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An Analysis of Correlation Between Agrichemical Contaminated Wells and Birth Defects in Nebraska

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Materials and Methods

Study population: The study population included in 264,188 live births from 2005-2014 in the 93 counties of Nebraska that are potentially exposed to surface water. All cases of birth defects were included in the study.

Outcome definition: The outcome is the birth defect rate for each of the 93 counties in Nebraska. This was calculated from county-level birth defects and live births from the database of Nebraska Department of Health and Human Services and expressed as case rate per 10,000 population. Any case of birth defect was included.

Exposures: Contaminant data was assessed using the Quality-Assessed Agrichemical Contaminant Database for Nebraska Ground Water. The 33 contaminants sampled from the wells were sub classified into 6 predictors and expressed as percentages for analysis in linear regression model with birth defect rates as the response variable. The agrichemicals sampled from the wells were also categorized into parent and degradate to examine the nature of agrichemicals associated with birth defects. The percentage for triazine and nitrates in domestic wells was 10.6% and 21.5% respectively. Birth defect rates were discovered to correlate with percentage of wells positive for triazine (r=0.21 p=0.041). Percentage of wells positive for triazine in domestic wells was found to be linearly associated with birth defect rates in the regression model (p=0.019). A stronger correlation was found between the parent contaminants and birth defect rates (r=0.22 p=0.043) than the degradates, (r=0.15 p=0.163).

This study suggests an association between birth defect and percent of wells positive for triazine. A linear regression model was fitted for the 6 predictors (nitrate, triazine, acetamide, carbamate, dinitroaniline, and substituted urea), well types and birth defect rates with the best fit model obtained through the backward model selection. All analyses were conducted using SAS version 9.4 (English).

Statistical analysis: We calculated the percentage of wells positive for agrichemicals. A linear regression model was fitted for the 6 predictors (nitrate, triazine, acetamide, carbamate, dinitroaniline, and substituted urea), well types and birth defect rates with the best fit model obtained through the backward model selection. All analyses were conducted using SAS version 9.4 (English).

Discussion

• Results of this research is consistent with other similar studies
• From this study it was observed that most of the wells sampled in the counties were irrigation and domestic wells. It is important in further studies to consider sampling additional wells. This factor could be a possible barrier to understanding the correlation between wells positive for agrichemicals and birth defect rates in Nebraska.
• However this study was able to bring some evidence of association between triazine and birth defect rates in Nebraska.
• Stayner et al. also showed that triazine, a member of triazine class is strongly associated with birth defect rates.(5)
• Another interesting finding is the association between parent pesticides and birth defect rates.
• This is important in understanding the danger of early exposure to agrichemicals and when to take actions from environmental health perspective
• While other studies have shown good correlation between nitrate and birth defect rates (7), this study does not support such evidence.

Conclusion and future recommendations

This study suggests an association between birth defect and percent of wells positive for agrichemicals. However, this association does not imply causation but provides direction for future investigation. Additional studies of direct exposures are needed (case-control).

Limitations

• These data do not constitute direct exposure of the mother to the water source
• These data does not consider other potential exposures to triazine...

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References