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# Geographical Analysis of Sudden Infant Death Syndrome (SIDS) and Associated Risk Factors in Douglas County, Nebraska

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# GEOGRAPHICAL ANALYSIS OF SUDDEN INFANT DEATH SYNDROME (SIDS) AND ASSOCIATED RISK FACTORS IN DOUGLAS COUNTY, NEBRASKA

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## Abstract

**Background** Sudden Infant Death Syndrome (SIDS) is defined as the sudden and unexpected death of a child less than one year of age without an identifiable cause. Known risk factors of SIDS include prone and side-sleeping positions, bed sharing, male sex, pre- and postnatal tobacco exposure, poverty, prematurity, low birth weight (<2,500 g), and poor prenatal care.[1]
**Significance of Problem** In the United States, SIDS is the most common cause of death in infants between one month and one year of age with approximately 2,500 infant deaths caused by SIDS each year.[1] The incidence of SIDS has decreased by more than 50% in the last 20 years largely due to the Back to Sleep campaign, which began in 1994. Unfortunately, in Nebraska, the mortality rate of SIDS has been higher than the national mortality rate every year since the campaign began in 1994, except in 2008, 2010 and 2013.[2]
**Questions** If geographically mapped, will SIDS localize to specific regions of Douglas County? If SIDS is localized to specific regions of Douglas County, will associated risk factors concentrate in those areas?
**Experimental Design** SIDS rates and known risk factors of SIDS, such as inadequate prenatal care, tobacco use during pregnancy, prematurity, and low birth weight, were geographically mapped in Douglas County, Nebraska using geographical information system (GIS) technology. Data was obtained from the Health Data and Vital Statistics branch of the Douglas County Health Department using birth and death certificates from 2005-2014. Statistical analysis was performed using SAS software version 9.4 (SAS Institute Inc., Cary, NC). P-values less than 0.05 are considered significant. Spearman correlations were used to analyze the associations between SIDS rates and known risk factors. Chi-square or Fisher's exact tests compared rates in East and West Northeastern regions to best performing regions for each risk factor.
**Conclusion:** A strategy that aims to lower the rate of SIDS in Douglas County should focus on more accessible first trimester prenatal care and smoking cessation during pregnancy, especially for patients in the East Northeast and West Northeast regions, where these risk factors were significantly different from the best performing regions in Douglas County. By addressing modifiable risk factors such as access to early prenatal care and smoking cessation in areas of demonstrated need, the incidence of preterm births, low birth weights and SIDS in Douglas County could eventually decrease over time.

## National and Statewide SIDS Mortality Rates

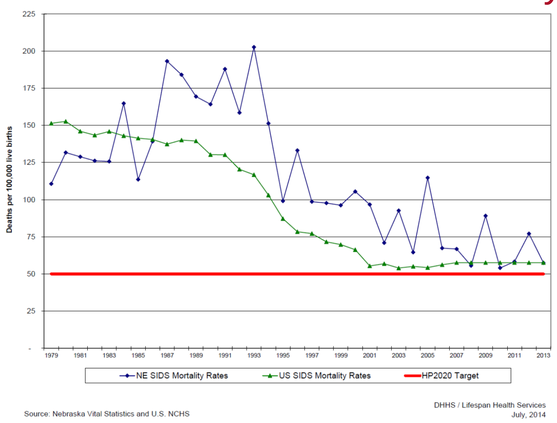


Figure 1: A comparison of SIDS mortality rates, calculated as deaths per 100,000 live births, in Nebraska (blue), the United States (green) and the Healthy People 2020 targeted goal (red). [2]

## SIDS & SUID Mortality Rate, 2005-2014

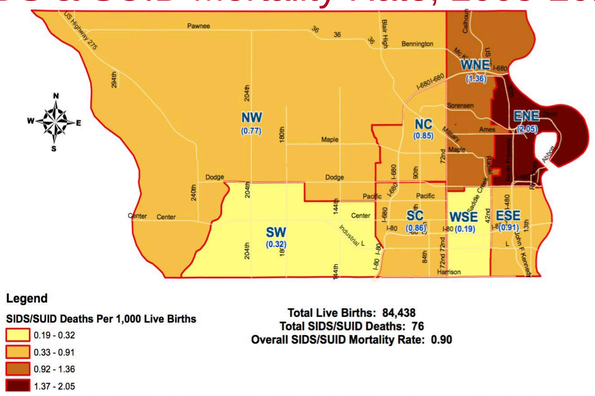


Figure 2: A geographical representation of SIDS and sudden unexplained infant death (SUID) mortality rates, calculated as deaths per 1,000 live births, in Douglas County from 2005-2014 with a total of 76 deaths caused by SIDS or SUID. A Fisher's exact test indicated a significantly higher SIDS mortality rate in the East Northeast region ($p<0.03$) compared to the West Southeast region, with the lowest mortality rate in Douglas County. Significant, positive correlations exist between SIDS mortality rates and percentage of low birth weight (rho = 0.90, p = 0.002) and percentage of premature birth (rho = 0.86, p = 0.007). A significant negative association exists between SIDS mortality rates and the percentage of births that received first trimester prenatal care (rho = -0.88, p =0.004).

## Prenatal Care in First Trimester, 2005-2014

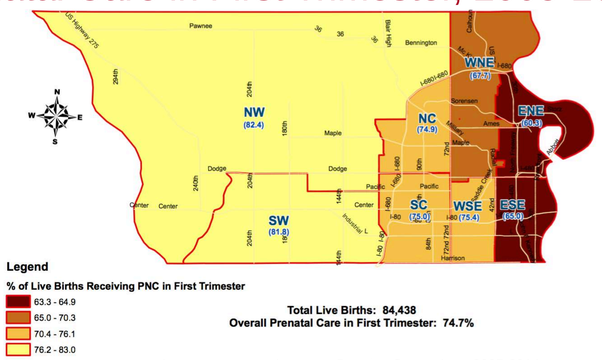


Figure 3: A geographical representation of the percentage of births in Douglas County from 2005-2014 in which mothers self-reported receiving prenatal care in the first trimester. A Chi-square test indicated a significantly lower percentage of first trimester prenatal care in the East Northeast and West Northeast regions when compared to the Northwest region of Douglas County ($p < 0.0001$).

## Births Involving Tobacco Use During Pregnancy, 2005-2014

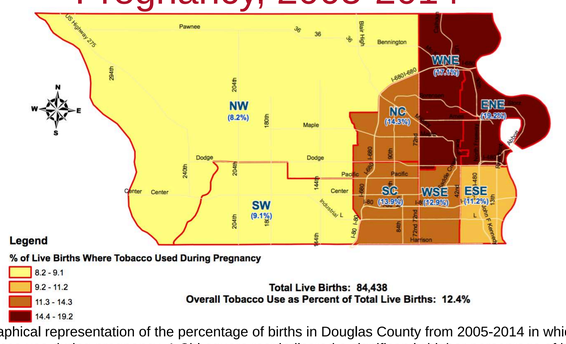


Figure 4: A geographical representation of the percentage of births in Douglas County from 2005-2014 in which mothers self-reported tobacco use during pregnancy. A Chi-square test indicated a significantly higher percentage of births involving tobacco use during pregnancy in the East Northeast and West Northeast regions compared to the Northwest region of Douglas County ($p < 0.0001$).

## Preterm Births, 2005-2014

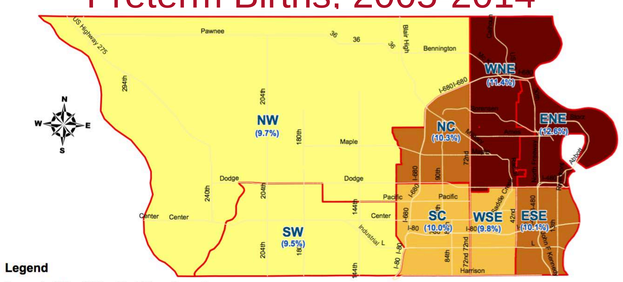


Figure 5: A geographical representation of the percentage of births in Douglas County from 2005-2014 that were preterm, or less than 37 weeks of gestation. A Chi-square test revealed no significant difference between the percentage of preterm births in the East Northeast and West Northeast regions compared to the Southwest region, with the lowest percentage of preterm births.

## Low Birth Weight, 2005-2014

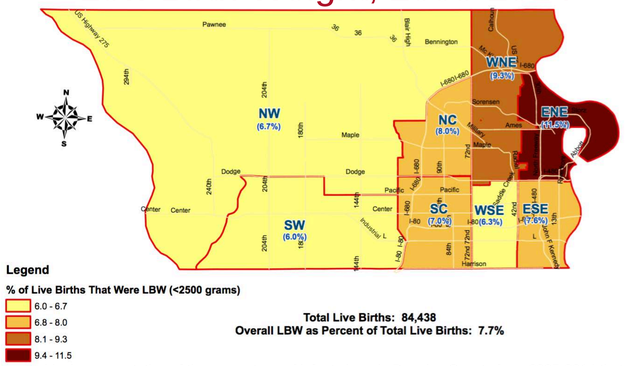


Figure 6: A geographical representation of the percentage of infants born in Douglas County from 2005-2014 that were low birth weight (LBW), or less than 2500 grams. A Chi-square test indicated a significantly higher rate of low birth weight infants in the East Northeast ($p < 0.0001$) and West Northeast ($p < 0.05$) regions compared to the Southwest region, with the lowest rate of low birth weight in Douglas County.

## Conclusions and Future Direction

Known risk factors for SIDS include inadequate prenatal care, tobacco use during pregnancy, prematurity, and low birth weight. Analysis of these risk factors in Douglas County demonstrated a positive correlation between SIDS mortality rates with low birth weight and with preterm birth. Additional analysis calculated a negative correlation between SIDS mortality rates with the percentage of women receiving prenatal care in the first trimester. Thus, a strategy that aims to lower the rate of SIDS in Douglas County should focus on more accessible first trimester prenatal care and smoking cessation during pregnancy, especially for patients in the East Northeast and West Northeast regions, where these risk factors were significantly different from the best performing regions in Douglas County. By addressing modifiable risk factors such as access to early prenatal care and smoking cessation in areas of demonstrated need, the incidence of preterm births, low birth weights and SIDS in Douglas County could eventually decrease over time.

Further analysis using GIS technology to identify locations where prenatal services are currently offered may partially explain why access to early prenatal care is lower in certain regions of Douglas County. Future research should extend the analysis of Douglas County performed here to the entire state of Nebraska, with the ultimate goal to lower SIDS mortality rates to meet national rates and, eventually, the Healthy People 2020 target of 0.05%.

## Acknowledgments

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## References

1. Adams, SM, Ward, CE, and Garcia, KL. Sudden Infant Death Syndrome. *American Family Physician*. 2015;91(11):778-783.
2. Safe Sleep and SIDS/SUID: Facts and Statistics. *Nebraska Department of Health and Human Services.* 2014.