

# Prenatal Care And Low-Birth-Weight Rates In Urban And Rural Wisconsin

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**Background:** The intent of this investigation was to study the distribution of obstetric providers and prenatal care utilization in Wisconsin and analyze the potential impact of these factors on the frequency of low birth weight.

**Methods:** State perinatal vital statistics and physician professional association surveys were used to compare the frequency of low birth weight, physician distribution, and utilization of prenatal care in all 72 counties in Wisconsin.

**Results:** Despite higher rates of suboptimal prenatal care utilization among women residing in rural counties, low-birth-weight rates were no different. Very-low-birth-weight rates were actually higher for residents of urban counties compared with those in rural counties. When low birth weight was examined based on the rate of suboptimal prenatal care, a positive association was found only for urban counties. In rural counties there was no increase in low-birth-weight rates as the use of prenatal care declined.

**Conclusions:** Inadequate prenatal care appears to be associated with low-birth-weight rates, but less so for women residing in rural counties when compared with those in urban counties. (J Am Board Fam Pract 1995; 8:17-21.)

Several studies have shown an association between decreased perinatal service availability or utilization and the frequency of low-birth-weight infants.<sup>1-5</sup> This observation has been reported for both rural<sup>1,2</sup> and urban<sup>6,7</sup> patient populations and has been used as evidence that prenatal care might be a protective factor preventing preterm delivery and low birth weight.

With the number of family physicians who include obstetrics in their practice decreasing<sup>8</sup> and a decline in the number of obstetrician-gynecologists who include routine obstetrics in their practice,<sup>9</sup> inner-city districts and rural areas will be hard-pressed to provide adequate prenatal and perinatal services. This study examined the distribution of obstetric providers throughout the state of Wisconsin and assessed the effects of obstetric availability and patient utilization of obstetric services on low-birth-weight frequencies in 1991.

## Methods

Data for low-birth-weight frequency, delivery rates, patient demographics, and patient prenatal care visits were abstracted from the 1991 Wisconsin county perinatal vital statistics for all 72

counties. This data base includes details from every birth certificate filed in the state during 1991. Because each child born in a hospital or arriving at a hospital shortly after birth has a birth certificate filed, this data base represents all births in the state for a given year excluding home births where no care was delivered.

Variables under consideration included rates of low birth weight, utilization of prenatal care, and supply of providers in the county. Low birth weight was defined as initial weight less than 2500 g and very low birth weight as less than 1000 g. Utilization of prenatal care is reported in categories that include no prenatal care, one to four visits, five to nine visits, etc. All patients who fell into the first two categories, i.e., had four or fewer visits, were defined as having inadequate prenatal care. Although other indices are more sensitive measures of adequacy of prenatal care,<sup>10,11</sup> because prenatal visits are classified by the vital statistics data base into the categories noted above, more precise computations of the adequacy of prenatal care were not possible.

Information on obstetricians in Wisconsin was obtained from the American Medical Association (AMA) masterfile.<sup>12</sup> All physicians listing their specialty as obstetrics in the AMA masterfile were considered to be practicing obstetrics. For family physicians, a county-coded listing of the total number of family physicians and the number who included obstetrics in their practice was obtained

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from the American Academy of Family Physicians (Gordon Schmittling, PhD, written communication, 1993), which conducts a biannual survey of all active members. Based on these sources, the total number of physicians providing obstetric care was estimated for each county. Delivery data for individual hospitals was obtained from the American Hospital Association annual survey for 1991.<sup>13</sup>

Definition of urban versus rural was based on inclusion of all or part of a particular county in a statistical metropolitan area (SMA). Those counties that were not included in an SMA were considered rural.

Data were analyzed using the Student t-test for normally distributed continuous variables with similar variances or the Kruskal-Wallis H test when variances differed. The chi-square statistic was used for categorical variables, with the Fisher exact test used for tests with small cell sizes. Analyses were performed using EpiInfo Version 5.<sup>14</sup> Statistical significance was defined as  $P < 0.05$  using two-tailed tests. To control for possible confounders, stepwise backward linear regression was performed using as independent variables patient residence (urban versus rural), ratio of births to obstetric providers in the county, the presence of a hospital providing obstetric services in the county, and rate of low prenatal care utilization. Low-birth-weight rate was used as the dependent variable. Because of categorical differences observed between low utilization rates of prenatal care and residence, additional models were constructed using the same variables except residence for women in urban and rural counties. Regression analyses were performed using True Epistat software.<sup>15</sup>

## Results

A large range in the availability of obstetric care was found among Wisconsin's 72 counties (Table 1). Seven counties had no obstetric providers at all. These counties were all rural. In general, though, when the ratio of deliveries to provider was calculated, the availability of obstetric providers did not differ significantly between rural and

urban counties (Table 1). As might be expected, rural counties were more likely to be served by family physicians while obstetricians were slightly more common in urban counties.

Table 2 shows the rates in which patients in rural and urban areas made fewer than five prenatal visits along with rates of low birth weight and very low birth weight. Women from rural counties made fewer than five prenatal visits during their pregnancies at a higher rate than did urban women, but rates for low-birth-weight deliveries were essentially equal for rural and urban women. Furthermore, women from rural counties had significantly lower rates of very-low-birth-weight delivery compared with urban women.

When examining for a relation between lower rates of prenatal care utilization and low birth weight, a strong positive association was found in urban counties (Figure 1). The slope of the association between suboptimal prenatal care for urban counties was 1.50 (95 percent confidence interval [CI] 1.18, 1.84). In contrast, when the low birth weight was examined based on the rates of suboptimal prenatal care for rural counties, no association was seen (Figure 2) (regression line slope = 0.02, 95 percent CI = -0.11, 0.16).

To examine the independent effects of the obstetric care access and low utilization of prenatal care on low-birth-weight frequency, a linear regression model was constructed using the rate of low birth weight as the dependent variable. Initially a single model using both urban and rural counties was tested using low prenatal care utilization, the ratio of births to providers in the

**Table 1. Availability of Obstetric Care in Rural (n = 53) and Urban (n = 19) Counties, Wisconsin, 1991.**

	Rural	Urban	P Value
	Mean No. $\pm$ SD	Mean No. $\pm$ SD	
Mean deliveries per county	394 $\pm$ 283	2682 $\pm$ 3601	<0.001
Deliveries per provider*	68.2 $\pm$ 44.6	75.2 $\pm$ 33.1	0.55
Obstetricians†	0.36 $\pm$ 0.65	0.63 $\pm$ 0.60	0.11
Family physicians‡	1.30 $\pm$ 1.17	0.90 $\pm$ 0.66	0.40
Counties without obstetric providers, No. (%)	7 (13%)	0	0.18

\*Counties with no obstetric providers not included in calculations.

†Expressed as number providers per 100 deliveries.

‡Limited to family physicians who include obstetrics in their practice.

**Table 2. Rates (per 1000 women) of Low Birth Weight Based on Residence in Rural (n = 53) and Urban (n = 19) Counties, Wisconsin, 1991.**

	Rural	Urban	P Value
	Mean $\pm$ SD	Mean $\pm$ SD	
Fewer than 5 prenatal visits	45.3 $\pm$ 28.0	29.6 $\pm$ 17.8	0.008
Low birth weight*	43.5 $\pm$ 11.7	44.6 $\pm$ 9.5	0.71
Very low birth weight†	7.6 $\pm$ 4.9	10.8 $\pm$ 3.6	0.01

\*Defined as birth weight <2500 g.

†Defined as birth weight <1000 g.

county, the presence of a hospital offering maternity services, and whether the woman lived in an urban or rural county as independent variables. This model showed no association between any of the independent variables and low birth weight. When individual models were constructed for urban and rural counties, however, an independent association was found in urban counties for low birth weight and suboptimal prenatal care (odds ratio 1.23 [95 percent CI 1.02,1.51]) when adjusted for other potential confounders. Again, no association was found between suboptimal prenatal care and low birth weight in rural counties.

### Discussion

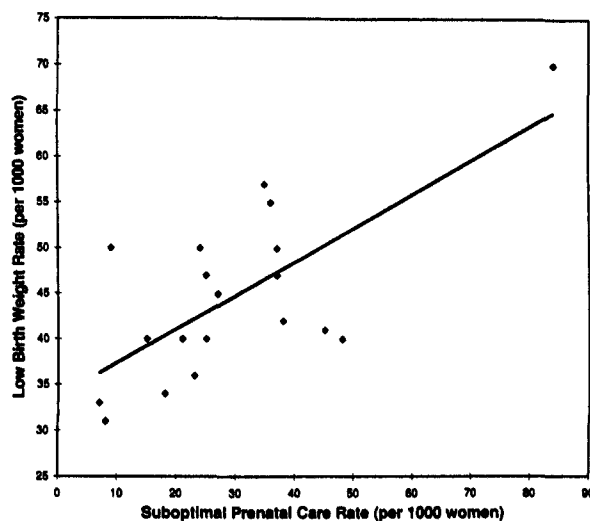
The findings of this study confirm previous associations between low birth weight and lack of prenatal care but suggest that this effect might be present only for residents of urban counties. Interestingly, low utilization of prenatal care was not associated with availability of providers; the number of deliveries per provider and the supply of physicians including obstetrics in their practice were not significantly different for rural Wisconsin counties compared with urban counties. While physician supplies were similar in urban and rural counties, rural counties were more dependent on family physicians for obstetric services. Because the practice of the typical family physician is not predominantly composed of maternity care, rural patients could have had a more difficult time initiating prenatal care. This study cannot conclusively examine this issue, however, and further research is needed to clarify how provider specialty influences obstetric service availability in rural and urban settings.

As noted above, this study found a relation between prenatal care utilization and low-birth-

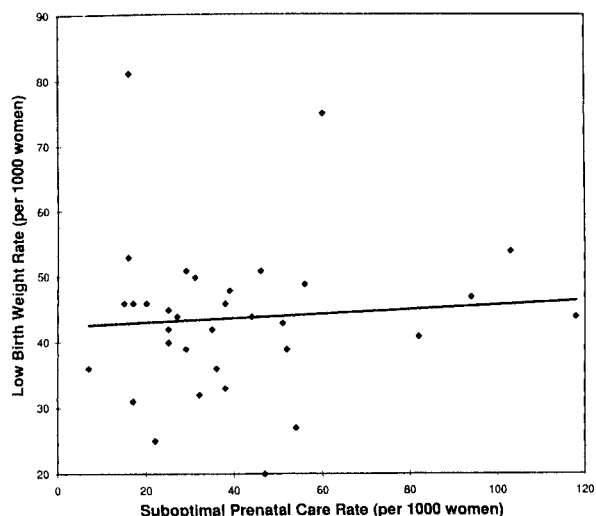
weight deliveries, but only in urban populations. Previous data from other studies have shown a consistent association between lack of prenatal care and suboptimal perinatal outcomes.<sup>16,17</sup> Additional evidence has also suggested that providing prenatal care services to potentially high-risk individuals could potentially protect against poor out-

comes.<sup>7</sup> The findings of this study suggest that these actions might be beneficial in urban areas but will have a less dramatic effect or could result in adverse consequences, as noted for other perinatal outcomes,<sup>18</sup> if attempted in rural areas.

The variable effects of prenatal care on obstetric outcomes in differing populations should not be unexpected. The effectiveness of prenatal care in preventing low birth weight and preterm delivery is likely due to multiple factors, such as early recognition of and intervention for risk factors, nutritional counseling, and recognition of vaginal or cervical infections.<sup>19</sup> The results of this study suggest that women in urban areas who fail to obtain prenatal care could be at risk for preterm delivery from such risk factors as drug dependency or genitourinary infection, which are amenable to prenatal intervention but are not found as often in



**Figure 1. Relation between frequency of low utilization of prenatal care and low birth weight in urban counties. Data are expressed as rates per 1000 births. Solid line represents regression line.**



**Figure 2. Relation between frequency of low utilization of prenatal care and low birth weight in rural counties. Data are expressed as rates per 1000 births. Solid line represents regression line.**

women from rural areas. Because of the difference in numbers of modifiable risk factors, women from urban areas might derive more benefit from early care if early care leads to changes in these risky behaviors.

Although the study findings suggest that women from rural areas are at less risk for low-birth-weight delivery than are urban women when few prenatal visits are made, this study is based on data from one state derived from a single year of observation. The general health status of the population in Wisconsin and the socioeconomic distribution of urban and rural residents might be unique and can limit application of these results to other locations.

Another limitation of this study is that by using the AMA masterfile data base, the number of obstetricians could have been overestimated. As noted earlier, obstetrician-gynecologists are increasingly limiting their practice by discontinuing obstetric services.<sup>9</sup> In addition, physicians who were trained in obstetrics and gynecology but who could have assumed other administrative positions are still categorized as obstetricians in the AMA masterfile. Thus, because our estimate for the number of obstetricians available assumes that all obstetricians provide full-time obstetric services, it should be considered a best case estimate.

Finally, the aggregate nature of the vital statistics data did not allow exploration of other socio-demographic variables, such as race, that have in-

fluenced utilization and effectiveness of prenatal care,<sup>20-22</sup> the content of the care received,<sup>23,24</sup> and the frequency of low birth weight.<sup>25</sup> Further research is needed to confirm that the urban and rural differences observed in this study are maintained when adjusted for patient ethnicity and socioeconomic status.

## Summary

The study results suggest that higher low-birth-weight rates are associated with a declining use of prenatal services but that this association is stronger in urban populations compared with rural populations. These findings suggest that relations between prenatal care and low birth weight might be more complex and dependent upon a variety of factors in the population examined. Further study assessing the factors that are addressed during prenatal visits could be helpful in delineating why use of prenatal care would be predictive for low birth weight for urban women but less important for rural women.

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