Geophysical Research Abstracts
Vol. 17, EGU2015-5692, 2015
EGU General Assembly 2015

Spatial vulnerability of fine particulate matter relative to the geographic disparities of adult's diabetes prevalence in the United States

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Potentially larger regional effects of climate change have been revealed on the elevation of fine particulate matter ($\leq$ 2.5 μg in diameter; PM2.5) in the U.S. In addition, recent research supports a link between diabetes and PM2.5 in both laboratory and epidemiology studies. However, research investigating the potential relationship of the spatial vulnerability of diabetes to concomitant PM2.5 levels is still sparse, and the level of diabetes geographic disparities attributed to PM2.5 levels has yet to be evaluated. We conducted a Bayesian structured additive regression modeling approach to determine whether long-term exposure to PM2.5 is spatially associated with diabetes prevalence after adjusting for the socioeconomic status of county residents. This study utilizes the following data sources from 2004-2010: the Behavioral Risk Factor Surveillance System, the American Community Survey, and the Environmental Protection Agency. We also conducted spatial comparisons with low, median-low, median-high, and high levels of PM2.5 concentrations. When PM2.5 concentrations increased 1 μg/m3, the increase in the relative risk percentage for diabetes ranged from -5.47% (95% credible interval = -6.14, -4.77) to 2.34% (95% CI = 2.01, 2.70), where 1,323 of 3,109 counties (42.55%) displayed diabetes vulnerability with significantly positive relative risk percentages. These vulnerable counties are more likely located in the Southeast, Central, and South Regions of the U.S. A similar spatial vulnerability pattern for concentrations of low PM2.5 levels was also present in these same three regions. A clear cluster of vulnerable counties at median-high PM2.5 level was found in Michigan. This study identifies the spatial vulnerability of diabetes prevalence associated with PM2.5, and thereby provides the evidence needed to prompt and establish enhanced surveillance that can monitor diabetes vulnerability in areas with low PM2.5 pollution.