

New Mexico Department of
Health Environmental Health
Tracking
of Cancer and Arsenic
in Drinking Water

NMEHC Meeting

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MAIN PROJECT COLLABORATORS



**New Mexico
Environment
Department**

Drinking Water
Arsenic Data



**Earth Data
Analysis
Center**

GIS & Technical
Support



**NIEHS
Environmental
Health Center
Family and
Community
Medicine**

Epidemiology and
Biostatistics



**The
Navajo
Nation**

American Indian
Studies

PURPOSE

To demonstrate and evaluate methods for establishing a state-wide environmental health surveillance system capable of monitoring cancer incidence and drinking water arsenic levels.



Arsenic Data Linkage Project Description

- ★ Compile the compliance monitoring data for statewide analyses of arsenic in drinking water and cancer risk at the census tract level.
- ★ Explore the utility of GIS technology to facilitate and promote data linkage, analysis, and data dissemination.
- ★ Demonstrate the utility of the linked data for surveillance with ecologic analyses of cancer incidence rates per drinking water arsenic levels.

SCIENTIFIC RATIONALE

- Arsenic = established human carcinogen
- Primary targets (ingestion) = skin, bladder, lung, kidney, & liver
- USEPA drinking water arsenic standard = 10 ug/L (effect. 2006)
- Arsenic content of New Mexico ground water = <1 – 600 ug/L
- Groundwater = primary source of drinking water in New Mexico



PROJECT FEATURES

Study Design: Ecologic, aggregate data linkage

Geographic Level: Census tract (2000 US Census)

Time Frame: 1988-2002

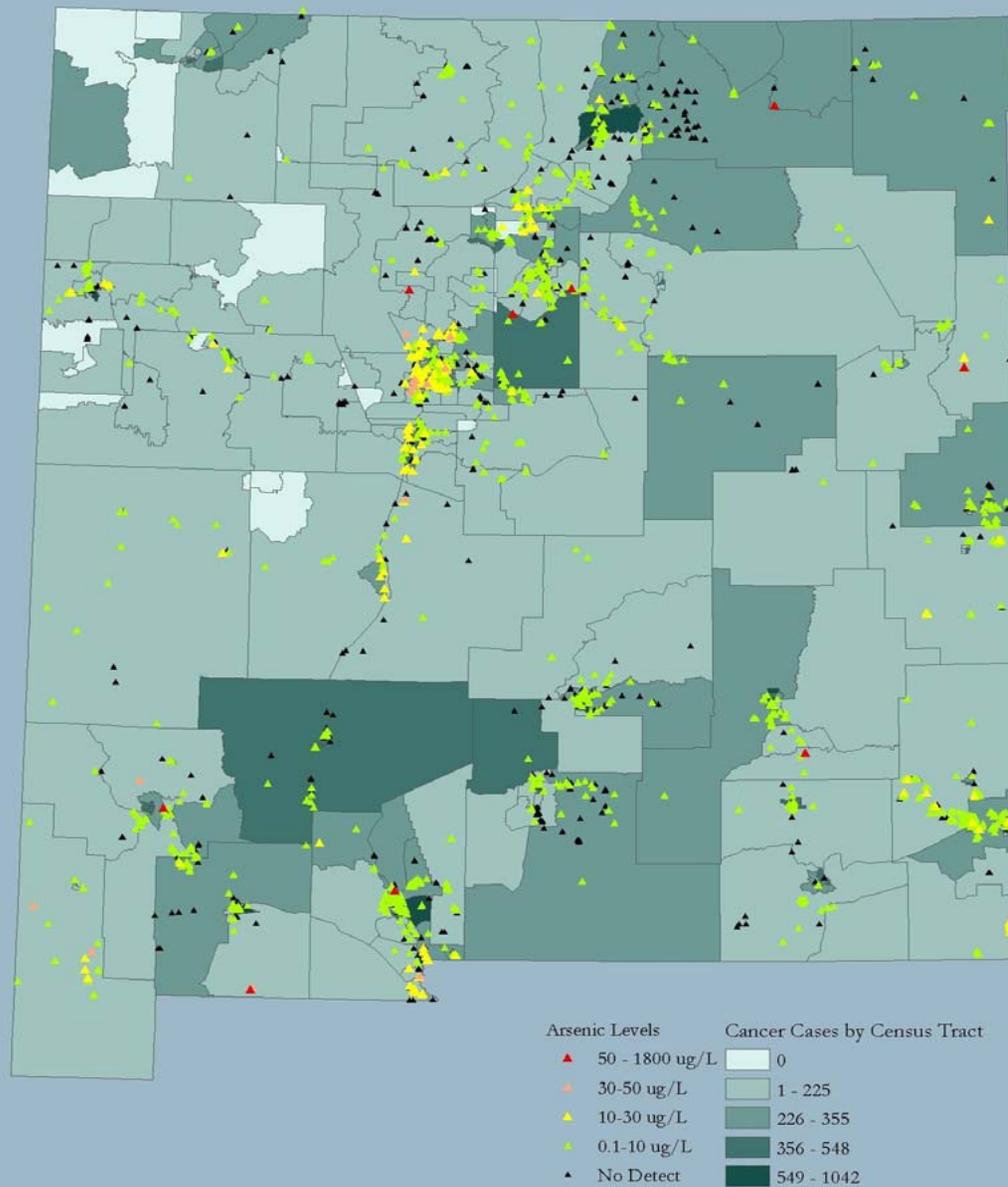
Health Outcomes: Bladder, lung, kidney, liver (primary)
Other cancers (secondary)

Arsenic Exposure: Municipal water systems (primary)
Private wells (secondary)

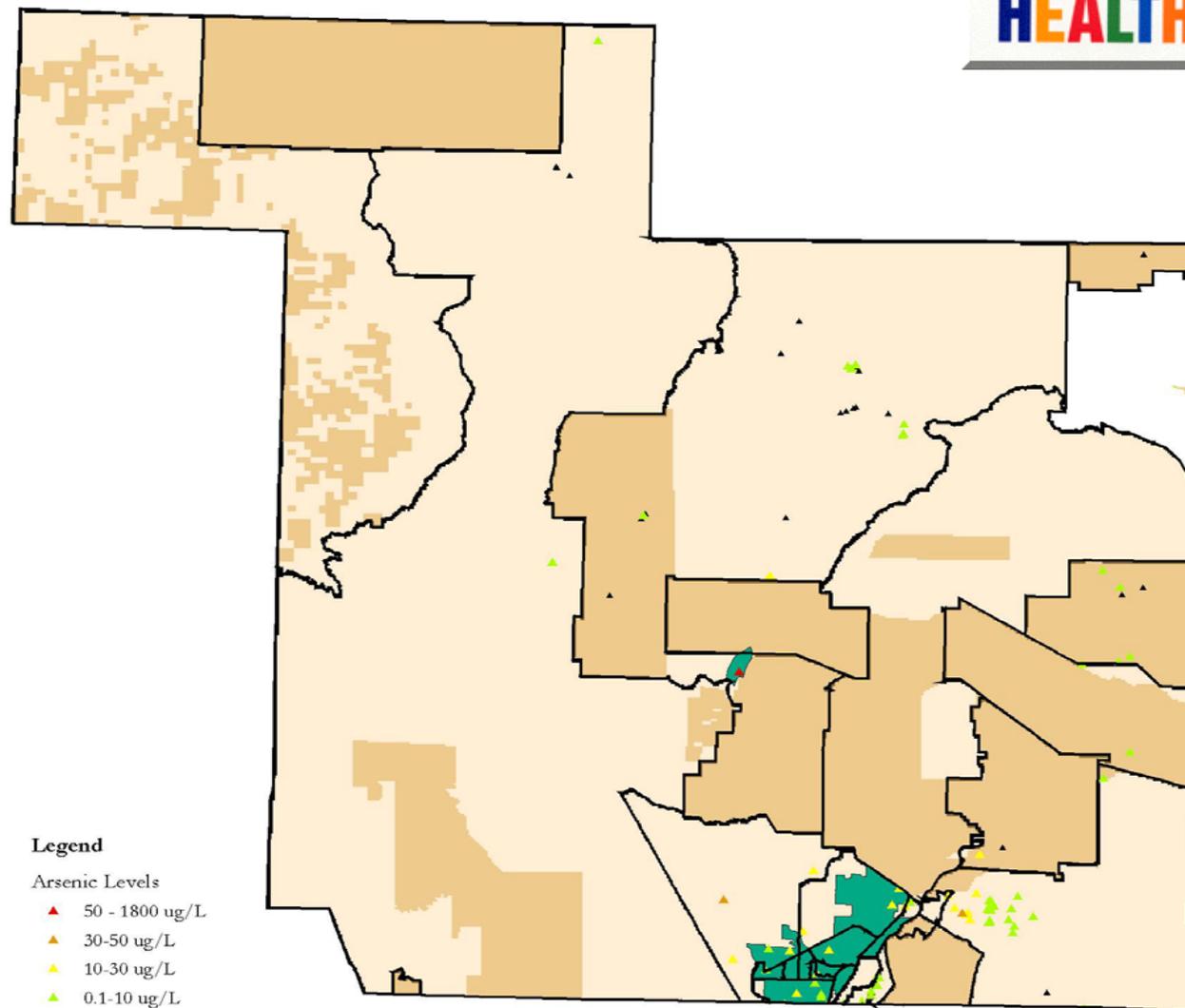
Data Management: Geographic information system (GIS)

Data Analysis: Exposure-stratified standardized incidence rate ratios (RRs)

Geographic Distribution of Drinking Water Arsenic (ug/L) and Newly Diagnosed Cancer Cases (excl American Indians), New Mexico, 1988-2001



Drinking Water Arsenic Levels (ug/L): Sandoval County, New Mexico



Legend

Arsenic Levels

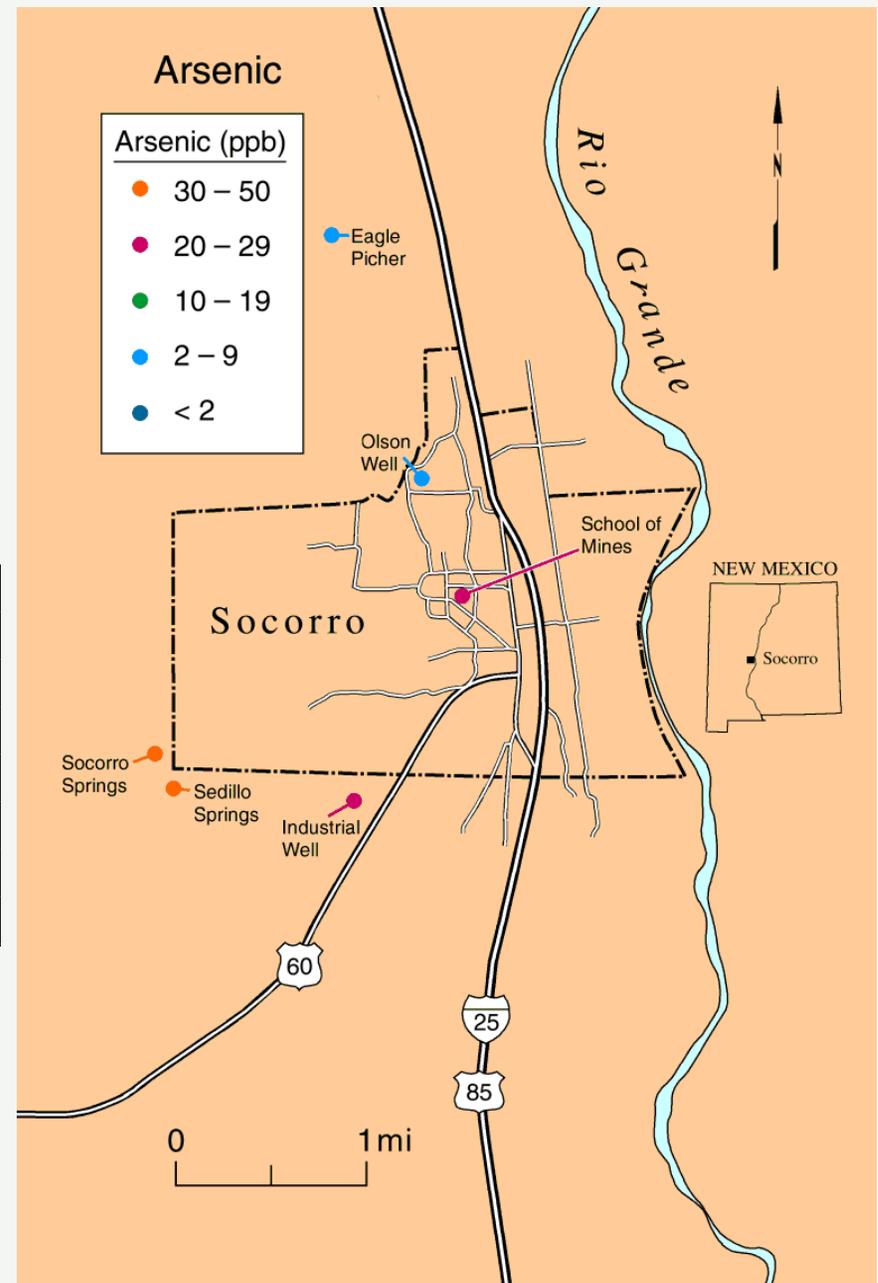
- ▲ 50 - 1800 ug/L
- ▲ 30-50 ug/L
- ▲ 10-30 ug/L
- ▲ 0.1-10 ug/L
- ▲ No Detect

- Study Areas
- Indian Reservation
- Census Tracts 2000

Characteristics of Socorro Public Water Supply System

- Residential Hookups 3040
- Commercial Hookups 400
- Industrial Hookups 48

Drinking Water Source	Percent Total Supply	Arsenic (ug/L)
Eagle Picher Well	10%	8
Olsen Well	37%	8
Industrial Park Well	19%	24
School of Mines Well	6%	24
Sedillo Springs	26%	40
Socorro Springs	2%	40

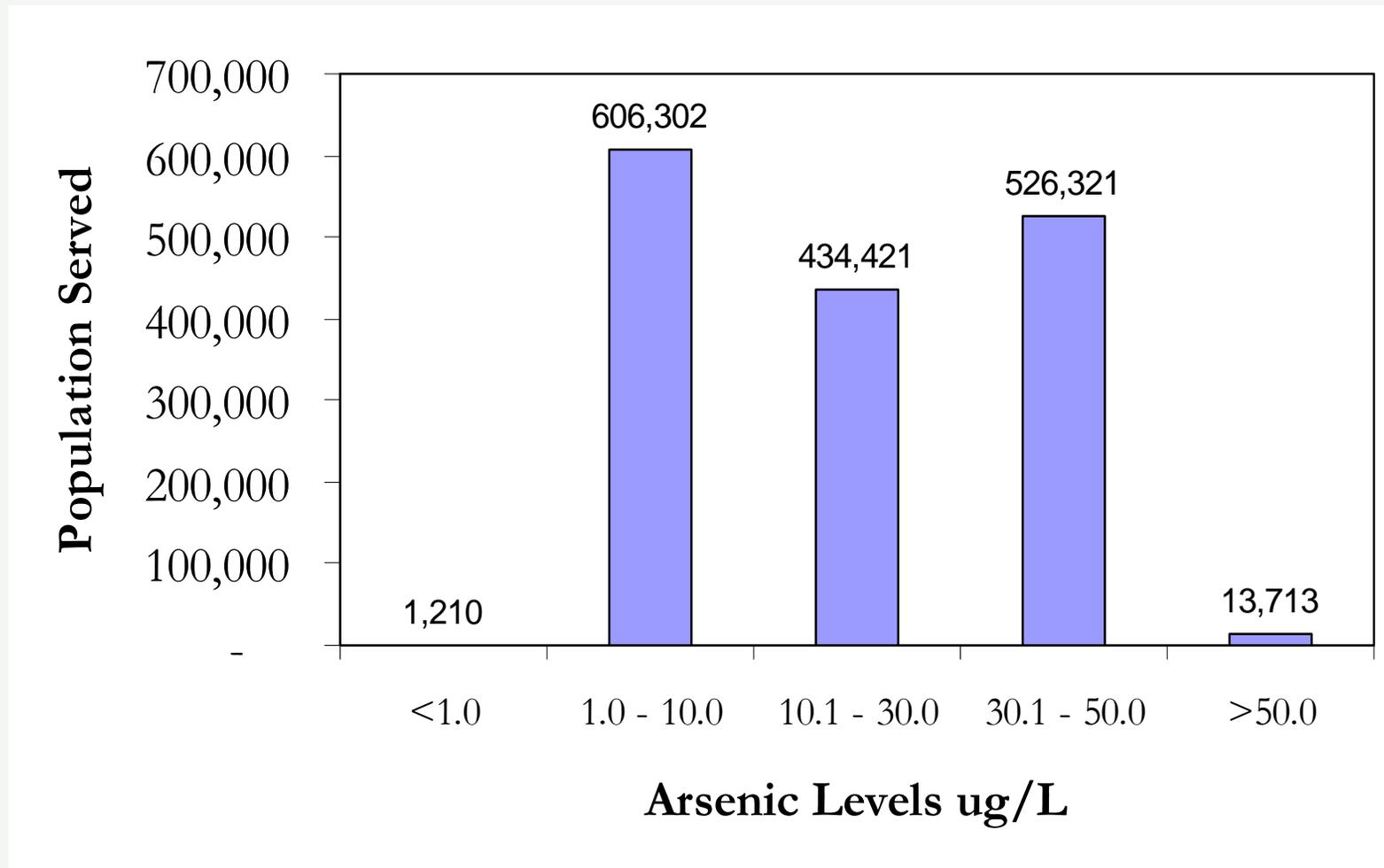


Exposure Assessment Issues

- ★ Public supply well concentration proxy for arsenic exposure
- ★ Range of detected values is 0.01 – 600 ug/L
- ★ Population migration an issue in some areas
- ★ Many census tracts have no detected values
- ★ Census tracts have multiple wells
- ★ Wells serve multiple census tracts
- ★ Wells are blended for compliance purposes
- ★ Other sources of arsenic exposure – dietary, smoking, mining and industrial releases



Population by Arsenic Level



Exposure Assessment Aspects

- ★ Well concentrations are fairly constant over time
- ★ Almost complete use of groundwater for supply wells
- ★ More than 90% of population served by public supply wells
- ★ High quality of water minimizes use of bottled water
- ★ Arsenic not removed by most home filtration products
- ★ Racially diverse populations that may have genetic differences in the metabolism/toxicity of arsenic



Data Linkage

- ★ **Cancer incidence and drinking water arsenic data will be linked at the census tract level (N=445 inhabited tracts) in order to calculate cancer incidence rates according to arsenic exposure levels in New Mexico.**
- ★ **Linkage with census tract socioeconomic and residential mobility data will be undertaken to address potential confounders, such as smoking and population migration.**



Cancer Incidence and Population Denominator Data

- **New Mexico Tumor Registry**

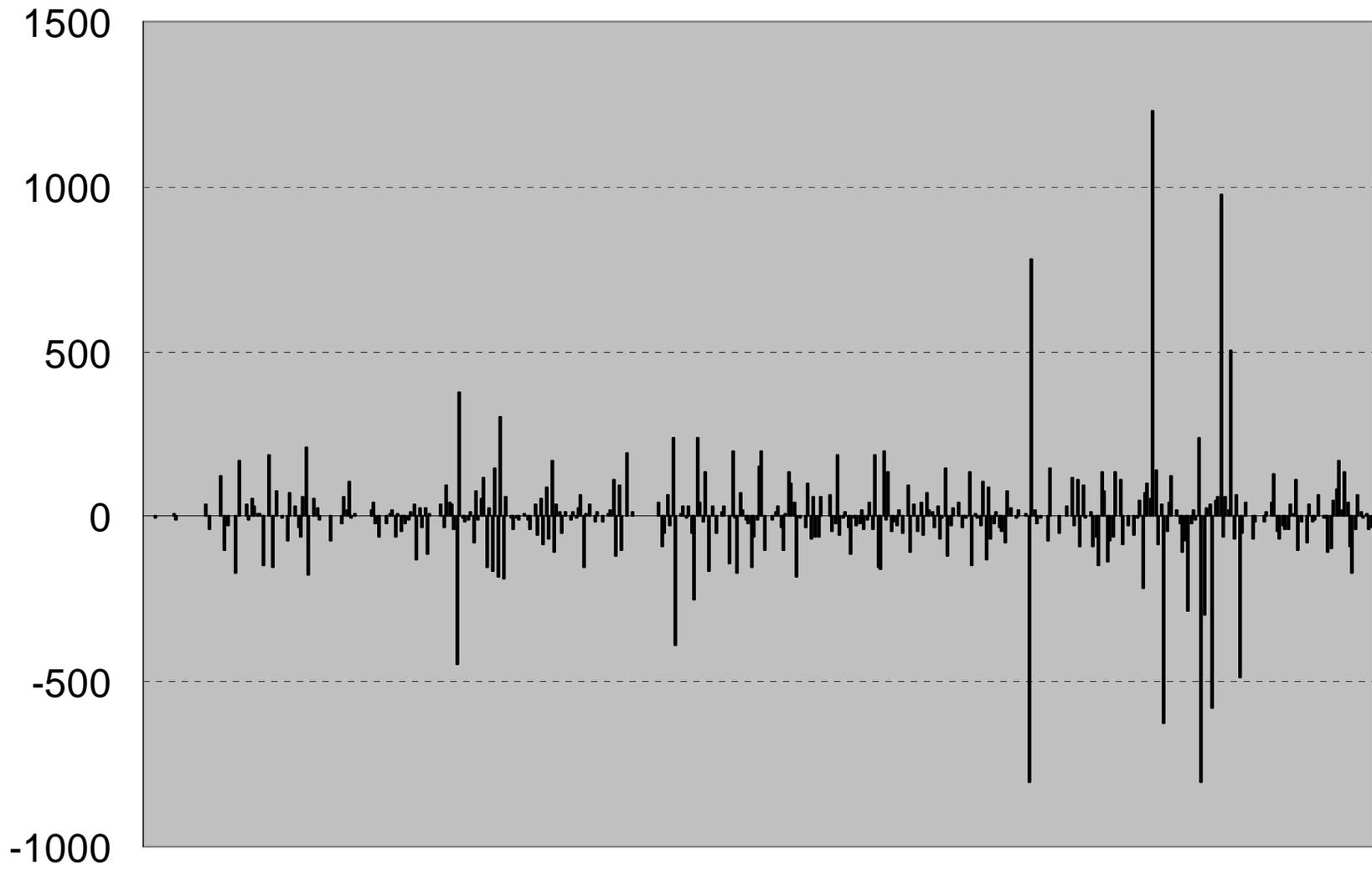
- NCI/SEER registry since 1973
- Statewide, population-based
- Approx 92,000 records for 1988 – 2002 study period
 - All invasive cancers (excl. non-melanoma skin)
 - Non-invasive bladder & breast cancer
 - Benign brain tumors (1996-)

- **US Census Bureau**

- Age, gender, racial/ethnic specific counts
 - 1990 Census (385 census tracts)
 - 2000 Census (445 census tracts)



**Difference between Geolytics and BBER 1990
Total Population into 2000 Census Tracts (N=456)**



2000 Census Tracts

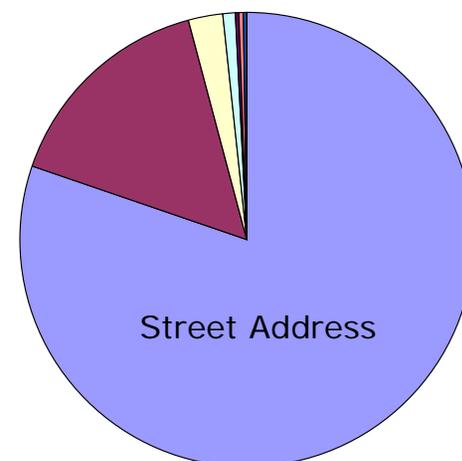
Health Effects Data

- **Significant geographic variability exists among New Mexico cancer registry records in regards to quality of geospatial patient information.**
- **The quality of geospatial information in health record datasets will influence the level of data linkage and analysis available for environmental public health tracking in New Mexico.**

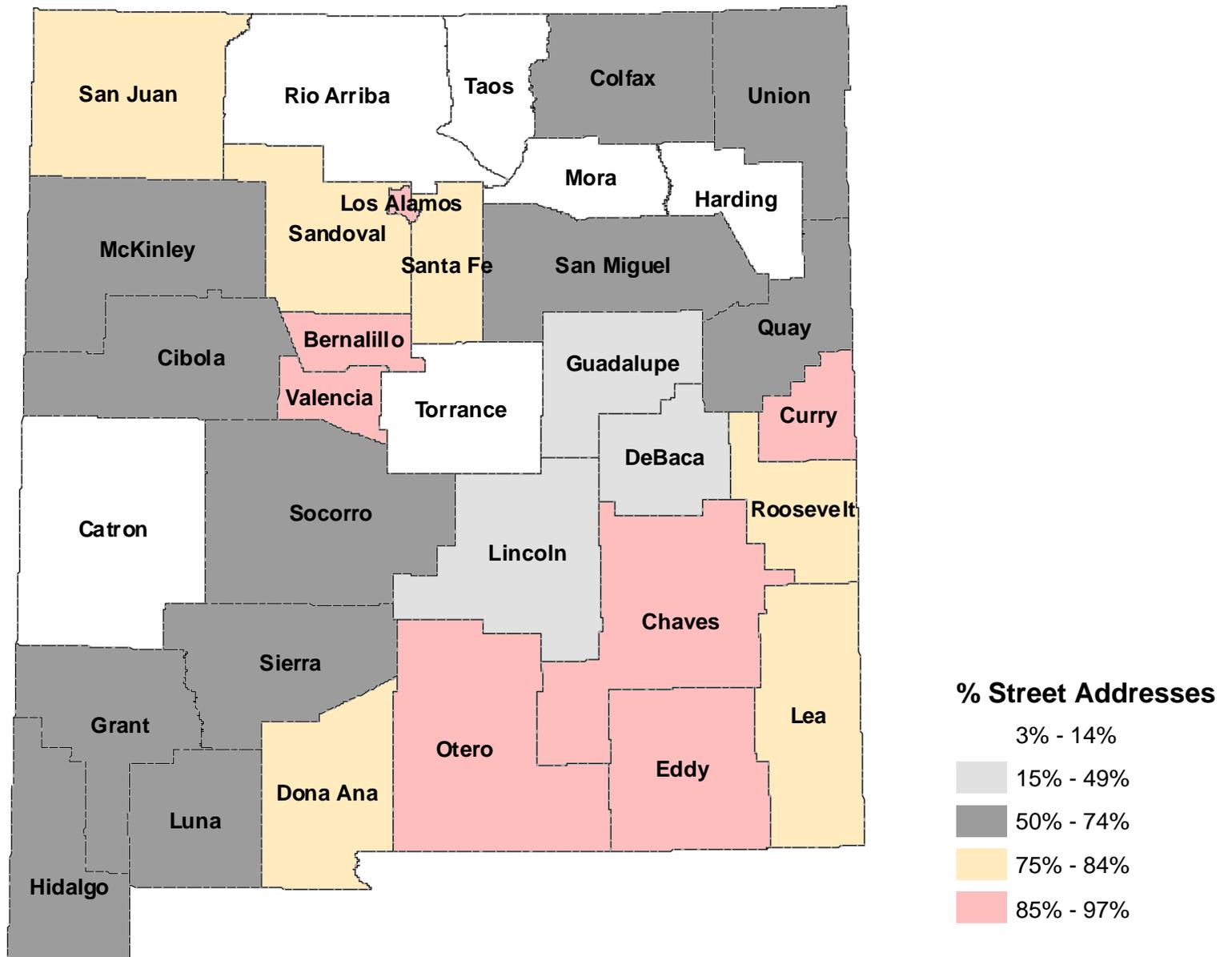


Distribution of Address Types in 1988-2001 NM State Cancer Registry Records (excluding American Indians)

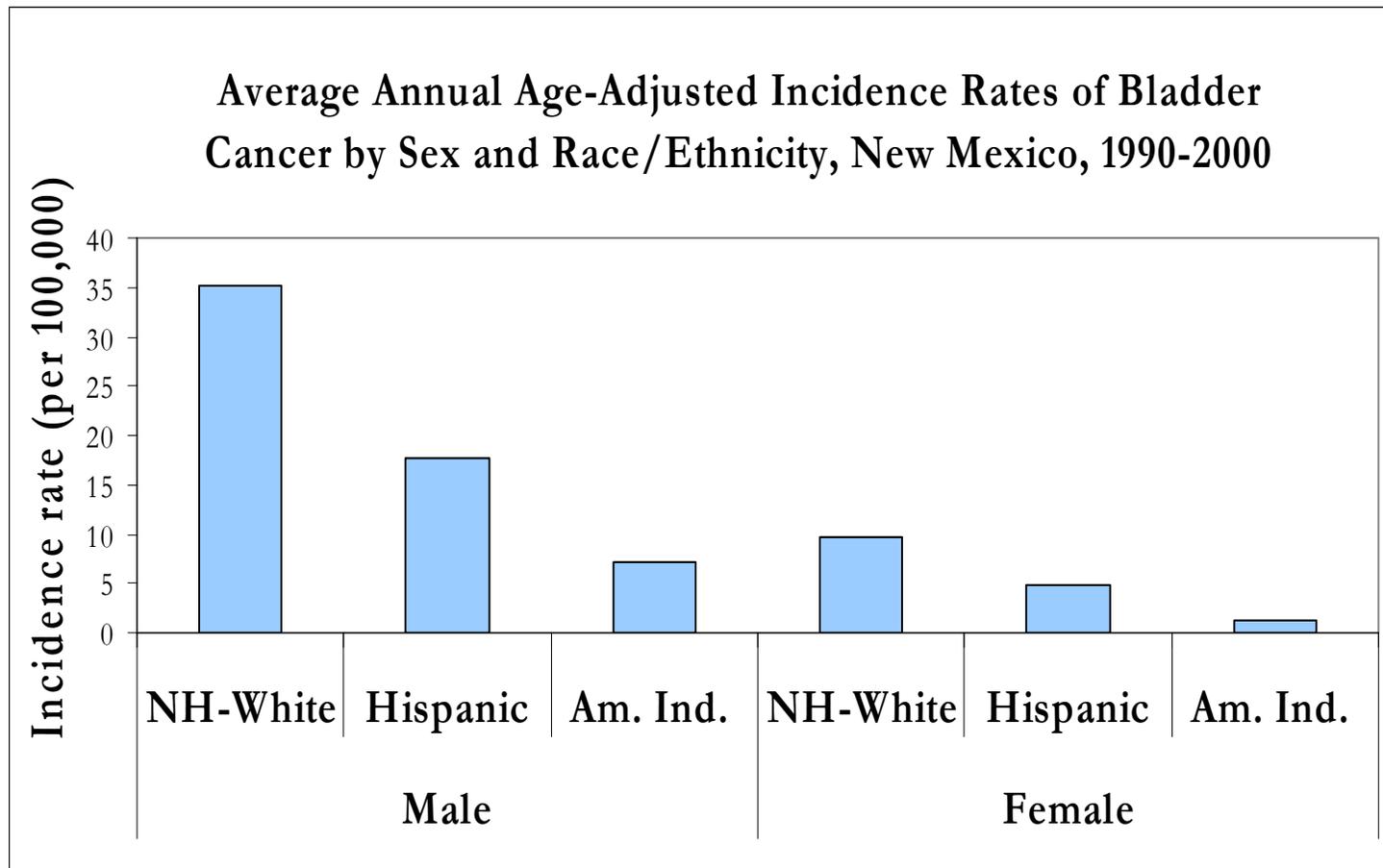
ADDRESS TYPE	NUMBER	%
Street Address	68517	80.3
Post Office (PO) Box	13343	15.6
Rural Route	2150	2.5
Highway Contract Route	670	0.8
Facility Name	281	0.3
General Delivery	212	0.2
City/Zipcode only	183	0.2
General Location	13	<0.1
TOTAL	85369	100.0



Percent (%) Street Addresses in 1988-2001 New Mexico State Cancer Registry Records (Excludes American Indians)



Cancer Demographics



Biomonitoring Consortium Studies Arsenic in Drinking Water Supplies

- ★ Relatively high levels of arsenic in groundwater throughout the Rocky Mountain region
- ★ Additional arsenic in urine studies of the general population will help validate assumptions for Tracking exposure assessment
- ★ Archived urine samples for Type 2 Diabetes to be analyzed for arsenic
- ★ Utilization of GIS mapping of water systems, biomonitoring results, and health effects

Current Findings

- ★ Drinking water compliance databases provide a useful source of environmental exposure data for linking with health effects databases
- ★ Database enhancement is necessary to meaningfully correlate exposure concentrations and exposed populations, and health effects databases
- ★ GIS is an appropriate platform to conduct the linkage
- ★ Exposure verification with biomonitoring is an important component of the study

