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Measuring Alcohol Outlet Density and its Associations with Alcohol-related Morbidity in New York City

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Alcohol outlet density is associated with many individual and neighborhood level negative health outcomes and social harms, such as injuries, violence, alcohol-related diseases and disorderly conduct. There is not one preferred method for measuring outlet density and different methods might influence observed associations. This report describes the methods and findings of measuring alcohol outlet density in New York City (NYC) in 2014.

Background

Alcohol outlet density is an environmental risk factor for excessive drinking.[1] It is also associated with many neighborhood-level stressors such as disorderly conduct, noise, public nuisances and property damage.[2] Excessive drinking is a risk factor for many acute and chronic health conditions.[3] The association between alcohol outlet density and health outcomes in NYC is not known. Measuring alcohol outlet density can help describe exposure to alcohol in communities.

Quantifying communities' exposure to alcohol—including understanding local relationships between alcohol outlet density and health outcomes—requires a measure of alcohol outlet density.

In 2017, the Centers for Disease Control and Prevention (CDC) published general guidelines for measuring alcohol outlet density.[1] The CDC recommends using one of three different approaches: container-based measures, distance-based measures and spatial access measures.

NYC is a unique environment in which to measure alcohol outlet density because of variations in the density of alcohol outlets and the population. NYC has both areas of very high alcohol outlet density and low alcohol outlet density. It also has areas with very high population density and areas where the population is much less concentrated. We considered each of the CDC's recommended approaches, and adapted them to account for NYC's unique spatial distribution of alcohol outlet density and population density.

Key Points:

- Alcohol outlet density is an environmental risk factor for excessive alcohol consumption.
- We created a distance-based buffer to measure the number of alcohol outlets near each alcohol outlet in NYC and adjusted for population density in our measures of association.
- There was no association between overall alcohol outlet density and either outcome, emergency department visits or hospitalizations for alcohol-related diagnoses at the city level.
- However, stratifying density by the type of alcohol outlet and borough revealed an association with these outcomes in some areas of NYC (e.g., off-premise alcohol outlet density in the Bronx).
- Future work will focus on the locations where patients experience alcohol-related illnesses and injuries, which lead to emergency department visits and hospitalizations.

1 Centers for Disease Control and Prevention. *Guide for Measuring Alcohol Outlet Density.* Atlanta, GA: Centers for Disease Control and Prevention, US Dept of Health and Human Services; 2017.
2 Campbell CA, Hahn RA, Elder R, et al. The effectiveness of limiting alcohol outlet density as a means of reducing excessive alcohol consumption and alcohol-related harms. *Am J Prev Med.* 2009;37(6):556–569.
3 Xuan Z, Blanchette J, Nelson TF, et al. The alcohol policy environment and policy subgroups as predictors of binge drinking measures among US adults. *Am J Pub Health.* 2014:e1–e7. doi:10.2105/AJPH.2014.302112.

In this report, we 1) describe alternative methods for measuring alcohol outlet density and 2) examine the association of alcohol outlet density with alcohol-related emergency department (ED) visits and hospitalizations.

CDC-recommended methods for calculating alcohol outlet density

The CDC's three recommended methods for measuring alcohol outlet density depend on the geographic level of analysis. While these methods were presented for measuring alcohol outlet density, they can also be applied when measuring outcomes of alcohol-attributable harms that are associated with alcohol outlet density.

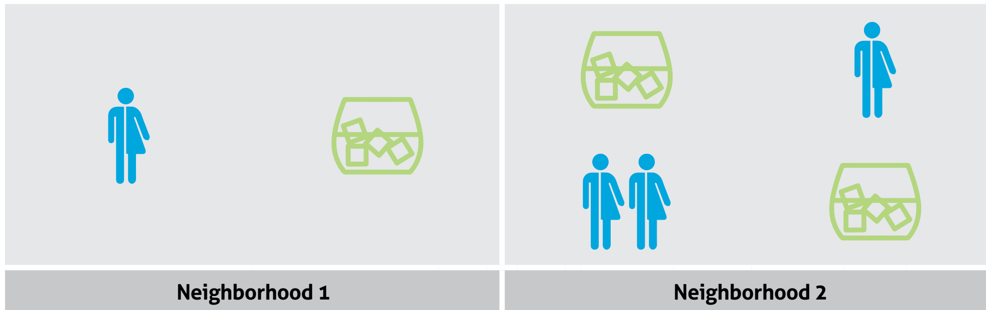
Container based-methods calculate the number of alcohol outlets in a specific geographic area, such as ZIP codes, counties or census tracts. Custom created boundaries may also be used for the calculation. Only the alcohol outlets inside the boundaries are counted, and those outside are not (Figure 1a). To calculate density, the total number of outlets can be divided by the number of residents or the size of the geographic area.

Distance-based methods calculate the distance between alcohol outlets or between alcohol outlets and a reference point. Unlike container-based methods, distance-based methods are not constrained by boundaries (Figure 1b).

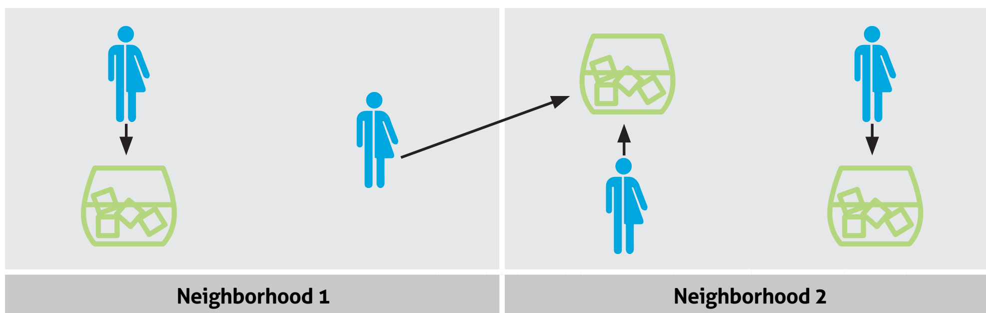
Spatial access-based measures are similar to distance-based in that they measure the distance to alcohol outlets. However, this method calculates the summed distance to a specified number of outlets (e.g., two outlets in Figure 1c) and then weights the distance (or inverse distance) to a third variable, such as population density.

Figure 1: CDC-recommended methods for calculating alcohol outlet exposure

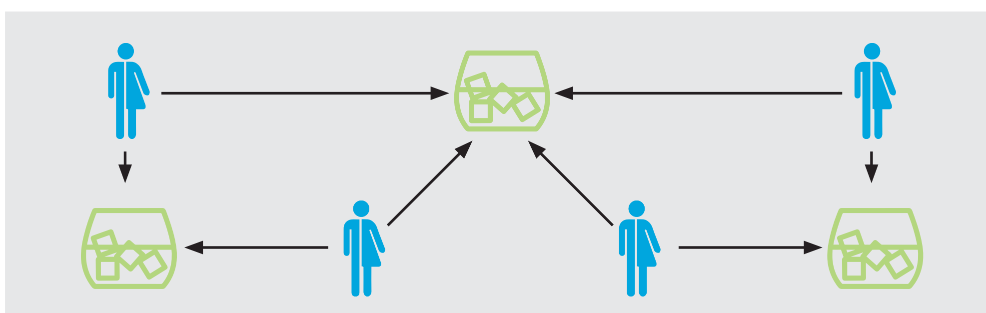
1a: Container-based methods Alcohol outlets (in green) and residents (in blue) are only counted within defined boundaries. Neighborhood 1 has one resident exposed to one alcohol outlet. Neighborhood 2 has three residents exposed to two alcohol outlets.



1b: Distance-based methods Exposure to alcohol outlets is determined by the distance between the residents and the closest alcohol outlet, regardless of which neighborhood they live in.



1c: Spatial access-based methods Resident's alcohol outlet exposure is described by the resident's distance to a specified number of outlets (e.g., the nearest two outlets). Their value might also be weighted to population density. The results are independent of neighborhood or other division.



Limitations of the CDC-recommended density measures

We assessed three CDC-recommended measures and determined that each has limitations and does not completely capture the NYC alcohol exposure environment.

Geopolitical containers, such as ZIP codes, census blocks and City Council districts, are designed for other functions, such as efficient mail delivery (ZIP codes), reliable population counting (census containers) or political divisions (city council districts). Such containers are not designed for measuring the distribution of alcohol outlet density, hospitalizations or ED visits. Selecting the wrong container could affect our results by introducing statistical bias (known as the modifiable areal unit problem).[4]

Distance-based and spatial access methods measure the distance to the closest specified number of outlets. For example, the distance from a reference point, such as the center of a neighborhood to the nearest seven alcohol outlets, might be small. Even if there were more alcohol outlets within the same distance, this method captures the distances to the nearest seven outlets. Since the closest number of outlets is a user-specified fixed parameter, the method would under report very high density areas.

If NYC were less densely populated with people and alcohol outlets, one of the CDC methods would likely be sufficient. However, due to the high density of alcohol outlets and the limitations of geopolitical containers, we created a more tailored approach for NYC.

The New York City approach

To account for the outlet and population density variability in NYC, we developed a new measure of alcohol outlet density. Our method uses elements from all three CDC recommended methods to calculate a distance-based buffer weighted by population density (Figure 2). We were concerned that, with so many outlets clustered near each other, the CDC-defined spatial access-based and distance-based measures would limit the variability seen in alcohol outlet density results. For example, if the measure of alcohol outlet density was based on the distance to the nearest five outlets, an area with five very close outlets would have the same alcohol outlet density value as an area that had 20 outlets within a similar distance.This is because the spatial-access measure would only measure to the first five. Because all of our data were formatted as geocoded points, we had the flexibility to use any type of method and were not limited to predefined containers. We created containers similar to the CDC's container-based method, but our containers were distance-based like the CDC's distance-based method. To account for variation in population density within NYC, we weighted our estimates based on the area's population density like the CDC's spatial access measure.

We used our buffer-based method to determine how many outlets were near each outlet, and how many health outcomes (i.e., hospitalizations and ED visits) occurred among residents of the same area. Then we weighted the exposure—the number of alcohol outlets—for the underlying population in each buffer, because the numerical outcomes (i.e., hospitalizations and ED visits) depend on the underlying population.

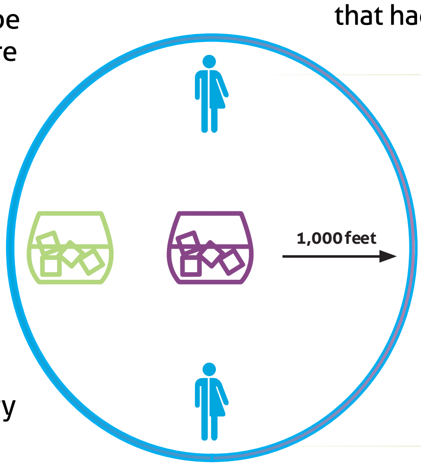


Figure 2: Using distance-based buffers, the combination of methods for calculating alcohol outlet exposure and outcomes

For the selected alcohol outlet (purple), there is one other neighboring outlet (green) within 1000 feet and two residents (blue) with hospital visits. For the selected alcohol outlet (purple), there is one other neighboring outlet (green) within 1000 feet and two residents (blue) with hospital visits.

Definitions

- **Alcohol outlet:** an establishment that has a license to sell alcohol
- **On-premise outlet:** an establishment that sells alcohol for consumption on-site (e.g., bar, restaurant)
- **Off-premise outlet:** an establishment that sells alcohol for consumption off-site only (e.g., liquor store, grocery store), regardless of the type of alcohol sold
- **Alcohol outlet density:** the concentration of establishments that have a license to sell alcohol in an area
- **High alcohol outlet density:** having a high concentration of retail alcohol outlets in a small area.1 There is no "gold standard" or benchmark value for what is considered high, and it can depend on the area.
- **Alcohol-related International Classification of Disease (ICD) 9 codes:** alcohol dependence (303), non-dependent alcohol abuse (305.0), alcohol induced mental disorders (291), toxic effect of alcohol (980.0), chronic liver disease and cirrhosis (571), portal hypertension (572.3), alcoholic cardiomyopathy (425.5), alcoholic gastritis (535.3), pellagra (265.2) and alcoholic polyneuropathy (357.5).
- **Alcohol-related hospitalization:** when a patient is admitted to the hospital—regardless of whether they entered through the ED—and at least one alcohol-related ICD-9 code is billed for the visit.
- **Alcohol-related emergency department (ED) visit:** when a patient is treated in the ED and then discharged, and at least one alcohol-related ICD-9 code is billed for the visit. These are also known as "treat and release visits."

4 "MAUP". GIS Dictionary. ESRI. No date. https://support.esri.com/en/other-resources/gis-dictionary/term/046637d1-de6e-47cf-a5dd-7062c842ef69

Methods

Defining the study area

Parks and airports cover a large proportion of land in NYC. By definition, these areas have no or very few residents. The few residents counted are usually unsheltered homeless individuals living in these areas. Counts of homeless individuals are not well captured by census data and result in low to zero population counts. Because of these concerns, we removed any alcohol outlets that were in parks or airports from this analysis and focused on residential areas with alcohol outlets. Since we aimed to understand the relationship of alcohol density and alcohol-related health outcomes, we also removed any alcohol-related hospitalizations or ED visits among patients with home addresses that geocoded to parks. There was one exception, which is explained in the "Calculation of the outcomes" section on page 6. Another large area—the correctional facility on Rikers Island—was also removed from this analysis because there are no alcohol outlets there. Low population count over these large areas would artificially increase the rate of hospitalizations or ED visits from that area.

Calculation of the exposure: alcohol outlet density

Data on the locations of alcohol outlets with liquor licenses that were active as of March 2014 were provided by the New York State (NYS) Liquor Authority. Addresses were geocoded and categorized into either on-premise or off-premise outlets. Licenses that geocoded to non-residential areas, such as airports and parks, were excluded.

We measured the number of alcohol outlets that fell within a 1,000-foot buffer of every alcohol outlet. This measurement captured how many other alcohol outlet choices a consumer would have within a 1,000-foot radius.

The buffer distance of 1,000 feet was selected because it was large enough to sample the area around an alcohol outlet and produce a large range of density values, and small enough to avoid continually sampling the same areas. Buffers that were too large would overestimate the exposure area. We conducted sensitivity analysis of smaller distance buffers, but this resulted in density values that were very low and did not realistically sample the neighborhood around the alcohol outlets. In addition, the 1,000-foot buffer is similar to current NYS rules governing the placement of alcohol outlets. For example, the 500 Foot Rule restricts the placement of some on-premise alcohol outlets within 500 feet of each other and the 200 Foot Rule restricts the placement of alcohol outlets on the same street within 200 feet of a school or house of worship, such as a church, mosque or synagogue.[5]

In addition to the overall density, we calculated the density of on-premise locations (i.e., locations where alcohol is consumed on-site) and off-premise locations (i.e., locations where alcohol is sold for offsite consumption) separately. On- and off-premise alcohol outlets are different and foster different consumer behaviors. This stratified analysis described the number of off-premise outlets within a 1,000-foot radius of other off-premise outlets, and the number of on-premise outlets within a 1,000-foot radius of other on-premise outlets.

Finally, we weighted our alcohol outlet density measures with population density estimates. Because our outcomes (i.e., hospitalizations and ED visits) depend on the number of residents in the area, the alcohol outlet density measures must be adjusted to reflect the exposure of the same residents. Calculation of the population density estimates is described in the next section.

Calculation of population density

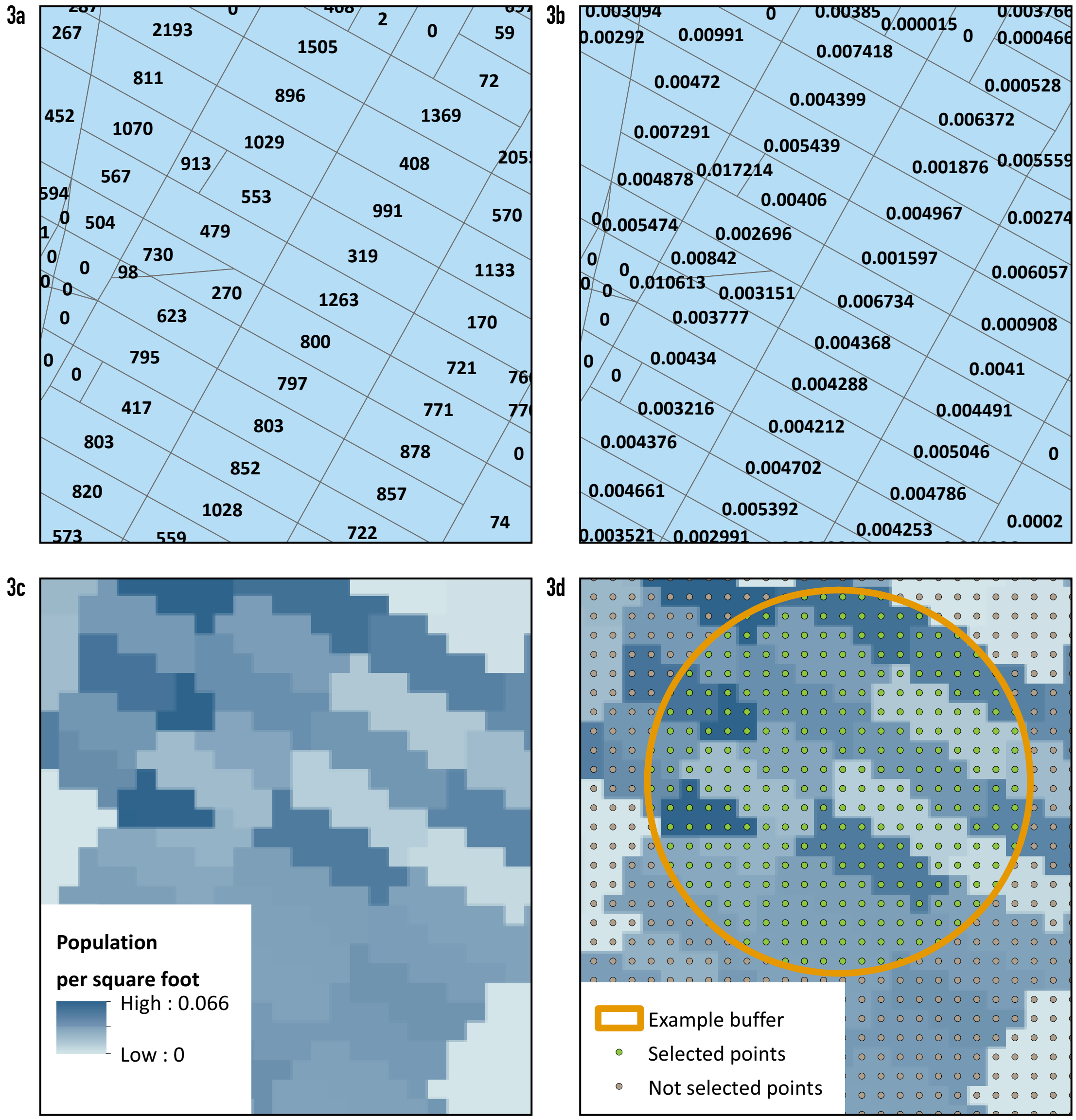
The numbers of hospitalizations and ED visits in a buffer are based on where people live and are influenced by how many people live in an area. Because of this, we adjusted the exposure (i.e., number of alcohol outlets) to account for how many people lived in each area. We weighted the alcohol outlet density measures with the estimated population in each buffer. Typically, population density is measured using geopolitical containers. However, the buffers we used are atypical spatial containers; they did not fit into geopolitical containers and could overlap each other, so we created a new method for calculating population density. To approximate how many people lived in each buffer, we changed census block population estimates to a rate of population per square foot by dividing the population count by the area of the census block. The census block shapes were converted to a raster file (i.e., a grid that covers the entire study area) of population per square foot. Then, using all raster cells that intersected with each buffer area, we calculated the average population per square foot and used that number to calculate the estimated population in each buffer area to weight the results (Figure 3).

5 "Measuring the Distance" The 200 and 500 Foot Rules. New York State Liquor Authority, Division of Alcoholic Beverage Control. No date. http://www.nyc.gov/html/mancb3/downloads/cb3docs/sla-200-500ft-rule.pdf

Figures 3: Example of calculating population density for atypical spatial containers using census block population counts and area

Census blocks with population counts (3a), were converted to census blocks—with the rate of population per square foot—by dividing the population counts by the area of the census blocks **(3b).**

Census blocks with the rate of population per square foot were converted to a grid of 100-foot by 100-foot cells (3c), for which each cell retained the rate value. For each buffer, all the intersecting centroids of the cells were used to create an average population per square foot rate for that buffer **(3d)**. Since the radius of the buffer is known (1,000 feet), the approximate population can be calculated.



For the selected buffer (3d):

Points that intersect the area = 315
Sum of population density for all intersecting points = 1.53
Mean population per square foot for area

= 1.53 / 315
= 0.0048 people per ft^2

Buffer population = Area * Mean population per ft^2

= π * $radius^2$ * 0.0048 people per ft^2
= approximately 15,079.64 people live in buffer

Calculation of the outcomes: emergency department visits and hospitalizations

We examined two health outcomes: alcohol-related ED visits and alcohol related hospitalizations. ED visits occurred when a patient was treated in the ED and discharged from the ED without being hospitalized. A hospitalization occurred when a patient was admitted for an inpatient hospital stay, regardless of whether the patient entered via the ED. We used all visits among NYC residents that had at least one alcohol-related diagnosis, determined by ICD-9 codes billed for that visit (see definitions box on page three for included ICD-9 diagnosis codes). All visits that met the inclusion criteria were counted, including patients who had multiple visits. For injuries that were co-listed with an alcohol-related diagnosis, all manners and intents (i.e., unintentional, self-harm, assault and undetermined intent) were included.

Excluded additional inclusion criteria for hospitalizations and emergency department visits

As noted in the "Defining the study area" section on page four, we excluded parks from our analysis, with one exception: Wards Island. Although Wards Island is often classified as a park, it includes non-parkland areas where homeless shelters, hospitals and other residential facilities are located. We reassigned residents of Wards Island to the location of a bus stop to Wards Island at 125th Street and 1st Avenue in East Harlem; this allowed us to include alcohol-related hospitalizations or ED visits among Wards Island residents in our analysis. Assigning Wards Island residents to the East Harlem location is reflective of their exposure to alcohol outlets. A prior assessment of the East Harlem area found that when Wards Island residents leave for the day, they go to 125th street.[6]

In addition to excluding Rikers Island from the study area, we excluded all visits for patients whose home addresses geocoded to a jail or prison in NYC. We also excluded any patient for which the NYC Department of Corrections was listed as a payer, indicating that the patient was incarcerated at the time of the hospitalization. Incarcerated populations on Rikers Island do not have alcohol outlet exposure on Rikers Island, so their alcohol-related visits were removed.

We excluded hospitalizations for alcohol or drug rehabilitation and alcohol and drug detoxification; visits for substance use treatment differ from hospitalizations and ED visits for conditions caused by alcohol consumption. We also excluded visits for which the patient's home address could not be geocoded.

Using these criteria, we counted the number of visits that occurred in the buffers around alcohol outlets as our outcome measures.

Statistical methods

All geographic calculations—creating the buffer, measuring alcohol outlet density and counting the number of hospitalizations and ED visits—were done using ArcMap.[7] We also used ArcMap to create maps and visually inspect the geographic distribution of the data.

We used SAS software[8] to assess statistical trends and descriptive statistics including the frequency and distribution of alcohol outlets and health outcomes. We examined the linear relationship between three measures of alcohol outlet density (overall and stratified by on-premise and off-premise) and our two outcomes (i.e., ED visits and hospitalizations). To account for population density, we multiplied the alcohol outlet density measures by the calculated buffer population—adjusting it for population density—and conducted correlation analysis. Due to the large sample size in this analysis, we knew that p-values would be significant regardless of the associations. Therefore, we assessed associations using R^2. For this analysis, we reviewed any R^2 value above 0.5, and considered an R^2 value above 0.7 to be strong.

To assess borough-level associations between alcohol outlet density and health outcomes, we repeated the correlation analyses with data stratified by borough license location.

Results

Descriptive statistics

In 2014 there were 20,957 alcohol outlets in our study area: 11,232 on-premise and 9,725 off-premise. Manhattan had the highest number of alcohol outlets (Figure 4), and more on-premise outlets than off-premise outlets. The proportion of on- and off-premise outlets varied by borough. Brooklyn, Queens and the Bronx had more off-premise outlets than on-premise outlets.

Alcohol outlet density varied throughout the city (see Table 1 in the Appendix). Much of Manhattan below 59th Street had high alcohol outlet density starting in Midtown and moving south to the Lower East Side, the East Village, SoHo and the West Village (Map 1). There were also smaller clusters with high alcohol outlet density in other parts of Manhattan on the Upper East and Upper West Sides, as well as in other boroughs, such as Williamsburg and

6 125th Street Study. Bureau of Alcohol and Drug Use, Prevention, Care and Treatment, NYC Department of Health and Mental Hygiene.Unpublished data. 2012.

7 ESRI 2014. ArcGIS Desktop: Release 10.3. Redlands, CA: Environmental Systems Research Institute.

8 SAS Institute Inc. July 2013. SAS® 9.4. Cary, NC: SAS Institute Inc.

Downtown Brooklyn in Brooklyn. There were clusters of alcohol outlets in Queens, Staten Island and the Bronx that were much smaller, compared with Manhattan.

Correlations
(See Table 2 in the Appendix)

Overall alcohol outlet density: There were no strong correlations between the overall alcohol outlet density measure and ED visits or hospitalizations at the city level. After stratifying by borough, we observed a correlation between the overall alcohol outlet density measure and ED visits in the Bronx (R^2=0.625). We also found correlations between the overall alcohol outlet density measure and hospitalizations in the Bronx (R^2=0.626) and Queens (R^2=0.530).

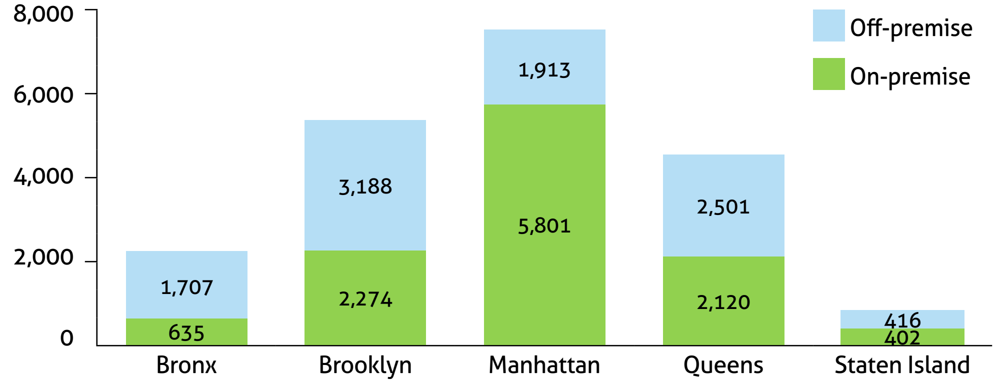
On-premise outlet density: On-premise outlets did not correlate with either outcome (R^2 ranged from 0.035 to 0.467).

Off-premise outlet density: There was a correlation between off-premise alcohol outlet density and hospitalizations for alcohol-related diagnoses at the city level (R^2=0.586), but not ED visits (R^2=0.381).

Stratifying by borough, the Bronx had strong correlations between off-premise alcohol outlet density and both ED visits (R^2=0.686) and hospitalizations (R^2=0.712). Staten Island had correlations between off-premise outlet density and ED visits (R^2=0.541) and hospitalizations (R^2=0.633). In Queens, there was only a correlation between off-premise density and hospitalizations (R^2=0.568). Very weak correlations were observed in Manhattan and Brooklyn.

Adjusting for population density by weighting the results strengthened the observed correlations between outlet density and outcomes *(See Table 2 in the Appendix)*.

Figure 4: Distribution of alcohol outlets by borough and type, New York City, 2014



Source: New York State Liquor Authority, Active Liquor Licenses in New York City, 2014.

Map 1: Density of alcohol outlets within 1000 feet of another alcohol outlet, New York City, 2014

Source: New York State Liquor Authority, Active Liquor Licenses in New York City, 2014.

Final Discussion and Recommendations for Analysts

NYC is a geographically large (i.e., approximately 300 square miles) city and has the highest population density of any major city in the United States. Within NYC, there are large variations in population density by neighborhood and borough. Additionally, there is substantial variation in the number of alcohol outlets in different areas of the city. The methods described by the CDC did not adequately capture this variation, so we developed a new approach, which could be used by other large, urban health departments.

We measured alcohol outlet density using a population-weighted buffer method because it was both easily calculated and combined the strengths of each of the CDC-recommended methods. Additionally, we wanted to develop a method that could be used by other jurisdictions and researchers without requiring sophisticated software. While other complex methods could be more accurate, given the large number of alcohol outlets in NYC the Health Department's computers would not have been able to do the calculations.

In this analysis, we developed a method tailored to the NYC landscape to calculate alcohol outlet density and assess its relationship to health outcomes. Off-premise alcohol outlet density was associated with alcohol-related hospitalizations, and alcohol-related ED visits in some NYC boroughs. The strongest correlation was between off-premise alcohol outlets and hospitalizations among Bronx residents. This means that in the Bronx, in areas where there are more off-premise outlets clustered near other off-premise outlets, there are more hospitalizations. This is concerning because off-premise outlets tend to provide access to alcohol that is less expensive and at higher volumes than on-premise outlets.

"In this analysis, we developed a method tailored to the NYC landscape to calculate alcohol outlet density and assess its relationship to health outcomes."

In contrast, we did not observe a strong relationship between on-premise outlets and either outcome in any borough. This may be due to limitations of the data.

It is likely that exposure to alcohol outlet density is not only related to home address, but also to where New Yorkers spend much of their time: at work, school and leisure activities. The "address of injury or illness" rather than the residential address might better capture this association. For example, the lack of associations in Manhattan and Brooklyn might be due to high density areas also being "destination drinking" areas (i.e., neighborhoods where many drinkers live in other neighborhoods or boroughs). In that scenario, the home address of a "destination drinker" would be listed in the hospital data and not the address where they were drinking. In this case, we were unable to assess the association between site of alcohol exposure and outcome. More research is needed on the methods of measuring exposure to alcohol outlet density and alcohol-related health events that occur away from home.

Developing a citywide alcohol outlet density measure is difficult because of the variability of many factors in NYC, including resident populations, alcohol consumption, drinking norms and other factors in NYC neighborhoods. Integrating population density and stratifying by on- and off-premise outlets, borough and ED visits versus hospitalizations revealed associations between alcohol outlet density and the health effects of excessive alcohol consumption. Our method may undercount the association between destination drinking areas and adverse health outcomes, especially in high outlet density areas in Manhattan and Brooklyn. We will continue to refine and develop new methods to measure the associations between alcohol outlet density and health, especially as new methods and technology become available. We plan to explore other health data, such as emergency medical services records, and other models that adjust for both individual–and neighborhood-level effects.

Other methods-related considerations

The buffers used in this analysis are Euclidean distance buffers. A network analysis could be used to create buffers that are based on walking distances on the street network, since Euclidean buffers are known to overestimate the size of the area.[9] Using network analysis to create buffers would have increased the accuracy of these buffers; we were unable to do so due to our current computer hardware's limited processing power.

We chose Euclidean buffers for the scope of this work, and recommend that public health jurisdictions with high processing computer hardware explore the buffers using network analytic techniques.

We calculated population density using the resources that were available to us, and that would likely be available to an average public health department. The results are an estimation of population density.

To improve the precision and accuracy of our population density estimates, we could implement a Cadastral-based dasymetric system to map population density, as described in Maantay, et al.[10] The methods we chose struck a balance between ease and accuracy.

We believe these proposed methods provide a balance between resources needed, ease and accuracy and are adaptable by other public health agencies that face similar challenges.

Technical notes:

The computers used for this analysis did not provide enough computing power to join all of the ED visits and hospitalizations to all of the buffers at the same time. As a result, the buffers were split into six different data sets: one for each outer borough and two for Manhattan. Then, the ED visits joined in, followed by the hospitalizations. The resulting data sets were combined to create a citywide data set. Additionally, while Manhattan, Staten Island and the Bronx are independent of the other boroughs, Brooklyn and Queens share a border. Therefore, the ED visit and hospitalization points for these two boroughs were kept together to ensure there would be no discrepancies around the border.

Data sources:

a) Statewide Planning and Research Cooperative System (SPARCS) (January 1, 2014, to December 31, 2014) is an administrative database of all hospital discharges reported by NYS hospitals to the NYS Department of Health.

b) New York State Liquor Authority, Active Liquor Licenses in New York City, 2014.

c) United States 2010 Census, US Census Bureau. 2010. Accessed 2018.

Suggested citation

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9 Morang M. Who does my public transit system serve? ArcGIS Blog. June 20, 2016. https://www.esri.com/arcgis-blog/products/networkanalyst/transportation/who-does-my-public-transit-system-serve/

10 Juliana Astrud Maantay, Andrew R. Maroko & Christopher Herrmann (2007) Mapping Population Distribution in the Urban Environment: The Cadastral-based Expert Dasymetric System (CEDS), Cartography and Geographic Information Science, 34:2, 77-102, DOI: 10.1559/152304007781002190

Appendix

Table 1. Buffer density measures for alcohol outlets, New York City, 2014

Source: New York State Liquor Authority, Active Liquor Licenses, 2014. Includes alcohol outlets that are in airports or parks.

	Overall density	On-premise density	Off-premise density
Number of outlets	**20,957**	**11,232**	**9,725**
Number of outlets within 1000 feet of each outlet			
Mean	43.5	47.1	10.6
Median	24	30	10
Mode	10	2	9
Range	(0-246)	(0-213)	(0-35)

Table 2. Correlations between alcohol outlet density (overall, on-premise, and off-premise) and alcohol-related hospitalizations and ED visits by NYC and borough, 2014

Source: Source: New York State Liquor Authority, Active Liquor Licenses, 2014.
New York State Department of Health, Statewide Planning and Research Cooperative System (SPARCS), 2014 (Data Update: October 2015)

Exposure	Overall outlet density			On-premise density			Off-premise density		
	Outcome	**Unweighted R^2 value**	**Population Weighted R^2 value**	**Outcome**	**Unweighted R^2 value**	**Population Weighted R^2 value**	**Outcome**	**Unweighted R^2 value**	**Population Weighted R^2 value**
NYC	**ED visits**	**0.153**	**0.230**	**ED visits**	**0.157**	**0.232**	**ED visits**	**0.330**	**0.381**
Bronx	ED visits	0.478	0.625	ED visits	0.203	0.357	ED visits	0.650	0.381
Brooklyn	ED visits	-0.012	0.096	ED visits	-0.042	0.035	ED visits	0.247	0.686
Manhattan	ED visits	-0.048	0.079	ED visits	-0.028	0.100	ED visits	0.107	0.271
Queens	ED visits	0.191	0.328	ED visits	0.065	0.283	ED visits	0.279	0.139
Staten Island	ED visits	0.172	0.438	ED visits	0.139	0.368	ED visits	0.272	0.360
NYC	**Hospitalizations**	**0.157**	**0.304**	**Hospitalizations**	**0.216**	**0.365**	**Hospitalizations**	**0.493**	**0.586**
Bronx	**Hospitalizations**	0.478	0.625	ED visits	0.203	0.357	**Hospitalizations**	0.650	0.381
Brooklyn	**Hospitalizations**	-0.012	0.096	ED visits	-0.042	0.035	ED visits	0.247	0.686
Manhattan	**Hospitalizations**	-0.048	0.079	ED visits	-0.028	0.100	ED visits	0.107	0.271
Queens	**Hospitalizations**	0.191	0.328	ED visits	0.065	0.283	ED visits	0.279	0.139
Staten Island	**Hospitalizations**	0.172	0.438	ED visits	0.139	0.368	ED visits	0.272	0.360

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