Uncertainties Treatment for Wastewater-Based Epidemiological Estimation of the Consumption of Illicit and Prescribed Neuropsychiatric Drugs in Two Urban Communities in Kentucky Using Ammonium Normalized Population and Monte Carlo Simulation

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The conventional estimation of the prevalence of substance use in a community based on self-reported surveys typically underestimates the actual consumption. Drug's residues in raw wastewater collected from the centralized wastewater treatment plants were utilized – *Wastewater-Based Epidemiology (WBE)* – to determine the consumption rate of illicit and prescribed neuropsychiatric residues in two urban communities in eastern Kentucky and two rural communities in western Kentucky. The ammonical nitrogen content in raw wastewater samples was used to minimize the uncertainty associated with the population dynamicity. Uncertainties associated with the several WBE parameters to back-calculate the consumption rate of drugs such as flow rate measurement, pharmacokinetic data, population, and stability of drug residues in wastewater were evaluated using Monte Carlo simulation. Communities investigated in eastern Kentucky had ~10-fold larger population and ~2-fold higher per-capita income than in western Kentucky. Cocaine was the dominant illicit drug consumed in the eastern communities (~3-fold higher than in western communities) while methamphetamine controls the consumption profile in the western communities (2 folds higher than in eastern communities). However, venlafaxine and citalopram were the two major prescribed neuropsychiatric drugs consumed in all communities. While the opioid epidemic has been declared as a national public health emergency in the USA, codeine and hydrocodone were the most consumed prescription opioids.