Spatiotemporal Estimation of Radon Exposure for Epidemiologic Risk Assessment, Regional Case Study

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Radon is a naturally occurring radioactive gas and is an intermediate product of the decay of uranium. Exposure to radon is the second leading cause of lung cancer in the United States and is hypothesized to cause strokes and other cardiovascular events. Additionally, radon levels seem to be rising across North America and may be linked to climate change. In the early 1990's, the US EPA created a map of three distinct radon zones, classified according to indoor radon measurements (pCi/L) from the State Residential Radon Survey, aerial radioactivity (ppm eU), geology, soil permeability and architecture type. The goal of this analysis is to create a refined spatial model for the geographic distribution of radon using a technique from spatial statistics known as kriging on indoor radon measurement data. Then, we venture to incorporate other data sources into the analysis, such as geologic radon potential and radon index, both computed in the original EPA study. From the indoor radon measurement analysis, a model was created for Tennessee with a mean absolute error of 1.8 pCi/L using spatial blocking cross-validation. From the indoor radon measurement and GRP integrated analysis, a model was created for Tennessee that shows signs of improved performance, particularly in its ability to estimate extreme values of radon exposure. Notably, the incorporation of an additional data source seems to have increased the accuracy of the kriging analysis and given us a more refined predictive measure of radon exposure. Future work on this project should include the radon index data to allow for a more granular classification of the EPA metric described above. Additionally, it should explore the temporal component of radon exposure using more recent data sources, possibly funding some form of repeated survey analogous to the original SRRS study.