaid coverage (MMC or MFFS). In California and Florida, women in MFFS were less likely to have a PAMC than those in MMC. In Maryland, women in MFFS were more likely to have a PAMC than those in MMC. In New York, PAMC rates did not differ notably between women in MMC and those in MFFS.

Figure 13
Percentage of Medicaid Deliveries with PAMCs, by Race/Ethnicity and MMC



Multivariate Analysis: Factors Affecting the Risk of a PAMC among Medicaid Deliveries

Multivariate logistic regression was used to examine effects of race and ethnicity, rural or urban status, MMC versus MFFS, and MMC penetration on PAMC risks, with patient and hospital characteristics held equal. Rural and urban results are shown in Figure 14. The only notable rural urban differences were found in South Carolina: women residing in rural areas had greater PAMC risks than those of women in urban areas; however, this result was only marginally statistically significant (OR 1.96, CI 0.99-3.88) (see also Tables B-11-B-14).

Figure 14
Adjusted Odds of Rural Residents with Medicaid Deliveries Having PAMCs, Compared to Urban Residents

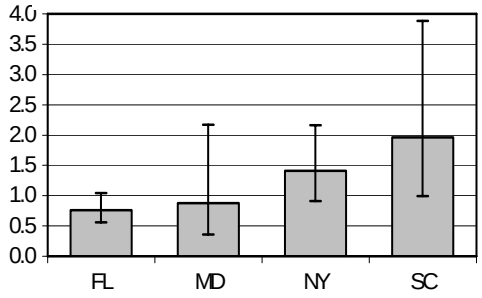
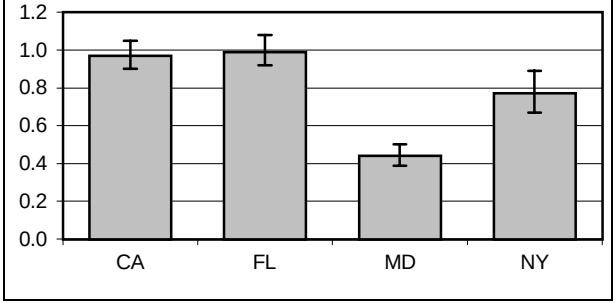


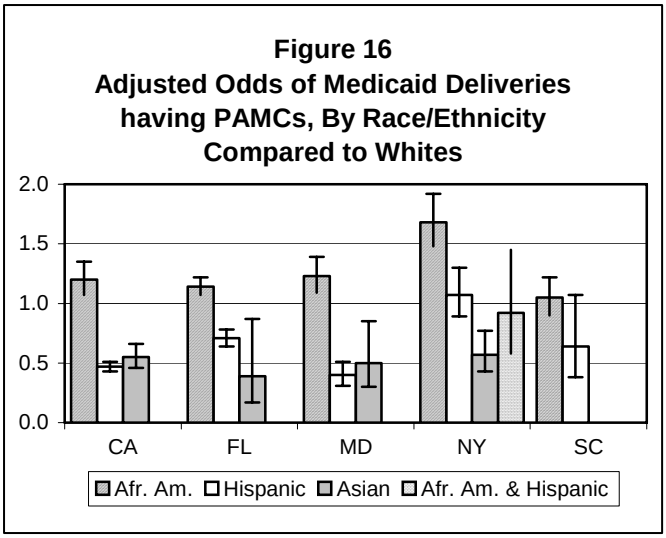
Figure 15 shows the adjusted results comparing PAMC risks for women in MMC versus MFFS. In no instance was MMC associated with greater PAMC risk. In Maryland and New York, women in MMC had lower PAMC risk than women in MFFS (OR 0.44, CI 0.39-0.50; OR 0.77, CI 0.67-0.89, respectively) (see also Tables B-12 and B-13). In California and Florida, PAMC risks did not differ between women in MMC and those in MFFS (see also Tables B-10 and B-11).

Figure 15
Adjusted Odds of Medicaid Recipients Enrolled in MMC Compared to Those Enrolled in MFFS



In Maryland and New York, greater MMC penetration was associated with lower PAMC risk for women in MMC: for each 1% increase in MMC penetration, PAMC risks were reduced by 0.83% in Maryland and by 1.07% in New York (penetration results not shown in tables). MMC penetration was not associated with PAMC risk for women in Florida. Because we could not obtain hospital or patient county identifiers for California, penetration effects could not be examined

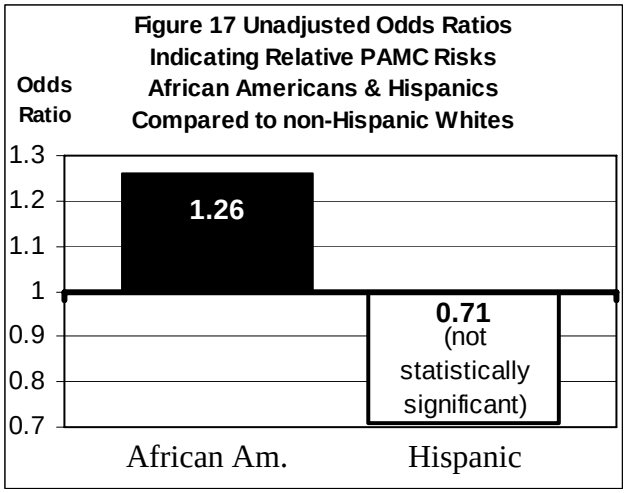
for that state.



The odds of having a PAMC were notably higher for African Americans than for whites in four of the five states studied (Figure 16 and Tables B-10 through B-13). PAMC risks among African American women were greater than whites in California (OR 1.20, CI 1.07-1.35), Florida (OR 1.14, CI 1.07-1.22), Maryland (OR 1.23, CI 1.09-1.39), and New York (OR 1.68, CI 1.48-1.92). For the multivariate analysis for New York State, the data permitted us to distinguish between African Americans who were also identified as Hispanic, and all other African Americans. Viewed from another perspective, in the New York analysis we were able to distinguish between Hispanics who were also identified as African American, and other Hispanics. In New York, PAMC risks for non-Hispanic African American women were greater than those for whites (OR 1.68, CI 1.48-1.92). In contrast, the risk for Hispanic African Americans did not differ statistically from the risk for whites. In New York, the risk for Hispanic women who were not also identified as African Americans did not differ from that of whites (Figure 16 and Table B-13).

Adjusted PAMC risks were notably lower for Hispanic women than for whites in most instances: California (OR .43, CI 0.43-0.51), Florida (OR .71, CI 0.64-0.78), and Maryland (.40, CI 0.31-0.51) (Figure 16 and Tables B-10-B-12). For Asian women, adjusted PAMC risks were substantially lower in all instances in which the data included sufficient numbers of women in this category: California (OR 0.55, CI 0.46-0.66), Florida (0.39, CI 0.17-0.87), Maryland (OR 0.51, CI 0.30-0.85), and New York (0.57, CI 0.43-0.77) (Figure 16 and Tables B-10-B-13).

Detailed Analyses of Individual-Level Risk Factors in South Carolina



The South Carolina analysis uses a rich, state-specific data set. This state provided a unique opportunity to study effects of individual characteristics on PAMC risks. At the population level, 4% of African American mothers experienced a PAMC at delivery, compared with 2.2% of white mothers. Figure 17 shows uncontrolled odds ratios of PAMC risks, focusing on differences by race and ethnicity. Not controlling for other factors, African American mothers had higher odds of having a PAMC than did white women (adjusted OR 1.26; p<.002); risks were not significantly

different for Hispanic women compared with whites (p=0.18) (Figure 17). To examine risks among race and ethnicity groups by rural and urban area of residence, we investigated interactions of the race and ethnicity categories and the rural covariate. None of the interactions were statistically significant.

Prior to controlling for other factors in a multivariate analysis, we examined the prevalence of individual characteristics that were likely risk factors for having PAMCs, comparing African American and white mothers (Table 2). Compared with white mothers, substantially and significantly higher proportions of African American mothers were single, not living with a spouse, had low income, were disabled, had anemia, diabetes, and/or hypertension, were obese, and lived in a rural area (Table 2).

Next we estimated a multivariate model, holding individual factors constant. When individual characteristics were held equal, the odds of experiencing a PAMC did not differ between African American and white mothers (see Table B-14). However, the multivariate analysis also found that the risk factors that disproportionately affected African Americans (being single, being age 17 or younger, having diabetes or hypertension, and so forth) contributed notably to PAMC risk. Given that these risk factors disproportionately characterize African Americans, we conclude that in this instance the unadjusted results provide more useful knowledge for policy development.

Table 2. Prevalence of Factors Affecting Risks of Potentially Avoidable Maternity Complications, African American and White South Carolina Medicaid Beneficiaries[a]

Characteristic	African American Women	White Women	p-value
Marital status, single	71.16	49.71	<0.0001
Marital status, married, living with spouse	7.24	26.77	<0.0001
Income below poverty threshold	84.09	76.18	<0.0001
Disabled	2.53	1.34	<0.0001
Ages 10-17	5.85	3.88	<0.0001
Have anemia comorbidity	8.14	5.20	<0.0001
Have asthma comorbidity	1.58	1.80	0.8230
Have diabetes comorbidity	1.05	0.55	<0.0001
Have hypertension comorbidity	1.35	0.90	0.0002
Obesity	1.57	1.25	0.0056
Education, 0 through 7 years	41.22	39.14	0.3576
Education, 8 through 11 years	15.88	20.94	<0.0001
Education, 12 years or more	42.90	39.92	<0.0001
Live in a rural county	17.39	14.73	<0.0001

[a]p-values indicate results of chi-square tests for statistically significant prevalence differences for the factors, comparing rates for African American women to those of white women.

Summary

Using data from five states that are diverse with regard to geography and race or ethnicity, there was little evidence of differences in PAMC risk between rural and urban areas. In no instance was MMC associated with higher PAMC risks. In Maryland and New York, mothers in MMC had lower PAMC risks than those in MFFS. In these same two states, greater MMC penetration was associated with reduced PAMC risk for women in MMC. PAMC risks were generally lower for Hispanic and Asian women than for whites. In South Carolina, adjusted odds of a PAMC did not differ between African Americans and whites. However, the prevalence of many notable risk factors was substantially higher for African Americans. Thus, we concluded that, in the instance of South Carolina, the unadjusted results provide the more reasonable foundation for policy development.

CHAPTER 5

Conclusions and Policy Implications

National Findings on PAMC Prevalence

We examined the national prevalence of PAMCs among women receiving Medicaid using a geographically diverse hospital discharge dataset representing 28 states. At the national level, we found that women receiving Medicaid benefits with deliveries in rural hospitals had lower PAMC risks than those in urban hospitals. This was the expected finding, because women at higher risk of PAMCs would be expected to deliver in urban hospitals, which are generally better equipped to address these greater risks. African American women with deliveries in rural hospitals, however, had greater PAMC risks than did white women, a difference that was not present in urban hospitals. Also, in urban hospitals, adjusted PAMC risks were substantially lower for Hispanics and Asians than for whites.

Effects of Medicaid Managed Care: Research in Selected States

Effects of Medicaid Managed Care (MMC) on PAMCs were studied using hospital discharge data from five geographically, racially and ethnically diverse states. We found little evidence suggesting notable differences between the PAMC risks of rural and urban areas. There was no evidence that our findings might result primarily from a lack of MMC enrollment in rural areas. Although the Florida MMC enrollment rate in urban counties was nearly three times as great as the rate in rural counties, such differences did not appear in other states. In Maryland, for example, a larger proportion of women delivering in rural hospitals were in MMC than were those delivering in urban hospitals. In New York, the proportion of rural residents in MMC was similar to the proportion of urban residents.

In the comparisons between MMC and MFFS, after holding individual, hospital, and area factors equal, in no instance was MMC associated with higher PAMC risk. In New York and Maryland, women in MMC had lower PAMC risk than did women in MFFS. There was also evidence suggesting that greater MMC penetration was associated with lower PAMC risk for women in MMC in Maryland and New York. Adjusted PAMC risks were generally lower for Hispanics and Asians, and generally higher for African Americans, all compared with the risks for whites.

In South Carolina, PAMC risks were higher for African Americans than for whites before controlling for other factors. We also found that the prevalence of risk factors was substantially higher for African Americans than for whites. For example, African American women in South Carolina were much more likely to have a serious chronic disease, such as anemia, diabetes, or hypertension. After we controlled for these risk factors, adjusted PAMC risks did not differ between African Americans and whites. We concluded, however, that the greater prevalence of PAMC risk factors among African Americans in South Carolina suggests that unadjusted results provide the more reasonable foundation for policy development. This is so because the prevalence of a wide array of factors that contribute notably to PAMC risks is substantially greater for African Americans than for whites in South Carolina. Thus, in South Carolina, and

possibly in similar states, the greater unadjusted risks of African Americans best show where prenatal care policies can be most efficiently targeted. From a policy perspective, this result suggests that policymakers and practitioners have an opportunity to target known risk factors underlying greater PAMC risks for minority women in South Carolina.

Because it used hospital discharge data, our study could not identify whether women in MMC were in better health early in their pregnancies than those in MFFS. However, the models controlled for important comorbidities (anemia, asthma, diabetes, hypertension, and obesity), age, and area income and education levels. Thus, the models controlled in part for differences in health status that may be associated with differences in enrollment based on individuals' health status.

To begin to understand the extent to which health status differences between MMC and MFFS may have played a role, we spoke with five public officials who were administrators in the Medicaid programs for pregnant women in California, Maryland, and New York, the states we studied in detail. (South Carolina had very little MMC; MMC administrators in Florida declined to speak with us.) All officials stated that the enrollment process was tightly regulated, and that MMC programs could not use incentives to recruit or select healthier women. Nonetheless, in two states, California and Maryland, officials indicated that women in MFFS tended to be in worse health than those in MMC. In New York, the public official indicated that there was no difference in health status between pregnant women in MMC and those in MFFS. In California and New York, officials indicated that MMC may provide care of better quality to pregnant women than that provided by MFFS. However, as we emphasize in Chapter 3, the responses we received may be biased. We stress that we have reported *opinions* of state officials who are speaking about the mechanisms in place to prevent bias, not objectively measured outcomes that would indicate whether these state MMC programs successfully avoid selection bias. Given the importance of our findings in this area for policymaking, future research should be designed to examine selection issues specifically.

We conclude that pregnant women in MMC in no instance fared worse than pregnant women with MFFS. In several instances, moreover, MMC enrollment was associated with reduced PAMC risks. Therefore, MMC should be encouraged. Florida had low rural MMC penetration. Low penetration may characterize rural areas in other states, as well, as research suggests that rural areas generally have less managed care penetration than do urban areas (Felk-List et al., 1999). We conclude that additional incentives or other creative policy interventions may be required to provide the benefits of MMC to women in rural areas.

We also tentatively conclude that rural African American women may face barriers to obtaining appropriate referrals. This conclusion is tentative because we do not know whether the evidence we found that suggests such barriers results from patient preferences, transportation difficulties, or bias on the part of practitioners.

Policy Recommendations

A number of studies have found that improvements in birth outcomes can be achieved when community-developed prenatal care case management programs are linked with Medicaid expansions (Buescher et al., 1991; Farrow et al., 1996; Griffin et al., 1999; Heins, Nance, and Ferguson, 198; Reichman and Florio, 1996). Our results showed that women enrolled in MMC had lower PAMC risks than those of women in MFFS, and that, among women enrolled in

MMC, PAMC risks were lower in areas with greater MMC penetration; these results are consistent with the findings of studies focusing on case management programs for pregnant women. Further, all of the public officials we spoke with indicated that MMC incorporates case management. Collectively, these results support the following recommendation:

- The Secretary of the Department of Health and Human Services (The Secretary) should direct the Centers for Medicare and Medicaid Services (CMS) to encourage the enrollment of pregnant Medicaid beneficiaries into managed care. Managed care should include outreach, case management, and management of major chronic diseases, particularly for women at higher risk of chronic disease and those who traditionally receive less prenatal care. MMC should include a special focus on risk factors among women in vulnerable groups and their providers, including: cultural competency of prenatal care providers; case management and other forms of support; transportation to prenatal care providers; health care home visits; and, faith-based interventions focused on healthy lifestyles.

The higher PAMC rates we observed using national data for African American mothers delivering in rural hospitals suggest both inadequate access to prenatal care and inadequate referral of high-risk women to urban hospitals, which are usually better equipped to address their needs. Thus, we recommend:

- The Secretary should direct CMS to monitor Medicaid deliveries in MMC and MFFS to identify contractors who do not appear to be referring appropriately. Policymakers and practitioners should develop guidelines for practitioners in rural areas that will improve rates of referral to urban hospitals for women with high PAMC risks. Practitioners should be monitored and potential sanctions developed.

Prior work has shown that, compared with urban areas, managed care penetration is less in rural areas (Felk-List et al., 1999), and that individuals living in rural areas are less likely to receive preventive services than those in urban areas (Casey, Thiede Call, & Klingner, 2001). These findings support the expansion of Healthy Start in rural areas:

- The Secretary should direct the Health Resources Services Administration to expand Healthy Start in rural areas. Currently only about 10% of Healthy Start programs are in rural areas. Greater access to Healthy Start, particularly for vulnerable women, may reduce pregnancy complications.

Recommendations for Further Research

- Conduct additional state-level analyses of the impact of MMC penetration on pregnancy complications, using the PAMC indicator.

- Evaluate outcomes of expanding access for at-risk mothers to Healthy Start, Community Health Centers, and other innovative initiatives using the PAMC indicator.
- Perform further analyses of race and ethnicity and PAMC risks, focusing on specific subgroups among Hispanic and Asian women, e.g., Cuban Americans, Mexican Americans, Japanese Americans, and Chinese Americans. Additional analyses should examine PAMC risks for American Indians. Studies such as these can help to identify groups that might particularly benefit from expanded prenatal care outreach.
- Conduct quantitative evaluations of MMC implementation, to examine possible differential selection processes affecting enrollment and retention in MMC.
- Develop guidelines to help rural providers direct women at high risk of pregnancy complications to urban hospitals, which are better equipped to manage complications.

Appendix A:

Potentially Avoidable Maternity Complications

Table 1. Potentially Avoidable Maternity Complications (PAMCs), Deliveries, Categories and Definitions[a]

Category	DX1	DXn
Convulsions	642(31,41,51,61,71), 65811, 66331	7803
Diabetes, Uncontrolled	64801	250(02,03,11,13,41,43,51,81,83,91,93)
	64421	25003
Drug, Alcohol, Substance, and Tobacco Abuse	65841,66131	64831
	65811	304(01,21)305(00,1,20,60,61,70),V1582
	65801	305(1,20,60),64831,V1582
	65651	305(00,1,20,60),64831,V1582
	65641	305(1,20,60),64831
	65631	64831
	65551	ANY
	64421	3051,303(90,91),304(01,20,21,30,31,70,71), 305(00,01,20,21,51,60,61,70,71,90,91),64831,V1582
	64271	64831
	64241	64831
	64231	305(1,20,60)
	64121	304(01,21),305(1,00,20,60,61,70,31),64831
	64111	64831
Eclampsia	64261	7803
Excessive Fetal Growth	65661	25000,64881,65701
Fetal Damage from Drugs, Diseases	ANY	65551
GU Infection	65881,64421	64662
Hepatitis B	64761,64671	07030
Infectious and Parasitic Diseases	65811	647(81,91)
	646(61,81),656(41,81)	64781
	64421	647(81,82),64791
Insufficient Prenatal Care	64(111,251,261,421),656(11,41,51,61,81), 66(602,612,622,702)	V237
Intrauterine Death	64(121,251,271,421,801),65(221,421,451,631)	65641
	65641	305(20,60),414,64(121,241,251,271,801,831,881), 65(611,651,661,801,821,841,881),V1581,V237
	658(01,11,21,41),66301	65641
Iron Deficiency Anemia	658(11,41)	2809
	65811	28(58,59)
	64421	28(09,58,59)
Non-compliance with medical treatment	656(41,51)	V1581
Poor fetal growth	65651	3051,V237
Pre-eclampsia	64251	51(80,84),7803,64(131,261),65641,66932
Premature Rupture of Membranes	65811	414,2809,13101,304(01,21),305(00,20,50,60,61,70), 5990,6160,646(51,61,62),64711,648(21,22,31),65641, 7803,7998,9953
Premature separation of placenta	64121	304(01,21),305(00,20,50,70)
Pyelonephritis	64(421,661)	59080
Rhesus Isoimmunization	64421,656(31,41,51),65701	65611
Ruptured Uterus	66511	ANY
Septicemia	64421	03842
Sexually transmitted diseases	65811	7811,7998,9953,64711
	65641	64711
	64781	7998
	64711	980
	64421	64711,7988,7998,980,9953
Status Asthmaticus	64421	49391

[a]All codes are ICD-9-CM, with implied decimal following the third digit; code abbreviations: e.g., 64(131,261)=641.31 or 642.61; commas between codes indicate "or"; ANY=any valid code; DX1=principal (first-listed) diagnosis; DXn=any secondary diagnosis; NOTE: PAMCs are defined by *pairs* of DX1 and DXn (both must be present in the discharge record).

Appendix B:

Data, Analytical Approach, Descriptive Tables

Data

Several data sources were used. Hospital discharge data from four states, California, Florida, Maryland, and New York, were obtained for the year 2000 from the Statewide Inpatient Database (SID) of the Healthcare Cost and Utilization Project (HCUP), from the United States' Agency for Healthcare Research and Quality. Hospital discharge data for South Carolina for the year 2000 was obtained from the South Carolina Office of Research and Statistics, of the state's Department of Health and Environmental Control (DHEC).

We supplemented the race/ethnicity and rural/urban residence state level analyses with nationally representative hospital discharge data from the 2000 Nationwide Inpatient Sample, also from the Healthcare Cost and Utilization Project. The NIS is a 20% sample of community hospitals in 28 states. We supplemented the SID and South Carolina Data with data from the year 2000 Area Resource File and the year 2000 annual survey of the American Hospital Association.

Analytical Approach

For the NIS analyses we used SUDAAN software to provide nationally representative results. To obtain the results for the individual state analyses, we used multilevel models, often referred to as random effects models. In states where each individual's county of residence was known (Florida, New York, South Carolina), the random effect is modeled at this residence county level. This approach adjusts the estimates for unmeasured characteristics of the mothers' counties of residence, and also for the clustering of data that occurs when multiple hospitalizations occur from each county. In Maryland, where residence county was not known but the county of the delivery hospital was known, we modeled the random effect at the level of the delivery hospital's county. This would similarly adjust the regressions for unmeasured characteristics of each hospital's county, and also for correlations among women who used the hospitals of a given county. Most important for our analyses, employing the multi-level modeling approach provides statistically valid measures of the effects of variables measured at the county level. In particular, this should provide valid results comparing rural and urban counties. This would not be true of results for such measures obtained using more traditional methods, where repeated observations on each county would produce artificially small standard errors for variables measured at the county level. In that regard, our results for these measures are likely to be more conservative than results that would be obtained using more traditional methods. Analysis of interactions between these levels allowed us to study of the effect of MMC penetration rates on the PAMC risk for individual MMC enrollees. We also examined interactions of race/ethnicity and rural/urban for all state level data and for the NIS.

The value of the random disturbance term is invariant for observations on a given hospital. Across hospitals, it is assumed to be normally distributed. The logistic analyses of the state analyses were conducted using MLwiN software (Rabash, Browne, & Goldstein, 2000)

with second order penalized quasilikelihood methods using restricted iterative generalized least squares estimation (Goldstein, 1989).

Dependent Variable

The dependent variable indicated whether the hospitalization included a PAMC. A hospitalization with one or more PAMC diagnoses was counted as one PAMC.

Independent Variables

Dummy variables representing various groups categorized by race/ethnicity, together with a dummy variable representing "other race" and a second representing "race missing," were included in the models. Age is represented in the models, with dummy variable groupings: 10-17, 18-24, 30-34, 35-39, 40 and over, with ages 25-29 as the omitted comparison category. County measures are OB/GYNs per 10,000, primary care physicians per 10,000, percent of the population age 25 and over with educational attainment less than high school, percent below the poverty threshold, median income (log), and a dummy variable indicating whether the county is rural. Additional county measures include whether the county has at least one federally qualified health center, and whether the county is classified as a Health Professional Shortage Area. Hospital measures included in the models are delivery volume, a dummy variable indicating whether the hospital is a teaching hospital, and ownership. Delivery volume was calculated for each hospital, by summing the number of annual deliveries in the available data.

To control for underlying health status, we created indicator variables for five comorbidities commonly associated with pregnancy outcomes: anemia, asthma, diabetes, hypertension, and obesity. We assigned comorbidities based on ICD-9-CM codes, examining all secondary diagnoses and excluding from the assignment for a given hospitalization any conditions that were identified as PAMCs during that stay. Aside from obesity, ICD-9-CM codes defining these comorbidities have been published (AHRQ, 2002). Obesity was defined by codes 278.00, 278.01, 646.11, 646.12, 646.13, or 646.14.

Given our assumption that hospital deliveries approximate the population of births, we measured Medicaid managed care penetration using the discharge data. We summed the number of deliveries covered by Medicaid managed care. This became the numerator of the penetration equation. The denominator was the number of deliveries covered by Medicaid. The summations were made for patients' counties of residence where this information was known. In other instances, it was made for counties in which the delivery hospitalization occurred.

Analysis Limitations

Selection bias may occur if Medicaid recipients systematically select into MMC or MFFS in selected counties, resulting in unmeasured heterogeneity among counties. This could occur, for example, if Medicaid caseworkers in a given county systematically enroll women with a particular profile of health risk into MMC or MFFS, and if approaches to enrollment differ across counties. One approach to addressing this problem uses county level indicators (fixed effects) representing individuals' counties of residence, to investigate and control for potential selection bias (Garrett, Davidoff, & Yemane, 2003). A limitation of the fixed effects approach implemented at the county level is that it does not permit estimation of the impact of variables of

interest that are measured at the same level. In this study, the impact of MMC penetration is of special interest. To permit the estimation of the impact of MMC penetration while nonetheless addressing unmeasured heterogeneity among counties, models were estimated with random effects at the county level, with a variable representing MMC penetration rates included in the model explicitly. Although this approach addresses bias associated with counties' approaches to MMC enrollment, it does not address a potential bias associated with individual beneficiaries' decisions about MMC enrollment.

The models address this potential bias, in part, by including individual-level measures that may be associated with these decisions. Such measures include comorbidities, race/ethnicity, and age. Income and education measures representing beneficiaries' counties of residence also control, in part, for factors associated with these decisions. Similarly, bias may exist in the data as a result of Medicaid managed care providers attempting to selectively enroll healthy women, to limit their costs and maximize net income. To the extent that our control variables for age, comorbidities, and area measures provide effective controls for characteristics associated with risk, we have removed this source of bias from the results for Medicaid managed care.

Table B-1. Means and Standard Error of the Mean of Variables Used in the Models, Medicaid Beneficiaries with Delivery Hospitalizations, Nationally Representative Data from the Nationwide Inpatient Sample, Year 2000.[a]

	Mean	(SE)
Individual-level Measures		
Non-Hispanic white	28.6%	(1.64)
African American	16.2%	(1.23)
Hispanic	26.2%	(2.41)
Asian or Pacific Islander	2.2%	(0.59)
Other race or missing race	26.8%	(2.28)
Age 10 through 17	8.0%	(0.16)
Age 18 through 24	52.6%	(0.51)
Age 25 through 29	21.8%	(0.24)
Age 30 through 34	11.4%	(0.26)
Age 35 through 39	5.0%	(0.13)
Age 40 or over	1.2%	(0.04)
Anemia comorbidity[b]	4.4%	(0.27)
Asthma comorbidity[b]	1.6%	(0.15)
Diabetes comorbidity[b]	0.4%	(0.03)
Hypertension comorbidity[b]	0.5%	(0.03)
Obesity	1.1%	(0.09)
Patient's Zip Code		
Median Income < $25,000	16.5%	(1.75)
Median Income $25,000-$34,999	36.5%	(1.37)
Median Income $35,000-$44,999	25.7%	(1.08)
Median Income > $45,000	20.1%	(1.51)
Hospital Measures		
Private, investor owned	11.6%	(1.15)
Public non-federal	8.9%	(0.75)
Private, not for profit	4.6%	(0.44)
Teaching	44.0%	(2.18)
Small size	9.6%	(1.03)
Medium size	30.8%	(1.79)
Rural	16.9%	(0.98)
Delivery volume (/1000)	2.657	(0.21)
Region		
Northeast	14.1%	(1.43)
Midwest	18.0%	(1.27)
South	43.6%	(2.10)
West	24.3%	(1.97)

[a]Source: Nationwide Inpatient Sample, year 2000, N=276,347; weighted sample N=1,349,432; estimated with SAS Proc Surveymeans, accounting for the sampling design; SE=Standard Error of the Mean.

[b]To avoid simultaneous involvement of the predictor and outcome variables, comorbidities are coded "1" only when the discharge record does not include a PAMC involving that condition; thus, the mean number of individuals in the data with a given condition will modestly exceed the mean number having that condition coded as a comorbidity.

[c]Consistent with the multilevel modeling approach used in the analyses, descriptive results for delivery hospital county are from data limited to one observation for each county.

Table B-2. Means and Standard Deviations of Variables Used in the Models, Medicaid Beneficiaries with Delivery Hospitalizations, California, Year 2000.[a]

	Mean	(SD)
African American	8.2%	(27.40)
Hispanic	66.4%	(47.20)
Asian or Pacific Islander	4.8%	(21.40)
Other race	2.0%	(14.00)
Missing race	0.5%	(6.90)
Age 10 through 17	6.5%	(24.70)
Age 18 through 24	44.5%	(49.70)
Age 25 through 29	24.6%	(43.10)
Age 30 through 34	15.3%	(36.00)
Age 35 through 39	7.2%	(25.90)
Age 40 or over	1.9%	(13.70)
Anemia comorbidity[b]	3.7%	(18.90)
Asthma comorbidity[b]	0.9%	(9.20)
Diabetes comorbidity[b]	0.7%	(8.10)
Hypertension comorbidity[b]	0.4%	(6.30)
Obesity	1.1%	(10.50)
Medicaid Managed Care	28.0%	(44.90)

[a]Source: 2000 State Inpatient Database, California, N= 239,663.
[b]To avoid simultaneous involvement of the predictor and outcome variables, comorbidities are coded "1" only when the discharge record does not include a PAMC involving that condition; thus, the mean number of individuals in the data with a given condition will modestly exceed the mean number having that condition coded as a comorbidity.

Table B-3. Means and Standard Deviations of Variables Used in the Models, Medicaid Beneficiaries with Delivery Hospitalizations, Florida, Year 2000.[a]

	Mean	(SD)
Individual-level Measures		
African American	33.1%	(47.10)
Hispanic	22.3%	(41.60)
Asian or Pacific Islander	0.6%	(7.80)
Other race	3.2%	(17.70)
Race missing	1.2%	(11.00)
Ages 10 through 17	8.1%	(27.30)
Ages 18 through 24	51.6%	(50.00)
Ages 25 through 29	21.6%	(41.10)
Ages 30 through 34	11.7%	(32.10)
Ages 35 through 39	5.8%	(23.40)
Ages 40 or over	1.3%	(11.50)
Anemia comorbidity[b]	4.7%	(21.20)
Asthma comorbidity[b]	2.1%	(14.30)
Diabetes comorbidity[b]	0.5%	(7.30)
Hypertension comorbidity[b]	0.7%	(8.30)
Obesity	1.4%	(11.80)
Received care in Medicaid managed care	14.7%	(35.40)
Mother's Residence County Measures[c]		
OB/GYNs per 10,000	3.260	(2.99)
Primary care physicians per 10,000	13.304	(9.87)
Percent age 25+ with education less than high school	23.522	(7.97)
Percent below the poverty threshold	13.940	(4.88)
Median income (log)	10.457	(0.17)
Rural	44.8%	(50.10)
Has at least one federally qualified health center	50.7%	(50.40)
Health Professional Shortage Area (HPSA), whole county	20.9%	(41.00)
Medicaid managed care penetration, residence county	10.602	(10.67)
Delivery Hospital Measures		
Delivery volume (/1000)	1.648	(1.66)
Teaching hospital	17.1%	(37.70)
Public hospital	17.4%	(37.90)
For-profit hospital	29.2%	(45.50)

[a]Source: 2000 State Inpatient Database, Florida, N=84,744.

[b]To avoid simultaneous involvement of the predictor and outcome variables, comorbidities are coded "1" only when the discharge record does not include a PAMC involving that condition; thus, the mean number of individuals in the data with a given condition will modestly exceed the mean number having that condition coded as a comorbidity.

[c]Consistent with the multilevel modeling approach used in the analyses, descriptive results for mother's residence county are from data limited to one observation for each county.

Table B-4. Means and Standard Deviations of Variables Used in the Models, Medicaid Beneficiaries with Delivery Hospitalizations, New York, Year 2000.[a]

	Mean	(SD)
Individual-level Measures		
African American, non-Hispanic	26.0%	(1.64)
African American, Hispanic	1.3%	(1.23)
Hispanic, not African American	11.9%	(2.41)
Asian or Pacific Islander	5.5%	(0.59)
Other race	0.6%	(2.28)
Race missing	20.7%	(0.16)
Ages 10 through 17	6.0%	(0.51)
Ages 18 through 24	44.0%	(0.24)
Ages 25 through 29	25.4%	(0.26)
Ages 30 through 34	15.9%	(0.13)
Ages 35 through 39	7.1%	(0.04)
Ages 40 or over	1.7%	(0.27)
Anemia comorbidity[b]	2.3%	(0.15)
Asthma comorbidity[b]	1.8%	(0.03)
Diabetes comorbidity[b]	0.3%	(0.03)
Hypertension comorbidity[b]	0.3%	(0.09)
Obesity	0.4%	
Received care in Medicaid managed care	16.2%	(1.75)
		(1.37)
Mother's Residence County Measures[c]		(1.08)
OB/GYNs per 10,000	4.78	(1.51)
Primary care physicians per 10,000	18.654	
Percent age 25+ with education less than high school	18.623	(1.15)
Percent below the poverty threshold	11.629	(0.75)
Median income (log)	10.589	(0.44)
Rural	24.2%	(2.18)
Has at least one federally qualified health center	41.9%	(1.03)
Health Professional Shortage Area (HPSA), whole county	3.2%	(1.79)
Medicaid managed care penetration, residence county	10.237	(0.98)
		(0.21)
Delivery Hospital Measures		
Delivery volume (/1000)	1.304	(1.43)
Teaching hospital	43.2%	(1.27)
Public hospital	20.3%	(2.10)
For-profit hospital	2.4%	(1.97)

[a]Source: 2000 State Inpatient Database, New York, N= 84,310.
[b]To avoid simultaneous involvement of the predictor and outcome variables, comorbidities are coded "1" only when the discharge record does not include a PAMC involving that condition; thus, the mean number of individuals in the data with a given condition will modestly exceed the mean number having that condition coded as a comorbidity.
[c]Consistent with the multilevel modeling approach used in the analyses, descriptive results for mother's residence county are from data limited to one observation for each county.

Table B-5. Means and Standard Deviations of Variables Used in the Models, Medicaid Beneficiaries with Delivery Hospitalizations, Maryland, Year 2000.[a]

	Mean	(SD)
Individual-level Measures		
African American	53.0%	(49.90)
Hispanic	10.1%	(30.10)
Asian or Pacific Islander	1.6%	(12.40)
Other race	3.0%	(17.10)
Race missing	0.4%	(6.50)
Ages 10 through 17	8.6%	(28.00)
Ages 18 through 24	50.0%	(50.00)
Ages 25 through 29	21.8%	(41.30)
Ages 30 through 34	12.1%	(32.70)
Ages 35 through 39	6.1%	(23.90)
Ages 40 or over	1.3%	(11.30)
Anemia comorbidity[b]	6.5%	(24.60)
Asthma comorbidity[b]	3.8%	(19.00)
Diabetes comorbidity[b]	0.6%	(7.70)
Hypertension comorbidity[b]	0.7%	(8.20)
Obesity	1.5%	(12.20)
Received care in Medicaid managed care	77.5%	(41.70)
Delivery Hospital County Measures[c]		
OB/GYNs per 10,000	3.26	(2.99)
Primary care physicians per 10,000	13.304	(9.87)
Percent age 25+ with education less than high school	23.522	(7.97)
Percent below the poverty threshold	13.94	(4.89)
Median income (log)	10.457	(0.17)
Rural	44.8%	(50.10)
Has at least one federally qualified health center	50.7%	(50.40)
Health Professional Shortage Area (HPSA), whole county	20.9%	(41.00)
Medicaid managed care penetration, residence county	10.602	(10.67)
Delivery Hospital Measures[d]		
Delivery volume (/1000)	1.149	(0.69)
Teaching hospital	40.4%	(49.10)
Public hospital[d]	n.a.	n.a.
For-profit hospital[d]	n.a.	n.a.

[a]Source: 2000 State Inpatient Database, Maryland, N=24,122.
[b]To avoid simultaneous involvement of the predictor and outcome variables, comorbidities are coded "1" only when the discharge record does not include a PAMC involving that condition; thus, the mean number of individuals in the data with a given condition will modestly exceed the mean number having that condition coded as a comorbidity.
[c]Consistent with the multilevel modeling approach used in the analyses, descriptive results for delivery hospital county are from data limited to one observation for each county.
[d]All but one hospital in Maryland are nonprofit; thus, ownership was not modeled.

Table B-6. Means and Standard Deviations of Variables Used in the Models, Medicaid Beneficiaries with Delivery Hospitalizations, South Carolina, Year 2000.[a]

	Mean	(SD)
Individual-level Measures		
African American	50.7%	(50.00)
Hispanic	2.8%	(16.50)
Other race or missing race	6.3%	(24.30)
Ages 10 through 17	10.0%	(30.00)
Ages 18 through 24	58.7%	(49.20)
Ages 25 through 29	19.1%	(39.30)
Ages 30 through 34	8.1%	(27.30)
Ages 35 through 39	4.1%	(19.90)
Education in years	6.945	(5.79)
Education missing	25.9%	(43.80)
Marital status, single (never married)	60.8%	(48.80)
Marital status, separated, divorced or widowed	5.5%	(22.90)
Marital status, missing	16.6%	(37.20)
Income from 100% to 133% of poverty threshold	15.9%	(36.60)
Income from 133% to 150% of poverty threshold	0.5%	(7.00)
Income missing	3.4%	(18.10)
Disabled	2.1%	(14.30)
Anemia	7.0%	(25.50)
Asthma	1.6%	(12.60)
Diabetes	0.8%	(9.00)
Hypertension	1.1%	(10.50)
Obesity	1.4%	(11.70)
Individual's Residence County Measures		
OB/GYNs per 10,000	4.302	(3.25)
Primary care physicians per 10,000	14.689	(10.70)
Percent age 25+ with education less than high school	27.573	(666.40)
Percent below the poverty threshold	15.848	(554.00)
Rural	48.5%	(50.80)
Has at least one federally qualified health center	48.5%	(50.80)
Health Professional Shortage Area (HPSA), whole county	15.2%	(36.40)
Delivery Hospital Measures		
Delivery volume (/1000)	0.922	(0.54)
Private ownership or hospital part of chain	14.7%	(35.40)
Medical university hospital	2.4%	(15.20)
Public hospital	29.4%	(45.60)

[a]Source: 2000 South Carolina Medicaid data, Office of Research and Statistics, N=26,869.
[b]To avoid simultaneous involvement of the predictor and outcome variables, comorbidities are coded "1" only when the discharge record does not include a PAMC involving that condition; thus, the mean number of individuals in the data with a given condition will modestly exceed the mean number having that condition coded as a comorbidity.
[c]Consistent with the multilevel modeling approach used in the analyses, descriptive results for delivery hospital county are from data limited to one observation for each county.

Table B-7. Risk of a Potentially Avoidable Maternity Complication, Nationally Representative Estimates, Year 2000[a]

Parameter	Odds Ratio	LB	UB	P-value	Odds Ratio	LB	UB	P-value	Odds Ratio	LB	UB	P-value
Individual-level Measures												
African American	1.16	1.01	1.33	0.0421	1.13	0.98	1.30	0.0878	0.99	0.87	1.14	0.9224
Hispanic	0.58	0.49	0.69	<0.0001	0.57	0.48	0.68	<0.0001	0.53	0.45	0.63	<0.0001
Asian or Pacific Islander	0.37	0.23	0.59	<0.0001	0.35	0.21	0.56	<0.0001	0.33	0.20	0.56	<0.0001
Other race or missing race	0.81	0.69	0.95	0.0116	0.81	0.69	0.95	0.0102	0.77	0.66	0.89	0.0005
Age 10 through 17					1.34	1.18	1.51	<0.0001	1.34	1.18	1.52	<0.0001
Age 18 through 24					1.03	0.96	1.12	0.4018	1.05	0.96	1.14	0.2690
Age 30 through 34					1.46	1.33	1.59	<0.0001	1.45	1.33	1.58	<0.0001
Age 35 through 39					1.54	1.38	1.71	<0.0001	1.52	1.37	1.69	<0.0001
Age 40 or over					1.69	1.41	2.02	<0.0001	1.67	1.39	2.00	<0.0001
Anemia					1.03	0.91	1.17	0.6024	1.03	0.91	1.17	0.6427
Asthma					1.96	1.68	2.29	<0.0001	1.81	1.54	2.12	<0.0001
Diabetes					1.04	0.75	1.43	0.8099	0.97	0.70	1.34	0.8407
Hypertension					1.85	1.43	2.40	<0.0001	1.78	1.38	2.29	<0.0001
Obesity					1.20	0.95	1.51	0.1220	1.23	0.98	1.54	0.0757
Patient's Zip Code Median Income												
< $25,000									1.00	0.87	1.16	0.9482
$25,000-$34,999									0.90	0.82	1.00	0.0528
> $45,000									0.79	0.69	0.92	0.0017
Hospital Measures												
Private, investor owned									0.80	0.54	1.20	0.2818
Public non-federal									0.78	0.57	1.08	0.1327
Private, not for profit									0.92	0.67	1.26	0.5933
Teaching									1.21	0.93	1.58	0.1619
Small size									1.00	0.69	1.46	1.0000
Medium size									0.92	0.75	1.12	0.3877
Rural									0.78	0.62	0.99	0.0400
Delivery volume (/1000)									1.02	0.96	1.08	0.5133
Region												
Northeast									0.88	0.54	1.43	0.6073
Midwest									1.03	0.80	1.32	0.8448
West									0.94	0.74	1.19	0.6114

[a]Source: Nationwide Inpatient Sample, 2000

Table B-8. Risk of a Potentially Avoidable Maternity Complication, Nationally Representative Estimates, Year 2000, Rural Areas[a]

Parameter	Odds Ratio	LB	UB	P-value	Odds Ratio	LB	UB	P-value	Odds Ratio	LB	UB	P-value
Individual-level Measures												
African American	1.66	1.15	2.38	0.0065	1.62	1.13	2.31	0.0082	1.72	1.26	2.36	0.0007
Hispanic	0.63	0.38	1.03	0.0638	0.62	0.38	1.02	0.0575	0.65	0.40	1.04	0.0743
Asian or Pacific Islander	0.41	0.09	1.88	0.2495	0.40	0.09	1.83	0.2343	0.37	0.08	1.72	0.2068
Other race or missing race	0.98	0.74	1.29	0.8799	0.98	0.75	1.29	0.8989	1.04	0.81	1.33	0.7830
Age 10 through 17					1.50	1.13	1.99	0.0051	1.52	1.15	2.00	0.0031
Age 18 through 24					1.24	1.02	1.51	0.0321	1.24	1.02	1.50	0.0325
Age 30 through 34					1.70	1.35	2.15	<0.0001	1.70	1.34	2.14	<0.0001
Age 35 through 39					1.80	1.27	2.56	0.0011	1.80	1.27	2.56	0.0010
Age 40 or over					1.69	0.83	3.43	0.1450	1.66	0.82	3.37	0.1595
Anemia					1.07	0.77	1.48	0.7056	1.07	0.77	1.48	0.6837
Asthma					2.17	1.19	3.97	0.0119	2.12	1.13	3.96	0.0192
Diabetes					0.88	0.28	2.75	0.8233	0.89	0.28	2.83	0.8459
Hypertension					1.90	0.78	4.64	0.1566	1.95	0.80	4.76	0.1407
Obesity					1.97	1.20	3.24	0.0072	1.98	1.21	3.24	0.0069
Patient's Zip Code												
Median Income < $25,000									0.98	0.71	1.37	0.9172
Median Income $25,000-$34,999									1.12	0.84	1.48	0.4475
Median Income > $45,000									1.29	0.81	2.05	0.2844
Hospital Measures												
Private, investor owned									1.00	0.42	2.38	1.0000
Public non-federal									0.86	0.54	1.36	0.5062
Private, not for profit									1.05	0.56	1.98	0.8693
Teaching									0.62	0.40	0.96	0.3383
Small size									0.78	0.46	1.30	0.5934
Medium size									1.11	0.75	1.64	0.8860
Delivery volume (/1000)												
Region									0.96	0.44	2.06	0.9079
Northeast									1.15	0.64	2.06	0.6383
Midwest									1.07	0.61	1.89	0.8099
West												

[a]Source: Nationwide Inpatient Sample, 2000

Table B-9. Risk of a Potentially Avoidable Maternity Complication, Nationally Representative Estimates, Year 2000, Urban Areas[a]

Parameter	Odds Ratio	LB	UB	P-value	Odds Ratio	LB	UB	P-value	Odds Ratio	LB	UB	P-value
Individual-level Measures												
African American	1.05	0.90	1.22	0.5285	1.03	0.88	1.19	0.7225	0.92	0.80	1.06	0.2606
Hispanic	0.53	0.44	0.64	<0.0001	0.52	0.44	0.63	<0.0001	0.51	0.43	0.61	<0.0001
Asian or Pacific Islander	0.34	0.20	0.55	<0.0001	0.32	0.19	0.52	<0.0001	0.32	0.18	0.55	<0.0001
Other race or missing race	0.79	0.66	0.94	0.0090	0.79	0.66	0.94	0.0077	0.72	0.60	0.85	0.0002
Age 10 through 17					1.33	1.17	1.52	<0.0001	1.32	1.15	1.51	0.0001
Age 18 through 24					1.02	0.94	1.11	0.6448	1.02	0.93	1.12	0.6309
Age 30 through 34					1.42	1.29	1.56	<0.0001	1.42	1.29	1.56	<0.0001
Age 35 through 39					1.49	1.33	1.67	<0.0001	1.49	1.33	1.67	<0.0001
Age 40 or over					1.66	1.38	2.00	<0.0001	1.66	1.38	2.00	<0.0001
Anemia					1.03	0.90	1.18	0.6867	1.02	0.89	1.16	0.8067
Asthma					1.90	1.62	2.22	<0.0001	1.77	1.50	2.08	<0.0001
Diabetes					1.05	0.75	1.46	0.7878	0.97	0.69	1.35	0.8477
Hypertension					1.83	1.40	2.40	<0.0001	1.79	1.37	2.33	<0.0001
Obesity					1.07	0.84	1.38	0.5688	1.08	0.85	1.39	0.5174
Patient's Zip Code Median Income												
< $25,000									1.00	0.86	1.17	0.9573
$25,000-$34,999									0.87	0.79	0.97	0.0124
> $45,000									0.77	0.67	0.89	0.0005
Hospital Measures												
Private, investor owned									0.80	0.51	1.26	0.3378
Public non-federal									0.74	0.47	1.16	0.1829
Private, not for profit									0.93	0.62	1.38	0.7112
Teaching									1.23	0.90	1.68	0.1896
Small size									1.01	0.68	1.52	0.9467
Medium size									0.89	0.72	1.11	0.3087
Delivery volume (/1000)												
Region									0.88	0.53	1.48	0.6362
Northeast									1.06	0.79	1.41	0.6978
Midwest									0.94	0.72	1.21	0.6168
West												

[a]Source: Nationwide Inpatient Sample, 2000

Table B-10. Risk of a Potentially Avoidable Maternity Complication, California, Year 2000

Parameter	Coeff.	(SE)	Odds Ratio	LB	UB	P-value	Coeff.	(SE)	Odds Ratio	LB	UB	P-value
African American	0.211	(0.057)	1.23	1.10	1.38	<.0001	0.184	(0.058)	1.20	1.07	1.35	0.0014
Hispanic	-0.753	(0.041)	0.47	0.43	0.51	<.0001	-0.752	(0.042)	0.47	0.43	0.51	<.0001
Asian or Pacific Islander	-0.544	(0.088)	0.58	0.49	0.69	<.0001	-0.596	(0.089)	0.55	0.46	0.66	<.0001
Other race	-0.285	(0.118)	0.75	0.60	0.95	<.0001	-0.295	(0.118)	0.74	0.59	0.94	0.0122
Missing race	-0.355	(0.240)	0.70	0.44	1.12	0.015	-0.340	(0.240)	0.71	0.45	1.14	0.1575
Age 10 through 17							0.217	(0.075)	1.24	1.07	1.44	0.0038
Age 18 through 24							-0.024	(0.046)	0.98	0.89	1.07	0.6086
Age 30 through 34							0.224	(0.057)	1.25	1.12	1.40	<.0001
Age 35 through 39							0.537	(0.065)	1.71	1.51	1.94	<.0001
Age 40 or over							0.640	(0.107)	1.90	1.54	2.34	<.0001
Anemia							0.373	(0.080)	1.45	1.24	1.70	<.0001
Asthma							0.701	(0.128)	2.02	1.57	2.59	<.0001
Diabetes							0.569	(0.168)	1.77	1.27	2.46	0.0007
Hypertension							0.843	(0.180)	2.32	1.63	3.31	<.0001
Obesity							0.634	(0.114)	1.88	1.51	2.35	<.0001
Medicaid Managed Care							-0.026	(0.039)	0.97	0.90	1.05	0.5086
Constant	-3.68	(0.033)				0.139	-3.815	(0.049)				<.0001
c=0.595							c=0.624					

Table B-11. Florida Medicaid PAMC Risks, Multilevel Model

Parameter	Estimate (SE)	Odds Ratio	LB	UB	P-value
Individual-level Measures					
African American	0.132 (0.034)	1.14	1.07	1.22	0.0001
Hispanic	-0.347 (0.049)	0.71	0.64	0.78	<0.0001
Asian or Pacific Islander	-0.949 (0.411)	0.39	0.17	0.87	0.0212
Other race	-0.215 (0.100)	0.39	0.17	0.87	0.0212
Race missing	-0.326 (0.182)	0.72	0.51	1.03	0.0741
Age 10 through 17	0.007 (0.057)	0.81	0.66	0.98	0.0312
Age 18 through 24	-0.094 (0.037)	0.91	0.85	0.98	0.0123
Age 30 through 34	0.100 (0.050)	1.10	1.00	1.22	0.0469
Age 35 through 39	0.209 (0.059)	1.23	1.10	1.38	0.0004
Age 40 or over	0.249 (0.103)	1.28	1.05	1.57	0.0162
Anemia	0.990 (0.038)	2.69	2.50	2.90	<0.0001
Asthma	0.397 (0.066)	1.49	1.31	1.69	<0.0001
Diabetes	0.259 (0.135)	1.30	0.99	1.69	0.0550
Hypertension	0.246 (0.121)	1.28	1.01	1.62	0.0415
Obesity	0.064 (0.101)	1.07	0.88	1.30	0.5257
Received care in Medicaid managed care	-0.005 (0.040)	0.99	0.92	1.08	0.8929
Individual's Residence County Measures					
OB/GYNs per 10,000	0.030 (0.025)	1.03	0.98	1.08	0.2410
Primary care physicians per 10,000	0.008 (0.008)	1.01	0.99	1.02	0.3235
Percent age 25+ with education < high school	-0.004 (0.011)	1.00	0.97	1.02	0.6865
Percent below the poverty threshold	-0.024 (0.019)	0.98	0.94	1.01	0.2169
Median income (log)	-0.876 (0.450)	0.42	0.17	1.01	0.0518
Rural	-0.269 (0.159)	0.76	0.56	1.04	0.0911
Has at least one federally qualified health center	-0.028 (0.087)	0.97	0.82	1.15	0.7523
Health Professional Shortage Area (HPSA), wc	-0.055 (0.164)	0.95	0.69	1.31	0.7383
Medicaid managed care penetration	-0.003 (0.004)	1.00	0.99	1.00	0.4775
Delivery Hospital Measures					
Delivery volume (/1000)	0.052 (0.018)	1.05	1.02	1.09	0.0039
Teaching hospital	0.455 (0.055)	1.58	1.41	1.76	<0.0001
Public hospital	-0.289 (0.066)	0.75	0.66	0.85	<0.0001
For-profit hospital	-0.046 (0.044)	0.96	0.88	1.04	0.2938
Constant	6.655 (4.857)				0.1710
Random effect associated with patient's residence cnty	0.039 (0.012)				0.0018
Extra-binomial variation	0.050 (<0.001)				<0.0001

wc=whole county

Table B-12. Maryland Medicaid PAMC Risks, Multilevel Model

Parameter	Estimate	(SE)	Odds Ratio	LB	UB	P-value
Individual-level Measures						
African American	0.208	(0.064)	1.23	1.09	1.39	0.0011
Hispanic	-0.926	(0.132)	0.40	0.31	0.51	<0.0001
Asian or Pacific Islander	-0.682	(0.263)	0.51	0.30	0.85	0.0097
Other race	-6.548	(0.182)	0.00	0.00	0.00	0.0000
Race missing	-0.326	(0.402)	0.72	0.33	1.59	0.4173
Age 10 through 17	0.202	(0.098)	1.22	1.01	1.48	0.0394
Age 18 through 24	0.023	(0.067)	1.02	0.90	1.17	0.7322
Age 30 through 34	0.252	(0.086)	1.29	1.09	1.52	0.0035
Age 35 through 39	0.505	(0.102)	1.66	1.36	2.02	<0.0001
Age 40 or over	0.511	(0.190)	1.67	1.15	2.42	0.0072
Anemia	-0.130	(0.106)	0.88	0.71	1.08	0.2213
Asthma	0.292	(0.112)	1.34	1.08	1.67	0.0091
Diabetes	0.159	(0.284)	1.17	0.67	2.04	0.5752
Hypertension	0.485	(0.227)	1.62	1.04	2.54	0.0329
Obesity	-0.215	(0.215)	0.81	0.53	1.23	0.3169
Received care in Medicaid managed care	-0.816	(0.059)	0.44	0.39	0.50	<0.0001
Delivery Hospital's County Measures						
OB/GYNs per 10,000	0.074	(0.109)	1.08	0.87	1.33	0.5003
Primary care physicians per 10,000	-0.013	(0.029)	0.99	0.93	1.04	0.6560
Percent age 25+ with education < high school	0.074	(0.111)	1.08	0.87	1.34	0.5046
Percent below the poverty threshold	-0.072	(0.118)	0.93	0.74	1.17	0.5440
Median income (log)	0.198	(2.066)	1.22	0.02	69.86	0.9238
Rural	-0.125	(0.460)	0.88	0.36	2.17	0.7850
Has at least one federally qualified health center	0.014	(0.380)	1.01	0.48	2.13	0.9700
Health Professional Shortage Area (HPSA), wc	1.169	(0.685)	3.22	0.84	12.32	0.0884
Medicaid managed care penetration	-0.015	(0.010)	0.99	0.97	1.00	0.1339
Delivery Hospital Measures						
Delivery volume (/1000)	-0.021	(0.052)	0.98	0.88	1.08	0.6822
Teaching hospital	0.054	(0.081)	1.06	0.90	1.24	0.5075
Constant	-4.023	(2.402)	0.02	0.00	1.98	0.0943
Random effect associated with hospital county	0.237	(0.097)	1.27	1.05	1.53	0.0152

wc=whole county

Table B-13. New York Medicaid PAMC Risks, Multilevel Model, Year 2000

Parameter	Estimate	(SE)	Odds Ratio	LB	UB	P-value
Individual-level Measures						
African American, non-Hispanic	0.521	(0.068)	1.68	1.48	1.92	<0.0001
African American, Hispanic	-0.088	(0.234)	0.92	0.58	1.45	0.7088
Hispanic, not African American	0.072	(0.098)	1.07	0.89	1.30	0.4596
Asian or Pacific Islander	-0.557	(0.150)	0.57	0.43	0.77	0.0002
Other race	-0.028	(0.096)	0.97	0.81	1.17	0.7718
Race missing	0.348	(0.110)	1.42	1.14	1.76	0.0015
Age 10 through 17	0.127	(0.113)	1.14	0.91	1.42	0.2598
Age 18 through 24	-0.173	(0.066)	0.84	0.74	0.96	0.0091
Age 30 through 34	0.281	(0.077)	1.32	1.14	1.54	0.0003
Age 35 through 39	0.635	(0.086)	1.89	1.59	2.23	<0.0001
Age 40 or over	0.586	(0.147)	1.80	1.35	2.40	0.0001
Anemia	0.027	(0.148)	1.03	0.77	1.37	0.8548
Asthma	0.553	(0.130)	1.74	1.35	2.24	<0.0001
Diabetes	0.896	(0.243)	2.45	1.52	3.94	0.0002
Hypertension	0.665	(0.251)	1.94	1.19	3.18	0.0081
Obesity	0.134	(0.226)	1.14	0.73	1.78	0.5535
Received care in Medicaid managed care	-0.257	(0.071)	0.77	0.67	0.89	0.0003
Individual's Residence County Measures						
OB/GYNs per 10,000	-0.035	(0.055)	0.97	0.87	1.08	0.5231
Primary care physicians per 10,000	0.013	(0.014)	1.01	0.99	1.04	0.3284
Percent age 25+ with education less than high school	-0.056	(0.024)	0.95	0.90	0.99	0.0193
Percent below the poverty threshold	-0.051	(0.035)	0.95	0.89	1.02	0.1494
Median income (log)	-2.120	(0.636)	0.12	0.03	0.42	0.0009
Rural	0.341	(0.220)	1.41	0.91	2.16	0.1224
Has at least one federally qualified health center	0.048	(0.195)	0.93	0.64	1.35	0.6985
Health Professional Shortage Area (HPSA), wc	-0.073	(0.189)	1.00	0.99	1.01	0.5749
Medicaid managed care penetration, residence county	0.002	(0.004)	1.00	0.99	1.01	0.5749
Delivery Hospital Measures						
Delivery volume (/1000)	0.110	(0.039)	1.12	1.03	1.20	0.0050
Teaching hospital	0.090	(0.066)	1.09	0.96	1.24	0.1713
Constant	20.319	(6.929)				0.0034
Random effect associated with patient's residence cnty	0.188	(0.054)				0.0005

wc=whole county

Table B-14. South Carolina Medicaid PAMC Risks, Multilevel Model

Parameter	Estimate	(SE)	Odds Ratio	LB	UB	P-value
Individual-level Measures						
African American	0.047	(0.079)	1.05	0.90	1.22	0.5520
Hispanic	-0.452	(0.264)	0.64	0.38	1.07	0.0872
Other race or missing race	0.241	(0.127)	1.27	0.99	1.63	0.0580
Age 10 through 17	0.248	(0.141)	1.28	0.97	1.69	0.0789
Age 18 through 24	0.062	(0.094)	1.06	0.88	1.28	0.5097
Age 30 through 34	0.296	(0.136)	1.34	1.03	1.76	0.0298
Age 35 through 39	0.322	(0.172)	1.38	0.98	1.93	0.0615
Education in years	-0.019	(0.008)	0.98	0.97	1.00	0.0177
Education missing	0.087	(0.106)	1.09	0.89	1.34	0.4120
Marital status, single (never married)	0.458	(0.112)	1.58	1.27	1.97	<0.0001
Marital status, separated, divorced or widowed	0.266	(0.176)	1.30	0.92	1.84	0.1310
Marital status, missing	0.317	(0.145)	1.37	1.03	1.82	0.0290
Income from 100% to 133% of poverty threshold	-0.351	(0.111)	0.70	0.57	0.88	0.0016
Income from 133% to 150% of poverty threshold	-0.194	(0.478)	0.82	0.32	2.10	0.6849
Income missing	-0.109	(0.198)	0.90	0.61	1.32	0.5821
Disabled	0.412	(0.216)	1.51	0.99	2.31	0.0568
Anemia	-0.316	(0.136)	0.73	0.56	0.95	0.0204
Asthma	0.179	(0.204)	1.20	0.80	1.78	0.3805
Diabetes	0.830	(0.240)	2.29	1.43	3.67	0.0006
Hypertension	0.093	(0.252)	1.10	0.67	1.80	0.7122
Obesity	-0.140	(0.278)	0.87	0.50	1.50	0.6147
Individual's Residence County Measures						
OB/GYNs per 10,000	-0.006	(0.082)	0.99	0.85	1.17	0.9417
Primary care physicians per 10,000	0.010	(0.022)	1.01	0.97	1.05	0.6495
Percent age 25+ with education < high school	0.020	(0.041)	1.02	0.94	1.11	0.6258
Percent below the poverty threshold	-0.023	(0.040)	0.98	0.90	1.06	0.5654
Rural	0.671	(0.349)	1.96	0.99	3.88	0.0548
Has at least one federally qualified health center	0.298	(0.299)	1.35	0.75	2.42	0.3192
Health Professional Shortage Area (HPSA), wc	-0.085	(0.449)	0.92	0.38	2.21	0.8499
Delivery Hospital Measures						
Delivery volume (/1000)	0.901	(0.138)	2.46	1.88	3.23	<0.0001
Private ownership or hospital part of chain	-0.338	(0.183)	0.71	0.50	1.02	0.0650
Medical university hospital	0.548	(0.225)	1.73	1.11	2.69	0.0150
Public hospital	0.081	(0.147)	0.15	0.81	1.45	0.5817
Constant	-5.268	(0.971)				<0.0001
Random effect associated with patients residence county	0.332	(0.108)				0.0022

wc=whole county

Appendix C:

Literature Review: Background on Pregnancy Outcomes and Medicaid

Race/Ethnicity Disparities

There are substantial disparities in birth outcomes in the United States by race and ethnicity. Most studies find that African American women receive significantly less prenatal care than non-Hispanic white women, and are more likely to have maternity-related complications (Alexander & Cornely, 1987; Bennett, Kotelchuck, Cox, et al., 1998; Brown, 1989; Clarke, Bono, Miller, & Malone, 1995; LaVeist, Keith, & Gutierrez, 1995; Miller, Clarke, Albrecht, & Farmer, 1996; Saftlas, Lawson, & Atrash, 2002). Notable disparities have been found for African American women even when controlling for insurance status (Barfield, Wise, Rust, Gould, & Gortmaker, 1996; Haas, Udvarhelyi, & Epstein, 1993). Some researchers attribute this result, in part, to disadvantage across the life course for women in minority groups (Lu & Halfon, 2003). Findings for Hispanic women are more complex. Hispanic women in various subgroups (e.g., Cuban Americans, Mexican Americans) differ substantially in demographic, social, and economic characteristics, and in other risk factors for prenatal care (Albrecht & Miller, 1996; Balcazar, Cole, & Hartner, 1992). Cuban Americans, for example, are more likely to have higher levels of care, and are at lower risk of pregnancy-related morbidity, compared with other Hispanic groups (Albrecht et al., 1996). Less studied are pregnancy-related outcomes for Asian Americans. There is some evidence that infant mortality is lower among Asian Americans than non-Hispanic whites (Patel, Patel, Piotrowski, & Nelson, 1995). However, researchers have found that there is substantial heterogeneity among women included in this group, with Chinese and Japanese American women having better pregnancy outcomes than women in other groups included in this category such as those in Filipino and Hawaiian groups (Le, Kiely, & Schoendorf, 1996; Singh & Yu, 1993, 1994).

Rural/Urban Differences

There is some evidence that access to care and birth outcomes vary among women, depending on rural or urban area of residence. Some researchers have found that pregnant women living in rural areas have more difficulty receiving adequate prenatal care, are more likely to receive their first prenatal care visit later in their pregnancies, and have fewer overall prenatal care visits, than those living in urban areas (Clarke et al., 1995; Miller et al., 1996). Clarke and colleagues (1995) found that pregnant women living in rural areas are more likely to receive inadequate care regardless of race and ethnicity or sociodemographic factors. This finding highlights the importance of examining the intersection of race and ethnicity and area of residence in pregnancy-related morbidity research.

Effects of Medicaid Expansions

The Medicaid eligibility expansions of the late 1980s were designed to increase access to

prenatal care and to improve birth outcomes among underserved populations. In a critical analysis of 14 recent studies, Howell (2001) concludes that the enrollment of pregnant women in Medicaid increased substantially in the late 1980s. There is evidence that some groups of women receiving Medicaid benefits received enhanced prenatal care. However, Howell (2001) concludes that the effect of the expansions on birth outcomes, as measured by low birth weight (LBW) and rates of preterm births, is weak. Nationally, the number of births covered by Medicaid nearly doubled from 1985 to 1991, with Medicaid covering 32% of all live births in 1991 (Singh, Gold, & Frost, 1994). In a recently published national analysis of the effect of the Medicaid expansions on birth outcomes, Dubay and colleagues (2001) found evidence that the expansions provided improved prenatal care access and lower rates of LBW for poor white women. However, there were no improvements for other groups of women, including African Americans. Using data from Tennessee, Ray and colleagues (1997) found that use of prenatal care increased when the enrollment of pregnant women into Medicaid grew. However, the rate of preterm births did not change. In an analysis of Florida data, Marquis and Long (2002) found that women enrolled in Medicaid during the expansion had better prenatal care access than uninsured women. These researchers also found that the delivery mode of prenatal care, whether the services were provided by private physicians or public health services, influenced the outcomes. Outcomes were better for women receiving care in the public health system than in the private system. Marquis and Long also found that these differences diminished over time. In sum, studies of Medicaid expansion provide conflicting evidence about its effects on access to prenatal care and pregnancy outcomes. There is also evidence that some groups of women may benefit more than others from the expansion.

A number of studies have found that improvements in birth outcomes can be achieved when locally-developed special prenatal care case management programs are linked with Medicaid expansions. These programs are often specifically designed to meet the needs of high risk pregnant women. Reichman and Florio (1996) found that HealthStart, an enriched prenatal care program in New Jersey, reduced the rate of LBW and decreased newborn costs for African Americans. They found no outcome or cost changes for whites. Using data from Rhode Island, Griffin and colleagues (1999) examined outcomes before and after implementation of the RIte Care prenatal care management program. They found that prenatal care, as measured by the Adequacy of Prenatal Care (APNCU) Index, improved following program implementation. The APNCU index is a useful measure, as it integrates information about timing of prenatal care and number of visits (Kotelchuck, 1994). Buescher et al. (1991) studied birth outcomes in North Carolina, comparing outcomes for women who received maternity care coordination services and those who did not. They found that women receiving the enhanced services had lower rates of LBW, lower rates of very LBW (VLBW), and lower infant mortality rates than women who did not receive the services (Buescher, Roth, Williams, & Goforth, 1991). Further, they found that the enhanced prenatal care was cost effective. Using data from South Carolina, Heins, Nance, and Ferguson (1987) examined the effect of the Resource Mothers Program, which focuses on improving outcomes though social support. They found that women enrolled in the program had lower rates of LBW and a higher rate of adequate prenatal care than women in a control group. There were no differences in infant mortality (Heins, Nance, & Ferguson, 1987). Farrow et al. (1996) examined the use of two different types of enriched prenatal care programs in Washington State, finding that women who were assigned to maternity support services were less likely to receive inadequate prenatal care, as measured by number of visits, than women assigned to a different level of prenatal support.

Several studies have found mixed results in this area. Baldwin and colleagues (1998) compared birth outcomes before and after the implementation of an expanded prenatal care program in Washington State. The results were compared with pregnant women in Colorado, which did not implement a special prenatal care program, and was used as a control state. Baldwin et al. (1998) found that prenatal care visits increased in both states following the Medicaid expansion. There was some evidence that the LBW rate in Washington may have decreased after expanded prenatal services were implemented; however, this decrease was not statistically significant. A study by Klerman et al. (2001) also found mixed results for an augmented prenatal care program for high-risk African Americans in a county in Alabama. Compared with women who were not enrolled in an augmented program, women in the augmented program were more satisfied with their care, and had greater knowledge of risk conditions. However, outcomes, measured by LBW and stays in neonatal intensive care units, did not differ significantly between the two groups. The authors attribute the lack of statistical significance to the small size of their sample.

Medicaid Managed Care versus Medicaid Fee-for-Service for Pregnancy

A number of studies have examined pregnancy-related outcomes comparing pregnant women in Medicaid managed care (MMC) with those enrolled in Medicaid fee-for-service (MFFS). Findings of these studies have been mixed. Using 1985 data for women in several counties in California and Missouri, Carey, Weis, and Homer (1991) found no significant differences in outcomes, using measures of LBW, complications of pregnancy, and cesarean section. Ray et al. (1998) compared outcomes before and after TennCare was implemented, finding no differences in LBW, VLBW, or infant mortality. Conover, Rankin, and Sloan (2001) also compared birth outcomes before and after TennCare was implemented, and used North Carolina as a control group. Compared to pregnant women in North Carolina, women enrolled in TennCare were more likely to initiate care in the third trimester or to obtain no prenatal care; Apgar scores fell slightly (Conover, Rankin, & Sloan, 2001). There were no differences in infant mortality between the two groups. Using 1987-1992 data, Tai-Seale, LosSasso, Freund, and Gerber (2001) found that MMC in California was associated with less care and shorter delivery stays.

Using 1994 birth data from Wisconsin, Levinson and Ullman (1998) found that women enrolled in MMC may be more likely to receive adequate prenatal care than women enrolled in MFFS. They found no differences in birth weight among women in these two groups. Schulman, Sheriff, and Momany (1997) compared pregnancy-related outcomes of women in Medicaid managed care and Medicaid fee-for-service in Iowa. Compared to women in MMC, women enrolled in MFFS were more likely to receive adequate prenatal care, more likely to initiate prenatal care in the first trimester, and more likely to receive enhanced prenatal care services (Schulman, Sheriff, & Momany, 1997). There were no differences in gestational age or birth weight. Using New York State hospitalization data for 1995-2000, Laditka, Laditka, Mastanduno, Lauria, and Foster (2003) found that women enrolled in MMC were at less risk of potentially avoidable maternity complications than were women in MFFS.

Appendix D:

Discussion Guide on Pregnant Women Covered by Medicaid

What percentage of women whose pregnancies are at some point covered by Medicaid are enrolled before their pregnancies begin?

Of those who are enrolled in Medicaid during pregnancy, what percentage would you say are
first enrolled:
In the first trimester?
In the second trimester?
In the third trimester, but before a hospitalization?
During an ante-partum or delivery hospitalization?

Does [state] offer both Medicaid Managed Care and fee for service Medicaid for pregnant women?

What are the basic characteristics of MMC plans in your state (e.g., case management)?
How does MMC differ from FFS Medicaid in your state?

About how many different providers (i.e., plans) offer MMC in your state?
Do they vary much in their enrollment practices? [describe extent of variation]
Do they vary much in the types of care they provide? [describe extent of variation]

How do women enter Medicaid managed care, as distinguished from Medicaid fee-for-service?
Is it the woman's choice, an official's choice, or is there no choice?
[If it is an official's choice: Do women have any way to "get around" the official's decision?
Does that happen commonly?]

[If women have choice, or can "get around the official's decision:]
Are there any incentives for women to choose either MMC or FFS Medicaid during their pregnancies?

Are there any incentives that encourage managed care providers to recruit or select healthier women?

When they are first enrolled, do women in Medicaid managed care tend to be in *better* or *worse* health than those in the traditional (FFS) Medicaid plan, or is there no difference in their health status?

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