

Spatial Analysis of Alcohol Outlets and Drug Overdose in Baltimore Neighborhoods

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Introduction

- There are significant disparities in drug overdose rates across urban neighborhoods.¹ Alcohol outlets may be one neighborhood feature that contributes to neighborhood disparities for drug overdose.
- More alcohol outlets are generally found in economically depressed, predominantly-minority neighborhoods, exacerbating health disparities in these communities.²
- Areas in close proximity to alcohol outlets may present as opportune locations for illicit drug sales as alcohol outlets are often located in communities with low social capital and collective efficacy.³
- Alcohol outlets licensed to sell alcohol for off-premise consumption are more strongly associated with drinking problems, violence, crime including drug arrests compared to outlets licensed for on-premise consumption only.⁴
- Few studies have looked at the associations between alcohol outlets and drug overdose. There is some evidence that alcohol outlet density is related to increased drug use; proximity to alcohol outlets is associated with past year marijuana use in youth.⁵
- AIM:** To investigate the impact of alcohol outlets on the neighborhood drug overdose rate; to evaluate possible changes in this relationship over time from 2013 to 2017.

Methods

Measures

- Drug overdose data: EMS records, in 2013 (n=2,330) and 2017 (n=8,454), aggregated to census block group (n=693). An EMS run was considered a drug overdose if the primary or secondary impression was listed as “substance/drug abuse” or “withdrawal/overdose drugs.”
- Alcohol outlet locations: Board of Liquor License Commissioners for Baltimore City, 2014. Off-premise (n=726); On-premise (n=531)
- Neighborhood Disadvantage score⁶: Using the formula $\{[(c/10+d/10)-(a/10+b/10)]/4\}$ with 5-year Census percentages for: (a) adults ≥ 25 years with a college degree, (b) owner-occupied housing, (c) households with incomes below the federal poverty threshold, (d) female-headed households with children; range=[-5 is very low/little disadvantage, +5 is very severe disadvantage].
- Percent of vacant lots—Baltimore City Housing Authority, 2015. Divided number of vacant lots by the total number of land parcels to calculate the percent of vacant lots in each block group.
- Demographic variables by census block group.

Analysis

- Alcohol outlet and overdose locations geocoded, mapped, and aggregated to census block group in ArcGIS 10.4.
- Negative Binomial regression in R 3.3, analyzed counts of overdoses per census block group for each year.
- Calculated model with all alcohol outlets (**all alcohol models**), then stratified by alcohol outlet type (**outlet type models**) for each year.
- Spatial autocorrelation assessed, regression inference adjusted accordingly.
- Control variables: median household income, neighborhood deprivation, vacant housing, population density.

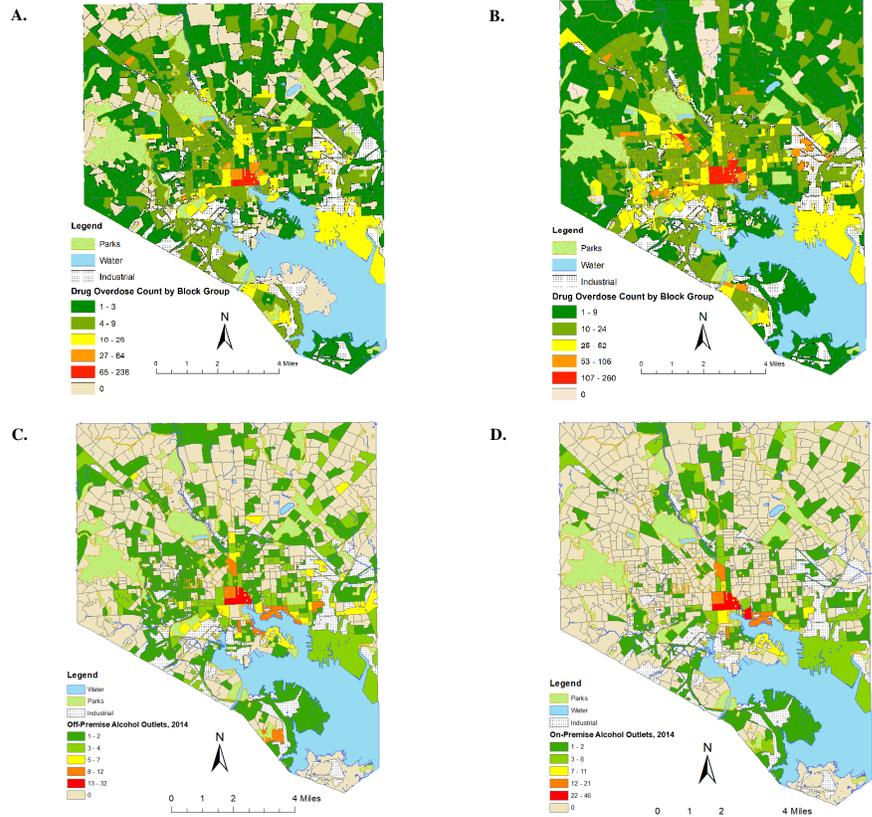
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Results

Distribution of Drug Overdoses and Alcohol Outlets by Census Block Group

Maps of drug overdoses in (A) 2013 (n=2,330) and (B) 2017 (n=8,454); (C) off-premise alcohol outlets (n=726) and (D) on-premise alcohol outlets (n=530) in 2014, by Baltimore City census block group



Rate of Drug Overdose by Census Block Group, Baltimore City, 2013 and 2017

Variable	2013 Adjusted*	2013 Adjusted*	2017 Adjusted*	2017 Adjusted*
	All Alcohol IRR (95% CI)	Outlet Type IRR (95% CI)	All Alcohol IRR (95% CI)	Outlet Type IRR (95% CI)
All alcohol outlets	1.07 (1.06, 1.10)		1.09 (1.07, 1.11)	
Off-premise alcohol outlets		1.11 (1.05, 1.18)		1.20 (1.15, 1.26)
On-premise alcohol outlets		1.05 (1.01, 1.09)		1.02 (0.98, 1.05)
Vacant lot %	1.40 (0.53, 3.75)	1.32 (0.50, 3.54)	4.91 (2.23, 10.99)	3.92 (1.81, 8.64)
Neighborhood disadvantage (-5 to +5)	1.21 (1.13, 1.30)	1.20 (1.12, 1.29)	1.23 (1.16, 1.30)	1.23 (1.16, 1.30)
Median household income (in \$10,000s)	0.96 (0.92, 1.01)	0.96 (0.92, 1.01)	0.93 (0.90, 0.96)	0.93 (0.90, 0.97)
Population density (per square mile in 10,000 residents)		--	1.09 (1.07, 1.11)	1.20 (1.15, 1.26)

Note: From negative binomial regression

*Adjusted for other covariates in the column

Discussion

- Each additional off-premise alcohol outlet was associated with an 11.4% increase in the neighborhood drug overdose rate in 2013; the strength of this association increased to 19.9% in 2017, adjusting for other neighborhood variables.
- On-premise alcohol outlets were marginally significant correlates of neighborhood drug overdose rate in 2013 but were not significantly associated with the drug overdose rate in 2017.
- Information on specific substances involved in overdose was not available; 31.5% (n=736) of 2013 overdoses and 44.5% (n=3,758) of 2017 overdoses received naloxone, indicating possible opioid-involved overdose.
- This study provides preliminary public health evidence for informing policy decisions about alcohol outlet licensing and zoning.
- Alcohol outlets could be potential community partners for harm reduction strategies such as naloxone distribution or health communication on drug purity or identifying overdose symptoms.

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