



The Association of Elongated Mineral Particles to Restrictive Lung Disease in Taconite Miners.

Nnaemeka U. Odo MD, MPH,^a Jeffrey H. Mandel MD, MPH,^a Bruce H. Alexander, PhD,^a Rich F. MacLehose, PhD,^a Gurumurthy Ramachandran, PhD, CIH.^a
a - School of Public Health, University of Minnesota.

BACKGROUND

We examined associations between cumulative exposure to elongated mineral particles (EMPs, aspect ratio $\geq 3:1$ and length $\geq 5\mu\text{m}$) and prevalent restrictive lung disease (RLD) assessed using spirometry in taconite industry workers.

METHODS

We conducted a cross-sectional study of current & former workers in the Minnesota taconite industry. From an initial sample of 3,313 workers, 1,045 participants had usable spirometry. Age, BMI, smoking status, gender and work history were assessed by questionnaires. Cumulative exposures to EMP (EMP/cc*years) were estimated based on job histories, historical and current measurements using NIOSH 7400 method (Phase Contrast Microscopy). Forced Vital Capacity (FVC) values less than lower limits of normal (5th percentile) for age, height, race and gender were used to determine RLD. Odds-ratios (OR) and 95% confidence intervals (CI) were estimated using multivariate logistic regression models.

RESULTS

Prevalent RLD was observed in 76 of the 1045 participants in this sample (7.27%). No association was observed between median cumulative exposure and prevalent RLD in either the crude (OR= 1.01, 95% CI= 0.96-1.06) or multivariate (OR=1.00, 95% CI=0.94-1.07) logistic models. RLD was associated with increased BMI (OR=1.13, 95% CI= 1.09-1.18) and current smoking status (OR= 2.81, 95% CI= 1.35-5.85) in the multivariate model.

Descriptive Tables					
Parameter	N (%)	Restriction	Non-Restriction	Chi-square P-values	
Gender					
Female	101 (9.67)	7	94	0.8892	
Male	944 (90.33)	69	875		
Smoking status					
Current	131 (12.54)	14	117	0.1813	
Never-smoker	391 (37.42)	23	368		
Former smoker	520 (49.76)	39	481		
Missing	3 (0.29)				
	Mean (SD)			T-test P-values	
Age (years)	59.73 (10.85)	61.7	59.57	0.1006	
BMI (Kg/m²)	31.36 (5.39)	34.66	31.66	<0.0001	
Total Median Exposure (EMP/cc*ys)	2.50 (4.29)	2.64	2.49	0.7844	
Total work time (years)	24.81 (14.28)	25.56	25.41	0.9149	

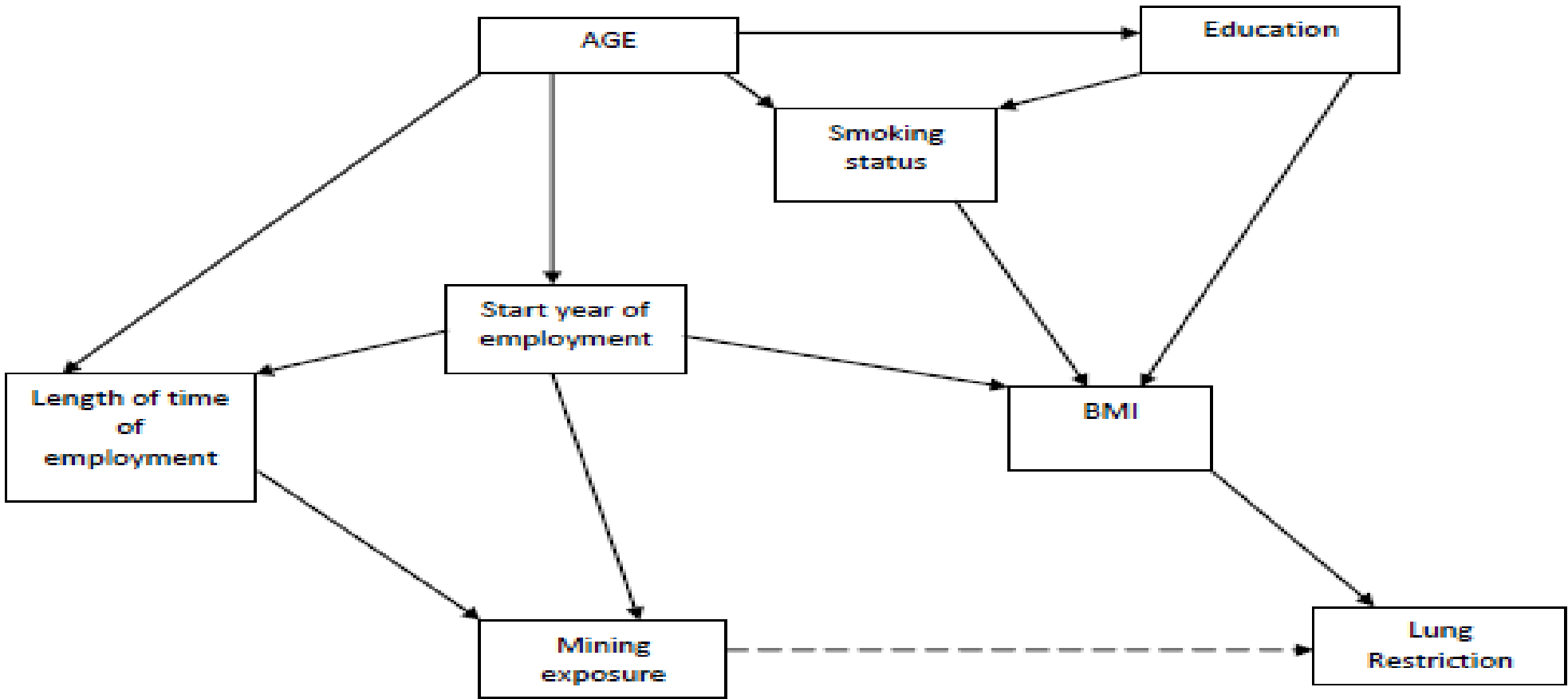


Figure 1: Directed Acyclic Graph (DAG) depicting exposure-disease relationship and covariates

RESULTS

Logistic Regression Models of the Relationship between Median cumulative total EMP exposure and spirometric restriction			
Parameter	Odds ratio	95% CI	P Value
Cumulative Total EMP (EMP/cc*years)	1.00	0.94 - 1.07	0.9516
Age (years)	1.03	1.00 - 1.06	0.0444
BMI (Kg/m ²)	1.13	1.09 - 1.18	<0.0001
Gender Male vs. Female	0.92	0.38 - 2.26	0.8603
Smoker Current vs. Never	2.81	1.35 - 5.85	0.0056
Smoker Former vs. Never	1.02	0.58 - 1.82	0.9399

CONCLUSIONS

These preliminary findings suggest that cumulative concentrations of total EMPs are not associated with RLD as measured by spirometry. In this population, BMI and current smoking were important covariates in the prevalence of RLD and should be considered in other exposure-specific analyses.

Acknowledgments:

This research is part of studies being funded by the State of Minnesota for the Minnesota Taconite Workers' Health Study (MTWHS). The results and inferences are the opinion of the authors and are not the official position of the state of Minnesota.