Detection of substances commonly abused using wastewater at a college football game Published manuscript; Code

Questions: Among attendees at a college football game, can we use stadium wastewater samples to detect substances commonly abused and/or their metabolites? Can we estimate the number of doses?

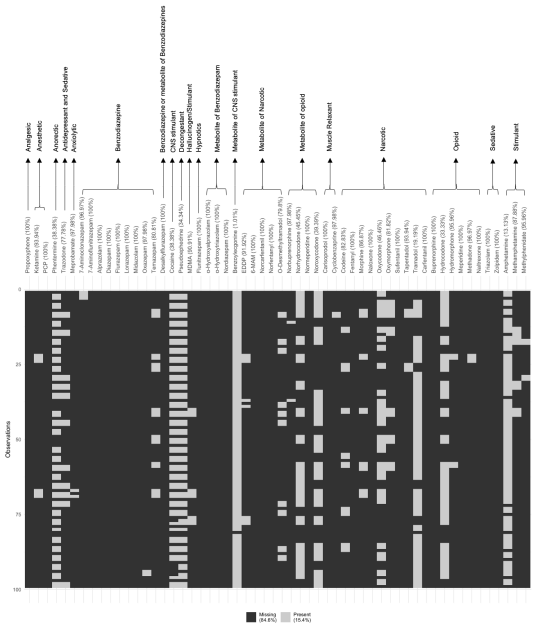
Target population: Attendees of University of Kentucky vs. University of Florida football game in 2018 at Ben Hill Griffin Stadium (80,651 attendees)

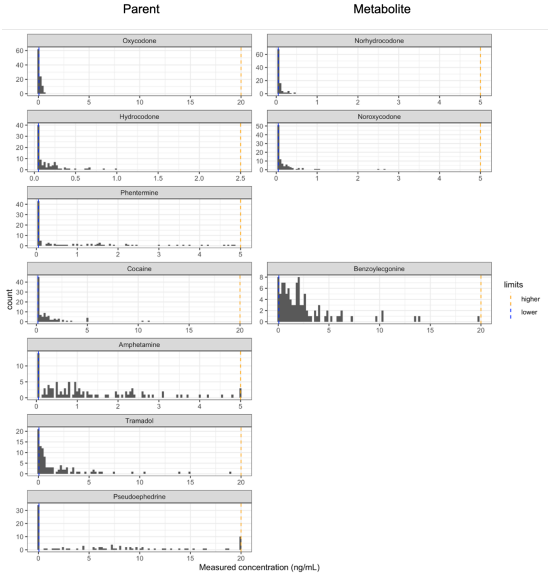
Sampling strategy: Collect samples from each of the 3 wastewater lines at 30 minute intervals during the game

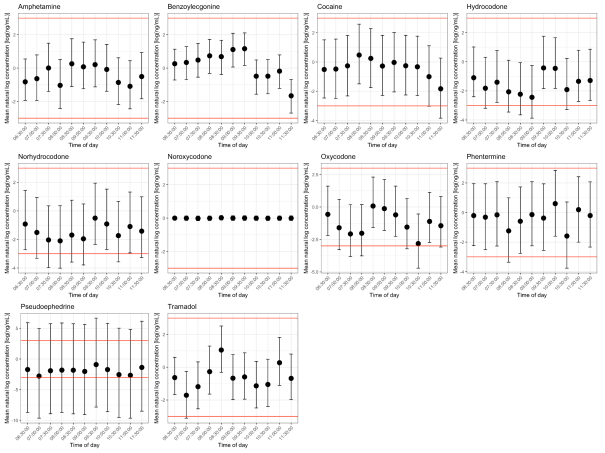
Data analysis strategy: Exploratory data analysis, then fit Bayesian multilevel models for each of 10 substances that was detectable in >= 50% of the samples.

Modeled the natural logarithm of concentration with a Gaussian distribution, where the mean depended upon time of sampling (fixed effect), as well as the random effects of location (3 locations), extraction (2 different students), and machine (2 different MS machines used).

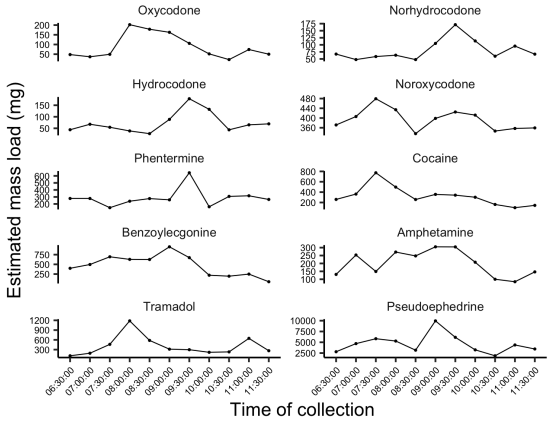
Model fit was checked using posterior predictive checks (i.e., does the model simulate observations that look like the original dataset).







Median estimated mass load (mg) for each substance through system over previous 30 minutes



Y axes are different scales in order to accomodate the orders of magnitude differences in concentrations among some substances.