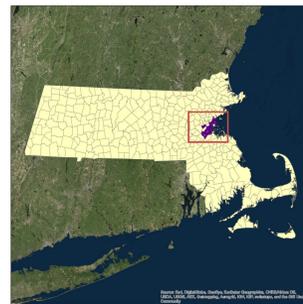


Food Access Within Walking Distance in Dorchester, MA



BACKGROUND

Food insecurity is an essential dimension of household and individual well-being and can result in poorer quality of dietary intake, which can lead to further health decrements. Food insecurity is defined as uncertain or limited availability of nutritionally adequate or safe food or the inability to acquire personally acceptable foods in socially acceptable ways¹. In a recent study assessing frailty in individuals with HIV (n=50), we discovered that 26% of the participants lived in Dorchester, MA and of those participants, 69% were food insecure², defined by the Radimer/Cornell survey³. The purpose of this project is to look into ways of assessing a geographic component of food access for the Dorchester residents of the Frailty Study².



Map 1: Suffolk County, home of Dorchester.

There are many dimensions of food access. This study will focus only on the accessibility of quality food within walking distance of healthy food retailers in Dorchester. The CDC has a measure, the modified retail food environment index (mRFEI), to assess the quality of food access within census tracts. I propose to use a model that has a finer-grained way of representing food access via kernel density and will compare this with the CDC's mRFEI.

METHODS

The methods of geographic food access were modeled after the CDC's mRFEI⁴. The mRFEI was calculated by the CDC using the following equation:

$$mRFEI = 100 \times (\# \text{ healthy food retailers} / (\# \text{ healthy food retailers} + \# \text{ less healthy food retailers}))$$

Scores for the mRFEI range from 0 to 100, with a higher score indicating more availability of healthier food retailers within a census tract. For example, a score of 10 means that 10 out of every 100 stores are healthy, with the other 90 stores providing less healthier access. The raw data for the mRFEI is not available for the public, but the mRFEI numbers per census tract are available⁴. The CDC used the North American Industry Classification Codes (NAICS) to identify healthy and less healthy food retailers, as outlined in Table 1.

For my geographical analysis of food access, kernel density was used. Only healthy food retailers were accounted for in this analysis. Reference USA was used to identify food retailers based upon the NAICS codes utilized by the CDC's mRFEI. The only discrepancy was the NAICS code for fast food since the code provided by the CDC was outdated

(722211) and is now replaced by a different code (722513). In addition, healthy food retailers for my analysis included grocery stores with 4-9 employees, which were omitted in the mRFEI. Table 1 shows which food retailers were included in this geographic analysis. A walking buffer of 500 meters was provided around each of my defined healthy food retailers as the distance limit residents would be willing to walk to a particular food retailer. The kernel density function was used to create a heat map with a search radius of 500 meters to determine the number of nearby food retailers and more specifically, which areas have more or less food access.

Type of Retailer	NAICS #	# Retailers	In mRFEI	In KD
Big Grocery Stores (≥ 10 employees)	445110	4	✓	✓
Medium Grocery Stores (4-9 employees)	445110	7		✓
Small Grocery Stores (≤ 3 employees)	445110	42	✓	
Fruit and Vegetable Markets	445230	5	✓	✓
Warehouse Clubs	452910	0	✓	
Convenience Stores	445120	9	✓	
Fast Food Restaurants	722211 for mRFEI 722513 for KD	103	✓	

NAICS=North American Industry Classification Codes
mRFEI=CDC's modified retail food environment index
KD=Kernel Density

RESULTS

Map 2 shows the mRFEI for Dorchester with the number of all grocery stores and fruit and vegetable markets. Map 3 depicts the less healthy food retailers (food swamps) according to the mRFEI's definition.

My definition of food access only included healthy food retailers, since I deemed this to be the most important measure of high quality food access. Map 4 shows the distinction of the food retailers and Map 5 accounts for the kernel density of these retailers. Map 6 shows the mRFEI with the healthy food vendors used in the kernel density analysis.

A comparison of two areas in Dorchester (A and B, depicted in Maps 5-6) was conducted to see which model is better suited to represent food access. In each area, at least one Frailty Study participant with the level of food insecurity was included to show the fabric of the neighborhood and location of stores. In Area A, the kernel density showed approximately two healthy food retailers in the 500 meter buffer and the two participants resided within zero food retailers. However, for mRFEI, Area A showed a score of 6-10 but there were no healthy food retailers within that tract. The healthy food retailers were in the neighboring tract which actually showed a lower mRFEI score (1-5). In Area B, there were two healthy food retailers and one food insecure participant lived outside of the 500 meter buffers, showing poorer food access. The mRFEI score conflicted with this finding since it provided

this area a score of 0 for the two tracts, which did not account for the healthy food retailers within each census tract. To the right of Area B, there were several tracts with mRFEI scores of 1-5 but there were no healthy retailers identified in the tracts.

CONCLUSIONS

The kernel density analysis of food access provided a finer grained assessment of geographic food access compared to the mRFEI. The kernel density measure is a better reflection of the situation for residents to characterize this single dimension of food insecurity and eliminates the need to assess by tracts but rather by what is actually within a 500 meter walking distance. The model assumes that individuals will only access food within walking distance and does not evaluate transportation availability to expand food access. Also, the model assumes that having access to healthier food stores equates to healthier food purchasing and that the choice of less healthy foods is not a predominant concern for measuring actual food access. This model also does not account for the cost of foods and other dimensions of food insecurity including income, education, and other social determinants of health, which may be the critical levers for public health interventions and not necessarily only measuring food access via location of retailers. Food access via retailers seems to be adequate in most areas of Dorchester so the issue of food insecurity requires more examination.

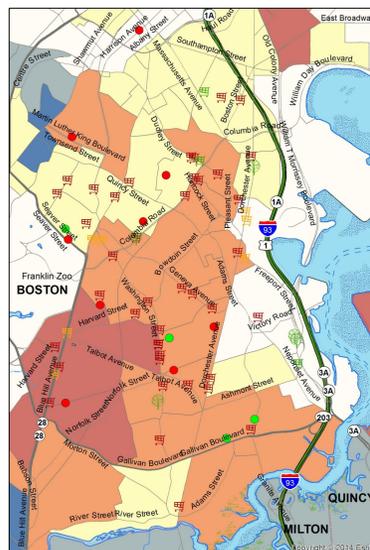
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2. Smit E, Wanke C, Dong K, et al. Frailty, food insecurity, and nutritional status in people living with HIV. *J Frailty Aging*, 2015;4(4):191-7.
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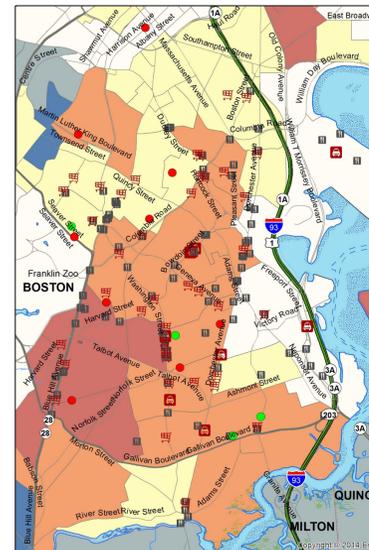
CARTOGRAPHY SOURCES

- Food Retailers: Reference USA, US Businesses
Roads: MA Dept of Transportation—Office of Transportation Planning, June 2014
MassDEP Hydrography: MassDEP GIS Program, March 2013
Open Spaces: Executive Office of Energy & Environmental Affairs, October 2015

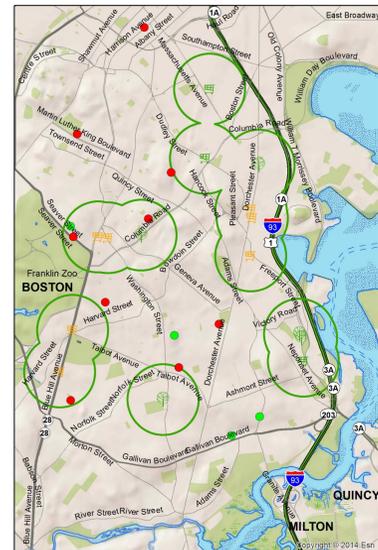
Map 2: mRFEI with all levels of grocery stores in Dorchester



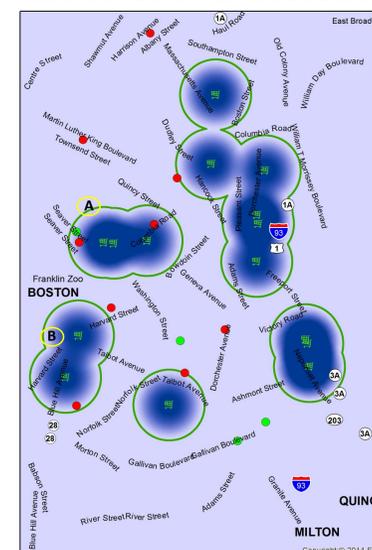
Map 3: mRFEI with food swamps in Dorchester



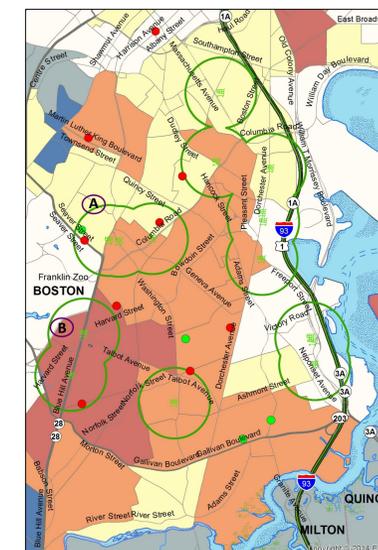
Map 4: Types of food retailers included in kernel density analysis



Map 5: Kernel density analysis of major food retailers in Dorchester. Areas A and B included.



Map 6: mRFEI comparison with Areas A and B.



Projection: NAD 1983 State Plane MA Mainland FIPS 2001

- Big Grocery Stores
- Medium Grocery Stores
- Fruit Veggie Markets
- Small Grocery Stores
- Convenience Stores
- Fast food Retailers
- KD Food Retailers
- 500 meter Buffer
- Kernel Density (KD) High : 11.5985 Low : 0
- mRFEI Score
 - 0
 - 1 - 5
 - 6 - 10
 - 11 - 15
 - >15
 - mRFEI No Data
- Frailty Study
 - Food Secure
 - Food Insecure

