

# Characterizing Health Risks in Privately-Supplied Drinking Water Due to Agricultural Practices in Rural Western Kentucky, Leading to an Intervention Study

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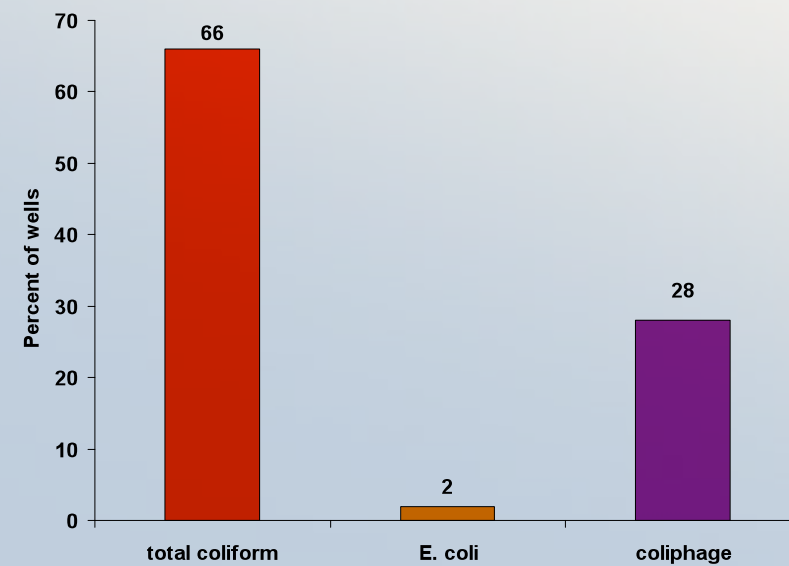
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## Abstract

Within Kentucky, limited data are available on the levels of domestic groundwater contamination from nitrate-N, herbicides, and bacteria, and the potential health effects from consumption of untested water supplies is an active area of research. We are currently undertaking a cross-sectional study to characterize the domestic drinking water supplies from groundwater sources with respect to current levels of nitrates, herbicides (e.g. atrazine, simazine, etc.), and bacteria (*E.coli*) among residents in the 8-county area of the Jackson Purchase region. 554 households have been sampled from the listing of residences on domestic well water supplies provided by the Kentucky Geologic Survey and are being contacted for participation in the study. Samples from tap water supplies are being obtained and analyzed for the contaminants of concern. A questionnaire which obtains information on demographic characteristics, drinking water usage patterns, specific health outcomes, and covariates associated with the health conditions is being administered to household residents. Statistical analysis of data will use regression methods for examining the association between levels of water contaminants and health outcomes, while controlling for necessary covariates. The series of health outcomes potentially associated with nitrate exposure and herbicides will include adverse birth outcomes (low-birth weight, congenital malformation, neural tube defects, spontaneous abortions, stillbirths, premature birth, or intrauterine growth retardation) and site-specific cancers (Non-Hodgkin's lymphoma and bladder, ovarian, stomach, breast, and liver cancer. Gastroenteritis will be examined as an adverse health outcome related to bacteria (*E.coli*) contamination. This collaborative project between the University of Kentucky College of Public Health and the Kentucky Geological Survey will establish a cohort of persons who receive their drinking water from groundwater sources, which can be used to further study health outcomes related to contaminants in well water sources.

## Aims and Methods

- Aims: (1) Characterize groundwater quality in the Jackson Purchase Region, demonstrating that land use, well construction type, and local hydrogeology are directly related to local groundwater quality. (2) Characterize the health status of a cohort of Kentucky residents, via a survey designed to elucidate known health effects. (3) Combine the water quality dataset and the health effects dataset and analyze the data for trends.
- Groundwater-quality data were collected between 1998 and 2008. Well water samples were tested for total coliform, *E. coli*, nitrate-N (Figure 2) and herbicides (Figure 3).

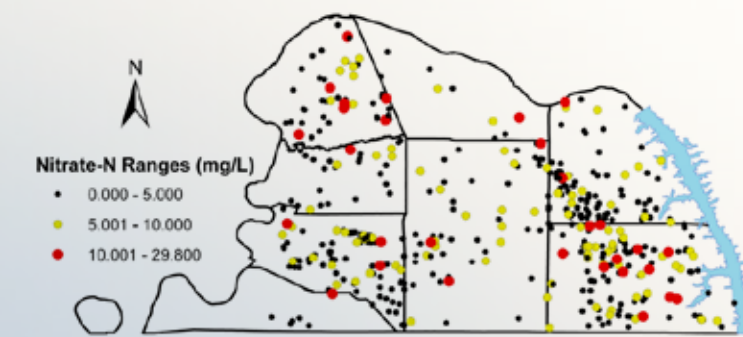


**Figure 1. Recent bacteria results**

Percentage of well water samples tested in 2008 showing positive results for total coliform, *E.coli*, and coliphage. N=50. All samples shown are from Hickman County. Total coliform results are consistent with samples from the rest of the region. These samples were analyzed by Chris Shidel.

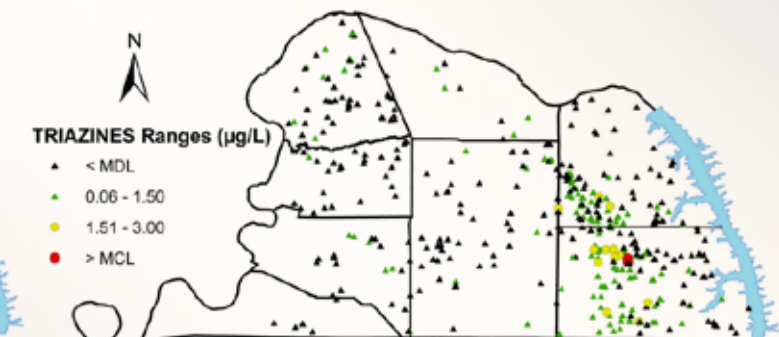
## Introduction

- The Jackson Purchase Region of Kentucky has a total population of 193,495.
  - 58% of the population lives in rural areas.
  - 41% of the total acreage is used for crop cultivation.
  - 70% of the total population in the region relies on groundwater.
  - 22% of the rural population relies on private domestic water wells for their household water.
- Many domestic wells are at risk for contamination with surface contaminants including nitrate-N, herbicides and bacteria, each of which are known causes of adverse health outcomes.
- Potential sources of groundwater contamination in the region are chemicals associated with row crops, animal feedlots (active and abandoned), and septic tanks.



**Figure 2**

Distribution of nitrate-N levels in 546 domestic water wells in the Jackson Purchase Region, Kentucky, tested between 1998 and 2008. (Beck and others, 2005)



**Figure 3**

Distribution of triazine levels in 463 domestic water wells in the Jackson Purchase Region, Kentucky, tested between 1998 and 2008. (Beck and others, 2005)

## References

- Beck EG, Dinger J, McMeans M, Thom W, Henken K. Status Report: Bacteria and Other Contaminants in Domestic Water Wells in the Jackson Purchase Region, University of Kentucky Cooperative Extension Service, Environmental and Natural Resources Issues Report ENRI-221 2005