Water Quality and Public Health

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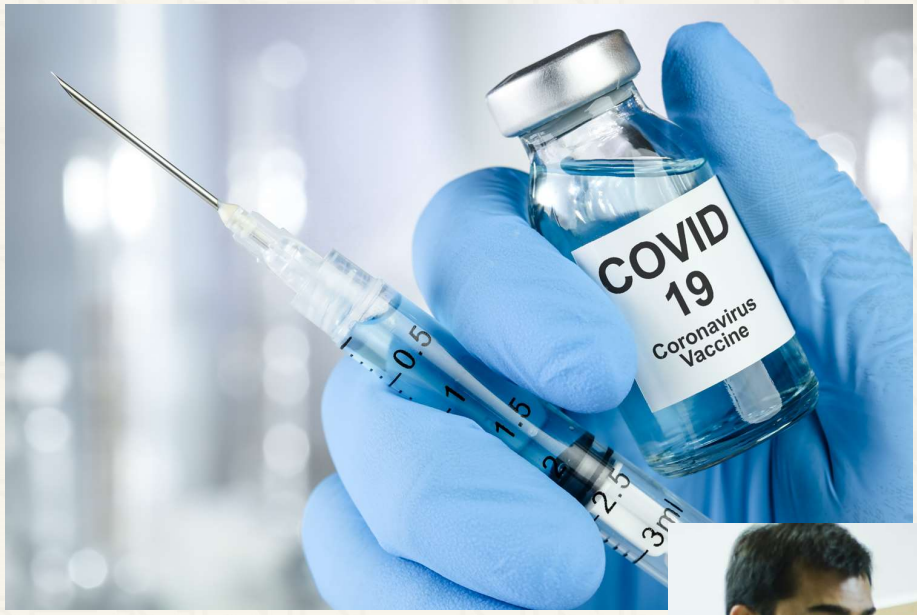
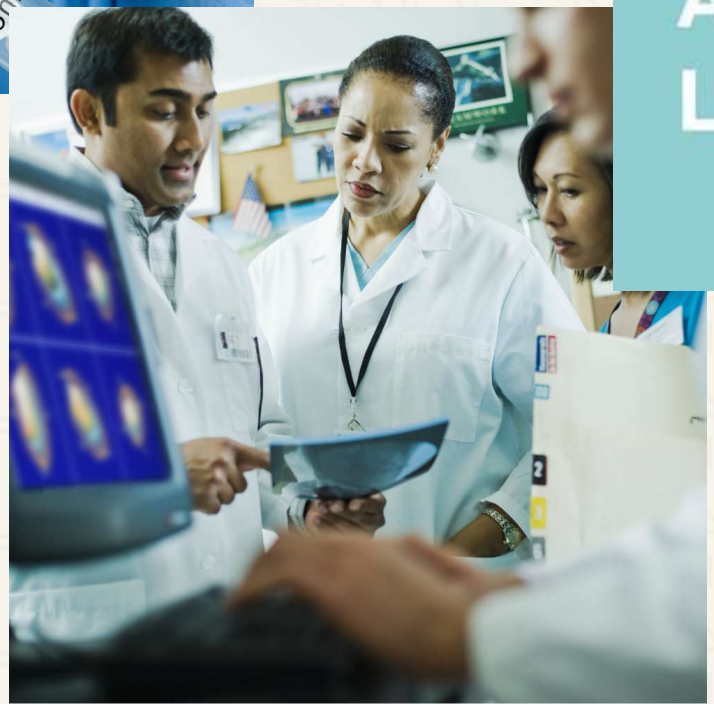
What is Public Health?





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The science and art of preventing disease, prolonging life and promoting health through the organized efforts and informed choices of society, organizations, public and private, communities and individuals.

(Journal of Public Health, 2011)

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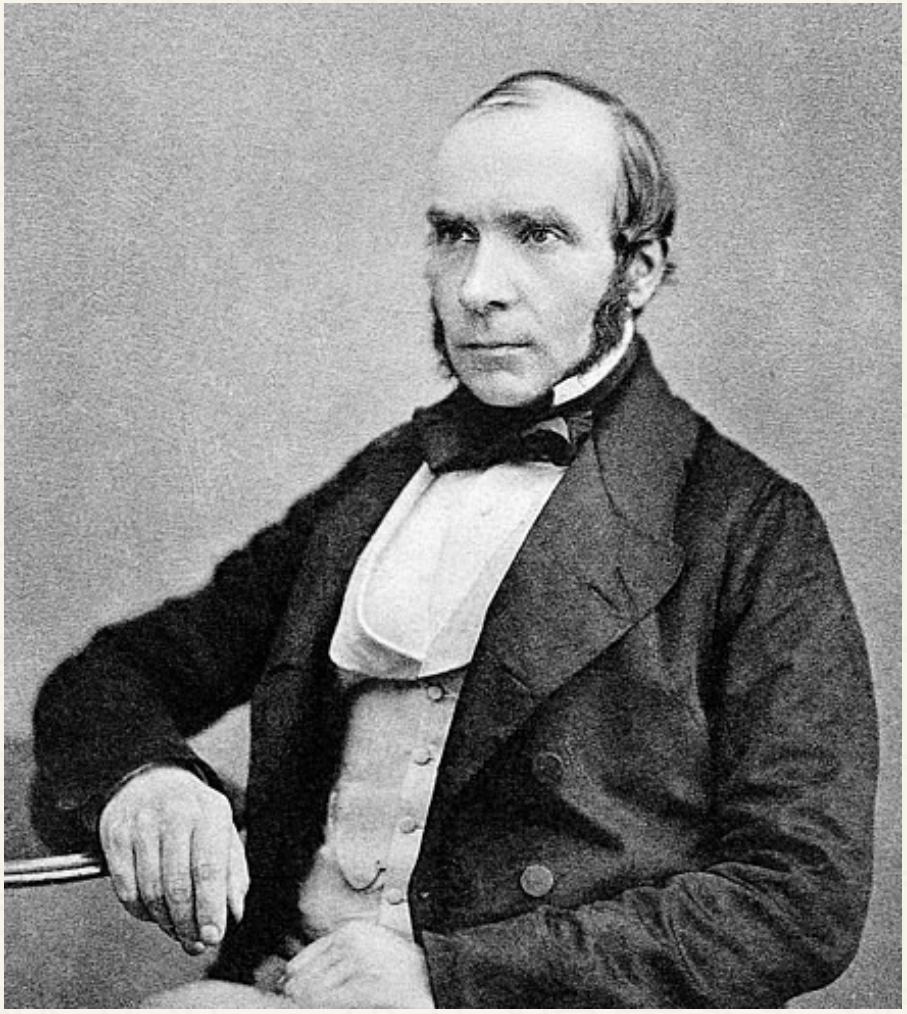
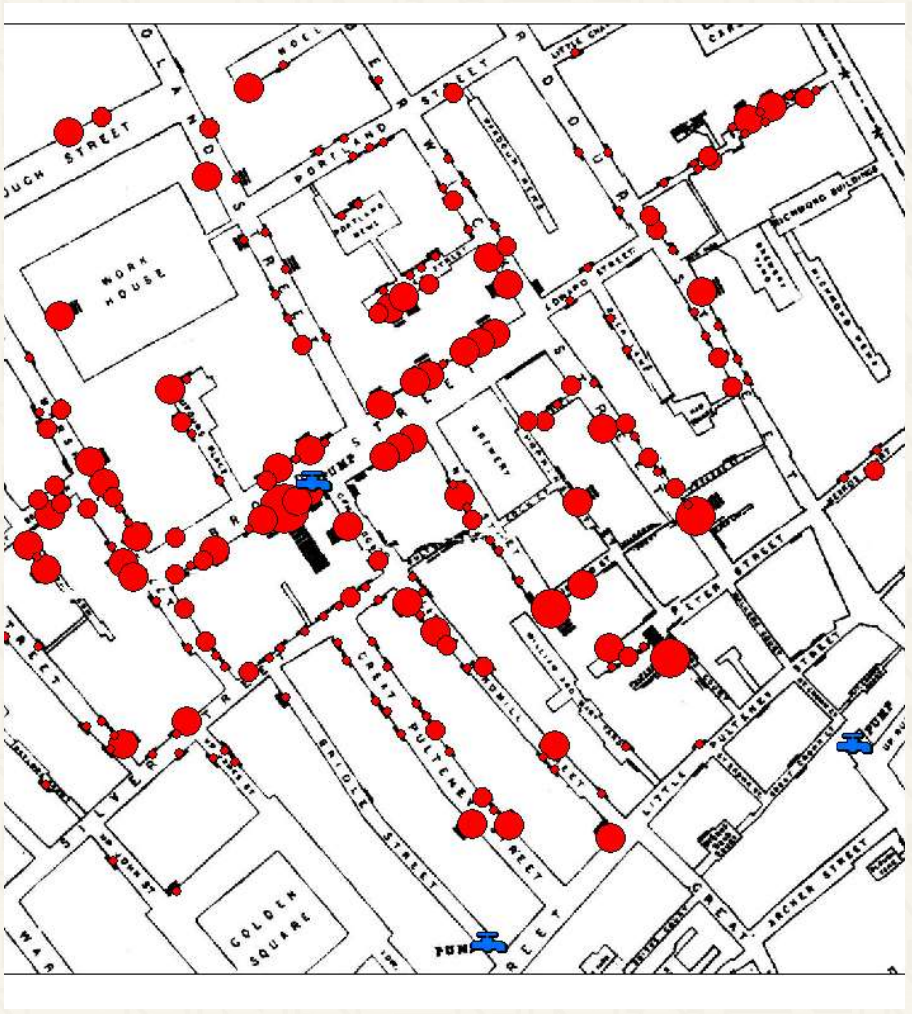
Public Health History





What We Can Learn from Snow

- We need to observe patterns
- Public health challenges extend beyond just determining the causes of health issues
- You need local champions
- Perseverance is the key to success

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Water Quality Issues in Nebraska

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Importance of Water Quality

- Over 88% of water systems are groundwater
  - 95% if you exclude Omaha MUD
- 590 Groundwater Public Water Systems
  - Serve ~1.5 million people
- 583 Systems serve less than 10,000 people
  - Serves ~448,000

Courtesy of Tatiana Davila, NDEE

Nebraska towns pay millions to fight nitrates as water bills go up

By Jessica Fargen Walsh Special to The World-Herald
May 1, 2020

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Nitrate and Drinking Water

- Sources: Nitrogen fertilizers, animal waste, human waste
- Regulatory limit: 10 ppm
- Greatest Exposure
  - Agricultural areas
  - Private wells
    - Not regulated
    - Sparse measurements

Nitrate and Human Health

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Links

- Methemoglobinemia (blue baby syndrome)
  - Most well-known
  - Set the regulatory limit (10 ppm)
- Continued scientific studies
  - High nitrate concentrations linked to more health impacts
- Strongest links:
  - Methemoglobinemia
  - Preterm birth issues
  - Birth defects
  - Pediatric cancers
  - Adult cancers

Adult Health Issues

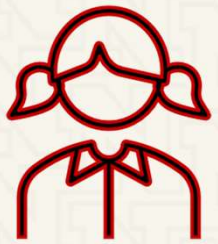
- Increased heart rate, nausea, headaches, and abdominal cramps

- Cancers:
  - Colorectal cancer (5 studies; 4 positive)
  - Thyroid disease (3 positive studies)
  - Kidney cancer (2 studies; 2 positive)
  - Bladder cancer (4 studies; 2 positive)
  - Non-Hodgkin Lymphoma (3 studies; 1 positive)

- Alzheimer's Disease, Diabetes, and Parkinson's Disease

Children Health Issues

- Methemoglobinemia (infants less than 6 months)
- Pediatric brain cancers (2 studies; 2 positive)
- Non-Hodgkin Lymphoma (3 studies; 1 positive)
  - NH Lymphoma had a three-fold increase in risk with nitrate and atrazine in Nebraska study (Rhodes et al., 2013)



Maternal and Fetal Health Issues

- CDC report 1998 showed cluster of miscarriages in rural Indiana
  - Private wells 19-26 mg/L
- California study found an increase in spontaneous preterm births with nitrate level 5-10 ppm (Sherris et al. 2021)
- Fetal grown restriction with exposure of high nitrate in drinking water (Coffman et al. 2021)
- Fetal hemoglobin is particularly susceptible to oxidation
  - Study shows elevated methemoglobin cord blood with exposure to nitrate during pregnancy (Tabacova et al. 1998)
- Central Nervous System Malformations
  - 5 of 6 studies found a positive association with nitrate
  - 4 of studies had concentrations less than 10 ppm

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Most Vulnerable Populations

- Pregnant women
- Young infants (<6 months)
- Children
- People with oxygen transport delivery conditions
- People with high nitrate in private well
  - Diet can have impact as well

Health Concerns in Nebraska

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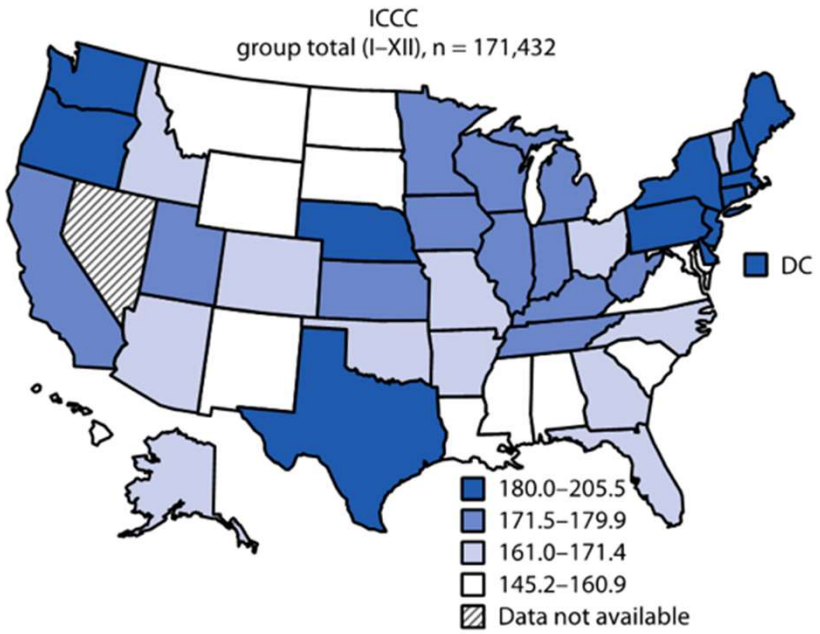
Centers for Disease Control

Data from 2003 – 2014 and reported as age-adjusted incidence rates of childhood cancer per 1 million:



ICCC: International Classification of Childhood Cancer

United States	173.7
New Hampshire	205.5
New Jersey	192.3
Maine	190.5
New York	190
Pennsylvania	186.6
Connecticut	185.8
Nebraska	183.2
Texas	183.2
Oregon	182.6
Massachusetts	181.5

Siegel et al. Geographic Variation in Pediatric Cancer Incidence - US, 2003–2014. *MMWR*, 2018

Courtesy of Don Coulter, MD

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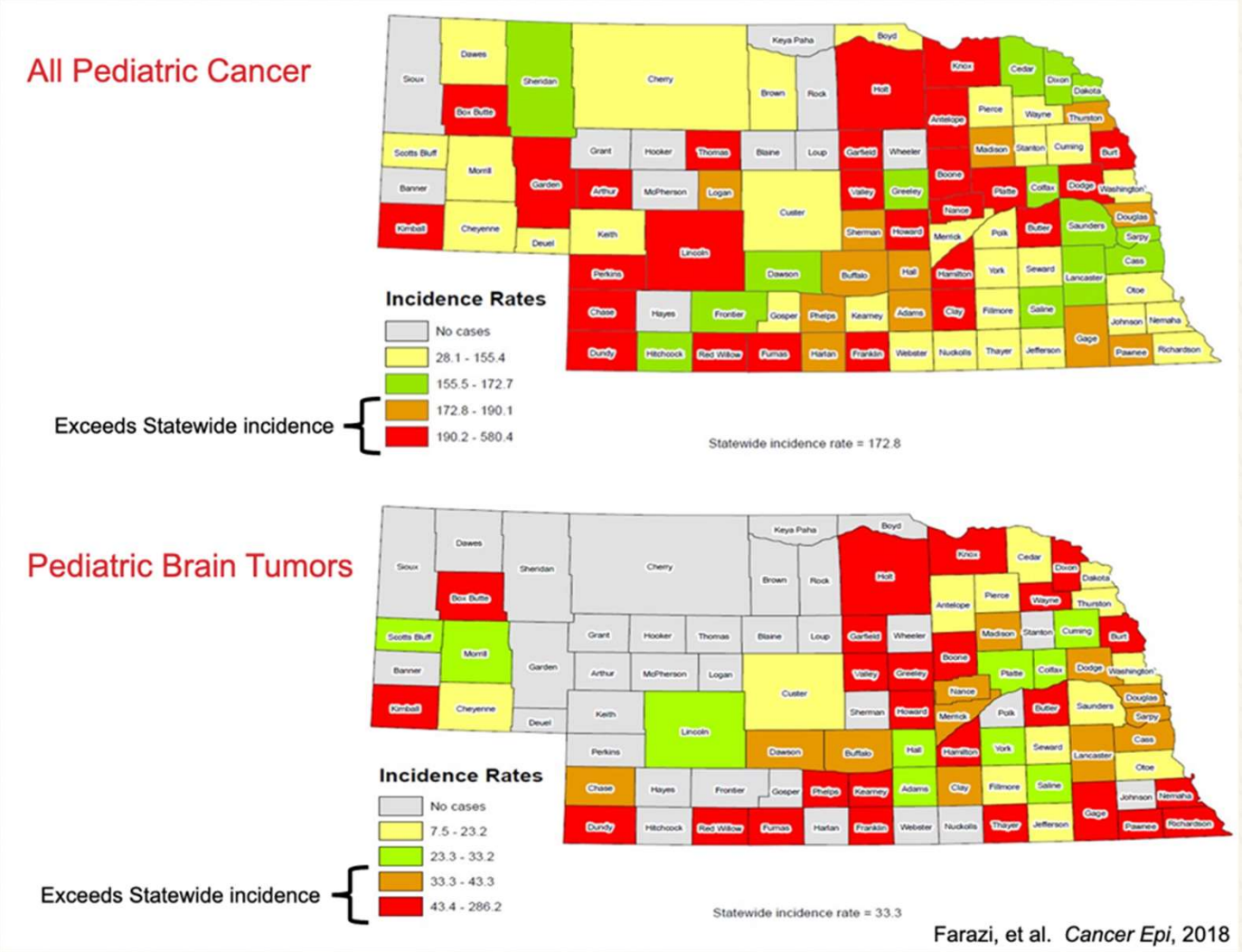
Incidence of pediatric cancers in Nebraska is among the **five highest** in the United States (Farazi et al., 2018).



Courtesy of Don Coulter, MD

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Watershed

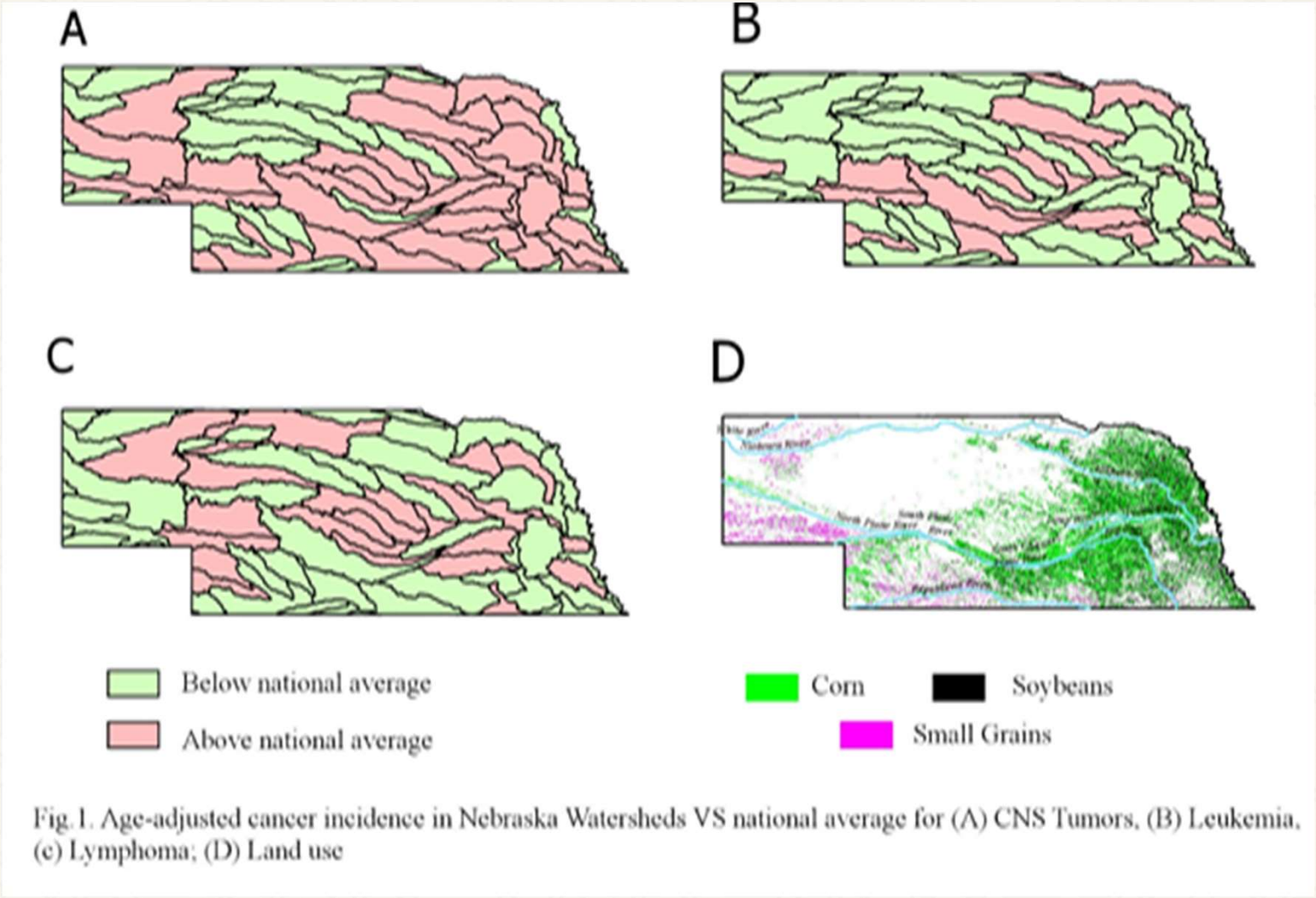

Fig. 1. Age-adjusted cancer incidence in Nebraska Watersheds VS national average for (A) CNS Tumors, (B) Leukemia, (c) Lymphoma; (D) Land use

Unexpected Costs

- Moving
- Financial burden
- Higher rates of bankruptcy
- Wisconsin Study
  - $250,000-$1.5 billion in medical expenditures
  - $1.3-$6.5 billion lost in productivity

So Now What…

Importance of Education

Nitrate in Drinking Water is a Risk to Human Health!

Target At-Risk Populations

Inform Healthcare

Community Leaders

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Opportunities

Research to better explore patterns and relationships

Improve education and outreach to medical professionals and higher risk populations

Monitoring and testing water for households with private wells

Creating solutions for improved water quality for households with private wells

The solutions already exist

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THE DAUGHERTY WATER for FOOD GLOBAL INSTITUTE at the University of Nebraska

University of Nebraska Medical Center

NEBRASKA DEPT. OF ENVIRONMENT AND ENERGY

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