WASHINGTON TRACKING NETWORK: VALIDATING LEAD AND RADON RISK EXPOSURE MAPS
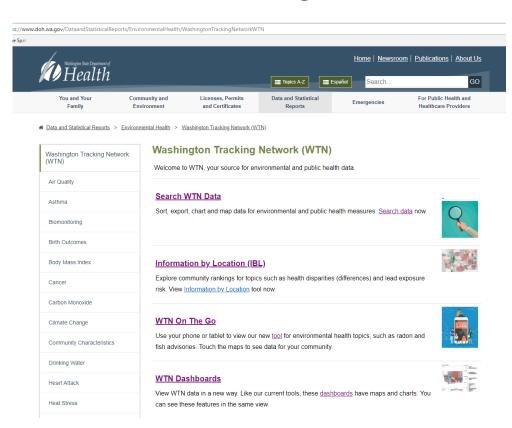
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Environmental Epidemiology Section

Background

Washington Tracking Network

- Suite of tools that display environmental and public health data using tables, charts, and maps

- Includes interactive maps describing risk of potential environmental exposures
  - Lead risk exposure
  - Radon risk geology

Lead

What is lead?

- Naturally occurring metal element

- Can be found in the air, soil, water, and inside our homes.

How can I be exposed?

- Lead-based paint and lead-contaminated dust are the main sources of lead poisoning.

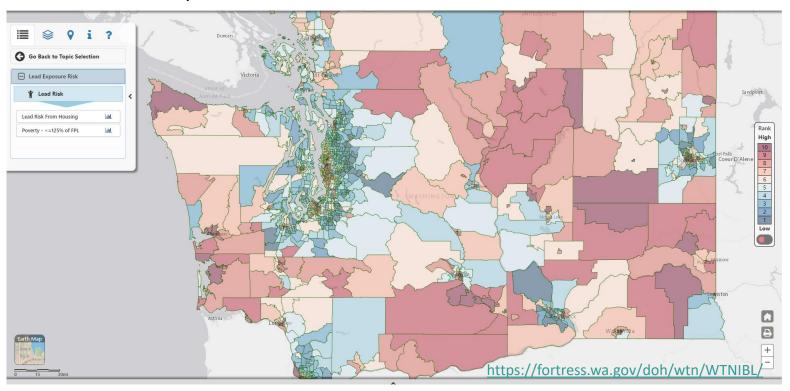- Houses built before 1978 are likely to contain lead-based paint.

What are the health effects?

- Lead can affect almost every organ and system in your body.

- Children six years old and younger are the most susceptible to the effects of lead, and very low levels can affect IQ.

- The only way to know if a child has been exposed to lead is to perform a blood lead level test

Lead Exposure Risk Map

Information By Location (IBL) Tool

- Information for parents and providers on targeting testing and preventing childhood lead exposure

https://fortress.wa.gov/doh/wtn/WTNIBL/

- Combines American Community Survey (ACS) data on households living below 125% poverty level & age of housing

Radon

What is radon?

- Naturally occurring radio-active gas

- Created by the radioactive decay of uranium

- Radon is everywhere (rocks, soil, water, and the air we breathe)

How can I be exposed?

- Indoor air radon concentrations at home are the main source of exposure

- Risk of exposure is higher in areas with more radon in the soil

What are the health effects?

- Leading cause of lung cancer among non-smokers

- Second leading cause of lung cancer overall

- The only way to determine your potential exposure is to test

Radon Risk Geology Map

WTN On The Go Tool

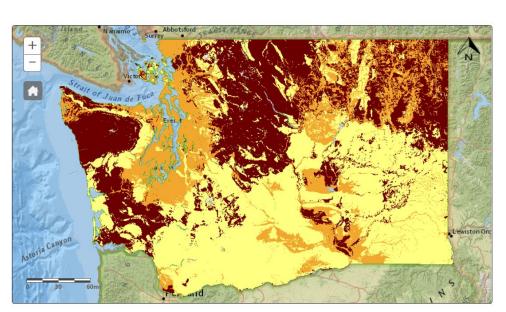Information on radon testing and radon risk geology optimized for mobile device users.

The radon topic displays:

- Radon tests above EPA's action level of 4.0 pCi/L

- Radon risk geology categories (low, medium, high)

Radon Risk Geology Map and Indoor Air Radon Test Results

WSDNR Radon Hazard Map

- Used USGS standards to categorize ~57,000 uniquely identifiable rock and soil areas into 5 radon hazard categories based on their likelihood of producing radon gas.
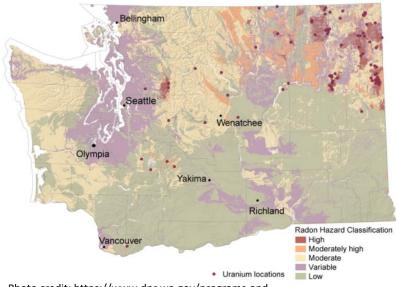

Photo credit: https://www.dnr.wa.gov/programs-and-services/geology/geologic-hazards/hazardous-minerals#uranium-and-radon

WTN Radon Risk Map

- **High:** Areas known to contain uranium

- **Medium:** Areas where the surface geology or rock *may* contain uranium from glacial or other events

- **Low:** Areas unlikely to contain uranium

Objectives

The variables and methods used to design both mapping tools are based on scientific literature, but do not incorporate blood lead or indoor radon test results.
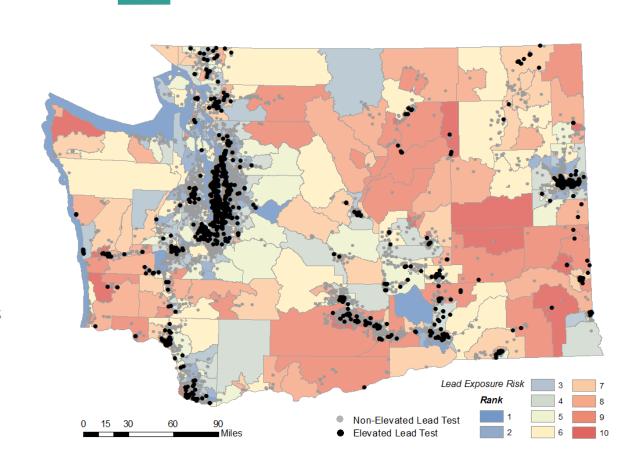
1. How do the risk ranks on the lead exposure risk map compare to child blood lead test results from the Washington lead registry?

2. How do the high, medium, and low risk categories on the radon risk geology map compare to indoor radon test results?

Validating WTN Risk of Exposure Maps

LEAD

Lead exposure risk map and childhood blood lead results

Methods

1. Lead registry data
   - Tests from 2011 – 2015 to match ACS poverty data

     AND
   - Tests that had a patient address with an accurate match in geocoding (33,028 tests)
     - This likely introduces bias, as elevated tests are more likely to have patient address information

Lead Exposure Risk
Rank
- 1
- 2
- 3
- 4
- 5
- 6
- 7
- 8
- 9
- 10

● Non-Elevated Lead Test
● Elevated Lead Test

0 15 30 60 90 Miles

Lead exposure risk map and childhood blood lead results

Methods

2. Extract rank (1-10) from lead WTN risk map associated with patient address for each test

3. Summarize number of elevated and non-elevated tests in each rank (1-10)

Lead exposure risk map and childhood blood lead results

Methods

4. Test for correlation between increasing risk ranks and the percentage of elevated tests

   - Spearman rank correlation coefficient between rank number and % elevated tests in each rank
     - Rho = 0.83
     - P-value = 0.005

5. Calculate odds ratios for the relationship between elevated lead test results and risk rank categories

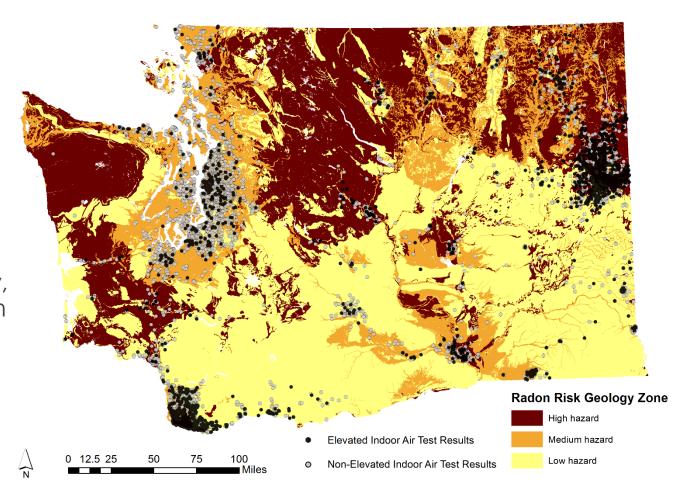| Risk Rank	Odds Ratio	P-Value
2	**0.52**	**0.00**
3	1.10	0.54
4	0.84	0.29
5	1.12	0.46
6	1.20	0.23
7	1.14	0.37
8	**1.82**	**0.00**
9	1.14	0.36
10	**1.77**	**0.00**

Results

- Higher census tract ranks on the lead risk map are significantly correlated with a higher percentage of elevated lead test results

- The odds of having an elevated test are only significantly increased in risk ranks 8 and 10 (compared to risk rank 1)
  - We do not know the source of elevated results and elevated results in high risk census tracts are not necessarily associated with poverty and age of housing

- This exploratory analysis suggests that our lead risk map could be capturing increased risk of elevated lead levels

- It also suggests that there could be other factors at play, and 10 bins might not be the most meaningful way to categorize risk

- **Next steps:** consider census tract population and lead testing coverage

Validating WTN Risk of Exposure Maps

RADON

Radon Risk Geology Map and Indoor Air Radon Test Results

Methods

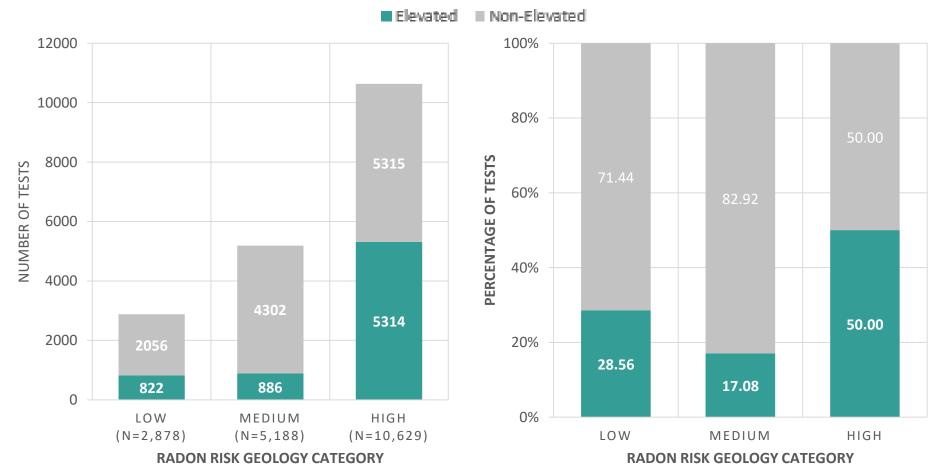1. Limit indoor air radon test results (1989-2015) to include only accurately geocoded test results (n=18,695).

2. Extract radon risk geology value (low, medium, high) from the WTN radon risk geology map for each test result.

Radon Risk Geology Zone
- High hazard
- Medium hazard
- Low hazard

- ● Elevated Indoor Air Test Results
- ○ Non-Elevated Indoor Air Test Results

0 12.5 25   50   75   100
Miles

N

Radon Risk Geology Map and Indoor Air Radon Test Results

Methods

3. Summarize number of elevated and non-elevated tests in each radon risk geology category.

Radon Risk Geology Map and Indoor Air Radon Test Results

Methods

4. Calculate odds ratios for the relationship between elevated tests and increasing radon risk geology categories using logistic regression.

Radon Risk Geology Map and Indoor Air Radon Test Results

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Results

- The odds of having an elevated radon test result significantly increase in a high radon risk geology area when compared to the low risk geology category.

Radon Risk Geology	Odds Ratio	p-value
Medium Risk	0.515	0.00
High Risk	2.501	0.00

- Results of this exploratory analysis suggest that our radon risk geology map could be capturing the increased risk of radon exposure in our high radon risk geology category.

Radon Risk Geology Map and Indoor Air Radon Test Results

Methods

4. Calculate odds ratios for the relationship between elevated tests and increasing radon risk geology categories using logistic regression.

Results

- The odds of having an elevated radon test result significantly increase in a high radon risk geology area when compared to the low risk geology category.

Radon Risk Geology	Odds Ratio	p-value
Medium Risk	0.515	0.00
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- Results of this exploratory analysis suggest that our radon risk geology map could be capturing the increased risk of radon exposure in our high radon risk geology category.

Next Steps

- Consider additional variables related to housing, testing, and environmental characteristics.

Validating WTN Risk of Exposure Maps

SUMMARY AND CONCLUSIONS

Summary and Conclusions

- The results of these exploratory analyses show that our WTN lead and radon risk exposure maps may be capturing the increased risk of exposure to these environmental hazards.

- Room for enhancing exposure maps with the consideration of additional variables.

- Importance of incorporating site-specific data to develop and validate these important environmental health tools

Questions?

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Health