

The Association between Residential Proximity to Animal Feeding Operations and Childhood Asthma

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Introduction

Livestock production in the US has become increasingly industrialized. This concentrating of animals has had negative consequences to both the environment and residents in surrounding communities. We evaluated the association between residential proximity to swine operations and physician-diagnosed childhood asthma.

Methods

Study design: 565 children (0-17 yrs.) who resided in a rural county were included in the analysis. Demographic and health data was collected using standardized questionnaires at a research facility in a centrally located town within the county. The primary outcome of interest was self-reported physician-diagnosed asthma.

Identification of AFOs: Publicly available tax records were used to locate 168 animal feeding operations (AFOs) in the county. Information regarding facility size, date of construction, and coordinates were also obtained from this database.



Estimate of exposure: Coordinates of the homes and AFOs were imported into ArcGIS 9.2 and plotted. A 4.8 km radius was drawn around each home and every AFO within this radius was considered as having potential influence. Distance and direction from the home to every AFO was then calculated. In an effort to establish temporality, any facility that was constructed after the child's questionnaire was excluded from analysis.

Equation 1: AFO exposure metric

$$= \log \sum \left(\frac{a}{d^2} * w \right)$$

Where: a= AFO area (m²)

d= distance from AFO to the home (m)

w= % of wind ≤ 4 m/s blowing from the AFO to the home

Statistical analysis: To account for multiple children living in the same household, correlated logistic regression was used to evaluate the relationship between estimated exposure and asthma. Fourteen asthma risk factors were considered as potential covariates.

Results

Table 1: Demographic characteristics of the study population

Variable	N or %
Study population	565
Gender	
Male	45.5%
Female	54.5%
Age (years)	
0-6	25.7%
6-12	43.5%
12-17	30.8%
Highest education achieved in the household	
Did not complete high school	1.4%
High school or GED	21.1%
Some college	42.5%
College grad or above	35.0%
Household income	
<\$20,000	5.3%
>\$20,000 and <\$40,000	18.1%
>\$40,000 and <\$80,000	53.0%
>\$80,000	23.7%

Figure 1: Childhood asthma prevalence in the study population

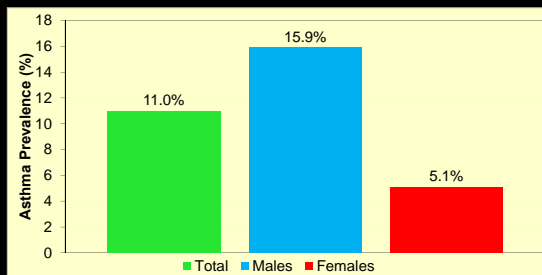


Table 2: Multivariable analysis of physician-diagnosed asthma, continuous exposure metric, and risk factors

Variable	OR (95% CI)	p-value
AFO exposure metric (1 unit)	1.22 (1.06-1.40)	0.006
Age (1 year)	1.10 (1.02-1.18)	0.009
Male gender	3.32 (1.54-7.17)	0.002
Parental history of asthma	3.03 (1.00-9.21)	0.050
Premature birth (<37 weeks)	4.42 (1.91-10.22)	0.005
Physician diagnosed allergies	4.43 (2.35-8.38)	<0.001
Respiratory infection before 2 years	0.70 (0.06-7.94)	0.767
AFO exposure metric*respiratory infection	1.31 (0.96-1.79)	0.088

- The prevalence of asthma in the study population was comparable to rates found in the rest of the United States.
- Boys had a significantly higher prevalence of asthma compared to girls.
- A positive association was observed between physician-diagnosed childhood asthma and estimated airborne exposure to swine AFOs when adjusting for significant risk factors.
- Children diagnosed with a respiratory infection before the age of two, had an elevated risk of asthma as their estimated exposure to AFOs increased.



Conclusions

- Results are consistent with previous studies that have observed adverse respiratory outcomes due to environmental exposure to AFOs.
- Additionally, this study shows that a cumulative environmental exposure to smaller swine operations has similar effects as an exposure from larger facilities.
- There is still limited environmental data on residence living near these facilities and future studies need to quantify rural individuals' exposure from AFOs.

Acknowledgements

The authors would like to acknowledge the many contributions of the Keokuk County Rural Health Study staff.