SPATIAL ANALYSIS OF DRINKING GROUNDWATER AND BLADDER CANCER RISK IN SOUTHWESTERN TAIWAN: APPLICATION OF GENERALIZED ADDITIVE MODELS TO CASE-CONTROL DATA

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Background and Aims: According to a governmental survey, more than half a million residents in Taiwan had drank water containing arsenic levels higher than 0.05 ppm, and therefore health effects of arsenic in drinking water are important public health issues especially in southwestern Taiwan. We conducted a study to evaluate the association between arsenic exposure in groundwater and bladder cancer risk geographically in southwestern Taiwan with application of generalized additive models to case-control data.

Methods: We conducted a hospital-based case-control study and recruited participants through two teaching hospitals in southwestern Taiwan. We interviewed the participants using a standard questionnaire to collect data on demographic characteristics, smoking habits, drinking water history, and potential confounders. Arsenic levels were assessed using the data from a governmental nationwide census survey of wells. We applied generalized additive models (GAMs), statistical models that combine smoothing Kriging with the ability to analyze binary outcome data and adjust for covariates, to analyze the data. We converted outcome data from log odds to adjusted odds ratios (ORs) and then located participants' residences and continuous ORs into WGS84 map using the GSLIB to identify the "hot spot."

Results: A total of 78 bladder cancer patients and 201 controls without any cancers participated in the study. We found that old age, male gender, low educational level, and cigarette smoking were associated with the risk of bladder cancer. In addition, we found that drinking groundwater over 15 years (as a latency period) and a history of drinking water with high arsenic concentration were also risk factors of bladder cancer. We also observed a high correlation between "hot spots" of bladder cancer and high arsenic levels in drinking water exposure.

Conclusions: Our results observed the association between arsenic exposure and bladder cancer and demonstrated the application of the GAM to analyzing data at an individual level.

References:

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