What Farming Can Do To Your Lungs:
How It Can Make You Sick & How It Can Protect

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### Causes of Death in Farmers vs. the General Population

**Blair & Zahm Env Health Perspect 1995**

<table>
<thead>
<tr>
<th>Lower</th>
<th>Higher</th>
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<td>All causes</td>
<td>Traumatic injury</td>
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<td>Leukemia</td>
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<tr>
<td>All cancer</td>
<td>Non-Hodgkin’s lymphoma</td>
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<td><strong>Lung cancer</strong></td>
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<td>Cancer of the esophagus</td>
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<tr>
<td>Kidney cancer</td>
<td>Soft tissue sarcoma</td>
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### Lower Causes of Death

1. **All causes**
2. Heart disease
3. All cancer
4. **Lung cancer**
5. Bladder cancer
6. Liver cancer
7. Colon cancer
8. Cancer of the esophagus
9. Rectal cancer
10. Kidney cancer

### Higher Causes of Death

1. Traumatic injury
2. Leukemia
3. Non-Hodgkin’s lymphoma
4. Multiple Myeloma
5. Skin cancer (melanoma, other)
6. Cancer of the lip
7. Cancer of the prostate
8. Cancer of the brain
9. Cancer of the stomach
10. Soft tissue sarcoma

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*Note: The table above compares lower and higher causes of death in farmers versus the general population.*
Exposures were different on family farms where agriculture was practiced on a small scale.
Agriculture is changing rapidly

Large animal confinement barns are now common

This created new human respiratory health concerns for workers
32 yo man who became ill with fever, chills, a dry cough and a headache 6 hours after cleaning a grain bin

What is the most likely diagnosis?

Organic Dust Toxic Syndrome
Organic Dust Toxic Syndrome History

- Seen after cleaning a grain bin, working in hog confinement, uncapping a silo
- Often several people working together become ill
- Symptoms begin 4-8 hours later
  - Fever, chills, intense muscle aches, headache
ODTS Epidemiology

- Affects about 30% of farmers who grow grain and raise livestock
  - Von Essen et al, Chest 1999
- 5 times more common than farmer’s lung
- Very rarely causes respiratory failure
One cause is exposure to endotoxin
  - Fungal spores may be able to elicit the same response

Symptoms related to release of inflammatory proteins from the lung into the blood stream
Normal oxygen level

Chest X-ray is usually normal

Elevated white blood count
Antibiotics are not necessary

Medication available over-the-counter to treat fever, rest

Use a respirator to prevent future episodes
  • Important because ODTS causes increased cough, chest tightness with future exposures to dust
Respiratory protection factor (RPF) = 16

Available in 3 sizes, also with charcoal to absorb ammonia for use in hog or poultry barns

Users must breathe against resistance

Cost ~$3

Note: single strap respirators not recommended
RPF = 19

Different filters to be used for various tasks (handling grain vs. spray painting vs. application of anhydrous ammonia)

You breathe against resistance so less comfortable if you have asthma or COPD symptoms

Initial cost ~$35, then you just have to replace the filters
Powered-air Purifying Helmet

- RPF = 30
- Advantages: not having to breathe against resistance, higher protective factor, works when other respirators do not fit
- Cost ~$1000+
Farmer’s lung is one of many forms of hypersensitivity pneumonitis (HP)

This is a reaction to bacteria or fungi present in spoiled hay or grain in large amounts

- *Micropolyspora faeni*, thermophilic actinomycetes
- *Aspergillus* spp., other fungi
  - Only susceptible people get sick, and this susceptibility is rare so this problem is uncommon

Can also see farmer’s lung from bird exposure, including chickens and turkeys, but very rarely
Incidence highest in damp climates

Incidence is 2-30/10,000 farmers
  • Incidence low in relatively dry climates where farming is highly mechanized (like this part of the Midwest)

Most common cause of HP now is from water leaks in homes or offices or exposure to pet birds indoors (parrots, parakeets or pigeons)
Prior exposure and sensitization required

- Sensitization measured by serum allergic precipitins
  - IgG antibodies to a fungus like Aspergillus or thermophilic bacterium or a bird protein
  - Are a marker of exposure, not disease
  - 30% of farmers are serum allergic precipitin positive and are not ill
Acute farmer’s lung

- Chills, fever, malaise and dry cough 4-6 hours after exposure, which last for days
- Repeated bouts of acute farmer’s lung can lead to pulmonary fibrosis and death so these illnesses are to be prevented
Clinical Presentation of Acute Farmer’s Lung

- Low blood oxygen level
- Abnormal chest X-ray
- Abnormal CT scan of the chest
- Mildly increased while blood count
- Abnormal lung function test
A Surgical Lung Biopsy May Be Necessary to Make the Diagnosis
Acute Farmer’s Lung Treatment

- **Prednisone 60 mg per day**
  - Shortens the duration of the illness
  - Minimal effect on lung function

- **Use of respirators with future exposures**
  - May purchase from Gempler’s catalog (800/382-8473) or from local vendors

- **Avoidance of tasks that caused the symptoms**
Subacute Farmer’s Lung

- Subacute farmer’s lung
  - Symptoms less severe and less clearly related to exposure
  - Symptoms may last for weeks and may include weight loss
  - Treatment is prednisone, avoidance of exposure
    - Change in work practices
    - Respirators
Chronic Farmer’s Lung

- Chronic farmer’s lung presents with long-standing (years) shortness of breath and dry cough

- Pulmonary fibrosis on lung biopsy
  - Cannot be distinguished from most other forms of pulmonary fibrosis
Chest X-ray in Chronic Farmer’s Lung
Chronic Farmer’s Lung

- Chronic farmer’s lung may progress to right heart failure and death.
- Only curative treatment is lung transplantation.
  - This option is available to very few patients.
- Supportive treatments include supplemental oxygen, diuretics, low sodium diet.
37 yo farmer with cough and chest tightness after working in this structure each day

What is causing his symptoms?
Asthma-like Syndrome

- Seen in hog confinement barn workers, poultry barn workers

- Associated with exposure to **dust**, **endotoxin** from the dust, **ammonia**
  - Elholm et al Clin Epidemiol 2010
Asthma-like Syndrome

- Symptoms include cough, chest tightness, shortness of breath on exertion
- Lung function tests can be normal or may show mild airways obstruction
- Chest X-ray is unremarkable
- This is not allergic disease
  - Caused by the endotoxin, ammonia and dust
  - Fewer allergies seen in these workers
Diagnosis of the Asthma-like Syndrome

- Symptoms
- Work history
- Lung function tests
Reduce or avoid exposure

- Wear a respirator, especially when loading and power washing
- Frequent power-washing of buildings
  - But do not have the affected person do this high exposure task
- Optimize ventilation in barns
- If nothing else helps, consider changing jobs

Medications used for asthma usually not effective for this condition
Asthma on the Farm

- Some evidence that farming causes asthma
  - Farmer’s children are less likely to have asthma
    - This is the hygiene hypothesis
    - They are exposed to a greater variety of microbes especially if the farm has livestock
      - Ege et al NEJM 2011
  - Rarely, farmers become allergic to pigs, grain

- Asthma affects 5-10% of the adult population

- But….farm exposures can exacerbate or aggravate existing asthma
Exposures to hog barns and grain dust may significantly worsen asthma and also COPD symptoms.
Treating Farmers with Asthma

- Reducing exposures that cause symptoms
  - Respirators
  - Change in work practices

- Medications commonly used to treat asthma need to be increased during times of heavy exposure to dust, like harvest
Irritant Asthma from Farm Exposures

- Can follow high exposure to an irritant gas, like anhydrous ammonia

- Very rarely cause severe lung injury
  - More likely patients need intubation, a mechanical ventilator because of swelling in throat, not damage directly to the lungs

- Wheezing starts within minutes after high exposure and may persist for months
Acute bronchitis is common after heavy exposure to grain dust

Chronic bronchitis (a form of COPD) is more common in those who farm
  • Historically seen in 25% of hog confinement workers, not known how common it is now
  • Slightly more common in farmers but is usually mild unless the farmer also smokes
Smoking, agricultural exposures additive

Severe chronic bronchitis seen only in smoking farmers & those who have an underlying genetic disorder like alpha-1 antitrypsin deficiency
Chronic Bronchitis Treatment

- Reduce or avoid exposure
- Medications commonly used to treat chronic obstructive pulmonary disease (COPD)
  - Mainly inhalers
- Supplemental oxygen for severe COPD
Irritation of nose, throat, eyes
- Common in hog, poultry confinement workers
- May present with hoarseness
  - Must rule out GERD, laryngeal cancer
- Use respirators, goggles to prevent
- Improve air quality in barns
Uncommon Causes of Pneumonia

- **Q fever**
  - Caused by *Coxiella burnetti*
  - From exposure to cattle, sheep or goats

- **Chlamydia pneumonia**
  - Caused by *Chlamydia psittaci*
  - From exposure to chickens or turkeys
Rancher From the NE Sandhills with Acute Lung Injury

- 58 yo man who developed pneumonia, then severe respiratory failure
- All bacterial cultures were negative
- No response to broad-spectrum antibiotics
  - He died 5 days later
- His blood later tested positive for Hantavirus
Another Cause of Pneumonia

- Swine influenza
  - Swine herds are an important source of new strains of influenza
  - Pneumonia a rare outcome but can be very severe
Lung Cancer

- Smoking cigarettes
- Radon
  - Occupational and from home exposure (air in basements)
- Arsenic
  - Ingredient in some pesticides, can increase risk of lung cancer
  - Increased in drinking water in some communities in this region
- Asbestos
- Smoke from cooking fires (seen in developing countries)
- Silica
Fruit consumption?
  • Maybe

Vegetable consumption?
  • Possibly
    • The evidence is not as strong
Study of US death certificates from 26 states showed that the pooled relative risk for lung cancer was reduced by 20% in crop farmers and by 30% in livestock farmers.

Endotoxin (from manure, stored grain) is suggested as the protective factor that explains the lower risk.

The End

- Photo by Dan Brooks