Radon testing and risk characterization in the era of precision public health

Judy Y. Ou PhD MPH[1], Joemy M. Ramsay PhD MS[1], Greg Lee[1], James A. VanDerslice PHD[1,2], Marissa Taddie PhD[1,2], Anne C. Kirchhoff PhD MPH[1,3], Deanna Kepka PhD[1,4], Heidi A. Hanson PhD[5,6]

[1]Cancer Control and Population Sciences, Huntsman Cancer Institute, Salt Lake City, Utah
[2]Division of Preventive Medicine, University of Utah, Salt Lake City, Utah
[3]Department of Pediatrics, University of Utah, Salt Lake City, Utah
[4]College of Nursing, University of Utah, 10 S 2000 E, Salt Lake City, UT
[5]Department of Surgery and Population Health Sciences, University of Utah
[6]Computer Sciences and Engineering Division, Oak Ridge National Laboratory, Oak Ridge, TN

Introduction

Currently, there are no reliable estimates of radon exposure at scales smaller than the county and data from urban monitoring stations may not capture radon emissions in rural areas. Radon emission soil potential maps are available nationally and can be linked to residential data. We determined the association between residential radon tests and high radon emission potential soil (HREPS) at the residential and block group levels using a large Utah-based dataset. We also identified characteristics of block groups with limited tests in the dataset.

Methods

We geocoded a dataset of residential radon tests obtained from 2001 to 2017 by a statewide educational program. We linked each location to a radon soil emission potential map, the Environmental Protection Agency's (EPA) county classification system. We also calculated the number of tests conducted in each block group and linked block groups to demographic data from the 2020 United States census.

Log-linear and logistic models identified the association between residential home test results and 1) high radon soil potential of the residence, 2) percent of residences on high radon emission soils in block groups, and 3) EPA's county classification. We compared demographic characteristics among block groups with ≥5 or <5 residential tests in our dataset.

Results

Approximately 42% of homes in the dataset had a maximum test of ≥4 pCi/L. In the linear and logistic models, we found significant positive correlations for residential radon test results with 1) residential location on HREPS and 2) block groups with >0% of residences on HREPS. EPA county classification had no correlation with residential test results in either model. Block groups with <5 homes tests had higher than median percentages of Hispanic (OR=2.46, 95% CI=1.89-3.21) and Native American residents (OR=2.90, 95% CI=2.25-3.75). A greater percent of rural block groups and block groups with 1-24% of residences on HREPS had <5 residences in the dataset than their comparison groups.

Discussion

High radon soil emission potential is a significant predictor of residential home radon tests at the block group level. More efforts are needed to improve radon testing in block groups that are rural, have 1-24% of homes on HREPS, and greater percentages of racial minorities.