GEOGRAPHIC TOOLS IN HEALTH RISK RESEARCH

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SETTING THE CONTEXT: GEOGRAPHY AND HEALTH

- Two decades of research by geographers (and others) have demonstrated that the environment is a critical component of individual health
  - Place and neighborhoods are important factors of individual health outcomes
  - Where you live and work matters

- A variety of geospatial tools and methods have been developed to account for some of the challenges of using health and environmental data in a spatial framework
  - Measurement
  - Visualization
  - Decision support

John Snow Cholera Map: Broad Street Pump 1854

Drinking Water
Drinking water access on the Navajo Nation remains a critical challenge:

- Approximately 30% of residents (~50,000 individuals) do not have access to regulated public water systems.
  - Lack access to safe drinking water.
- Rely on water hauling as their sole source of drinking water.
  - Many people haul water from unregulated sources.
  - Water quality at these sources remains unknown and may be an important source of heavy metal exposure.
- Challenge: Assessing metal exposure through drinking water.
UNREGULATED WATER QUALITY: DATA SOURCES

Some sampling has been done but by multiple agencies over a long period of time. These data exist in multiple locations, in multiple formats and aren't easily consolidated.

Need: Compile existing water quality measurements.

Water quality data collected by:

- DEI (Dine Environmental Institute)
- CDC (Centers for Disease Control and Prevention)
- Navajo Nation Environmental Protection Agency
- USGS (U.S. Geological Survey)
WATER QUALITY DATABASE OBJECTS (ABBREVIATED)

Water Sources
- Name/ID
- Aquifer
- Water Uses
- Type
- Data Source
- Regulation Status
- Water Source Status

Database Management System
- PostgreSQL (PG) version 9.3.5
- PostGIS version 2.1.3
- Benefits of using PG and PostGIS:
  - Natively store location geometry
  - Connect with GIS software
  - Open source

Water Analytes
- Results
- Sources
- Analysis Lab
- Analysis Method
- Sampling Agency
- Analyte Code

Political Areas
- Chapters
- Grazing District
- BIA Agency
MCL: Maximum Contaminant Level – the legal threshold for a contaminant in public drinking water. MCL for arsenic is 10 parts per billion in drinking water.

Unregulated Water: Groundwater sources that are not part of public water systems.

Mining areas: Generalized areas of former uranium mining in and near the Navajo nation.

- 13% of tested wells have Arsenic > 10 ppb
MCL for uranium is 30 parts per billion on drinking water.

- 13% of tested wells have Uranium > 30 ppb.
- The locations of the arsenic contaminated wells are different than the areas where we find uranium contaminated wells. Drinking water contamination by these two metals are not spatially co-located.
HEATH, ENVIRONMENT AND DECISION SUPPORT

- Proto type application that visualizing unregulated water source contamination through the Navajo Nation.
- Benefits: Interactive, dynamic and user friendly

Hoover et al. 2014

deLemos et al. 2009
NEXT STEPS

Use compiled geospatial information to assess:

- Exposure pathways: statistical modeling and visualization
- Community health and environmental literacy
- Results dissemination via online tools
- Assess spatial uncertainty in data and models
- Evaluate the spatial distribution of contaminated water sources
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