The Importance of Geographic Data Aggregation in Assessing Disparities in American Indian Prenatal Care

Pamela Jo Johnson, MPH, PhD, Kathleen Thiede Call, PhD, and Lynn A. Blewett, PhD

The 2007 National Healthcare Disparities Report suggests that many indicators of disparity in quality of care between American Indians/Alaska Natives (AIANs) and Whites and most indicators of disparity in access to care between the 2 groups are improving.1 However, these conclusions are drawn from nationally aggregated data. Questions remain about whether, and to what extent, national data on AIAN disparities mask geographic variation in access to care and disparities in access at subnational levels (e.g., states and localities).

Access to care is a critical element to improving health status and is 1 of the 10 Leading Health Indicators that is monitored at the national level.2 Each Leading Health Indicator has Healthy People 2010 objectives associated with it. For example, the objectives used to monitor access to care in the United States are (1) insurance coverage, (2) having a usual source of care, and (3) prenatal care utilization.2 For this article, we focus on prenatal care as a key indicator to measure both access to care and disparities in access for the AIAN population.

It is generally assumed that women who receive adequate prenatal care have better birth outcomes, although the relevant content and effectiveness of prenatal care remain debatable.3,4 Initiating prenatal care early in pregnancy and continuing with prescribed visits provides opportunity for medical management of health complications, lifestyle and health behavior advice, and referral to additional health and social welfare resources when necessary.

Between 1990 and 1998, the proportion of all infants whose mothers began prenatal care in the first trimester increased, but the rate for AIANs still lagged behind other population groups. The rate for AIANs increased from 58% to 69%, compared with an increase from 83% to 88% for non-Hispanic Whites.3 Increases in early prenatal care have been greatest among those whose risk profiles and adverse birth outcome rates are highest. However, AIANs are still more than 3.6 times more likely than are non-Hispanic Whites to enter prenatal care in the third trimester or to have no prenatal care at all.5

The Healthy People 2010 goals for the nation include goals to increase the proportion of pregnant women who receive early and adequate prenatal care. The 2 specific goals are: (1) to increase the proportion of all infants whose mothers begin prenatal care in the first trimester from a baseline of 83% to the target of 90%, and (2) to increase the proportion of all infants whose mothers have early and adequate prenatal care from a baseline of 74% to the target of 90%.5 Although the goals are the same for all groups, the baseline rates for AIANs and non-Hispanic Whites are quite different. The baseline proportion of all infants whose mothers had adequate prenatal care was 57% for AIANs and 79% for non-Hispanic Whites.

Disparities in prenatal care utilization have narrowed for some groups,6 but AIANs have consistently recorded the highest rates of inadequate prenatal care use compared with all other races.7,8 Few studies have closely examined AIAN disparities in prenatal care utilization; those that have tend to use nationally aggregated data. However, beginning with 2005 data, the National Center for Health Statistics revised its data-release policy to comply with state requirements. The revised policy is “consistent with CDC and NCHS goals to make data available as widely as possible while protecting respondent confidentiality, assuring data quality, and conforming to state laws and regulations on release of vital statistics data.”9 In practice, national vital records public-use data files no longer contain geographic identifiers, making local-area analyses more difficult.

We disaggregated national-level data to regional and state levels to examine whether national data on AIAN disparities mask geographic variation and substantial subnational disparities in prenatal care utilization.

Objectives. We sought to determine whether aggregate national data for American Indians/Alaska Natives (AIANs) mask geographic variation and substantial subnational disparities in prenatal care utilization.

Methods. We used data for US births from 1996 to 1997 and from 2000 to 2002 to examine prenatal care utilization among AIAN and non-Hispanic White mothers. The indicators we studied were late entry into prenatal care and inadequate utilization of prenatal care. We calculated rates and disparities for each indicator at the national, regional, and state levels, and we examined whether estimates for regions and states differed significantly from national estimates. We then estimated state-specific changes in prevalence rates and disparity rates over time.

Results. Prenatal care utilization varied by region and state for AIANs and non-Hispanic Whites. In the 12 states with the largest AIAN birth populations, disparities varied dramatically. In addition, some states demonstrated substantial reductions in disparities over time, and other states showed significant increases in disparities.

Conclusions. Substantive conclusions about AIAN health care disparities should be geographically specific, and conclusions drawn at the national level may be unsuitable for policymaking and intervention at state and local levels. Efforts to accommodate the geographically specific data needs of AIAN health researchers and others interested in state-level comparisons are warranted. (Am J Public Health. 2010;100:122–128. doi:10.2105/AJPH.2008.148908)
indicators of access: late entry into prenatal care and inadequate utilization of prenatal care. Our intent is not to dispute the conclusions of the National Healthcare Disparities Report but rather to examine whether the story is more complicated than what the report indicates.

METHODS

We used publicly available data from the National Vital Statistics System at the National Center for Health Statistics. The data are from the National Perinatal Mortality Data files, which are compiled annually at the national level and contain birth-certificate data for all live births collected by each of the 50 states. Our analytic sample comprises all records for singleton infants born from 1995 through 1997 and from 2000 through 2002 to AIAN mothers (n=111520 and n=123231, respectively) and non-Hispanic White mothers (n=6870891 and n=6741055, respectively).

Measures

Prenatal care utilization is assessed most simply by the trimester in which prenatal care began, with entry into prenatal care in the first trimester considered the goal. However, the trimester in which prenatal care began, in isolation, provides little information about the pattern of prenatal care utilization throughout pregnancy. Thus, indices representing adequacy of prenatal care utilization have been developed that take into account the timing of entry into prenatal care as well as the number of prenatal care visits, adjusted for the gestational age of the infant at delivery. Each index uses an algorithm to define categories of prenatal care utilization ranging from intensive to adequate care. The Adequacy of Prenatal Care Utilization Index is used to classify women’s prenatal care utilization into 4 categories: adequate-plus, adequate, intermediate, and inadequate. We could not calculate adequacy of prenatal care for 3.5% of our records because data were missing for at least 1 of the necessary variables.

For analysis, dichotomous indicator variables were created for each prenatal care measure. Late prenatal care was defined as not entering care in the first trimester compared with all others. Inadequate prenatal care was defined as not receiving adequate or adequate-plus care compared with all others. For each indicator variable, missing data were coded as late prenatal care or inadequate prenatal care, respectively. Table 1 shows the percent missing for each indicator by race, geography, and time.

Geographic levels for analysis included regions and states. Although policy is not made at regional level, we used region juxtaposed with state to demonstrate geographic variability at changing levels of data aggregation. Geography was defined according to mother’s residence at time of delivery. State of residence was identified on each birth record by Federal Information Processing Standards codes, and we used these codes to classify records according to US Census Bureau–defined regions.

Analysis

First, we calculated race-specific rates and measures of disparity for each indicator at the national, regional, and state levels. Rates are presented as percent of infants with mothers who did not enter prenatal care in the first trimester (late prenatal care) and percent of infants whose mothers did not receive our findings in terms of adverse events: late prenatal care and inadequate prenatal care. Late entry into prenatal care was defined as not receiving prenatal care in the first trimester of pregnancy. We could not calculate late prenatal care for 1.8% of our records because data about the month prenatal care began were missing. Inadequate prenatal care utilization was calculated using the Adequacy of Prenatal Care Utilization Index, which is calculated on the basis of a comparison of actual number of visits to the recommended number of visits based on month of entry into care and length of the pregnancy.

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Analysis

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adequate prenatal care (inadequate prenatal care). Second, we examined whether estimates for regions and for states differed significantly from national estimates for each race group. We calculated z scores to test for the difference between 2 proportions (i.e., subnational rate compared with national rate for each subnational stratum). Finally, using a difference-in-differences approach, we estimated state-specific changes in prevalence rates and rate disparities for late prenatal care and inadequate prenatal care between the 2 time periods. State analyses focused on the 12 states with the largest AIAN birth populations, which we defined as those with more than 2100 births to AIAN mothers during each period (Table 1). All analyses were conducted using Stata statistical software, version 9.2.

RESULTS

Regional rates of late prenatal care were significantly different from the national rate of late prenatal care for both races and in both time periods, with the exception of the Midwest AIAN rate for the 2000–2002 period (Table 1). Regional rates of inadequate prenatal care were also significantly different from the national rate of inadequate prenatal care for both races and in both time periods, with the exception of the Midwest AIAN rate for the 2000–2002 period.

The upper panel of Table 2 displays the difference between state rates and the US rates for late prenatal care by maternal race and time period. For AIANs in the 1995–1997 period, state rates of late prenatal care range from 9.0% lower than the US AIAN rate in North Carolina to 12.6% higher than the US AIAN rate in New Mexico. For AIANs in the 2000–2002 period, state rates of late prenatal care range from 9.9% below the US AIAN rate in North Carolina to 10.6% points above the US AIAN rate in New Mexico.

The lower panel of Table 2 shows differences between state rates and US rates for inadequate prenatal care by maternal race and time period. For AIANs, state rates of inadequate prenatal care range from 16.1% below the US AIAN rate in North Carolina to 12.5% above the US AIAN rate in Minnesota for the 1995–1997 period, and from 18.3%
below in North Carolina to 12.9% above in North Dakota for the 2000–2002 period. For Whites, state rates of inadequate prenatal care range from 10.5% below the US White rate in North Carolina to 15.4% above in New Mexico for the 2000–2002 period, and from 10.0% below in North Carolina to 15.3% above in New Mexico for the 1995–1997 period, and from 10.5% below the US White rate in New Mexico for the 1995–1997 period, and from 10.0% below in North Carolina to 12.9% above in New Mexico for the 2000–2002 period. For Whites, state rates of inadequate prenatal care shrank by nearly 1 percentage point (from 16.0% to 15.9% in 2000–2002 period (from 20.4% to 19.5%; P < .001); the Midwest had the largest absolute AIAN–White disparity for late prenatal care in both periods (26.9% and 27.9%), although no statistically significant changes occurred over time.

Table 3 displays late prenatal care rates and inadequate prenatal care disparities by maternal race and geography over time. For the nation, the AIAN–White disparity for late entry into prenatal care shrank by nearly 1 percentage point (from 23.2% to 16.3%; P < .001), but North Dakota demonstrated an increase in disparity of 9 percentage points (from 16.4% to 25.4%; P < .001). Minnesota had the largest absolute AIAN–White disparity for late prenatal care in both periods (26.9% and 27.9%), although no statistically significant changes occurred over time.

Table 4 shows inadequate prenatal care rates and inadequate prenatal care disparities by maternal race and geography over time. Overall, the AIAN-White disparity in rates of inadequate prenatal care declined by 0.6 percentage points from the 1995–1997 period to the 2000–2002 period (from 21.3% to 20.7%; P = .002). For the Northeast, the decline in disparity was again more dramatic, at more than 4 percentage points (10.2% and 6.1%; P < .001); the Midwest, South, and West regions showed no significant changes. Patterns for state-level disparities also varied. Washington had the largest decline in AIAN–White disparity, at 4.6 percentage points (from 19.0% to 14.4%; P < .001), and North Dakota again had a disparity increase, this time of more than 6 percentage points (from 21.4% to 27.7%; P < .001).

### DISCUSSION

Rates of late prenatal care and inadequate prenatal care utilization varied by region and state both for AIANs and for non-Hispanic Whites. Disparities also differed by geographic level, revealing stark differences from the national average. The Midwest generally had the widest AIAN–White disparities for both indicators, even though it was the only region with no significant change in disparities over time. When focused on the 12 states with the largest AIAN birth populations, our analysis suggests that changes in disparities in prenatal care utilization varied dramatically, with some states showing substantial reductions in disparities and other states showing marked increases in disparities.

Our findings are consistent with previous studies that have shown geographic variation in

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**TABLE 3—Late Prenatal Care Rates by Maternal Race and Geographic Region, and Changes in Disparities Over Time:**

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<tbody>
<tr>
<td>US rate</td>
<td>34.5</td>
<td>14.1</td>
<td>20.4 (0.14)</td>
<td>19.5 (0.13)</td>
<td>-0.9 (0.20)</td>
<td>-4.42</td>
<td>&lt; .001</td>
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<tr>
<td>Northeast</td>
<td>30.0</td>
<td>14.0</td>
<td>16.0 (0.66)</td>
<td>10.4 (0.57)</td>
<td>-5.7 (0.87)</td>
<td>-6.47</td>
<td>&lt; .001</td>
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<tr>
<td>Midwest</td>
<td>33.5</td>
<td>13.7</td>
<td>19.8 (0.33)</td>
<td>20.5 (0.31)</td>
<td>0.7 (0.46)</td>
<td>1.62</td>
<td>.105</td>
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<tr>
<td>Minnesota</td>
<td>42.9</td>
<td>16.0</td>
<td>26.9 (0.88)</td>
<td>27.9 (0.80)</td>
<td>1.0 (1.19)</td>
<td>0.84</td>
<td>&lt; .001</td>
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<tr>
<td>North Dakota</td>
<td>30.4</td>
<td>14.1</td>
<td>16.4 (1.02)</td>
<td>25.4 (1.02)</td>
<td>9.1 (1.45)</td>
<td>6.27</td>
<td>&lt; .001</td>
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<tr>
<td>South Dakota</td>
<td>37.7</td>
<td>14.8</td>
<td>22.9 (0.74)</td>
<td>23.1 (0.73)</td>
<td>0.2 (1.04)</td>
<td>0.19</td>
<td>.851</td>
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<tr>
<td>Wisconsin</td>
<td>33.1</td>
<td>12.4</td>
<td>20.7 (0.94)</td>
<td>16.3 (0.84)</td>
<td>-4.4 (1.26)</td>
<td>-3.47</td>
<td>&lt; .001</td>
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<tr>
<td>South</td>
<td>31.1</td>
<td>13.6</td>
<td>17.5 (0.28)</td>
<td>16.6 (0.25)</td>
<td>-0.8 (0.38)</td>
<td>-2.24</td>
<td>&lt; .05</td>
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<tr>
<td>North Carolina</td>
<td>28.5</td>
<td>10.7</td>
<td>17.8 (0.67)</td>
<td>13.1 (0.60)</td>
<td>-4.7 (0.90)</td>
<td>-5.22</td>
<td>&lt; .001</td>
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<tr>
<td>Oklahoma</td>
<td>35.4</td>
<td>24.9</td>
<td>10.6 (0.44)</td>
<td>12.4 (0.40)</td>
<td>1.8 (0.60)</td>
<td>3.01</td>
<td>.003</td>
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<tr>
<td>West</td>
<td>36.7</td>
<td>15.8</td>
<td>20.9 (0.20)</td>
<td>20.3 (0.19)</td>
<td>-0.7 (0.28)</td>
<td>-2.40</td>
<td>&lt; .016</td>
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<tr>
<td>Alaska</td>
<td>25.5</td>
<td>17.0</td>
<td>8.5 (0.59)</td>
<td>13.7 (0.63)</td>
<td>5.2 (0.87)</td>
<td>5.95</td>
<td>&lt; .001</td>
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<tr>
<td>Arizona</td>
<td>41.4</td>
<td>17.7</td>
<td>23.6 (0.41)</td>
<td>21.6 (0.38)</td>
<td>-2.1 (0.56)</td>
<td>-3.65</td>
<td>&lt; .001</td>
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<tr>
<td>California</td>
<td>31.0</td>
<td>13.9</td>
<td>17.1 (0.47)</td>
<td>15.6 (0.47)</td>
<td>-1.6 (0.66)</td>
<td>-2.35</td>
<td>&lt; .019</td>
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<tr>
<td>Montana</td>
<td>33.5</td>
<td>15.8</td>
<td>17.6 (0.82)</td>
<td>20.9 (0.79)</td>
<td>3.3 (1.14)</td>
<td>2.86</td>
<td>&lt; .004</td>
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<tr>
<td>New Mexico</td>
<td>47.1</td>
<td>23.9</td>
<td>23.2 (0.57)</td>
<td>16.3 (0.56)</td>
<td>-6.9 (0.80)</td>
<td>-8.63</td>
<td>&lt; .001</td>
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<tr>
<td>Washington</td>
<td>34.6</td>
<td>18.7</td>
<td>15.9 (0.67)</td>
<td>15.8 (0.64)</td>
<td>-0.2 (0.93)</td>
<td>-0.20</td>
<td>.838</td>
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Note. AIAN = American Indian/Alaska Native. An AIAN infant is defined as an infant born to an AIAN mother. A White infant is defined as an infant born to a non-Hispanic White mother. The only states listed individually are those with more than 2100 AIAN births for each period.
One study of nationwide urban AIAN maternal and infant health found that Minneapolis–St. Paul, Minnesota, was the urban area with the highest rate of inadequate prenatal care for AIANs from 1989 through 1991 (29.8%), and the lowest rate of inadequate prenatal care for AIANs in rural, and the opposite was true for 4 other IHS service areas. (Rural–urban comparisons were not made for the other 2 IHS service areas because 1 of the areas was classified as entirely rural, and the other was predominantly urban.)

Several studies have suggested that maternal demographics on the birth certificates were generally good. This was likely due, in most circumstances, to demographic data being supplied by the mother. However, 1 study indicated that although maternal race/ethnicity data on the birth certificate was quite good for most race groups, the sensitivity for maternal race data for AIANs in California was only 54%. This may have been because hospital staff reported race rather than mothers providing self-reports. California is 1 of the states highlighted in this study, so it is possible that some AIAN women were miscategorized as White in our analyses for that state.
Validation studies on the use of birth certificate data for determining prenatal care utilization have produced mixed results. Some studies indicated acceptable prenatal care data quality, whereas others indicated extremely poor agreement between birth certificates and medical records. To the extent that the prenatal care data available in our vital records data underestimated the timing and adequacy of care for both groups, the pattern of disparities is likely robust. However, if there was differential misclassification of late or inadequate prenatal care by maternal race, by time period, or by state, our calculation of AIAN–White disparities may be biased.

Finally, missing vital-records data elements are also a concern. Specifically, we needed data on the month when prenatal care began, the number of prenatal visits, and gestational age to calculate our measures of prenatal care utilization. However, excluding those who were missing data would have caused the removal of those potentially at highest risk for inadequate prenatal care; thus, it is recommended that incomplete records be included in analyses of vital records data. For our calculations, we assumed that missing prenatal care data often results from late or inadequate care. Therefore, we retained those with missing data and classified them in the adverse category. To assess the robustness of our results in light of this assumption, we ran the analyses with the missing data excluded, and the results did not change appreciably, with the exception of Oklahoma and Alaska (results not shown). For Oklahoma, the change in both prenatal care disparities over time became nonsignificant. For Alaska, late prenatal care disparity did not change, and inadequate prenatal care disparity increased significantly.

Conclusions

The 2007 National Healthcare Disparities Report suggests that many indicators of disparity in quality of care and most indicators of disparity in access to care for AIANs compared with Whites are improving. However, these conclusions are drawn from nationally aggregated data. Results from our current study suggest that substantive conclusions about AIAN health care disparities should be geographically specific, and conclusions drawn at the national level may be inaccurate—even misleading—for policymaking and intervention at state and local levels. It is therefore necessary to monitor health care access disparities for AIANs at relevant geographic levels.

Information to track national trends is important, but decisions regarding policy and funding priorities are often made at the state and local levels. Under the new National Center for Health Statistics data-release policy, states are still able to perform their own analyses on internal data. However, AIAN communities, Tribal Epidemiology Centers, and Urban Indian Health researchers are finding it increasingly difficult to access data for specific communities or geographic areas. Without easily accessible data to show improvements in prenatal care for AIAN women and reductions in the disparity between AIANs and non-Hispanic Whites, it will be all but impossible to target resources effectively. We recommend that efforts be made to accommodate the geographic data needs of researchers studying AIAN health, to better inform decision makers and care providers committed to improving the health status of AIAN mothers and newborns.

Level of data aggregation does matter for AIAN health care disparities research, especially when the direction or magnitude of difference from national rates varies between the race groups being compared. Moreover, although most state-specific measures of disparity remained the same or decreased over time, the magnitude of AIAN-White disparities in prenatal care utilization remains unacceptable high. Additional research is warranted to understand the causes and consequences of state-specific or local-area disparities in prenatal care utilization for AIANs.

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Contributors

F.J. Johnson conceptualized the study, carried out the analyses, and wrote the initial draft of the article. K.T. Call helped interpret findings and provided comments on the article. L. A. Blewett helped interpret findings and provided critical revision of the article. All authors revised the article and approved the final draft.

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Human Participant Protection

No protocol approval was necessary because data were obtained from secondary sources.

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