SPATIAL DISTRIBUTION AND EVIDENCE OF FACTORS CAUSING OBESITY/LIFESTYLE DISEASES FOR DISTINCT SUB-POPULATIONS

Nasier Mohamed Fakier

Advisor: Dr Justine Blanford
TOP CAUSES OF DEATH IN 2015

- Heart Disease: 8.8 million
- Stroke: 6.2 million
- COPD: 3.2 million
- Respiratory Infection: 3.2 million
- Cancer: 1.7 million
- Diabetes: 1.6 million


RISK FACTORS

Uncontrollable
DNA
Age

Controllable
Substance Use
Physical Activity

Obesity

- What factors cause obesity and diabetes?
- Are these spatially correlated?
- Are there relationships between factors and population characteristics?

- Obesity and diabetes – definitions and background
- What work has already been done?
- Objectives
- Data and Analysis
- Expected Results and Timeline
• **Body Mass Index (BMI)** = Body Mass in kg/Square of height in meters (kg/m²)

• Obesity is spreading worldwide

• Previously considered a disease of affluence

• Developing countries will have more obese by 2030 (Kelly et al)

More than half of American children set to be obese by age 35, study finds

Harvard researchers predict 57% of children will grow up obese

'It's definitely a shocking and sobering number' says lead author

'A 2-year-old who is obese is more likely to be obese at 35 years of age than an overweight 19-year-old,' the study found. Photograph: McCrickard/Rex Shutterstock
• **Diabetes**: high blood glucose levels

• **2 types**
  • Type 1: no insulin production – autoimmune disorder
  • Type 2: insulin resistance

• **Rapidly growing disease**

• **Link between diabetes and other lifestyle diseases**

*Source: World Health Organization*
• What are the determining factors in obesity/lifestyle diseases?
• Do these factors have a spatial dependency?
<table>
<thead>
<tr>
<th>Study</th>
<th>Description</th>
<th>Population Characteristics</th>
<th>Stratification</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ludwig(2001)</td>
<td>SSB and obesity</td>
<td>11-12 year olds in selected MA schools</td>
<td>Neighborhood walkability</td>
<td>Massachusetts</td>
</tr>
<tr>
<td>Morland(2006)</td>
<td>Supermarkets and obesity</td>
<td>ARIC participants</td>
<td></td>
<td>MI, NC, MY, MN</td>
</tr>
<tr>
<td>Lopez(2007)</td>
<td>Neighborhood Risk factors</td>
<td>Adults with BMI &gt; 30</td>
<td></td>
<td>USA</td>
</tr>
<tr>
<td>Smith(2008)</td>
<td>Walkability and BMI</td>
<td>Utah Population Database BM &gt; 18.5</td>
<td>Gender</td>
<td>Salt Lake County</td>
</tr>
<tr>
<td>Kwate(2008)</td>
<td>Fast food density in NYC</td>
<td>NYC Dept of Health restaurant list</td>
<td>Race, Income</td>
<td>New York City</td>
</tr>
<tr>
<td>Morland(2006)</td>
<td>Supermarkets and obesity</td>
<td>ARIC participants</td>
<td></td>
<td>MI, NC, MY, MN</td>
</tr>
<tr>
<td>Lopez(2007)</td>
<td>Neighborhood Risk factors</td>
<td>Adults with BMI &gt; 30</td>
<td></td>
<td>USA</td>
</tr>
<tr>
<td>Smith(2008)</td>
<td>Walkability and BMI</td>
<td>Utah Population Database BM &gt; 18.5</td>
<td>Gender</td>
<td>Salt Lake County</td>
</tr>
<tr>
<td>Kwate(2008)</td>
<td>Fast food density in NYC</td>
<td>NYC Dept of Health restaurant list</td>
<td>Race, Income</td>
<td>New York City</td>
</tr>
<tr>
<td>Lovasi(2009)</td>
<td>Built environment and obesity in disadvantaged populations</td>
<td>low socioeconomic status, black race, or Hispanic ethnicity</td>
<td></td>
<td>USA</td>
</tr>
<tr>
<td>Black(2009)</td>
<td>Neighborhoods and obesity</td>
<td>Adults with BMI &gt; 30</td>
<td></td>
<td>New York City</td>
</tr>
<tr>
<td>Zick(2009)</td>
<td>Neighborhoods and obesity</td>
<td>Utah Population Database BM &gt; 18.5, age 25-64</td>
<td>Income</td>
<td>Salt Lake County</td>
</tr>
<tr>
<td>Brown(2009)</td>
<td>Walkability and BMI</td>
<td>Utah Population Database BM &gt; 18.5, age 25-64</td>
<td>Gender</td>
<td>Salt Lake County</td>
</tr>
<tr>
<td>Michimi(2010a)</td>
<td>Supermarket accessibility</td>
<td>BRFSS</td>
<td>Urban/Rural</td>
<td>USA</td>
</tr>
<tr>
<td>Michimi(2010b)</td>
<td>Spatial patterns of obesity</td>
<td>BRFSS</td>
<td></td>
<td>USA</td>
</tr>
<tr>
<td>Block(2011)</td>
<td>BMI and fast food</td>
<td>Adults in Framingham Study</td>
<td>Age, gender, education</td>
<td>Massachusetts</td>
</tr>
<tr>
<td>Smith(2011)</td>
<td>Walkability and weight</td>
<td>Utah Population Database 17-20 and 27-30</td>
<td></td>
<td>Salt Lake County</td>
</tr>
<tr>
<td>Laraia(2014)</td>
<td>Spatial pattern of BMI in Northern California</td>
<td>Adults with Diabetes</td>
<td></td>
<td>Northern California</td>
</tr>
<tr>
<td>Gartner(2016)</td>
<td>Spatial distribution of gender differences in obesity prevalence</td>
<td>BRFSS</td>
<td>Gender</td>
<td>USA</td>
</tr>
<tr>
<td>Althoff(2017)</td>
<td>Activity inequality and obesity</td>
<td>Adults who walked</td>
<td>Gender, income</td>
<td>Worldwide</td>
</tr>
</tbody>
</table>
KEY FINDINGS

• Obesity is a key factor in lifestyle disease
  • NHLBI review (2013)
  • Basu et al. cite high obesity/low diabetes, low obesity high diabetes

• Obesity result of consumption of energy dense-foods and reduced physical activity
  • WHO

• Walkability has an influence on obesity
  • Saelens, Smith
  • Feng et al. found no correlation
  • Zick et al. observed an inverse correlation for low income neighborhoods
• Diabetes and obesity show definite spatial clustering in US
  • Gartner et al

CDC: Map shows Southern obesity belt (2016)

KEY FINDINGS (CONT.)

• Proximity of food stores unclear
  • Trapp: positive correlation with proximity of supermarket
  • Michimi: further distance to supermarket resulted in higher obesity only in urban areas
  • Block: no relationship between obesity and distance to fast food outlet
  • Pearce: in poor neighborhoods, highest obesity observed in those furthest from fast food outlets!
  • Kwate: higher density of fast food outlets in African American neighborhoods (with higher obesity)

• Increased sugar consumption identified as a main contributor to obesity rates
  • Increased SSB consumption noted by Malik, Singh, Han
  • Positive correlation (Ludwig, Vasanti)
Diabetes Prevalence

Soft Drinks Consumed

Adult Obesity

Physical Activity

Data Source: https://maps.communitycommons.org
• Limitations of the current studies
• Few have looked at national level
• Discrete populations
  • Adults (BRFSS, Utah Populations, Framingham study)
    • With diabetes, who were obese, who walked
  • 11-12 year olds
  • Low socioeconomic status
  • Ethnicity

• This study will examine obesity at the national level
OBJ ECTIVES

• Examine distribution and growth of obesity (and lifestyle diseases) at the national level (USA)

• What, if any, commonalities exist between geographic locations influencing obesity
Examine the distribution and growth of obesity (and lifestyle diseases)

- Perform Hotspot analysis on obesity and diabetes prevalence to determine hot and cold clusters
  - Getis-Ord Gi*
- Analyze at the national level (2005, 2015)

Diabetes hot spots and cold spots
Grubesic et al (2014)

Obesity hot spots and cold spots
Michimi et al (2010)
What if any commonalities exist between geographic locations influencing obesity

Examine areas:
• Contain high-high obese rates
• For outlier areas (areas with high obese rates surrounded by areas with low obese rates)

Within these areas select subpopulations that are similar

For each area analyze variables that may affect obesity and diabetes:
• Walkability and its sub-factors (land use, climate, crime levels)
• Population characteristics
• Availability of food types (supermarkets, fast-food restaurants, sugar sweetened beverages)
• Geographic distribution of other measured variables

Analysis of clusters and outliers with Morans’I and LISA
Statistical analysis to assess similarities, differences and correlations
DATA SOURCES

• BRFSS SMART data : https://www.cdc.gov/brfss/smart/smart_data.htm
  • 2002-2015
  • City level (MMSA Metropolitan/micropolitan statistical area)
  • Demographics, Health assessment, BMI, Smoking, Alcohol, Diet, Physical Activity

• CDC 500 Cities project : https://www.cdc.gov/500cities/
  • Data at census tract level for Cancer, Heart Disease, Diabetes, Stroke, Physical Activity, Obesity

• USDA

• TIGER
EXPECTED RESULTS

• Identify key obese areas throughout the USA
• Characterize key obese areas and outlier areas
• Determine similarities and differences

• Results could provide guidance regarding response to obesity and diabetes
TIMELINE

Dec

Abstract Submission

Conf Paper Submission

Jan-Sep

Conference Presentation (tentative)

Conf paper submission

Conference presentation preparation

Oct

Capstone Presentation

Data Preparation Analysis

Conference presentation preparation
THANK YOU

QUESTIONS?


