

# How Much Money can be Made? Using the Huff Gravity Model to Predict Sales of Prospective Food Retailers in Atlantic Canada

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CPHA 2019, April 20th, Room 205, 2:00PM-3:30PM



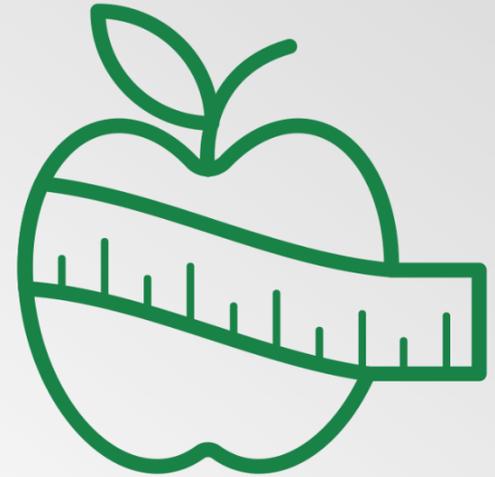
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# Disclosure Statement

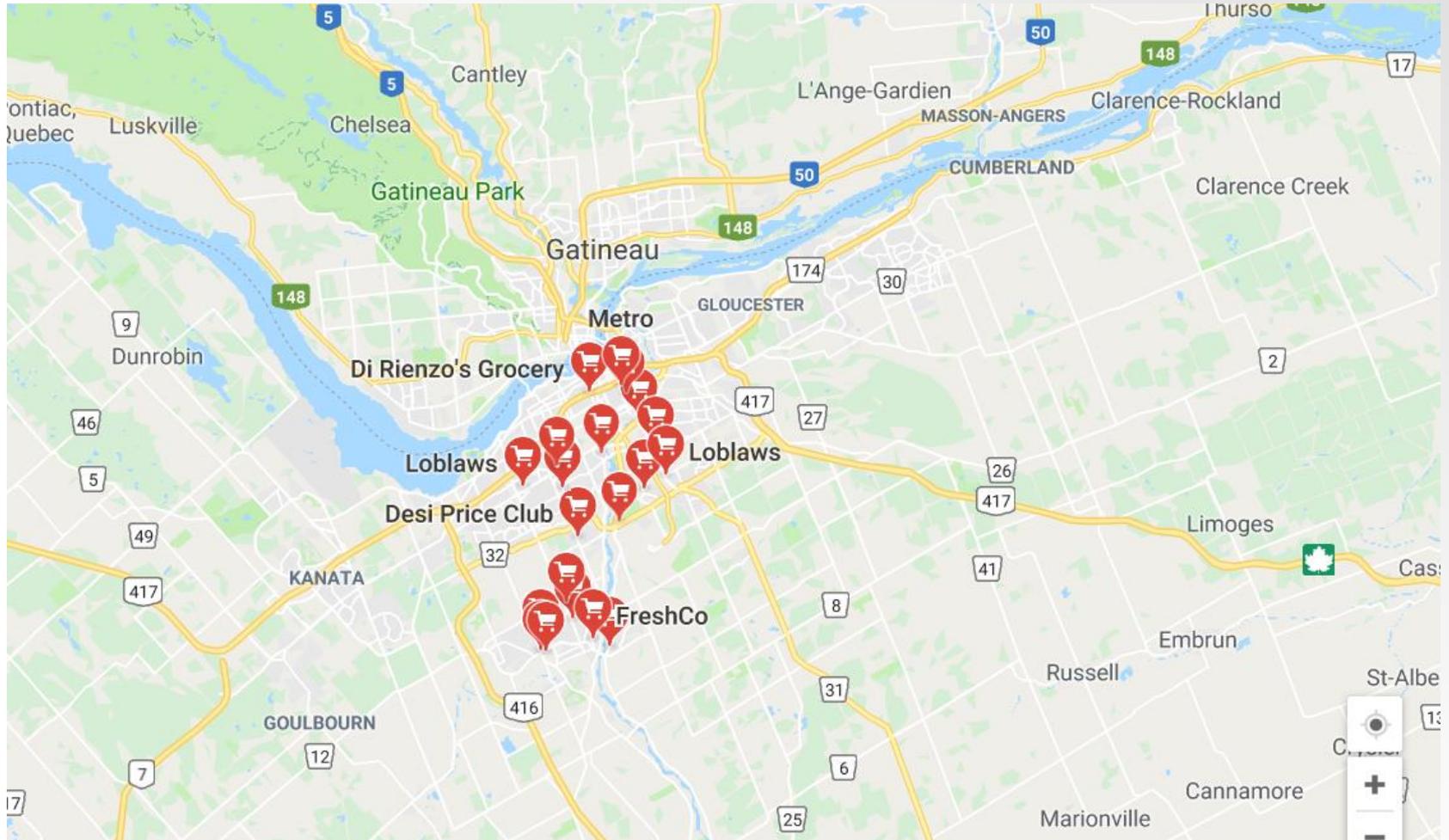
- I have no affiliation (financial or otherwise) with a pharmaceutical, medical device or communications organization.

# Diet and Place

- The 2015 Global Burden of Disease study identified diet-related causes as the leading risk factor for death and disability globally (Forouzanfar et. al. 2016)
- How available, accessible and affordable food is can shape our diets and over time lead to poor health outcomes (Swinburn et. al. 1999)
- A wealth of evidence has linked inequities in access to food with SES and rurality but some interventions remain ineffective or unstable (Abeykoon et. al. 2017)



# Food Desert



# Business Deserts vs. Food Deserts

Food Desert	Variable	Business Desert
Low	Median Income	High
Public or No Access	Transportation	High
High	Unemployment Rate	Low
<b>Low</b>	<b>Existing Businesses</b>	<b>Low</b>
Inner-city neighbourhood isolated from services, Underserviced rural area	Conventional Neighbourhood	Suburban residential neighbourhood, Newly gentrified area with ease of access

# What communities are best suited for new food retailers?

# Part 1: Identifying Communities of Interest

# The Model/Approach

- To identify the best areas for new retailers a variety of variables were chosen to approximate profit potential
- Notably, some variables are treated inversely to a public health approach (Spending on food, PROOF)

Variable	Weight
Spending on Food from Stores as a percentage of total Food Spending	0.2
Average Household Income	0.25
Households with 4+ People as a percentage of Total Households	0.25
Population Driving to Work as a percentage of Total Travelers to work	0.1
Unemployment Rate	0.1
Spending on Fruits and Vegetables as a percentage of spending on Food from Stores	0.1

# Areas of Interest



- High Suitability Areas:  
In and around the HRM, Truro, New Glasgow  
(Suburban, low-spatial access)

Low Suitability Areas:  
Southwestern Nova Scotia, western Newfoundland, much of Labrador  
(Rural, underserved, lower-income)

# Part 2: Assessing the competition

# The Model/Approach

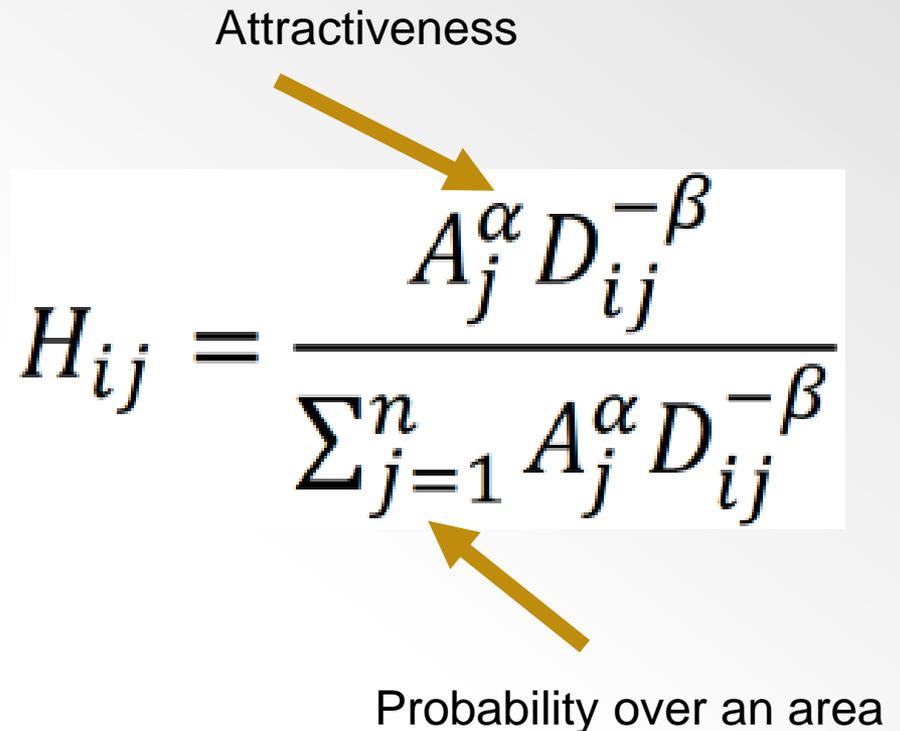
- The Huff model is conventionally referred to as a gravitational model
- The model considers distance to be inversely proportional to customer visits and 'attractiveness' to be directly proportional to customer visits
- Often structured as a probabilistic model over a certain spatial area

## Huff Model

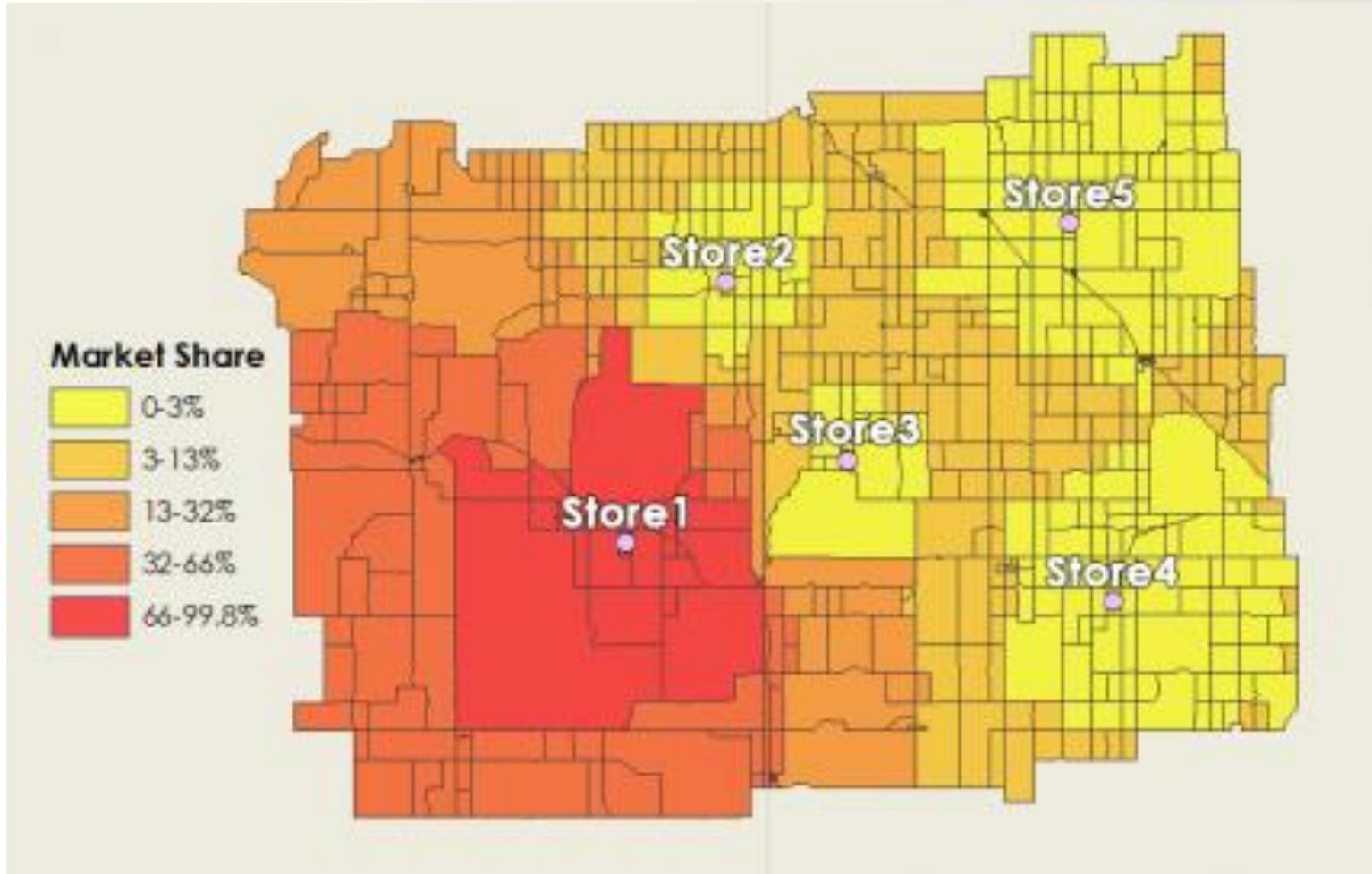
Attractiveness

$$H_{ij} = \frac{A_j^\alpha D_{ij}^{-\beta}}{\sum_{j=1}^n A_j^\alpha D_{ij}^{-\beta}}$$

Probability over an area

The diagram shows the Huff Model equation. A yellow arrow points from the word 'Attractiveness' to the term  $A_j^\alpha$  in the numerator. Another yellow arrow points from the phrase 'Probability over an area' to the denominator  $\sum_{j=1}^n A_j^\alpha D_{ij}^{-\beta}$ .

# The Model/Approach



<https://gisgeography.com/huff-gravity-model/>

# Profit Potential by Community

Site	Community	Weighted Suitability	Predicted Sales
NB1	New Maryland	4	6,418,000
NB2	Hurlett	3.9	3,418,000
NB3	Fredericton West	4.15	5,046,000
NB4	McGregor Brook	3.75	2,582,000
NB5	Little Tracadie	3.7	3,922,000
NS1	Port Williams	4.1	3,263,000
NS2	Hammonds Plains	4	5,428,000
NS3	East Shearwater	4.1	30,207,000
NS4	St. Andrews	4	2,851,000
NS5	River Ryan	3.9	2,070,000
PE1	St Lawrence	3.9	2,706,000
PE2	East Kensington	4.1	2,476,000
PE3	South Freetown	3.85	3,313,000
PE4	Winslow South	3.85	1,884,000
PE5	Marie	3.75	9,646,000
NL1	Upper Island Cove	4.2	5,549,000
NL2	Paradise	4.2	39,534,000
NL3	Maddox Cove	4	20,892,000
NL4	North St. John's	3.95	5,543,000
NL5	Goose Bay	4.15	1,810,000

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# Discussion

- Successful sites are situated within areas experiencing high access but have low spatial access
- Modeling approach built on private sector strategies favours income and variables that are highly colinear with income (PH?)
- Existing policies contribute to the exacerbation of inequities through market mechanisms



# Conclusions



- Private sector considerations of community needs may vastly differ from public health
- Currently, profit-potential is considered highest in areas with low spatial-access and higher incomes (Suburban Canada)
- Assessing community need from a private sector perspective may provide insights for future public health interventions

# Future Work

- Use of a new custom-built algorithm in R to process distance matrices
  - Enables sensitivity analysis of models
  - Facilitates transparent reporting
- Investigating the profit-potential of high-need, low-suitability DAs
  - Can social enterprise provide a market-based intervention strategy?
- Relating market suitability to health

# Thank you!

- Noun Project Users:
  - Romzicon
  - Massupa Kaewgaha
  - Ben Davis
  - Vectors Market
- Funders and Institutional Affiliations



# Data Sourcing

Data	Source
Business Data	Esri, InfoGroup
Demographics (Census Variables)	Environics Analytics
Consumer Spending	Environics Analytics
PRIZMC5 Information	Environics Analytics
Rural Area and Population Center Classification Data	Statistics Canada
Dissemination .shp files	Statistics Canada