

Perinatal Health in the Rural United States, 2005

Laura-Mae Baldwin, MD MPH
Meredith A. Fordyce, PhD
C. Holly A. Andrilla, MS
Mark P. Doescher, MD MSPH

WWAMI Rural Health Research Center
University of Washington
October 2013

ACKNOWLEDGEMENTS:

This series of policy briefs was produced with funding from the **Federal Office of Rural Health Policy (ORHP)** of the **Health Resources and Services Administration (HRSA)**, U.S. Department of Health and Human Services, through the **WWAMI Rural Health Research Center** (grant U1CRH03712).

Series design by **Alessandro Leveque** and **Martha Reeves**.



University of Washington
Department of Family Medicine, Box 354982
Seattle, WA 98195-4982
Phone 206-685-0402
<http://depts.washington.edu/uwrhrc/>

Policy Brief Series

#138: LOW BIRTH WEIGHT RATES IN THE RURAL UNITED STATES, 2005

#139: LOW BIRTH WEIGHT RATES AMONG RACIAL AND ETHNIC GROUPS IN THE RURAL UNITED STATES, 2005

#140: INADEQUATE PRENATAL CARE IN THE RURAL UNITED STATES, 2005

#141: INADEQUATE PRENATAL CARE AMONG RACIAL AND ETHNIC GROUPS IN THE RURAL UNITED STATES, 2005

These briefs cover the issue of perinatal outcomes in rural areas across the United States in 2005. Low birth weight, a key indicator of the health of the U.S. population, and adequacy of prenatal care, a critical indicator of access and quality of health care, are explored to discover how they are related to rural or urban location, race, and ethnicity.

The key finding of this brief is:

- The states with levels of rural inadequate prenatal care (less than 50% of expected visits) in the “worst” or “worse than mid-range” categories were largely in southern and southwestern areas of the United States.



Funded by the Federal Office of Rural Health Policy
www.ruralhealthresearch.org

Inadequate Prenatal Care in the Rural United States, 2005

BACKGROUND

Maternal and infant outcomes such as receipt of prenatal care, low birth weight, and infant death are critical indicators of access to and quality of health care. A WWAMI Rural Health Research Center study of prenatal care and birth outcomes between 1995 and 1997 found that nationally, women living in rural areas had higher rates of inadequate prenatal care compared to those living in urban areas.¹ An earlier (1985-1987) study of maternal and infant outcomes measured at the state level found higher rates of late prenatal care among women living in rural versus urban areas across half of the states.² Medicaid coverage expanded across the United States in the late 1980s and early 1990s,³ aiming to increase access to prenatal care in both rural and urban areas. Expanded coverage for prenatal care now has been in place for over two decades. However, rates of inadequate prenatal care are not routinely reported in rural areas, and the variation between states in rural rates of inadequate prenatal care is unknown.

STUDY AIM

To describe 2005 rates of inadequate prenatal care (less than 50% of expected visits) among rural women in each U.S. state, and among rural women living in counties closer to (adjacent) and farther from (non-adjacent) urban counties.

STUDY DESIGN

This is a national, cross-sectional analysis of the 3,998,753 singleton U.S. births using a special version of the 2005 Period National Linked Birth/Infant Death Database that included county identifiers. Urban Influence Codes identified births to mothers residing in rural (i.e., non-metropolitan) counties, and distinguished rural counties adjacent and non-adjacent to urban counties. Inadequate prenatal care was calculated by the National Center for Health Statistics using Kotelchuck's Adequacy of Prenatal Care Index.⁴ This index calculates an expected number of prenatal visits based on the number of weeks of pregnancy, and defines inadequate prenatal care as receipt of

less than 50% of expected visits. In 2005, 38 states, including the District of Columbia, used the 1989 version of the birth certificate, and 11 states used the 2003 version. Vermont switched from the 1989 to the 2003 birth certificate version on July 1, 2005; New York State used the 2003 version, New York City the 1989 version. Information regarding prenatal care was recorded differently on the two birth certificate versions (e.g., when prenatal care began, see Variation in Data Collection between the 1989 and 2003 Birth Certificate Versions section in Appendix 1), so inadequate prenatal care rates cannot be compared directly between states using the different birth certificates. To solve this problem, we created a standardized inadequate prenatal care score (Z-score) for each birth (see Appendix 1: Technical Documentation). With this standardization method, states' levels of rural inadequate prenatal care can be compared and displayed in categories from "best" to "worst" on the same map.

FINDINGS

- The states with levels of rural inadequate prenatal care in the "worst" or "worse than mid-range" categories were largely in southern and southwestern areas of the United States: New Mexico, Texas, Arizona, South Carolina, Florida, Oklahoma, Colorado, and Nevada. States in other areas of the U.S. with levels of rural inadequate prenatal care in the "worst" or "worse than mid-range" categories included Delaware, Alaska, Hawaii, South Dakota, and Washington. (Figure 1 shows state levels of rural inadequate prenatal care by standardized category from "best" to "worst"; see Appendix 2 for rural inadequate prenatal care rates by state and birth certificate version [1989 or 2003].)
- Nationally, there were statistically significant, but not meaningful, differences in the rates of inadequate prenatal care between rural counties adjacent and non-adjacent to urban counties (e.g., 12.3% vs. 12.7% for states using the 1989 birth certificate version, $P \leq 0.01$; 19.2% vs. 18.8% for states using the 2003 birth certificate version, $P \leq 0.05$; see Appendix 3).

- Unlike these national findings, within several states there were meaningful, statistically significant differences in the rates of inadequate prenatal care between adjacent and non-adjacent rural counties. There was not a consistent relationship between rates of inadequate prenatal care and whether a rural county was closer (adjacent) or farther (non-adjacent) from an urban county. In some states rural counties adjacent to urban counties had higher inadequate prenatal care rates (e.g., New Mexico, 27.2% inadequate prenatal care in adjacent counties vs. 21.5% inadequate prenatal care in non-adjacent counties, $P \leq 0.001$ [1989 birth certificate version]). In other states adjacent rural counties had lower inadequate prenatal care rates (e.g., in South Carolina, 20.6% inadequate prenatal care in adjacent counties vs. 28.6% inadequate prenatal care in non-adjacent counties, $P \leq 0.001$ [2003 birth certificate version]; see Appendix 3).

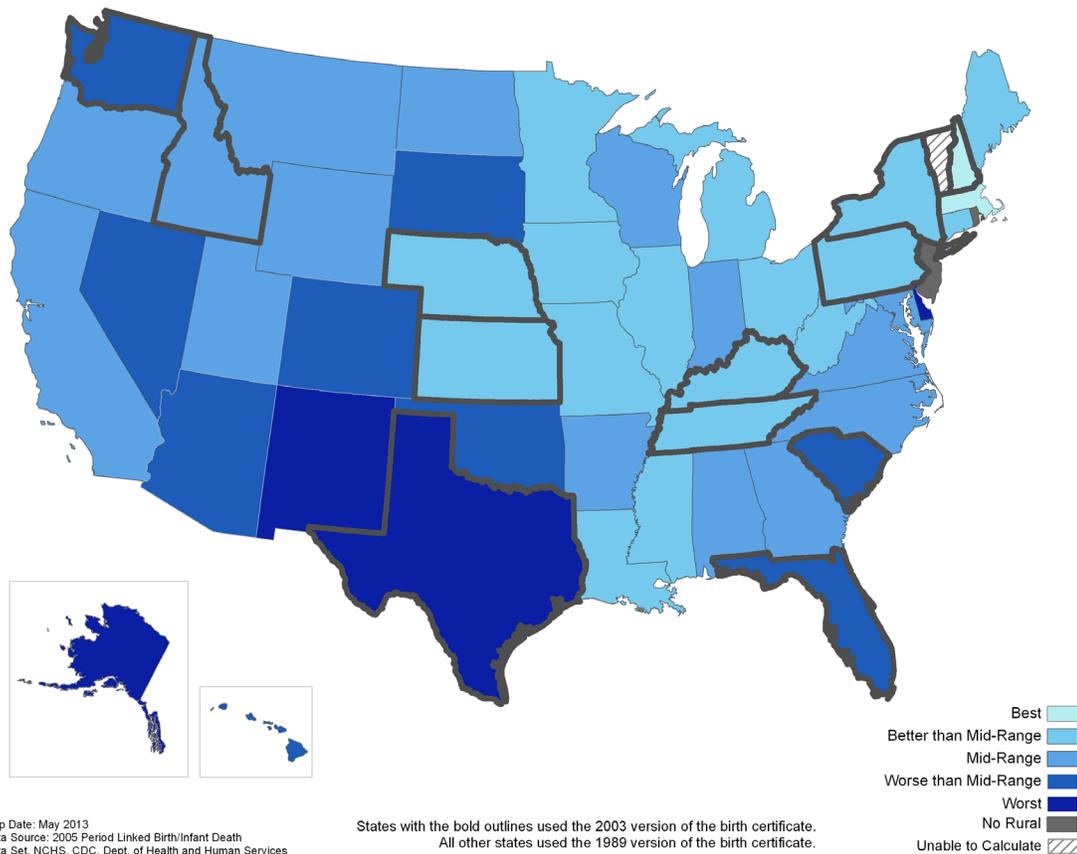
LIMITATIONS

Because of differences in the way that prenatal care data were reported on the 1989 and the 2003 birth certificate versions, we have compared states using standardized levels of inadequate prenatal care rather than their actual percentages of inadequate prenatal care.

CONCLUSIONS

There was substantial variation in levels of rural inadequate prenatal care by state, with some of the “worst” levels of rural inadequate prenatal care in Alaska, Delaware, New Mexico, and Texas. These variations in rural prenatal care receipt by state and county type are consistent with findings from our concurrent study⁵ demonstrating substantial geographic variation in another key perinatal outcome, low birth weight.

Figure 1: Rural Inadequate Prenatal Care by State, 2005



IMPLICATIONS FOR POLICY, DELIVERY, OR PRACTICE

States have placed great emphasis for over two decades on increasing access to prenatal care by expanding Medicaid insurance coverage, simplifying eligibility and enrollment processes, and developing outreach strategies to support these efforts.^{6,7} With these many changes across most states, it is difficult to identify the reasons that some states still had high levels of inadequate prenatal care in 2005. This study's findings can help states determine if and where they have troubling rural prenatal care patterns, thereby facilitating these states' development of local and regional solutions.

REFERENCES

1. Larson EH, Murowchick E, Hart LG. *Poor Birth Outcome in the Rural United States: 1985-1987 to 1995-1997*. Final Report #119. Seattle, WA: WWAMI Rural Health Research Center, University of Washington; 2008.
2. Larson EH, Hart LG, Rosenblatt RA. Is non-metropolitan residence a risk factor for poor birth outcome in the U.S.? *Soc Sci Med*. Jul 1997;45(2):171-188.
3. Kaiser Commission on Medicaid and the Uninsured. *A Historical Review of How States Have Responded to the Availability of Federal Funds for Health Coverage*. Washington, DC: Author; 2012.
4. Kotelchuck M. An evaluation of the Kessner Adequacy of Prenatal Care Index and a proposed Adequacy of Prenatal Care Utilization Index. *Am J Public Health*. Sep 1994;84(9):1414-1420.
5. Baldwin L-M, Fordyce MA, Andrilla CHA, Doescher MP. *Low Birth Weight Rates in the Rural United States, 2005*. Policy Brief #138. Seattle, WA: WWAMI Rural Health Research Center, University of Washington; 2013.
6. Hill I, Hogan S, Louise P, et al. *Medicaid Outreach and Enrollment for Pregnant Women: What Is the State of the Art?* Washington, DC: Urban Institute; 2009.
7. Ranji U, Salganicoff A, Stewart AM, Cox M, Doamekpor L. *State Medicaid Coverage of Perinatal Services: Summary of State Survey Findings*. Menlo Park, CA: Henry J. Kaiser Family Foundation; 2009.

Suggested Citation

Baldwin L-M, Fordyce MA, Andrilla CHA, Doescher MP. *Inadequate Prenatal Care in the Rural United States, 2005*. Policy Brief #140 in the series *Perinatal Health in the Rural United States, 2005*. Seattle, WA: WWAMI Rural Health Research Center, University of Washington, Jul 2013.

APPENDIX 1:

Technical Documentation: 1989 and 2003 Birth Certificate Version Differences and Standardization of Inadequate Prenatal Care Variable Using Z-Scores

DATA FILE

These studies used the 2005 Period Linked Birth/Infant Death Data Set with county identifiers, obtained from the U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Health Statistics (NCHS), Hyattsville, Maryland.

CASE SELECTION

These studies included only the 3,998,753 singleton births to mothers residing in the United States. This represented 96.5% of the 4,145,883 total births in the 2005 Period Linked Birth/Infant Death Data Set.

BIRTH CERTIFICATE VERSIONS

In 2005, two versions of the birth certificate were in use: the 1989 and 2003 revisions of the U.S. Standard Live Birth Certificate. The 2003 revision was phased in at the state level over a period of years. As of 2005, 13 states were using the 2003 revision: Pennsylvania, Washington, Florida, Idaho, Kentucky, New Hampshire, South Carolina, Tennessee, Kansas, Nebraska, Texas, New York State (except for New York City), and Vermont (from July 1 through December 31, 2005). New York City used the 1989 version throughout 2005, and Vermont used the 1989 version from January 1 through June 30, 2005. All other states were using the 1989 version.

VARIATION IN DATA COLLECTION BETWEEN THE 1989 AND 2003 BIRTH CERTIFICATE VERSIONS

The 1989 and 2003 versions of the birth certificate gathered data on prenatal care use differently.* In the 2003 revision, “month prenatal care began” was changed to “date of first prenatal visit.” Additionally, the 2003 revision recommends that prenatal care records or medical records serve as the source for prenatal care information; the 1989 version makes no recommendation. Because of these differences, the values for the adequacy of prenatal care variable are not comparable across the two birth certificate versions and require separate analysis.

HANDLING OF CASES WITH DIFFERING BIRTH CERTIFICATE VERSIONS BETWEEN BIRTH STATE AND MOTHER’S RESIDENCE STATE

The mother’s state and county of residence were used to define geography-based variables (i.e., state, adjacency to urban county), not the state and county in which the birth occurred. If the mother’s state of residence was different than the state in which the birth occurred, and those two states used different versions of the birth certificate, the adequacy of prenatal care variable from the birth certificate would not be compatible with that from the mother’s residence state. Therefore, for analyses including the adequacy of prenatal care variable, we excluded those births in which the birth state differed from the mother’s state of residence and these two states used different versions of the birth certificate. This mismatch in birth certificate version affected 46,651 births (1.2%). These exclusions did not apply to analysis of variables that were consistent between the two birth certificate versions, such as low birth weight.

Vermont and New York posed special problems in this regard. For Vermont, which used the 1989 birth certificate revision from January through June 2005 and the 2003 revision from July through December 2005, assignment to mismatch status for the purposes of the inadequate prenatal care analysis was based on the version of the birth certificate in use at the time of birth. We handled the assignment of mismatch status for New York State and New York City in the same way. If a New York City resident gave birth elsewhere in New York State or outside New York State, and the birth certificate in use at the birth location was the 2003 birth certificate revision, this birth was considered to have a birth certificate mismatch, because New York City was using the 1989 revision. Likewise, if a New York State resident gave birth in New York City or in another state that used the 1989 birth certificate version, this birth was considered to have a birth certificate mismatch, because New York State was using the 2003 version. These Vermont and New York birth certificate mismatches are included in the total 46,651 births noted above.

STANDARDIZING VARIABLES FROM DIFFERENT BIRTH CERTIFICATE VERSIONS FOR COMPARABILITY

Because of differences in the definition of prenatal care utilization between the 1989 and 2003 birth certificate versions (see Variation in Data Collection between the 1989 and 2003 Birth Certificate Versions section above), we conducted the inadequate prenatal care analyses separately for states using the two different birth certificate versions. However, we wanted to rank the levels of inadequate prenatal care across all U.S. states on the same map. To do so, we used the following method to standardize each state's rate of inadequate prenatal care to a Z-score that was comparable across all states. A Z-score is the number of standard deviations that an observation is above or below the population mean. This unitless measure is calculated by subtracting the population mean from each observation and dividing the result by the standard deviation.

We first calculated the standard deviation (SD) for the percent of inadequate prenatal care by state, based on the 1989 and 2003 birth certificate versions separately. We removed from the analysis those outlier states whose rates of inadequate prenatal care were more than 3 SDs from the mean inadequate prenatal care rate, and recalculated the SDs and mean rates. We calculated Z-scores for each state, and used the following groupings to map the Z-scores:

Best	Less than or equal to -1.51
Better than mid-range	-1.50 to -0.49
Mid-range	-0.50 to +0.50
Worse than mid-range	+0.51 to +1.50
Worst	Greater than or equal to +1.51

For Vermont, which used the 1989 birth certificate version in the first half of 2005 and the 2003 birth certificate version in the second half of 2005, we generally were either unable to standardize across the entire year or had insufficient data to report, and therefore we were unable to map these results. Results for the individual six-month data periods for Vermont are available in Appendices 2 and 3.

DESIGNATION OF INADEQUATE PRENATAL CARE

NCHS calculates the inadequate prenatal care variable based on the Adequacy of Prenatal Care Utilization Index (APNCU), and includes the calculated variable* in the data file. This index accounts for the month prenatal care began, the number of prenatal visits, and gestational age at birth as reported on the birth certificate.

DESIGNATION OF RURAL COUNTIES

We used the 2003 Urban Influence Codes (UIC) developed at the Economic Research Service, USDA,† to distinguish between non-metropolitan (referred to as rural) counties that were adjacent to metropolitan (urban) counties (UIC = 3-7), and rural counties that were not adjacent to urban counties (UIC = 8-12). Rhode Island, New Jersey, and the District of Columbia had no rural counties and therefore have no data represented on the maps.

* U.S. Department of Health and Human Services. *Detailed Technical Notes, United States, 2005 Natality*. Hyattsville, MD: USDHHS, Centers for Disease Control and Prevention, National Center for Health Statistics; 2008.

† U.S. Department of Agriculture, Economic Research Service. Briefing rooms: Measuring rurality: Urban Influence Codes. <http://webarchives.cdlib.org/sw15d8pg7m/http://ers.usda.gov/Briefing/Rurality/UrbanInf/>. Accessed October 7, 2013.

APPENDIX 2: Rural Inadequate Prenatal Care Rates by State, 2005

State	Total Rural Births	% Rural Inadequate Prenatal Care
States using 1989 birth certificate version		
Alabama	16,127	14.5
Alaska	3,302	21.8
Arizona	9,335	20.5
Arkansas	13,086	14.9
California	8,705	13.9
Colorado	7,758	17.0
Connecticut	2,951	5.6
Delaware	2,178	28.8
District of Columbia	N/A	N/A
Georgia	23,671	14.4
Hawaii	4,668	20.9
Illinois	17,696	7.7
Indiana	17,526	14.2
Iowa	15,505	7.9
Louisiana	15,631	10.4
Maine	5,312	6.7
Maryland	3,434	12.1
Massachusetts	318	4.4
Michigan	19,936	8.9
Minnesota	16,675	9.2
Mississippi	22,016	10.4
Missouri	18,743	9.5
Montana	7,080	12.5
Nevada	2,704	16.6
New Jersey	N/A	N/A
New Mexico	9,179	24.2
North Carolina	32,428	11.8
North Dakota	4,087	11.0
Ohio	26,182	9.9
Oklahoma	16,559	17.5
Oregon	8,782	13.8
Rhode Island	N/A	N/A
South Dakota	5,632	16.9
Utah	4,922	14.0
Vermont†	1,693	6.9
Virginia	11,154	11.7
West Virginia	8,670	10.4
Wisconsin	16,807	11.2
Wyoming	4,619	12.2
All states using 1989 birth certificate version	405,071	12.5
States using 2003 birth certificate version		
Florida	11,559	21.7
Idaho	7,177	18.9
Kansas	12,157	15.6
Kentucky	21,184	17.0
Nebraska	9,184	15.2
New Hampshire	3,998	9.4
New York	15,880	13.2
Pennsylvania	18,288	16.9
South Carolina	12,549	22.0
Tennessee	17,388	16.8
Texas	40,352	26.0
Vermont†	1,952	8.4
Washington	8,537	19.8
All states using 2003 birth certificate version	180,205	19.1

† = Vermont used the 1989 revision of the birth certificate from January 1 through June 30, 2005, and the 2003 revision from July 1 through December 31, 2005.

N/A = not applicable because of no rural births.

Geographic location is based on mother's state of residence.

26,778 rural births were excluded due to missing adequacy of prenatal care data.

APPENDIX 3: Rural Inadequate Prenatal Care Rates by State and Proximity to Urban Counties, 2005

% Inadequate Prenatal Care Among Women Living in Rural Counties		
State	Adjacent to Urban Counties	Not Adjacent to Urban Counties
States using 1989 birth certificate version		
Alabama	14.6	13.7
Alaska	27.1	21.5
Arizona	20.4	22.2
Arkansas	14.2*	15.7
California	13.8	14.2
Colorado	16.6	17.2
Connecticut	5.6	N/A
Delaware	28.3	N/A
District of Columbia	N/A	N/A
Georgia	14.6	13.7
Hawaii	N/A	20.9
Illinois	8.3***	6.7
Indiana	14.7***	12.1
Iowa	7.3***	8.7
Louisiana	10.1***	13.9
Maine	7.1*	5.5
Maryland	12.1	N/A
Massachusetts	N/A	4.4
Michigan	9.6***	8.2
Minnesota	9.0	9.4
Mississippi	10.0	10.6
Missouri	10.0*	9.0
Montana	15.0**	11.9
Nevada	14.0***	20.9
New Jersey	N/A	N/A
New Mexico	27.2***	21.5
North Carolina	12.4***	8.9
North Dakota	16.2***	9.3
Ohio	9.7***	12.0
Oklahoma	16.0***	19.5
Oregon	12.5***	16.1
Rhode Island	N/A	N/A
South Dakota	10.6***	18.4
Utah	12.1***	16.5
Vermont†	6.9	6.9
Virginia	10.8***	14.1
West Virginia	10.0	10.9
Wisconsin	11.5***	8.9
Wyoming	12.9	12.1
All states using 1989 birth certificate version	12.3**	12.7
States using 2003 birth certificate version		
Florida	21.7	N/A
Idaho	17.1***	21.3
Kansas	12.6***	16.7
Kentucky	15.9***	17.8
Nebraska	15.7	15.2
New Hampshire	8.7*	10.7
New York	13.9***	10.1
Pennsylvania	17.1	15.6
South Carolina	20.6***	28.6
Tennessee	17.1*	15.5
Texas	26.0	26.0
Vermont†	8.2	8.6
Washington	20.0	18.8
All states using 2003 birth certificate version	19.2*	18.8

* $P \leq 0.05$.

** $P \leq 0.01$.

*** $P \leq 0.001$.

† Vermont used the 1989 revision of the birth certificate from January 1 through June 30, 2005, and the 2003 revision from July 1 through December 31, 2005.

N/A = not applicable because of no rural births.

Geographic location is based on mother's state of residence.