Association between Ultrafine Particle Exposure and Type 2 Diabetes Mellitus

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According to the International Diabetes Federation, in 2019, approximately 463 million adults aged 20-79 years were affected by Type 2 Diabetes Mellitus (T2DM), with 374 million people living with an increased risk of developing T2DM. T2DM is a leading cause of cardiovascular disease which can often lead to fatal complications of coronary artery disease, high blood pressure, and elevated glucose levels as well as long-term complications of diabetic retinopathy, nephropathy, and neuropathy. Recent studies have demonstrated that ultrafine particles (UFP) can cross the pulmonary alveolar membrane and can have direct effects including systemic inflammation and autonomic dysfunction leading to metabolic disorders. Also, recent epidemiological studies have shown a relation between exposures to particulate matter and T2DM. However, the characterizing of the relationship between UFP exposure and T2DM in epidemiological studies is inconsistent, potentially due to ground-based monitors' inability to provide widespread UFP exposure measurements. Alternatively, a land-use regression model provides long-term, large-scale UFP exposure estimates that capture urban and rural variations. This land-use regression modeling framework estimates UFP as a particle number concentration (PNC). The PNC values are used to provide widespread UFP coverage for nearly 6 million residential census blocks in the contiguous United States. The yearly PNC geographic coordinates were matched with the county-level T2DM incidence data obtained from the Centers for Disease Control and Prevention for the subsequent year. We performed a linear regression to predict T2DM incidence subject to UFP exposure, with several controls including race, ethnicity, age, income, gender, and education level. With the results from this investigation, we hypothesize that we will attain a more thorough understanding of the validity of the relationship between UFP exposure and T2DM, and the limitations that the absence of widespread UFP measurements imposes on population exposure studies.