

Hospital Level and Delivery Volume And Neonatal Mortality Among Very Low Birth Weight Infants

Indiana, 2000-2005 Birth Cohort

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Executive Summary

This report presents information on the delivery and neonatal deaths (under 28 days of age) of very low birth weight (VLBW, <1,500 grams) infants in Indiana between 2000 and 2005 according to hospitals' average annual delivery volume, VLBW delivery volume, and neonatal level of care. This study determined whether Indiana met the *Healthy People 2010 Objective* of increasing the proportion of VLBW infants born at level III hospitals (or subspecialty Perinatal centers) to 90 percent and examined the significant predictors of delivery outside level III hospitals. This study also assessed the impact of delivery outside level III hospitals on neonatal mortality rate of VLBW using the 2000-2005 linked birth/infant death data files.

Compared to all infants, VLBW infants were more likely to be delivered in hospitals with larger delivery volumes (more than 1000 per year) and higher level of neonatal care (level III). The proportion of VLBW infants born at level III hospitals increased from 82.9 percent in 2000 to 86.0 percent in 2002 and declined gradually to 84.5 percent in 2005, putting Indiana below the Healthy People 2010 Objective of 90 percent. The VLBW infants born at below level III hospitals were more likely to be less than 500 grams and less than 24 weeks of gestation and were less likely to be a multiple birth or cesarean delivery than those born at level III hospitals.

Controlling for the potential contributing factors, the strongest predictor of delivery outside level III hospitals was the mother's county of residency. Residents of non-metropolitan counties were 10.8 times more likely to deliver outside level III hospitals compared to residents of the large central metropolitan county (Marion). Other significant predictors were less than adequate prenatal care, prenatal smoking, no college education, and being a teenager.

The neonatal mortality rate of VLBW infants was highest for those born in hospitals with less 1,000 average annual deliveries and in hospitals with less than 10 average VLBW deliveries; the rates for VLBW infants born in larger hospitals were lower but did not follow a specific pattern. The neonatal mortality rate of VLBW infants delivered at below level III hospitals (307.0 deaths per 1,000 births) was significantly higher (by 43 percent) than the rate for those delivered at level III hospitals (215.3 deaths per 1,000 births); this pattern was consistent among non-Hispanic whites, non-Hispanic blacks, and Hispanics (higher rates by 45-47 percents) but it reached statistical significance only among non-Hispanic whites. Controlling for delivery variables and maternal demographic risk factors, delivery of VLBW infants at below level III hospitals was associated with significantly higher risk of death (Odds Ratio [OR] =1.5, 95% confidence interval [CI], 1.24 to 1.73); this association remained statistically significant when infant risk factors were also controlled (OR=1.2, 95% CI=1.01-1.50).

Results of this study suggest that increased use of hospitals with level III neonatal care might reduce neonatal mortality among VLBW infants. Indiana needs to boost its efforts in increasing the delivery of VLBW infants in subspecialty hospitals to reach *Healthy People 2010 Objective*, especially among residents of rural counties. The higher proportion of VLBW infants weighing less than 500 grams who are at the highest risk of death, among those delivered at below level III hospitals, warrants further investigations.

Preface

This report (*Hospital Level and Delivery Volume and Neonatal Mortality Among Very Low Birth Weight Infants: Indiana, 2000-2005 Birth Cohort*) presents information on the delivery of very low birth weight (VLBW, <1,500 grams) infants in Indiana between 2000 and 2005 according to hospitals' average annual delivery volume, VLBW delivery volume, and neonatal level of care. This study determined whether Indiana met the *Healthy People 2010 Objective** (increase the proportion of VLBW infants born at level III hospitals or subspecialty perinatal centers to 90 percent), compared the characteristics of mothers who delivered at level III neonatal care hospitals to those who did not deliver at the recommended level, examined the significant predictors of delivery outside level III hospitals, and assessed the impact of delivery outside level III hospitals on neonatal mortality rate of VLBW.

The data for this study were obtained from the linked birth and death records of 6,725 VLBW infants who were born in Indiana hospitals between 2000 and 2005 and whose mothers were Indiana residents. Information on classification of Indiana hospitals according to levels of neonatal care, definitions of the levels of neonatal care, methods used for statistical analysis, prenatal care utilization index, and urbanization level of county of residence are presented in the [Technical Notes](#). The numbers of all live births and VLBW births from 2000 to 2005 and level of neonatal care for all Indiana hospitals are presented in the [Appendix A](#). Urbanization level of Indiana counties are presented in the [Appendix B](#).

****Healthy People 2010 Objective***

Obstetrical Care (16-8)

Increase the proportion of very low birth weight (VLBW) infants born at level III hospitals or subspecialty perinatal centers.

Target: 90 percent

<http://www.healthypeople.gov/document/HTML/Volume2/16MICH.htm>

Highlights

Very Low Birth Weight (VLBW) Infants and Delivery Hospitals

Hospital Volume:

- During the period of 2000-2005, more than half a million infants were born in Indiana; more than 98 percent of them were born in Indiana hospitals. Of 497,767 Hoosier infants born in Indiana hospitals, 6,725 were very low birth weight (VLBW) infants (under 1,500 grams).
- Compared to all infants, VLBW infants were more likely to be delivered in hospitals with larger delivery volumes. Close to 60 percent of VLBW infants were born in hospitals with 2000 or higher annual deliveries compared to 40 percent of all births. (Table 1, Figure 1)
- Of all VLBW infants, 40.3 percent were born in hospitals that on average delivered more than 100 VLBW infants per year and 12.6 percent were born in hospitals with less than 10 annual VLBW deliveries. (Table 1, Figure 2)

Hospital Level of Neonatal Care:

- Based on hospitals' self-reported level of neonatal care:
 - 50 percent of all births and 85 percent of VLBW births were in level III hospitals. (Table 1, Figure 3)
 - Of all 6,725 VLBW deliveries in 104 Indiana hospitals during 2000-2005:
 - 5 percent (N=333) were delivered in level I hospitals; all of the 49 level I hospitals had less than 10 average annual VLBW deliveries.
 - 10.1 percent (N=680) were delivered in level II hospitals; of 34 level II hospitals, all but 3 had less than 10 average annual VLBW deliveries.
 - 3.9 percent (N=260) were delivered in level IIIA hospitals; only 2 hospitals were at this level and both had 10-24 annual VLBW deliveries.
 - 36.6 percent (N=2,459) were delivered in level IIIB hospitals; of 14 level IIIB hospitals, 4 hospitals had less than 25 annual VLBW deliveries.
 - 21.5 percent (N=1,447) were delivered in level IIIC hospitals; two of the three level IIIC hospitals had more than 100 VLBW deliveries per year.
 - 23.0 percent (N=1,546) were delivered in the 2 level IIID hospitals with more than 100 VLBW deliveries per year. (Table A, Table 1, Figure 4)

- The proportion of VLBW infants born at level III hospitals increased from 82.9 percent in 2000 to 86.0 percent in 2002 and declined gradually to 84.5 percent in 2005, putting Indiana below the Healthy People 2010 Objective of 90 percent. (Table 1, Figures 5-6)
- The VLBW infants born at below level III hospitals were more likely to have birth weight of less than 500 grams and be less than 24 weeks of gestation compared to those born at level III hospitals. (Table 2, Figures 7)
- Compared to mothers who delivered in level III hospitals, those whose VLBW infants were delivered at level I or II hospitals were more likely to be non-Hispanic white, resident of non-metropolitan counties, under 20 years of age, less educated, unmarried, late in beginning prenatal care, and smoker. (Table 2, Figures 8)
- The proportion of VLBW infants born at level III hospitals varied noticeably across different population subgroups.
 - 92 percent of non-Hispanic black mothers delivered in level III hospitals compared to 80-83 percents for non-Hispanic whites and Hispanics. (Figure 9)
 - 97 percent of mothers residing in the large central metropolitan county (Marion County) delivered in level III hospitals compared to 87 percent of those in small metropolitan counties and only 71 percent of those in non-metropolitan counties. (Figure 10)
 - Almost 90 percent of mothers who had more than high school education delivered in level III hospitals compared to 80 percent for those who had less than 12 years of education. (Figure 11)
 - 87 percent of mothers who received more than adequate prenatal care delivered in level III hospitals compared to 77 and 73 percents for those who received less than adequate or no care, respectively. (Figure 12)
- Controlling for the potential contributing factors (maternal race and Hispanic origin, age, education, marital status, prenatal care, smoking, and county of residency, the strongest predictor of delivery outside the level III hospitals was the mother's county of residency.
 - Compared to mothers who resided in the large central county (Marion County), those residing at non-metropolitan counties were 10.8 times more likely to deliver outside level III hospitals (95% confidence interval [CI], 7.8-15). Other significant predictors were less than adequate prenatal care, smoking, no college education, and under 20 years of age. (Table 3)

Neonatal Mortality of VLBW Infants According to Hospital Delivery Volume and Level of Neonatal Care

- The neonatal mortality rate of VLBW infants declined as the hospital total delivery volume increased from less than 1,000 per year (267.7 deaths per 1,000 births) to 2,000-2,999 per year (192.2), but the rate increased to 237.5 deaths per 1,000 births for VLBW infants delivered at hospitals with 3,000 or more annual deliveries.
(Table 4, Figures 13)
- The neonatal mortality rate was highest for VLBW infants born in hospitals with less than 10 average annual VLBW deliveries (302.7 deaths per 1,000 births). However, the rates for infants born in hospitals with higher VLBW delivery volumes (10-<25, 25-<50, 50-<100, and 100+) fluctuated and did not follow a specific pattern.
(Table 4, Figures 14)
- The neonatal mortality rate of VLBW infants delivered at level I hospitals (321.3 deaths per 1,000 births) and level II hospitals (300.0 deaths per 1,000 live births) were higher than the neonatal mortality rate of those delivered at level III hospitals (215.3 deaths per 1,000 births) by 49 and 39 percents, respectively.
(Table 4, Figures 15)
- Among VLBW infants born at level III hospitals, the neonatal mortality rate was highest for those born at level IIID hospitals (243.9 deaths per 1,000 births) and lowest for those born at level IIIA hospitals (142.3).
(Table 4, Figures 16)
- Classification of hospitals according to a combination of level of care and VLBW delivery volume showed a consistently higher neonatal mortality rate among VLBW infants born in hospitals with lower care level (I and II) and lower annual VLBW deliveries volume (<25 VLBW deliveries per year). The rates at level III hospitals with varying volumes of VLBW deliveries, however, fluctuated and did not follow a specific pattern.
(Table 4, Figure 17)
- The neonatal mortality rates of VLBW infants delivered outside level III hospitals were consistently higher compared to those delivered at level III hospitals for non-Hispanic whites (by 45 percent), non-Hispanic blacks (by 48 percent), and Hispanics (by 47 percent) but the difference was statistically significance only for non-Hispanic whites.
(Table 5, Figure 18)
- Compared with level III neonatal care, delivery of VLBW infants at lower levels was associated with significantly higher odds ratio for death (OR=1.6, 95% CI, 1.38 to 1.86). Controlling for maternal (race/Hispanic origin, age, education, marital status, parity, smoking, prenatal care, county of residency), delivery (multiple, cesarean), and infant (gender, congenital anomalies, and birth weight under 500 grams) variables, this association remained statistically significant (OR=1.2, 95% CI=1.01-1.50).
(Figure 19)

