

# Evaluation of Pulmonary Function Cross-Shift Changes in Dairy Parlor Workers Using Spirometry and Exhaled Nitric Oxide

M Gallagher<sup>1</sup>, M Nonnenmann<sup>1</sup>, M Hornick<sup>1</sup>, S Reynolds<sup>2</sup>, J Levin<sup>3</sup>, V Boggaram<sup>3</sup>

<sup>1</sup>Department of Occupational & Environmental Health, The College of Public Health, The University of Iowa

<sup>2</sup>Department of Environmental & Radiological Health Sciences, College of Veterinary Medicine & Biomedical Sciences, Colorado State University

<sup>3</sup>Department of Occupational Health Sciences, University of Texas Health Science Center at Tyler

## Background

Inhalation of organic dusts, including endotoxins, have been associated with the inflammatory response of the pulmonary system.

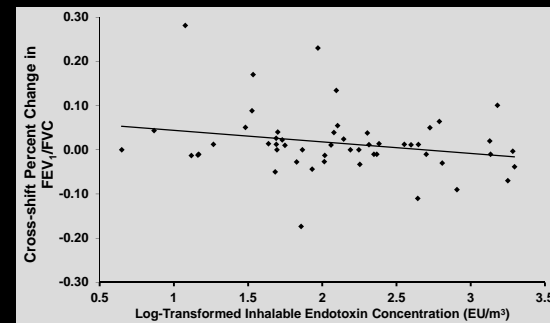
Limited studies have evaluated dairy farm workers for cross-shift changes in pulmonary function and bronchoconstriction.

Dairy parlor workers often labor for long hours in one area with little task variability.

Exhaled nitric oxide measurements used to assess lung inflammation in clinical settings may have use in agricultural settings including dairy parlors.



## Results



## Objectives

- 1) Quantify exposures of inhalable dust and endotoxin among dairy parlor workers
- 2) Evaluate acute cross-shift changes in respiratory status using spirometry
- 3) Assess the effectiveness of exhaled nitric oxide (eNO) for detecting acute cross-shift inflammation changes

## Methods

Cross-sectional study involving 8 large herd dairy farms and 62 dairy parlor workers from Iowa, Minnesota, Wisconsin, and South Dakota

- Data collected from May 2012 to January 2013
- Administered pulmonary symptom questionnaire

Equipment:

- Button aerosol samplers
- Gravimetric analysis for inhalable dust concentrations
- Endotoxin analysis using Recombinant Factor C Endotoxin Assay
- KoKo spirometer
- NIOX-MINO for eNO measurements

### Characteristics of Dairy Parlor Workers

Characteristic	Number (%) or Mean (SD)
Number of participants	62
Mean age	31.6 (9.8)
Male	90.3%
Hispanic or Latino	93.5%
Ever-smoked	30.6%
Second hand smoking exposures	42.1%
Mean months worked in farming	49.8 (46.8)
Mean months worked in current job description	41.9 (45.2)
Mean hours worked per week	54.4 (12.3)
Currently living on farm	38.7%
Mean years of education	8.1 (3.8)
Median annual family income range	\$10,000 – 30,000
Employee's concerned breathing dust at work or home may cause breathing problems	52%

### Summary Measures for Occupational Exposures

Occupational Exposure	Geometric Mean (Range)
Inhalable Dust (mg/m <sup>3</sup> )	0.58 (0.09 - 4.95)
Inhalable Endotoxin (EU/m <sup>3</sup> )	117 (4 - 1968)

### Group Pre-shift & Cross-shift Changes in Lung Function

Characteristic	Mean Group Values (Range)
Pre-shift Percent-predicted FEV <sub>1</sub>	93.4% (72-110%)
Pre-shift Percent-predicted FVC	99.6% (72-110%)
Pre-shift Percent-predicted FEV <sub>1</sub> /FVC	94.2% (67-112%)
Cross-shift Percent Change FEV <sub>1</sub>	-1.16%
Cross-shift Percent Change FVC	-0.01%
Cross-shift Percent Change FEV <sub>1</sub> /FVC	+0.01%

### Exhaled Nitric Oxide Values

	Moderate eNO Values (25-50 ppb)	Low eNO Values (<25 ppb)
Number	6	56
Cross-Shift change in FEV <sub>1</sub>	-3.19%	-0.91%
Mean age	32.3 (9.1)	31.6 (9.9)
Ever-smoked	16.6%	32.1%
Currently living on farm	33.3%	44.0%
Mean months worked in farming	52.2 (71.0)	49.5% (44.2)
Mean hours worked per week	54.0 (12.3)	55.6 (9.1)

## Conclusions

Dairy parlor workers are exposed to concentrations of organic dusts that may adversely impact health.

The group pre-shift spirometry FEV<sub>1</sub> measurements were less than predicted by reference values. The group cross-shift change FEV<sub>1</sub> decreased by -1.16%.

Participants with moderate eNO measurements experienced cross-shift changes in FEV<sub>1</sub> of -3.19%.

## Future Research

Future studies should test interventions in milking parlors to reduce dust exposure among dairy workers.

