No Car ≠ No Food

Filling the Gaps of Healthy Food Accessibility without A Car in Vancouver, BC, Canada

Introduction

"Food security exists when all people in a household, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life", according to Health Canada[1]. Food retail environment is one measurement of physical food access. A community with healthy food retail environment is one surrounded by retailers selling fresh fruit, vegetables, and other whole foods, rather than prepackaged food. These retailers include grocery stores, farmers' markets, and other specialty produce stores (e.g. bakeries, butchers', etc.)[2]. According to a methodology review conducted by Charreire *et al.*, geographic information system (GIS) methods are applicable and innovative approach to determine the physical availability and proximity of food outlets[3], which supports the validity of this project.

In 2014, the City of Vancouver launched the "Healthy City for All" campaign to advocate equal access to high-quality community[4]. The goal is to increase the 25% Vancouverites in accessing services by 2025[4]. A baseline analysis of the current healthy food retailer (HFR) service coverage was conducted using HFR data in 2016 and Canadian Census 2011. It shows that 499,834 out of 605,071 (82.6%) Vancouverites are living within a 500m walking distance to a HFR (Figure 1). Despite the high coverage percentage, there are still 105,237 people unserved. Additionally, the population in Vancouver has increased rapidly since 2011, so the total number of unserved people could be higher. As a pioneer in public health, Vancouver still needs to close the gaps in HFR accessibility via walking, biking, or public transportation, in the spirit of equity[4].

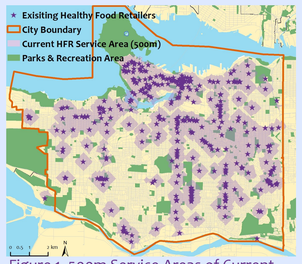


Figure 1. 500m Service Areas of Current Healthy Food Retailers in Vancouver

This GIS project is aiming to develop and analyze the validity of a geospatial model in the determination of gaps in healthy food retailer access without a car, and to propose potential locations to fill in the gaps, in Vancouver, BC, Canada.

Methods

Walkability

A common walking distance used in GIS analysis is 1000m. However, given the considerations that a) walking with groceries takes extra effort, b) Vancouver has more-than-half-year rainy season, the walkability distance in this project is set as 500 meters.

Model development

There are many aspects to consider in identifying and filling in the gaps of healthy food retail access. However, only five criteria were included in this model (Table on the right).

	Criteria	Requirements	Score
A	Zoning regulations	Within "Commercial" districts	N/A
B	Existing HFR counts within 500m	Zero	2
		1-5	1
		>5	0
C	Population density within 500m	>3000	2
		500-3000	1
		0-500	0
D	Distance to public transit stop	0-500m	2
		500m-1000m	1
		>1000m	0
E	Near bikeways	Required	N/A
	Total score = B+C*2+D		

Within commercial zoning districts and near bikeways were required criteria. A raster cell size of 10m*10m was used for existing HFR density, population density, and Euclidean distance to public transit stops. A score of 0-2 was assigned to raster cells for criteria B, C & D, where 0 means "not an ideal location for new HFR", 1 means "less ideal", and 2 means "very ideal" (Table). The calculation of total score is shown in the Table. At the end, two new HFR locations were chosen based on their distance to the nearest bikeways.

Evaluation of the model

There are quantitative and qualitative approaches to evaluate the model. The population under service coverage after the addition of the HFR determined in the model will be compared to the baseline. The 500m service area is created through road distance network analysis. The qualitative evaluation includes result comparison with other literature on this topic and the discussing limitations of this model.

Results

Figures 2 to 5 show the intermediate results for each criterion in the model. The total scores assigned to each raster cell range from 4 to 8 (Figure 6). "4" means eligible areas with satisfied HFA access, and "8" means eligible areas with gaps of access. As predicted, the gap of healthy food access is not huge. Only a few locations got the full score (dark purple). Two 8-score locations are close to bikeways and therefore determined as the most ideal location for new HFR establishments. A building environment is shown in the two pop-up windows, suggesting new grocery stores are feasible there.

By adding these two new food retailers, the total population with non-driving access to healthy food retailers will increase from 499,834 to 516,927 (85.4%). 17,093 more residents in Vancouver will gain economic access.

Limitations

The Census data was from 2011 and the latest (2016) census data was not available yet. Therefore, the quantitative evaluation cannot reflect the true up-to-date situation of the city.

Additionally, in the network analysis, only walking distance to the food retailers were considered, but the analysis neglected the service area that can be reached via public transit. This further resulted an inaccuracy in calculating the people being served by food retailers. However, it won't affect the comparison between baseline and after addition.

The HFR in this dataset sell different produces, and to access stores with diversified produces is one of the requirement for a healthy food environment. Nonetheless, this model didn't analyze the produce diversity of the food retailers. A neighborhood with high existing HFR density may not reflect a satisfied healthy food retail environment, yet it was not considered as locations with poor food access in this model.

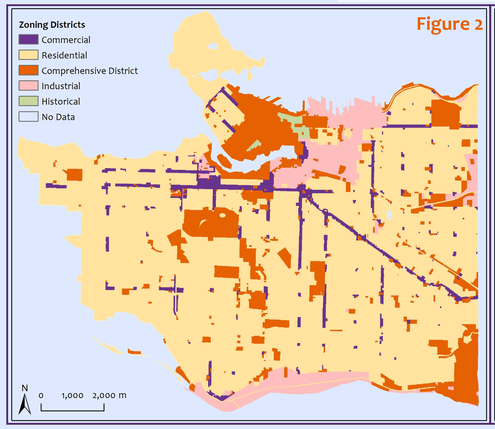
In zoning regulation criterion, the model neglected all districts of "comprehensive development" for simplicity. Yet, some area under this category can be used for retail business in reality.

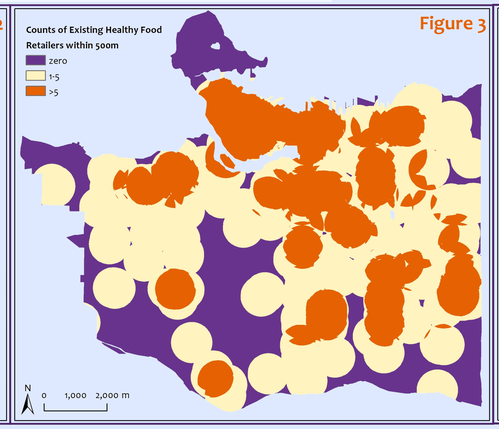
Conclusion

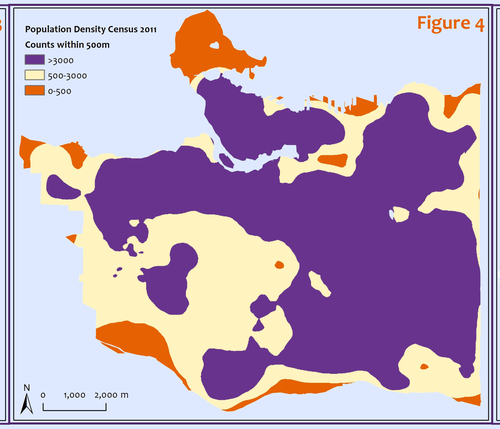
Overall, this model is a simplified approach to identify the gaps of healthy food access and will underestimate Vancouver's problem of accessing healthy food retailers by means other than driving. Future study is recommended to build on this model and take into considerations of the produces diversity and expand the study area.

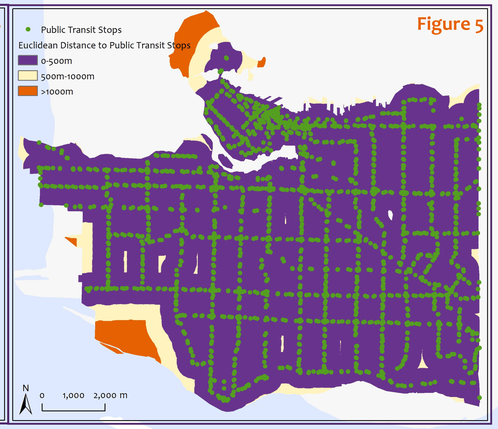
References

1. Household Food Insecurity in Canada: Overview - Food and Nutrition Surveillance - Health Canada. Hc-scgcca. 2012. Available at: http://www.hc-sc.gc.ca/fn-an/surveill/nutrition/commun/insecurit/index-eng.php. Accessed May 7, 2017.
2. USDA Defines Food Deserts | American Nutrition Association. Americannutritionassociationorg. 2011. Available at: http://americannutritionassociation.org/newsletter/usda-defines-food-deserts. Accessed May 7, 2017.
3. Charreire H, Casey R, Salze P et al. Measuring the food environment using geographical information systems: a methodological review. 2010.
4. City of Vancouver. Healthy City Strategy. Vancouverca. 2014. Available at: http://vancouver.ca/people-programs/healthy-city-strategy.aspx. Accessed May 7, 2017.









Tufts University | School of Medicine — Public Health & Professional Degree Programs

Author: Ruijia Niu

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Data Sources:
Bikeway, City of Vancouver Open Data, 2016;
Healthy Food Retailers, Vancouver Coastal Health, 2016;
Hydrography, DataBC, 2011;
Population Density by Dissemination Block, DataBC, 2011;
Public Transit Stops, Translink BC, 2016;
Roads, DMTI Spatial Inc., 2014;
Zoning Districts, City of Vancouver Open Data, 2016