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The Impact of Welfare Reform on Insurance Coverage before Pregnancy and the Timing of Prenatal Care Initiation

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Objective. This study investigates the impact of welfare reform on insurance coverage before pregnancy and on first-trimester initiation of prenatal care (PNC) among pregnant women eligible for Medicaid under welfare-related eligibility criteria.

Data Sources. We used pooled data from the Pregnancy Risk Assessment Monitoring System for eight states (AL, FL, ME, NY, OK, SC, WA, and WV) from 1996 through 1999.

Study Design. We estimated a two-part logistic model of insurance coverage before pregnancy and first-trimester PNC initiation. The impact of welfare reform on insurance coverage before pregnancy was measured by marginal effects computed from coefficients of an interaction term for the postreform period and welfare-related eligibility and on PNC initiation by the same interaction term and the coefficients of insurance coverage adjusted for potential simultaneous equation bias. We compared the estimates from this model with results from simple logistic, ordinary least squares, and two-stage least squares models.

Principal Findings. Welfare reform had a significant negative impact on Medicaid coverage before pregnancy among welfare-related Medicaid eligibles. This drop resulted in a small decline in their first-trimester PNC initiation. Enrollment in Medicaid before pregnancy was independent of the decision to initiate PNC, and estimates of the effect of a reduction in Medicaid coverage before pregnancy on PNC initiation were consistent over the single- and two-stage models. Effects of private coverage were mixed. Welfare reform had no impact on first-trimester PNC beyond that from reduced Medicaid coverage in the pooled regression but separate state-specific regressions suggest additional effects from time and income constraints induced by welfare reform may have occurred in some states.

Conclusions. Welfare reform had significant adverse effects on insurance coverage and first-trimester PNC initiation among our nation's poorest women of childbearing age. Improved outreach and insurance options for these women are needed to meet national health goals.

Key Words. Econometrics, state health policies, Medicaid maternal and perinatal care and outcomes, health policy/politics/law/regulation, access/demand/utilization of services, instrumental variables

Despite recent improvements in many maternal and infant health indicators, maternal and infant morbidity and mortality continue to be public health problems in the United States. Throughout most of this century, policymakers have endorsed prenatal care (PNC) as one means of improving maternal and infant health. In particular, initiation of PNC early in pregnancy has been advocated because it allows for early detection and treatment of existing medical and obstetric conditions and provides an opportunity for encouraging healthy behavior and educating women early in their pregnancies about proper nutrition, adequate weight gain, dangers of smoking, alcohol and drugs, and other factors that may affect pregnancy outcomes (Lewis, Mathews, and Heuser 1996). *Healthy People 2000* (NCHS 2001) included a target that 90 percent of pregnant women initiate PNC in their first trimester. When the target was not met (only 83 percent of women initiated care in their first trimester in 2000), it was reiterated in *Healthy People 2010* (USDHHS 2000; NCHS 2001).

To increase the use of PNC, policymakers and program planners focused on improving access to it. Beginning in the mid-1980s, the federal government gradually expanded eligibility requirements for Medicaid to include more low-income pregnant women. By 1989, states were required to cover pregnant women with family incomes up to 133 percent of the federal poverty level (FPL) and could opt to include pregnant women with family incomes up to 185 percent of the FPL (Gold, Singh, and Frost 1993). In addition, states could implement presumptive eligibility, extending temporary Medicaid coverage to pregnant woman so that they can receive PNC immediately; outstationing, signing pregnant women up for Medicaid at provider offices instead of solely at welfare offices; and continuous eligibility, allowing women to retain Medicaid coverage throughout pregnancy despite fluctuations in

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income (Gold, Singh, and Frost 1993). The federal government also began providing matching funds to states for a broader set of services for pregnant women, including case management.

As a consequence of these expansions, the percentage of live births paid for by Medicaid increased significantly, from 17 percent in 1985 to 35 percent in 1998 (The Alan Guttmacher Institute 1987; NGA 2001). Early PNC initiation also increased in the first half of the 1990s; the percentage of mothers initiating PNC in the first trimester of pregnancy increased from 76 percent in 1985 through 1991 to 83 percent in 1998 (Lewis, Mathews, and Heuser 1996; USDHHS 2002). How much of this increase was due to the Medicaid expansions remains uncertain. A review of the literature on this issue suggests that the expansions led to modest improvements in PNC use but only in some states and only for some groups of affected women (Howell 2001).

Payment of delivery costs by Medicaid does not necessarily mean that women enrolled in Medicaid initiated PNC early in their pregnancies. Studies have found that the timing of PNC initiation is strongly associated with the timing of coverage (Egerter, Braveman, and Kristin 1999) and that women with Medicaid-covered deliveries often do not enroll until their second or third trimester and therefore initiate PNC later in their pregnancies than women with prior coverage (Braveman et al. 1993; Kaestner 1999).

Recent changes in social welfare programs may have slowed or threatened further improvements in first-trimester PNC initiation. In particular, the Personal Responsibility and Work Opportunity Reconciliation Act (PRWORA) of 1996 may have stalled or reversed improvements in early initiation of PNC among low-income women in the United States. PRWORA replaced Aid to Families with Dependent Children (AFDC) with the Temporary Assistance for Needy Families (TANF) program. The new program restricted welfare tenure and imposed new work requirements and sanctions for noncompliance.

PRWORA also uncoupled welfare and Medicaid eligibility and barred most immigrants entering the country after August 22, 1996 from receiving federally supported Medicaid benefits for at least 5 years. Although drafters of the welfare reform legislation required states to retain Medicaid eligibility for families with dependent children who were at or below the states' AFDC income eligibility levels as of July 1996, beneficiaries were no longer automatically enrolled in Medicaid by their social workers as they had been under AFDC. Studies show parallel reductions in welfare and Medicaid caseloads with concurrent increases in the number of uninsured adults (Ellwood 1999; Holahan and Pohl 2002; Holl, Slack, and Stevens 2005).

Because welfare recipients are primarily women of childbearing age, they are particularly vulnerable to becoming uninsured (Gold 1999; Thorpe, Flome, and Joski 2001; Kaestner and Kaushal 2003). Private insurance options have not been available for many women who are diverted from welfare or who leave welfare for work (Garrett and Holahan 2000). A recent study of data from eight states found that welfare reform decreased the probability that unmarried pregnant women with children who met the July 1996 AFDC income standards were insured before pregnancy by an average of 7.9 percentage points (Adams et al. 2005). Pregnancy may be a motivating factor for many of these eligible women to enroll in the program. Delays in enrollment or in finding Medicaid participating providers may lead these women to initiate PNC later in their pregnancies.

Three prior studies investigated the effects of recent welfare reforms on PNC initiation (Joyce et al. 2001; Currie and Grogger 2002; Kaestner and Lee 2005). Using National Natality Files (NNF) for 1990 through 1996, Currie and Grogger (2002) investigated the effects of pre-PRWORA reforms. They found statistically significant positive effects of the rate of welfare receipt on whether women received first-trimester PNC. Furthermore, they found a larger estimated effect for unmarried teens and high school dropouts compared with married college-educated women, which they argue provides evidence that the effects were related to changes in the welfare program. In a subsequent study, using a similar longitudinal analysis and data from the NNF extending beyond PRWORA implementation (i.e., 1992–2000), Kaestner and Lee (2005) found welfare caseloads to be positively associated with first-trimester PNC among unmarried women with less than 12 years of education. However, when they applied a difference-in-difference approach to separate out the effects of changes in welfare caseloads due to general economic trends from those due to welfare reform, they found welfare reform to have a much smaller and statistically insignificant impact on PNC initiation. Joyce et al. (2001) used a difference-in-difference approach and natality files pre- and post-PRWORA to investigate the impact of welfare reform on PNC initiation among foreign-born Latino women, as a proxy for recent immigrants, versus U.S.-born Latino women in California, New York City, and Texas. They found no evidence that welfare reform altered early initiation of PNC among foreign-born Latinas in these areas.

These authors were unable to accurately identify the population affected by PRWORA with the natality files and therefore unable to clearly determine PRWORA's effect on the population of interest. The sample of low-educated, unmarried women used by Currie and Grogger and by Kaestner and Lee and

the sample of foreign-born women used by Joyce and colleagues exclude many pregnant women affected by the welfare policies and include many who were not affected, adding noise to their estimates and potentially lowering the magnitude and significance of their findings. Furthermore, because the NNF do not include data on insurance coverage, neither Currie and Grogger nor Kaestner and Lee were able to determine whether the estimated effect was a result of lower insurance coverage or other barriers to care arising from welfare reform, making it more difficult to identify corrective policies.

To investigate these questions more fully, we used data from the Pregnancy Risk Assessment Monitoring System (PRAMS) before and after the implementation of welfare reform to conduct an analysis of first-trimester PNC initiation among pregnant women financially eligible for Medicaid at welfare income levels. The database includes information on women's family income and health insurance coverage before pregnancy not available on natality files. We were therefore able to more accurately identify the population of interest and to separate out the effects of changes in insurance coverage and other barriers to care resulting from welfare reform.

METHODS

Data Sources

PRAMS is a state-level, population-based surveillance system that assesses maternal behaviors and experiences before and during a woman's pregnancy and during the early infancy of her child (Colley Gilbert et al. 1999). In each participating PRAMS state, a stratified random sample of new mothers is selected monthly from birth certificates for a total annual sample of 1,300–3,000 women. States oversample women at risk for adverse pregnancy outcomes, variously defined by the states as women with low birthweight infants or women of minority race/ethnicity. Sampled mothers are sent a self-administered questionnaire 2–6 months after delivery; nonrespondents are contacted again via telephone. The PRAMS research files include information from the birth certificates and responses from 52 core questions asked in every state.

For this analysis, we pooled PRAMS data from eight states that had response rates of 70 percent or better each year from 1996 to 1999. These states include Alaska, Florida, Maine, New York (excluding New York City), Oklahoma, South Carolina, Washington, and West Virginia. The pooled sample can be considered as one large stratified random sample with state and

year as stratifiers in addition to the women's risk status. The sample represents only the experience of women in the eight states, not the nation as a whole.

Table 1 presents information on selected features of the TANF and Medicaid programs in these states. We obtained these data from The Urban Institute, the Centers for Medicare and Medicaid Services, and the study states' websites and publications. We also obtained information on state and county economic variables from various sources, including the Area Resource File, the Current Population Survey core and March supplement files, and the Consolidated Analysis Centers Inc. database of census data.

Target Population

The population most affected by welfare reform is women meeting the categorical and financial criteria of the AFDC program as of July 1996. The categorical requirements are the same for all states—that the woman is single and has dependent children. The financial criteria varied from a low of 23 percent of the 1996 FPL ($12,980 for a family of three) in West Virginia to a high of 95 percent of the FPL in Alaska (Table 1). Most PRAMS state questionnaires ask women what category their family income falls into, with the income categories differing across the states. The income data were missing for approximately 9 percent of the sample.

We imputed the missing income data in each state with the *NORM* software (Windows 95/98/NT program for multiple imputation) based on race, age, marital status, and education. We then identified as welfare-related Medicaid eligibles (WELFARE) all single women with prior births or minor children living in the household and with family incomes equal to or less than the income category closest to the state's July 1996 AFDC income limit. We also identified expansion-related Medicaid eligibles to serve as a comparison group. All of the eight study states' PRAMS questionnaires had income intervals ending at $25,000, which was about 185 percent of the FPL for a family of three in 1996. This was the income cutoff for Medicaid eligibility under the poverty-related expansions in most study states (Table 1)—Alaska had an income cutoff of 166 percent of the FPL and Oklahoma and West Virginia had income cutoffs of 150 percent of the FPL. Because the expansion-related eligibility criteria have no categorical requirements, we identified as expansion-related eligible all women with incomes under $25,000 who were not previously identified as welfare-related eligible. Finally, we identified noneligible women (NONELIGIBLE) as those with incomes of $25,000 or more. We kept these women in the analysis as a second comparison group.

Table 1: State Temporary Assistance for Needy Families (TANF) and Medicaid Program Characteristics

	TANF Program Characteristics				*Medicaid Program Characteristics*					
	Month and Year Implemented	*Cash Diversion Policy*	*Family Cap Policy*	*Time Limit (in Months) for Cash Assistance*	*Welfare-Related Income Limit (% of FPL)*	*Expansion-Related Income Limit (% of FPL)*	*Managed Care for Welfare-Related*	*Managed Care for Expansion-Related*	*Percent of Medicaid Enrollees in Managed Care*	
									1996 (%)	*1999 (%)*
Alaska	July 1997	Yes	No	60	95	166	NA	NA	0.0	0.0
Florida	October 1996	Yes	Yes	24	28	185	1996: statewide voluntary PCCM or HMO 1997–1999: statewide mandatory PCCM or HMO	Excluded	63.7	60.3
Maine	November 1996	Yes	No	60	51	185	1996: mandatory PCCM in 5 counties 1997–1999: mandatory PCCM in 7 counties and voluntary HMO in 9 counties	Same as welfare-related	0.8	14.1
New York*	December 1996	No	No	60	58	185	1996: Voluntary PCCM or HMO in some counties 1997–1999: mandatory PCCM or HMO in same set of counties	Same as welfare-related	23.5	29.2
Oklahoma	October 1996	No	Yes	60	60	150	Mandatory PCCM or HMO depending on county	Excluded	19.4	52.1

South Carolina	October 1996	No	Yes	24	48	185	Voluntary HMO in some counties	Same as welfare-related	0.6	4.7
Washington	January 1997	Yes	No	60	50	185	Mandatory HMO; Native Americans can choose between PCCM or HMO	Same as welfare-related	99.8	99.9
West Virginia	January 1997	Yes	No	60	23	150	Mandatory HMO	Same as welfare-related	30.4	43.4

Sources: Information on the state TANF programs come from Rose, Gretchen, *Welfare Rules Databook, State TANF Policies as of July 1999*, The Urban Institute, Assessing the New Federalism, Washington, DC, November 2000. Available at: http://newfederalism.urban.org/WRD/WRDCodingManual.HTML and Crouse, Gil, *State Implementation of Major Changes to Welfare Policies, 1992–1998*, Office of Human Services Policy, Assistance Secretary for Planning and Evaluation, U.S. Department of Health and Human Services, 1999. Available at: http://aspe.hhs.gov/hsp/Waiver-Policies99/policy_CEA.htm. The welfare-related and expansion-related eligibility category income limits come from the National Governors' Association and direct state contact; the FPL for a family of three in 1996 was $12,980. Information on states' Medicaid managed care options come from Centers for Medicare and Medicaid Services. National Summary of State Medicaid Managed Care Programs as of June 30, 2000. Available at http://www.cms.hhs.gov/MedicaidDataSourcesGenInfo/Downloads/descstprograms00.pdf. Percentages of Medicaid enrollees in managed care come from Centers for Medicare and Medicaid Services. 1996 Medicaid Managed Care Enrollment Report. Available at: http://www.cms.hhs.gov/MedicaidDataSourcesGenInfo/Downloads/mmcer96.pdf and Centers for Medicare and Medicaid Services. 1999 Medicaid Managed Care Enrollment Report. Available at: http://www.cms.hhs.gov/MedicaidDataSourcesGenInfo/Downloads/mmcer99.pdf.

TANF, Temporary Assistance to Needy Families; FPL, federal poverty level; HMO, health maintenance organization; PCCM, primary care case management.

*Excludes New York City.

Insurance Coverage

The core PRAMS survey asks each woman to recall her insurance status just before she got pregnant—in particular, whether she had any health insurance coverage not counting Medicaid and then whether she had Medicaid coverage. Thus, we were able to define three mutually exclusive categories of insurance coverage before pregnancy: (1) private coverage, (2) Medicaid coverage, and (3) uninsured. We categorized women covered by Medicaid and a private health insurance plan as privately insured. The private insurance category also included women covered by public insurance other than Medicaid, including Medicare and military insurance (e.g., TRICARE). As found in our earlier study (Adams et al. 2005), we hypothesized that welfare reform decreased Medicaid coverage before pregnancy among welfare-related Medicaid eligibles.

PNC Initiation

The PRAMS core questionnaire also asks women how many weeks or months pregnant they were at their first PNC visit. We used these data to determine whether the women initiated PNC in the first trimester. We hypothesized that welfare reform would lower first-trimester PNC initiation among women eligible for Medicaid under welfare-related criteria by increasing the costs of seeking PNC through (1) decreased insurance coverage and (2) increased time and income barriers. Our basic model is

$$Y = f(PRIV,\ MCAID,\ BARRIERS,\ X) \tag{1}$$

where Y is a dichotomous variable for whether the woman initiated PNC in the first trimester; PRIV and MCAID are indicators for private health insurance and Medicaid coverage, respectively, with uninsured as the omitted category; BARRIERS is a set of variables that we used to estimate the impact of the time and income barriers, as described below; and X is a vector of other exogenous factors affecting the timing of PNC initiation.

We hypothesized that because women covered by Medicaid or private insurance before becoming pregnant faced lower out-of-pocket costs for care and were more likely to have established a regular source of care, they would be more likely to initiate PNC in the first trimester compared with uninsured women. Therefore, a significant, positive coefficient for MCAID would suggest that policies, such as welfare reform, that lowered Medicaid coverage before pregnancy could result in fewer women initiating PNC in the first trimester.

We also hypothesized that the new work requirements and sanctions for noncompliance of the TANF program would increase time and income barriers to PNC among welfare-related eligible women. To estimate the impact of the effects of the increased time and income barriers, we identified a pre–post indicator (POST); we assigned women who delivered before the state's TANF implementation date to the prereform period and those who delivered more than 10 months after this date to the postreform period. All women with deliveries in the intervening months were dropped from the analysis. Because other policy or health system changes aimed at low-income pregnant women during the study period could confound the effect of welfare reform measured in this way, we interacted this indicator with the Medicaid eligibility indicators. We omitted the expansion-related eligibility category so that the coefficient for the interaction term between the WELFARE and POST indicators (POST × WELFARE) would measure the effects of welfare reform through time and income barriers on welfare-related Medicaid eligibles. We hypothesized that the coefficient of this term would be negative and significantly different from 0. Equation (1) can be rewritten as

$$Y' = f'(\mathit{WELFARE},\ \mathit{NONELIGIBLE},\ \mathit{POST},\ \mathit{POST} \times \mathit{WELFARE},\ \mathit{POST} \times \mathit{NONELIGIBLE},\ \mathit{PRIV},\ \mathit{MCAID},\ X) \quad (2)$$

Most Medicaid policy changes (e.g., provider payment increases) that occurred over the study period would have affected both the welfare-related and expansion-related eligibles equally, and therefore, the difference-in-difference approach described above would separate out the effect of welfare reform from the effect of these policies. However, states often exclude Medicaid pregnant women enrolled under expansion-related categories from participation in managed care plans, which increased in popularity in the latter 1990s. Table 1 shows that all of the study states except Alaska offered either a primary care case management (PCCM) program or enrollment in a health maintenance organization (HMO) on a mandatory or voluntary basis to all or some pregnant women statewide or in selected counties. Two states, Florida and Oklahoma, excluded expansion-related eligibles from their managed care plans. Changes in these states' managed care programs over our study period could confound our analysis.

Florida had statewide managed care for welfare-related eligibles that changed from voluntary to mandatory in 1997, but the total penetration of managed care in Florida's Medicaid program did not increase over the study period. In Oklahoma, no major changes were made in the state's mandatory managed care program for welfare-related eligibles, but the penetration grew

from 19.4 percent of Medicaid enrollees in 1996 to 52.1 percent in 1999. If the expanded enrollment in managed care among welfare-related eligibles affected their first-trimester initiation of PNC, then our interaction terms would pick up this effect, confounding our measure of the impact of welfare reform. To test the robustness of our findings from the pooled sample of states, we also ran the PNC initiation equation separately for Florida, Oklahoma, and all other states combined.

Furthermore, to the extent that women anticipate their pregnancies, they may obtain private insurance coverage or enroll in Medicaid before becoming pregnant to reduce the out-of-pocket costs of pregnancy- and delivery-related care. In these cases, insurance coverage before pregnancy may be correlated with PNC initiation. We tested the endogeneity of insurance coverage by using the following two-equation model suggested by Terza (2002).

$$Y1 = (PRIV,\ MCAID) = f(X1,\ X2) \tag{3}$$

$$Y2 = f(X1,\ PRIV,\ MCAID,\ R1) \tag{4}$$

where $Y1$ is our trichotomous insurance coverage variable, with uninsured as the omitted category; $Y2$ is the dichotomous variable indicating initiation of PNC in the first trimester; $X1$ is a vector of exogenous factors common to the insurance and PNC equations (including WELFARE, NONELIGIBLE, POST, POST × WELFARE, POST × NONELIGIBLE); $X2$ is a vector of exogenous factors unique to the insurance equation (i.e., instrumental variables); PRIV and MCAID are the reported values of private insurance and Medicaid coverage, respectively; and $R1$ is the set of predicted residuals from the reduced-form equations for PRIV and MCAID. The residuals should capture the unobserved systematic component of the variation and correct for any bias in the estimated coefficients of these variables. If PRIV and MCAID are exogenous, then the coefficients of their predicted residuals should be insignificant (Terza 2002).

We tested a number of instrumental variables in the insurance equation that we ended up not using, including the percent of workers in the county who were employed in small firms, offered health insurance, and unionized; whether the state had a family cap policy; and TANF time limits. We included those variables with the most predictive value in our model: the ratio of minimum wage to the maximum income to qualify for Medicaid, which measures the attractiveness of work/private insurance relative to welfare/Medicaid; the percentage of single men in the state who were uninsured, which reflects the strength of the insurance market; whether the state had a cash diversion policy in its welfare program; and, to reflect general economic

growth, the annual percentage growth in households in the woman's county of residence, the county unemployment rate, and interactions of the unemployment rate with whether the county was a central city of a large metropolitan area, a fringe county of a large metropolitan area, another metropolitan area, or a nonmetropolitan area. None of these instrumental variables are strong predictors of insurance coverage by themselves. However, as a block, they were statistically significant in the estimated structural equation with a p-value $<.01$ (Wald's $\chi^2 = 33.36$ with 8 df).

Because the asymptotic properties of the Terza adjustment have not been studied for multinomial logistic models such as the one we used for health insurance coverage and because of our weak instrumental variables, we also estimated the PNC initiation equation with a simple logistic model, as well as with ordinary least squares (OLS) and two-stage least squares (TSLS) models and compared the marginal effects from each. All models were run in *Stata* version 9.1 using the *svy* estimators to adjust for the sampling design. Because the magnitude and significance of coefficients of interaction effects in nonlinear models do not equal the magnitude and significance of the marginal effects of the interaction terms, we used the *inteff* command in *Stata* developed by Norton, Wang, and Ai (2004) to compute the mean marginal effects and significance of the interaction effects in our logistic models.

In all models, we controlled for a variety of other factors affecting PNC, including the mother's age, race, and educational and marital status; whether she resided in a central city or fringe county of a large metropolitan area, another metropolitan area, or a nonmetropolitan area; whether the pregnancy was her first and whether it was intended; whether she drank, smoked, or was experiencing certain life stressors; whether she had any medical conditions putting the pregnancy at risk; the father's educational status; and the ratio of obstetricians to births in the county of residence. We also included state fixed-effects and a monthly time trend variable. In the two-stage models, these variables were entered into both the insurance and PNC initiation equations.

RESULTS

Descriptive Analysis

The percentage of study women eligible for Medicaid under both the welfare-related and expansion-related criteria dropped from 1996 to 1999, but the decline was statistically significant only for the welfare-related eligibles (Table 2). Among the welfare-related eligibles, the percentage enrolled in Medicaid before pregnancy dropped from 48.4 percent in 1996 to 29.1 percent in 1999 and

Table 2: Percentage of Medicaid Eligibles and Noneligibles with Health Insurance Coverage before Pregnancy and the Percentage of These Women with First-Trimester Initiation of Prenatal Care, 1996 and 1999

	Number and Percentage Distribution of Study Women		*Initiated Prenatal Care in the First Trimester of Pregnancy*	
	1996	*1999*	*1996*	*1999*
Number of observations	13,714	12,067	12,580	11,777
Weighted count	523,074	533,788	491,149	521,676
All study women (%)	100.0	100.0	76.8	77.8
Welfare-related eligible (%)	8.0	6.0***	57.1	55.3
Medicaid coverage before pregnancy	48.4	29.1***	61.1	58.0
Private coverage before pregnancy	17.9	21.4	61.6	55.9
Uninsured before pregnancy	33.7	49.5***	50.4	53.6
Expansion-related eligible (%)	45.5	43.9	68.2	69.7
Medicaid coverage before pregnancy	14.1	11.7	64.4	64.9
Private coverage before pregnancy	41.2	41.6	78.7	76.9
Uninsured before pregnancy	44.7	46.7**	60.0	64.3
Not eligible (%)	46.4	50.1***	88.2	87.5
Medicaid coverage before pregnancy	1.2	1.7	71.4	73.5
Private coverage before pregnancy	88.2	86.7	91.9	90.5
Uninsured before pregnancy	10.6	11.6	59.8	66.8

Source: Tabulations of data from the Pregnancy Risk Assessment Monitoring System (PRAMS) for Alaska, Florida, Maine, New York (excluding New York City), Oklahoma, South Carolina, Washington, and West Virginia.

Note: Percentages are based on weighted counts.

***A χ^2 test of the difference in the percentage of women with the characteristic in 1999 relative to 1996 was statistically significant at the $p<.01$ level.

**A χ^2 test of the difference in the percentage of women with the characteristic in 1999 relative to 1996 was statistically significant at the $p<.05$ level.

the percentage uninsured before pregnancy increased from 33.7 to 49.5 percent. We see the same trends but on a much smaller scale for expansion-related eligible women. The insurance status distribution of women designated not eligible for Medicaid did not change over the study period. There may be some mismeasurement in our groups as evidenced by the small number of noneligibles enrolled in Medicaid before pregnancy. These women may have had either a change in circumstances making them ineligible on average for the year or had such large medical expenditures that they spent down to the welfare-related income standards thereby qualifying for coverage.

Pregnant women were slightly more likely to initiate PNC during the first trimester in 1999 than in 1996, with the improvement coming primarily from women who were uninsured before pregnancy, regardless of whether

they were welfare-eligible, expansion-eligible, or not eligible for Medicaid during pregnancy. However, the percentage of all welfare-related Medicaid eligibles with first-trimester PNC initiation declined from 57.1 to 55.3 percent from 1996 to 1999. None of the changes in first-trimester PNC initiation among our study sample, though, were statistically significant.

Multivariate Analysis

Tables 3 and 4 show the estimated coefficients of the variables of interest in the equations for insurance coverage before pregnancy and first-trimester PNC initiation, respectively. The full set of estimated coefficients is available from the authors upon request.

We found a statistically significant negative effect of welfare reform on Medicaid coverage before pregnancy among welfare-related Medicaid eligibles and no statistically significant effect of welfare reform on private insurance coverage before pregnancy. The mean marginal effect of welfare reform measured from the interaction term for the postreform and welfare-related eligibility indicators is a 5.3-percentage-point drop in Medicaid coverage before pregnancy for welfare-related Medicaid eligible pregnant women relative to expansion-related eligibles, with a range in the estimated decline from 0.1 to 14.8 percentage points (Table 3).

Estimated marginal effects from the two-equation model with the Terza adjustment show women with Medicaid coverage before pregnancy to have had a 9.7 percentage point higher probability of first-trimester PNC initiation relative to women who were uninsured before pregnancy (Table 4). This effect is in the same range as the marginal effects of Medicaid coverage before pregnancy estimated from the OLS and single equation logistic models; the TSLS estimate is positive but larger and insignificant. The estimated 5.3-percentage-point drop in Medicaid coverage before pregnancy resulting from welfare reform represents an 11 percent drop in coverage from the 48.4 percent coverage level among welfare-related eligibles in 1996 (Table 2). Thus, in the study states, welfare reform lowered first-trimester PNC initiation among welfare-related Medicaid eligibles through this 11 percent reduction in Medicaid coverage by approximately 1.1 percentage points (0.11×9.7).

On the other hand, the two-equation model with the Terza adjustment shows no effect of private insurance coverage before pregnancy on first-trimester PNC initiation relative to uninsured women. This result is contrary to the consistent positive marginal effect from private insurance coverage of 11.6–14.9 percentage points found with the other models (Table 4).

Table 3: Estimated Regression Coefficients and Mean Marginal Effects in the Multinomial Logistic Equations for Health Insurance Coverage before Pregnancy (N= 38,940)

	Medicaid	*Private Insurance*
	Coefficients (95% confidence interval)	
Medicaid eligibility category (expansion-related eligible omitted)		
Welfare-related eligible	0.806***	0.052
	(0.418, 1.194)	(−0.392, 0.496)
Not eligible	−0.705***	1.421***
	(−1.181, −0.230)	(1.200, 1.642)
Postwelfare reform (Prewelfare reform omitted)	0.460	−0.078
	(−0.150, 1.070)	(−0.378, 0.222)
Interaction terms (postwelfare reform × expansion-related eligible omitted)		
Postwelfare reform × welfare-related eligible	−0.998***	−0.048
	(−1.610, −0.385)	(−0.569, 0.473)
Postwelfare reform × not eligible	−0.391	0.112
	(−0.931, 0.148)	(−0.141, 0.365)
	Mean marginal effects (range) in percentage point difference	
Interaction terms (Postwelfare reform × expansion-related eligible omitted)	−5.3**	−0.2
Postwelfare reform × welfare-related eligible	(−14.8, −0.1)	(−3.8, 8.5)

Source: Regression run on data from the Pregnancy Risk Assessment Monitoring System (PRAMS) for Alaska, Florida, Maine, New York (excluding New York City), Oklahoma, South Carolina, Washington, and West Virginia for 1996–1999.

***p<.01,

**p<.05.

Note: Other independent variables in the equation include mother's age, race, and educational and marital status; whether she resided in a central city or fringe county of a large metropolitan area, another metropolitan area, or a nonmetropolitan area; whether the pregnancy was her first and whether it was intended; whether she drank, smoked, or was experiencing certain life stressors during pregnancy; whether she had any medical conditions putting the pregnancy at risk; the father's education status; the ratio of obstetricians to births in the county of residence; indicators for the state of residence; and a monthly time trend variable. We also included the following variables as instrumental variables in this equation: the ratio of minimum wage to the maximum income to qualify for Medicaid; the percentage of single men in the state who were uninsured; whether the state had a cash diversion policy in its welfare program; and the annual percentage growth in households in the woman's county of residence, the county unemployment rate, and the interaction of the unemployment rate with the metropolitan designation of the county.

Table 4: Estimated Regression Coefficients and Marginal Effects in the Equations for Whether the Woman Began Prenatal Care in Her First Trimester

	Ordinary Least Squares[†]	*Two-Stage Least Squares*[†,‡]	*Single Equation Logistic Model*	*Two-Equation Model with Terza Adjustment*[†,‡]
Number of observations	38,174	38,943	38,174	38,174
		Coefficients (95% confidence interval)		
Insurance coverage before pregnancy (uninsured omitted category)				
Medicaid coverage	0.102***	—	0.541***	0.836*
	(0.070, 0.135)		(0.383, 0.699)	(−0.071, 1.744)
Predicted Medicaid coverage	—	0.276	—	—
		(−0.463, 1.015)		
Predicted residuals, Medicaid equation	—	—	—	−0.317
				(−1.240, 0.607)
Private insurance coverage	0.129***	—	0.739***	−0.484
	(0.107, 0.152)		(0.616, 0.862)	(−1.522, 0.554)
Predicted private insurance coverage	—	0.149	—	—
		(−0.433, 0.731)		
Predicted residuals, private equation	—	—	—	1.222**
				(0.181, 2.263)
Medicaid eligibility category (not eligible omitted)				
Welfare-related eligible	−0.016	−0.066	0.043	−0.134
	(−0.085, 0.053)	(−0.282, 0.150)	(−0.275, 0.361)	(−0.514, 0.245)
Not eligible	0.050***	0.058	0.400***	0.758***
	(0.019, 0.080)	(−0.088, 0.205)	(0.181, 0.619)	(0.422, 1.094)
Postwelfare reform (prewelfare reform omitted)	0.051**	0.053**	0.301**	0.355***
	(0.012, 0.090)	(0.010, 0.097)	(0.063, 0.540)	(0.116, 0.594)
Interaction terms (postwelfare reform × expansion-related eligible omitted)				
Postwelfare reform × welfare-related eligible	−0.005	0.020	−0.022	0.043
	(−0.083, 0.074)	(−0.108, 0.148)	(−0.380, 0.335)	(−0.330, 0.417)

continued

Table 4. *Continued*

	Ordinary Least Squares†	*Two-Stage Least Squares*†,‡	*Single Equation Logistic Model*	*Two-Equation Model with Terza Adjustment*†,‡
Postwelfare reform × not eligible	−0.033**	−0.039**	−0.207*	−0.248**
	(−0.065, −0.000)	(−0.077, −0.002)	(−0.445, 0.031)	(−0.487, −0.009)
	Marginal effect (95% confidence interval) in percentage point difference			
Insurance coverage before pregnancy (uninsured omitted category)				
Medicaid coverage	10.2***	27.6	6.9***	9.7***
	(7.0, 13.5)	(−46.3, 101.5)	(5.1, 8.6)	(1.6, 17.8)
Private insurance coverage	12.9***	14.9	11.6***	−6.8
	(10.7, 15.2)	(−43.3, 73.1)	(9.5, 3.6)	(−20.7, 7.2)
Postwelfare reform (prewelfare reform omitted)	5.1**	5.3**	4.6**	5.5***
	(1.2, 9.0)	(1.0, 9.7)	(0.8, 8.5)	(1.6, 9.3)
Interaction terms (postwelfare reform × expansion-related eligible omitted)			*Mean marginal effect (range) in percentage point difference*	
Postwelfare reform × welfare-related eligible	−0.5	2.0	−0.4	0.9
	(−8.3, 7.4)	(−10.8, 14.8)	(−0.5, −0.1)	(0.1, 1.3)
Postwelfare reform × not eligible	−3.3**	−3.9**	−3.7*	−4.9*
	(−6.5, −0.0)	(−7.7, −0.2)	(−5.2, −0.8)	(−6.5, −1.1)

Source: Regression run on data from the Pregnancy Risk Assessment Monitoring System (PRAMS) for Alaska, Florida, Maine, New York (excluding New York City), Oklahoma, South Carolina, Washington, and West Virginia for 1996–1999.

Notes:

***$p < .01$,

**$p < .05$,

*$p < .10$.

†Other independent variables in the equation include mother's age, race, and educational and marital status; whether she resided in a central city or fringe county of a large metropolitan area, another metropolitan area, or a nonmetropolitan area; whether the pregnancy was her first and whether it was intended; whether she drank, smoked, or was experiencing certain life stressors during pregnancy; whether she had any medical conditions putting the pregnancy at risk; the father's education status; the ratio of obstetricians to births in the county of residence; indicators for the state of residence; and a monthly time trend variable.

‡The first stage equation for both two-equation models was a multinomial logistic for whether the mother had Medicaid or private insurance coverage prior to becoming pregnant or whether she was uninsured. Besides the independent variables listed above, we also included the following variables as instrumental variables in this equation: the ratio of minimum wage to the maximum income to qualify for Medicaid; the percentage of single men in the state who were uninsured; whether the state had a cash diversion policy in its welfare program; and the annual percentage growth in households in the woman's county of residence, the county unemployment rate, and the interaction of the unemployment rate with the metropolitan designation of the county.

In particular, whereas the marginal effect of private insurance coverage before pregnancy changes dramatically moving from the single equation logistic to the two-equation logistic model with the Terza adjustment, it changes little moving from the single equation OLS model to the two-equation TSLS model, which also adjusts for simultaneity bias.

The Terza test for endogeneity of the insurance coverage variables in the two-equation model of first-trimester PNC initiation shows Medicaid coverage to be exogenous but private coverage to be endogenous to the decision to initiate PNC early; the coefficient of the predicted residuals from the private insurance equation is statistically significant whereas the coefficient of the predicted residuals from the Medicaid equation is not (Table 4). Thus, the Terza model suggests that women select into private insurance once they decide to become pregnant or find out they are pregnant, but they do not similarly select into Medicaid coverage.

Estimated coefficients of the Medicaid eligibility category variables show that, holding insurance coverage before pregnancy constant, welfare-related Medicaid eligible women were equally as likely and noneligible women were more likely than expansion-related eligible women to initiate PNC in their first trimester (Table 4). Furthermore, women were more likely to have first-trimester PNC in the postreform period compared to the prereform period, but the improvement was concentrated among Medicaid eligible women. The estimated marginal effect for the postreform indicator is consistently significant and positive whereas the estimated marginal effect for the interaction term between the postreform indicator and the indicator for noneligible women is consistently significant and negative over the different models (Table 4). The sum of these marginal effects show that women not eligible for Medicaid had a very small increase in first-trimester PNC initiation relative to the increase for expansion-related Medicaid eligibles—0.6 percent (5.5–4.9 in Table 4) versus 5.5 percent using the Terza model estimates.

Finally, the coefficient of the interaction of the postreform and welfare-related Medicaid eligibility indicators is not significantly different from 0 under any of the models. Thus, no evidence exists in the pooled data for an impact of welfare reform on first-trimester PNC initiation beyond its effect through lower Medicaid coverage before pregnancy.

In the state-specific models, the estimated coefficients of Medicaid coverage before pregnancy are consistently positive but not consistently significant (Table 5). Furthermore, the estimated effects of time and income barriers to care resulting from welfare reform vary by state. Table 5 shows results for Florida alone, Oklahoma alone, and the other six states together using

the single equation logistic model and the two-equation logistic model with the Terza adjustment. Results indicate that the mean marginal effects of the POST × WELFARE interaction term has the expected negative sign in Florida but not in Oklahoma. The mean marginal effect of the time and income barriers for the welfare-related eligibles relative to the expansion-related eligibles is a significant 15.4 percentage-point increase in Oklahoma using the Terza model. Our estimate may be picking up a favorable impact on first-trimester PNC initiation from the expansion of managed care for welfare-related enrollees in that state. For all three state subsets, private insurance coverage has a significant, positive effect in the single equation model but an insignificant, negative effect in the Terza model, similar to what we found in the eight-state pooled analysis.

DISCUSSION

This study makes several contributions to the literature. First, with the use of the PRAMS data, we were able to more accurately identify the target population and the means through which welfare reform impacts PNC initiation. We found that welfare reform had a significant negative impact on Medicaid coverage before pregnancy among welfare-related Medicaid eligibles. This drop resulted in a small decline of approximately 1.1 percentage points in first-trimester PNC initiation for these women. Thus, we confirmed Kaestner and Lee's finding of a small adverse impact of the PRWORA legislation on first-trimester PNC initiation.

We did not find any additional effect of welfare reform on first-trimester PNC initiation from increased time and income barriers due to work requirements and sanctions for noncompliance. However, we believe that this is partly due to other state policy changes that masked any impact from welfare reform.

Second, we applied novel methods of correcting for simultaneous equation bias developed by Terza (2002). Our estimate of the effect of Medicaid coverage before pregnancy using these methods is robust across different estimation methods, lending credibility to the Terza method. The insignificant, negative coefficient that we obtained for private health insurance though is troubling. States are looking to the private insurance market in developing insurance programs to cover the uninsured. Our results suggest that plans modeled after private insurance plans may not be as effective as Medicaid-type plans for women in these income strata.

Table 5: Estimated Regression Coefficients and Marginal Effects for Whether the Woman Began Prenatal Care in Her First Trimester by State

	Florida		*Oklahoma*		*Other Study States*[†]	
	Single Equation Logistic Model[‡]	*Two-Equation Model with Terza Adjustment*[‡,§]	*Single Equation Logistic Model*[‡]	*Two-Equation Model with Terza Adjustment*[‡,§]	*Single Equation Logistic Model*[‡]	*Two-Equation Model with Terza Adjustment*[‡,§]
Number of observations	6,393		6,165		25,616	
			Coefficient (95% confidence interval)			
Insurance coverage before pregnancy (uninsured omitted category)						
Medicaid coverage	0.551***	0.415	0.225	0.806	0.610***	1.762***
	(0.273, 0.829)	(−1.124, 1.955)	(−0.197, 0.646)	(−1.048, 2.660)	(0.395, 0.825)	(0.479, 3.046)
Predicted residuals, Medicaid equation	—	0.127	—	−0.629	—	−1.200*
		(−1.432, 1.686)		(−2.535, 1.278)		(−2.500, 0.100)
Private insurance coverage	1.003***	−0.377	0.699***	−1.122	0.579***	−0.888
	(0.776, 1.230)	(−2.639, 1.886)	(0.441, 0.956)	(−3.450, 1.205)	(0.419, 0.739)	(−2.068, 0.291)
Predicted residuals, private equation	—	1.384	—	1.838	—	1.460**
		(−0.882, 3.650)		(−0.494, 4.170)		(0.277, 2.643)
Medicaid eligibility category (expansion-related eligible omitted)						
Welfare-related eligible	0.118	−0.009	−0.463	−0.566	0.056	−0.426
	(−0.492, 0.729)	(−0.677, 0.660)	(−1.244, 0.318)	(−1.522, 0.390)	(−0.352, 0.463)	(−0.951, 0.100)
Not eligible	0.529**	0.824**	0.367	0.984**	0.384***	0.958***
	(0.073, 0.985)	(0.187, 1.460)	(−0.094, 0.827)	(0.118, 1.850)	(0.113, 0.655)	(0.531, 1.385)
Postwelfare reform (prewelfare reform omitted)	0.465**	0.546**	0.228	0.427	0.196	0.210
	(0.033, 0.897)	(0.105, 0.987)	(−0.276, 0.733)	(−0.136, 0.991)	(−0.119, 0.510)	(−0.103, 0.523)
Interaction terms (postwelfare reform × expansion-related eligible omitted)						
Postwelfare reform × welfare-related eligible	−0.536	−0.397	0.996**	0.837*	0.103	0.283
	(−1.268, 0.196)	(−1.157, 0.362)	(0.122, 1.870)	(−0.118, 1.793)	(−0.344, 0.549)	(−0.201, 0.767)

continued

Table 5. *Continued*

	Florida		*Oklahoma*		*Other Study States*[†]	
	Single Equation Logistic Model[‡]	*Two-Equation Model with Terza Adjustment*[‡,§]	*Single Equation Logistic Model*[‡]	*Two-Equation Model with Terza Adjustment*[‡,§]	*Single Equation Logistic Model*[‡]	*Two-Equation Model with Terza Adjustment*[‡,§]
Postwelfare reform × not eligible	−0.434*	−0.471*	−0.266	−0.416	−0.055	−0.101
	(−0.943, 0.075)	(−0.982, 0.040)	(0.765, 0.233)	(−0.944, 0.112)	(−0.346, 0.235)	(−0.393, 0.191)
	Marginal effects (95% confidence interval) in percentage point difference					
Insurance coverage before pregnancy (uninsured omitted category)						
Medicaid coverage	7.6***	5.9	4.1	12.8	6.7***	13.8***
	(4.3, 10.8)	(−13.5, 25.3)	(−3.2, 11.5)	(−10.6, 36.1)	(4.7, 8.6)	(8.3, 19.4)
Private insurance coverage	16.6***	−5.8	13.5***	−21.1	8.1***	−10.3
	(12.7, 20.6)	(−40.0, 28.4)	(8.5, 18.4)	(−63.8, 21.5)	(5.7, 10.5)	(−22.6, 2.0)
Postwelfare reform (prewelfare reform omitted)	7.9**	9.3**	4.5	8.6	2.6	2.8
	(0.0, 15.7)	(1.2, 17.5)	(−5.7, 14.8)	(−3.3, 20.6)	(−1.7, 7.0)	(−1.5, 7.1)
	Marginal effects (range) in percentage point difference					
Interaction terms (postwelfare reform × expansion-related eligible omitted)						
Postwelfare reform × welfare-related eligible	−9.3*	−6.7	17.8**	15.4**	1.5	4.8
	(−13.3, −0.9)	(−9.9, −0.6)	(4.2, 24.8)	(3.2, 20.7)	(0.2, 2.6)	(0.7, 7.4)
Postwelfare reform × not eligible	−7.7	−8.8*	−4.9	−8.6	−1.3	−2.6
	(−10.8, −1.2)	(−11.9, −1.7)	(−6.6, −1.5)	(−10.4, −2.8)	(−1.7, −0.2)	(−3.2, 0.1)

Source: Regression run on data from the Pregnancy Risk Assessment Monitoring System (PRAMS) for 1996 through 1999.

***$p<.01$,

**$p<.05$,

*$p<.10$.

[†]Alaska, Maine, New York (excluding New York City), South Carolina, Washington, and West Virginia.

[‡]Other independent variables in the equation include mother's age, race, and educational and marital status; whether she resided in a central city or fringe county of a large metropolitan area, another metropolitan area, or a nonmetropolitan area; whether the pregnancy was her first and whether it was intended; whether she drank, smoked, or was experiencing certain life stressors during pregnancy; whether she had any medical conditions putting the pregnancy at risk; the father's education status; the ratio of obstetricians to births in the county of residence; indicators for the state of residence; and a monthly time trend variable.

[§]The first stage equation for both two-equation models was a multinomial logistic for whether the mother had Medicaid or private insurance coverage before becoming pregnant or whether she was uninsured. Besides the independent variables listed above, we also included the following variables as instrumental variables in this equation: the ratio of minimum wage to the maximum income to qualify for Medicaid; the percentage of single men in the state who were uninsured; whether the state had a cash diversion policy in its welfare program; and the annual percentage growth in households in the woman's county of residence, the county unemployment rate, and the interaction of the unemployment rate with the metropolitan designation of the county.

Furthermore, if the results from the Terza approach are to be believed, we were also able to establish that Medicaid enrollment among women of childbearing age is independent of the decision to become pregnant whereas the decision to obtain private insurance is not. Additional evidence for this conclusion is provided in the coefficients of the variables for intendedness of pregnancy which we had entered in the reduced-form insurance equations (not shown); the coefficients of these variables were significant in the private insurance equation but not in the Medicaid equation, indicating that women planning to become pregnant are more likely to have obtained private coverage prior to pregnancy but are not more likely to have enrolled in Medicaid.

Our analysis has several limitations. First, the data came from eight states that were chosen because the PRAMS data were available for the study period. These states are not necessarily representative of all states. Only 77 percent of pregnant women in the eight states initiated PNC in the first trimester of pregnancy, compared to 82 percent of women nationally in 1996. Furthermore, because the federal government allowed states great flexibility in designing and implementing their TANF programs, time and income barriers to care will vary by state. Thus, as seen in our sensitivity analysis, the magnitude and significance of the impact of these barriers can vary by state, and the results from a pooled sample will depend on the states included in the sample.

Second, our method of estimating the impact of time and income barriers arising from welfare reform can capture other trends over the study time period. In our state-specific regression for Oklahoma, the interaction term for postreform welfare-related eligibles may be picking up a significant favorable impact on first-trimester PNC initiation from the managed care expansion that occurred during this time among welfare-related but not expansion-related pregnant women, confounding our estimated impact of welfare reform.

Third, the precision of our estimates is fair at best. Our method of adjusting for the simultaneous equation bias, like TSLS, results in consistent but not necessarily efficient estimates. Moreover, the asymptotic properties of the Terza adjustment have not been studied for multinomial logistic models such as the one we used to estimate health insurance coverage before pregnancy. Conflicting findings for the private insurance coverage variable raises concern about the validity of this method.

Although the number of welfare-related Medicaid women is relatively small and therefore the adverse effect on progress toward the Healthy People goal of 90 percent of all pregnant women initiating PNC in the first trimester may be minor, the affected women are among the neediest and the most likely

to benefit from early PNC. Improved outreach for eligible women within the current Medicaid program and the development of expanded Medicaid-like insurance options for women of childbearing age meeting welfare eligibility criteria should receive high priority in our political and legislative agendas.

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SUPPLEMENTARY MATERIAL

The following supplementary material is available for this article:

Appendix Table A1. Estimated Regression Coefficients (Upper, Lower 95 Percent Confidence Interval Limits) in the Equations for Insurance Coverage before Pregnancy and Whether the Woman Began Prenatal Care in Her First Trimester.

Appendix Table A2. Estimated Regression Coefficients (Upper, Lower 95 Percent Confidence Interval Limits) in the Equations for Whether the Woman Began Prenatal Care in Her First Trimester.

This material is available as part of the online article from: http://www.blackwell-synergy.com/doi/abs/10.1111/j.1475-6773.2006.00667.x (this link will take you to the article abstract).

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