Why WHAT you breathe matters.
Does what you EAT matter?

• The Mayo Clinic Diet
• The Mediterranean Diet
• The Scarsdale Medical Diet
• The Warrior Diet
• The Fast Metabolism Diet
• Eat to Live
• Grain Brain
Is some food dangerous?

- Organic food
- Food recalls (listeria, E.coli)
- FDA/DOA: food safety issues
If

- We are what we eat, then
- We are what we Breathe!
Breathing

- You eat 3-4x in 24 hours; you breathe every 5 seconds.
- If the food was not safe, you could go days without eating. How long can you live without breathing?
- You breathe: 5-10 liters a minute at rest; 100-150 liters/minute during exercise.
- 10,000 liters/day reach alveoli.
Lung is a filter

- 10 micron particles removed in upper airway.
- 2-10 microns: trachea, bronchi, bronchioles
- <2 micron reach alveoli ("PM 2.5")
- <0.1 micron pass through cell membranes
- Particles carry chemicals that dissolve in alveolar moisture (Think teabag).
Where does most of PM 2.5 come from in Fairbanks?
Major source:
Wood smoke is toxic because

- Incomplete combustion produces huge numbers of particles carrying chemicals
What are these chemicals?

- formaldehyde
- dioxin
- toluene
- lead
- Polycyclic aromatic hydrocarbons (PAH)
- 100s more
Where do these chemicals go?

- airway
- blood
- cells (brain, organs, placenta)
What do these chemicals do?

• Neurotoxins
• Carcinogens
• DNA damage
• Clot provokers
What is a safe amount of these chemicals to inhale?
How many cigarettes is it safe for your kid to smoke?
Setting limits for PM 2.5

- USA (EPA): 35
- Australia: 25
- WHO: 25
- EU: 20

- These are “regulatory limits” not “safety standards”!
- Levels of 5 are proven hazardous to health!
At PM 2.5 levels of 35 we inhale 100,000,000 particles in 24 hours.
Particle shape matters
Particle size matters

• surface area
• removal mechanisms
• cancer locations in smokers
Particle composition matters

- Particle as a vehicle
- PM 2.5 is a dangerous vehicle
- wood smoke 12x potential of 2nd hand smoke to cause lung cancer
What are the health hazards?

- Air pollution contributes to 4 of 5 leading causes of deaths:
- Heart attacks
- Strokes
- Cancer
- Respiratory illnesses
How large is the health effect?

- In the US, the annual deaths due to:
  - Air pollution: 50,000
  - Breast cancer: 40,000
  - Prostate cancer: 29,000
  - Gun-related deaths: 32,351
  - Motor vehicle deaths: 35,543
Which deaths are most easily preventable?
“Core Metrics for better health”
JAMA, May 19.2015

• 15 measures of communities that produce better health at lower cost:
  • addiction to tobacco, alcohol, drugs
  • unintended pregnancy
  • obesity
  • preventive services
  • air and water quality
  • community engagement in health issues
Death isn’t everything

- DVT increases 70% for each 10 mcg increase in PM 2.5
- spikes in pollution cause BP to rise within 30 minutes
- heart rhythms become irregular (AF)
- Alzheimer’s occurs earlier in life (a 10 mcg increase in long term PM 2.5 exposure increases cognitive aging 2 yrs)
Toxins cross the placenta

increased miscarriage
increase still births
increased birth defects
low birth weight
childhood development

• 5 year old children whose mothers breathed >2.26 nanograms/m3 of PAH showed IQ loss of 5 points

• Autism rates are correlated with air pollution.

• The neurotoxins in wood smoke are particularly harmful for developing brains

• Adults with more health problems/costs
Air pollution limits freedom to play

- Impaired lung function in healthy subjects for a week after short term pollution spike.
- Exercise in polluted air will deliver 10-30 times more pollutants to the lungs.
lung development

- Children who grow up with air pollution are less likely to develop full lung capacity.
Many pregnant women in Fairbanks will spend several weeks of critical fetal development breathing air proven to be toxic
My Conflict of Interest