

**Spatiotemporal trends of estimated drug consumption in Nassau County, New York,
determined by wastewater-based epidemiology**

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Abstract

Access to near-real-time data on drug consumption is essential to evaluate communities' health and effectively manage the U.S. drug overdose crisis. Conventional health data collection methodologies are time-consuming and necessitate integration with expedited data acquisition techniques. Wastewater-based epidemiology (WBE) is a cost-effective emerging tool to monitor public health on a near-real-time scale, complementing health survey data. The objective of this study was to evaluate trends in the consumption of drugs in Nassau County of New York State, during the study period. Municipal wastewater composited over 24 hours ($n=420$) was collected over seven months (December 2024 -June 2025) from nine wastewater sampling locations across Nassau County. Samples were analysed for urinary biomarkers of drug consumption using isotope-dilution liquid chromatography-tandem mass spectrometry. There were 27 analytical targets related to opioids, opioid antagonists, and the stimulant class of drugs; all but two of the 27 were detected at least once in community wastewater samples. Urinary metabolites morphine-3-glucuronide and norbuprenorphine were not detected in any wastewater samples. Biomarkers of methamphetamine, cocaine, methadone, codeine, morphine, hydromorphone, oxycodone, and 3,4-Methylenedioxymethamphetamine (MDMA) consumption were detected in wastewater samples with 100% frequency across all nine sewer catchments. Cocaine consumption estimates were the highest in all study locations. Overall, the data trend suggested a weak-to-strong weekly drug consumption pattern. This study also explored correlations between wastewater-derived data and other indicators related to drug consumption outcomes. Study findings suggest that the WBE approach to estimating drug consumption across communities can provide rapid, actionable data complementing other key indicators, thereby potentially helping health authorities to take protective actions to save lives and limit economic losses.