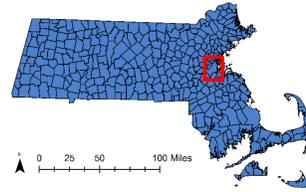


# Rate of New Cases of HIV in Boston from 2010-2014 and Access to PrEP Providers

## Background

Pre-Exposure Prophylaxis (PrEP) is a new prescription medication that can prevent individuals from becoming infected with HIV. While this intervention has started to reduce the rate of HIV, multiple studies and reports from the drug's manufacturer suggest that uptake of PrEP may be low in the communities most at risk of HIV, such as Black and Latino men who have sex with men.<sup>1-3</sup> This limits PrEP's usefulness in preventing new cases of HIV. It is critical to understand the reasons for low uptake among those at highest risk so that future interventions can be designed to maximize PrEP use.

Many researchers have found an association between geographic location within a city and risk of HIV.<sup>4,5</sup> Additionally, multiple studies have shown a positive relationship between proximity to organizations specializing in HIV/AIDS and use of their preventative services.<sup>6,7</sup> Thus, one potential explanation of the low uptake of PrEP in the communities most at risk may be that the locations of providers that prescribe PrEP are far from the areas with the highest rates of HIV. In fact, a report from the Office of HIV/AIDS in Massachusetts stated that limited points of access to PrEP is an issue that must be resolved in order to reduce the infection rate among groups most at risk of HIV in Boston.<sup>8</sup> This project will explore the geospatial relationship between PrEP providers and the rate of new cases of HIV throughout Boston in order to inform areas for outreach and expansion of PrEP.



Reference map of the city of Boston within Massachusetts

## Methods

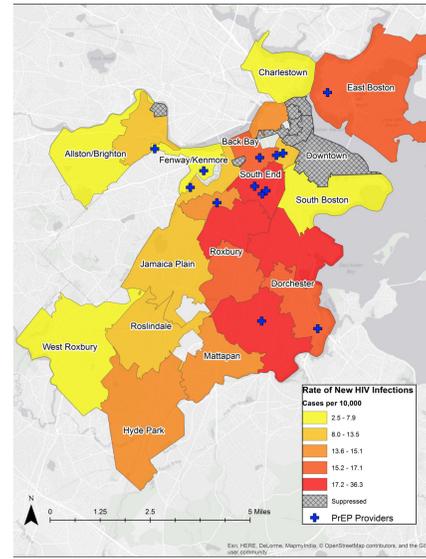
### Data Sources

Data on the location of PrEP providers and the number of new cases of HIV between 1/1/10 and 12/31/14 in each zip code were found on the AIDSvu website. Data were available for the total population, Whites, Blacks, and Hispanics/Latinos. To calculate the rates (cases per 10,000), data on population per zip code from the 2011-2015 American Community Survey were used. The following additional data sources were used: 2010 Census Tiger Roads from MassGIS, a 2015 TIGER/LINE Shapefile from the US Census Bureau, and a 2014 shapefile of EOT roads from MassGIS.

### GIS Procedures and Maps Generated

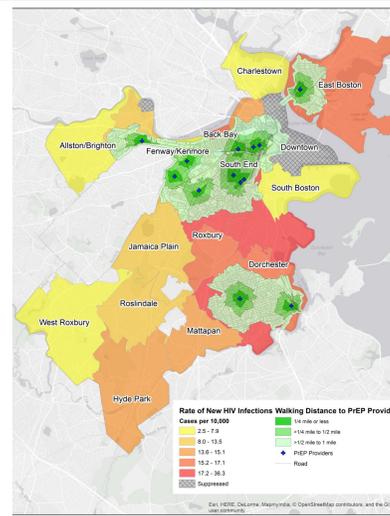
The addresses of providers were geocoded using the 2010 Census Tiger Roads shapefile. The total rates as well as the rates for each racial/ethnic subgroup in each zip code were joined to the shapefile from the US Census Bureau. To conduct the service area spatial analysis of walking and driving buffers, the Network Analyst tool was used with the shapefile from MassGIS. Six choropleth maps were created showing the rates of new HIV cases and the geocoded locations of the PrEP providers. To classify the scales for the choropleth maps for each of the four different population groups, the quintiles for each specific population group were used. Since data were suppressed for either too few cases or too small of a population in a zip code, it was not possible to estimate the number of cases in these areas. Thus, any zip codes with suppressed data were excluded from the quintile calculation and displayed as gray on the map. Additionally, two of the maps have a service area analysis overlaid on top. The walking distance map shows buffers of 1/4 mile, 1/2 mile, and 1 mile using the MassGIS streets shapefile, whereas the driving distance map shows buffers of 1 mile, 2 miles, and 3 miles using the same shapefile.

## Rate of New Cases of HIV from 2010-2014 in each Zip Code of Boston and the Location of PrEP Providers

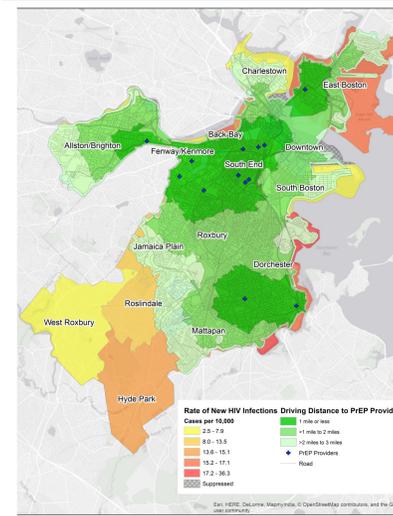


## Spatial Analysis of Access to PrEP Providers

### Walking Distance

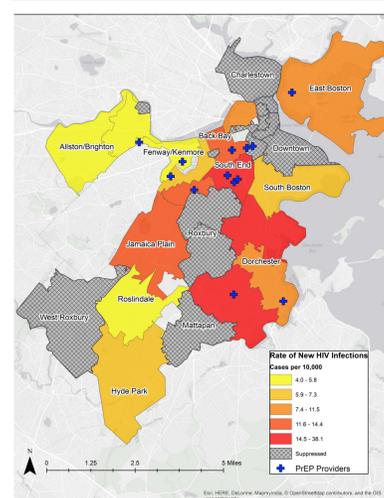


### Driving Distance

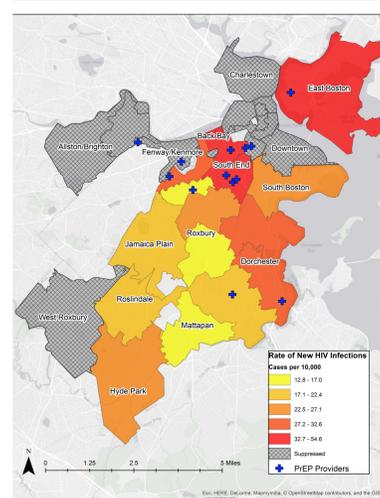


## Rate of New Cases and PrEP Stratified by Race/Ethnicity

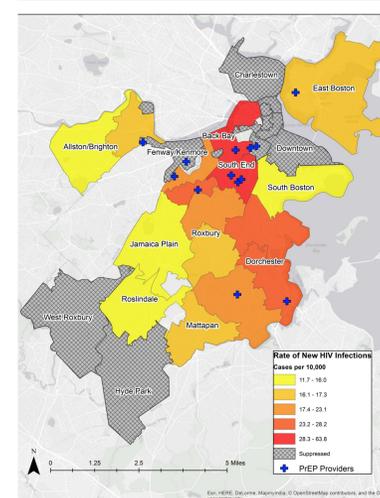
### White



### African-American/Black



### Hispanic/Latino



## Results

The majority of the PrEP providers in the city are clustered in the South End, Back Bay, and Fenway/Kenmore areas. There are two providers in the lower part of Dorchester and one in East Boston, but the lower Western part of the city does not have any PrEP providers. In the total population, while the South End and Back Bay have the highest rates and do have PrEP providers, there are clearly areas at high risk that do not have providers, most notably the Northern parts of Roxbury and Dorchester. In the analysis with walking distance buffers up to 1 mile, it is apparent that the high-risk Northern part of Dorchester is not within a 1 mile walking distance of a PrEP provider. Additionally, the lower Western part of Boston is still isolated from providers. Using the map of the driving distance buffers up to 3 miles, it is clear almost the entire city is covered. However, some high-risk parts of Dorchester, East Boston, and the most Western parts of Boston are still out of reach.

When stratified by race and ethnicity, the South End and Back Bay, which have many providers, are also in the highest quintile for all three subgroups. All three subgroups also have Northern Dorchester as an area with high risk. One important finding is that East Boston has only one provider and is an area of moderate risk for Whites and Hispanics/Latinos, but is in the highest quintile for Blacks. It is important to note that the rate of new cases among Blacks (20.6) and Hispanics/Latinos (18.1) was much higher than the rate overall (13.8) or among Whites (8.3).

## Discussion

These maps indicate that there are areas of the city, particularly Northern Roxbury and Dorchester, that are at high risk of HIV and are far from PrEP providers. Additionally, the distribution of risk of HIV in the city appears to differ by race and ethnicity, with East Boston as an area with a particularly high risk for Blacks. Finally, the lower Western parts of Boston are at moderate risk overall but are isolated from PrEP providers. The fact that there are areas at high risk of HIV that are far from PrEP providers may be one explanation for the low uptake of PrEP among individuals at the highest risk of HIV. Thus, public health professionals should improve access to PrEP in Northern Roxbury and Dorchester, East Boston, and in the Western areas of Roslindale and Hyde Park.

There are three important limitations to the data: homeless individuals were not included, many zip codes were suppressed when stratified by race and ethnicity, and the data is from 2010-2014 and thus is slightly outdated and does not reflect any changes in risk due to higher use of PrEP over the past few years. In terms of weaknesses of the maps, it is difficult to compare the rates of racial and ethnic groups since the maps display the unique quintiles for each demographic group. It is also worth noting that the maps do not consider the number of prescriptions made by each provider or that people may use public transportation to reach providers — these topics should be explored in future research. Nonetheless, these maps are still able to offer a preliminary suggestion of areas at high risk of HIV in need of increased outreach for PrEP.

## References and Acknowledgements

Cartographer: Daniel Cummings

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Class: PH262: GIS for Public Health

Professor: Dr. Tom Stopka

Projected Coordinate System:  
NAD 1983 StatePlane  
Massachusetts Mainland FIPS  
2001

1. Snowden JM, Chen Y-H, McFarland W, Raymond HF. Prevalence and characteristics of users of pre-exposure prophylaxis (PrEP) among men who have sex with men, San Francisco, 2014 in a cross-sectional survey: implications for disparities. Sexually transmitted infections. 2016;sextrans-2015-052382.
2. Kuhns LM, Hottel AL, Schneider J, Garofalo R, Fujimoto K. Use of Pre-exposure Prophylaxis (PrEP) in Young Men Who Have Sex with Men is Associated with Race, Sexual Risk Behavior and Peer Network Size. AIDS and Behavior. 2017;1-7.
3. Highleyman L. PrEP Use Exceeds 79,000 in US Pharmacy Survey, but Some Groups Lagging Behind. 2016. <http://www.aidsmap.com/PrEP-use-exceeds-79000-in-US-pharmacy-survey-but-some-groups-lagging-behind/page/3072084/>, 2017.
4. Marshall JB. An Analysis of Geography Project Data to Determine HIV and Behavioral Risk for High Risk Zip Codes and Low Risk Zip Codes in Fulton County, GA. 2012.
5. Fede AL-D, Stewart JE, Hardin JW, Mayfield-Smith K, Sudduth D. Spatial visualization of multivariate datasets: an analysis of STD and HIV/AIDS diagnosis rates and socioeconomic context using ring maps. Public health reports. 2011;126(3\_suppl):115-126.
6. Bauermeister JA, Eaton L, Andrijevic J, Loveluck J, VanHemert W, Pingel ES. Where you live matters: Structural correlates of HIV risk behavior among young Men Who Have Sex with Men in Metro Detroit. AIDS and Behavior. 2015;19(12):2358-2369.
7. Leibowitz AA, Taylor SL. Distance to public test sites and HIV testing. Medical care research and review. 2007;64(5):568-584.
8. HIV/AIDS in MASSACHUSETTS INTEGRATED HIV PREVENTION AND CARE PLAN. Massachusetts Department of Public Health 2017 2017.