Geospatial Human Health Exposure Science Connections to Toxicology

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Overview

Geospatial models represent valuable tools with expanding applications within the population-based human health risk assessment framework. The aim of this presentation is to open the discussion on how scientists can use recent advancements in geospatial modeling to effectively bridge gaps between disease outcomes obtained through epidemiological studies, and disease mechanisms obtained through toxicological studies, to better inform risk assessments. Two examples will be highlighted to cover issues of uncertainty quantification in exposure assessments, applications of geospatial methods in pharmacokinetic modeling, and translation of internal tissue dosimetry models and toxicological endpoints.

In the first example, an epidemiological analysis of groundwater radon and stomach cancer was performed[1], which was understudied despite plausible target organ doses demonstrated with pharmacokinetic studies. We expand upon this by showing how the geospatial methods used in the exposure assessment and dose-response characterization also have applications in the pharmacokinetic studies. In the second example, we perform an epidemiological analysis of traffic related air pollutants and cardiovascular disease in Oakland, California, with the exposure assessment based on high spatial-resolution estimates measured with Google Street View cars[2]. Air quality and human health outcome studies such as this can connect human external exposure to internal exposure estimated with NTP mechanistic studies by using dosimetry models to make comparable units[3], which will help interpretations and dissemination to the public. Together, the integration of geospatial statistical modeling into toxicological studies serves a novel utility towards improving the characterization of relationships between chemical exposures, disease outcomes, and ultimately the translation for public dissemination.

References

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