**TRAJECTORIES OF NEIGHBORHOOD-LEVEL OVERDOSE RISK PREDICTIONS FOR PRIORITIZATION OF HARM REDUCTION SERVICES: RESULTS FROM THE PROVIDENT STUDY**

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**Background:**
Across the United States, neighborhood-level overdose risk may vary over time. In Rhode Island, we developed and validated a machine learning model to identify the top 20 percent of census block groups (CBGs) at highest predicted risk of overdose death. We updated this model periodically between November 2021 and August 2024 to generate six sets of predictions. This study aims to characterize the trajectory of each CBG's predicted overdose risk across these six periods.

**Methods:**
In each prediction period, CBGs were or were not designated as "high risk" based on our model's 20 percent predicted overdose risk threshold. We implemented sequence analysis to describe unique trajectories in each CBG's risk designation over time. We calculated optimal matching distances to estimate dissimilarity between each pair of trajectories and applied agglomerative hierarchical clustering to group similar trajectories. We then described each trajectory group's demographic and socioeconomic conditions using 5-year estimates from the 2020 American Community Survey.

**Results:**
The 809 CBGs followed 60 unique trajectories in predicted overdose risk designation over the six prediction periods. Clustering of trajectories favored a solution with five trajectory groups. Most CBGs (73.4%) were rarely or never designated as "high risk", 7.9% of CBGs were always designated as "high risk", and the remaining 18.7% were designated as "high risk" in multiple prediction periods, represented by three trajectory groups with different patterning over time. The trajectory groups largely followed a racialized socioeconomic gradient, with CBGs in groups defined by more consistent designation as "high risk" having fewer white residents and poorer socioeconomic circumstances than those defined by less consistent designation as "high risk".

**Conclusion:**
Given the substantial variability in which CBGs were at highest forecasted overdose risk over time, dynamic machine learning predictions may inform harm reduction resource allocation by identifying neighborhoods with emerging needs.

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