Using GIS to assess the impact of childhood environments on obesity

Aims and Objectives

Aim
• To examine the relationship between environmental exposure near the school, home and ‘route’; and health outcomes among children

Objectives
• To undertake a national analysis of childhood obesity using the NZ health survey
• Identify the exposure of school children to obesity based on the characteristics of the food and physical environments in Hamilton
• To relate obesogenic environment and health among Hamilton children

Food Environment vs Physical Environment

• Access of food sources within a given community
• Obesogenic Food Environment characteristics:
  — High number of fast food outlets (Toxic food environment)
  — Low number of healthy food outlets
• Built and physical aspects of the environment, which influences how people interact within their environment
• Obesogenic Physical Environment characteristics:
  — Lack of accessibility to physical exercise
  — Lack of recreational grounds and parks
  — Lack of active transport infrastructure (walkability and cyclability)

Typically in areas of high social and economic deprivation

Background

• Childhood Obesity
  — Obesity is a major global public health issue
• Childhood Obesity in New Zealand
  — “One-third of children are overweight or obese; 11 percent are obese in 2011-12.” (NZHS, 2011).
• Obesogenic Environments
  — “Obesity is a normal response to an abnormal environment” (Weight Management Centre, 2010)
• Applications of GIS in Public Health
  — Processing, analysing and interpreting spatial and geographical data

Nationwide Analysis

• New Zealand Health Survey (NZHS) children aged 5-14. (n=2404)
• NZHS data variables: Age, Ethnicity, Social Deprivation, Nutrition, Mode of Transport, Food Security, Body Mass Index (BMI)
• Relationship between NZHS data variables and BMI
• Nationwide Regression Analysis between BMI and Active Transport
### Transport mode

#### Transport Mode of Participants

<table>
<thead>
<tr>
<th>Transport Mode</th>
<th>Number of Participants</th>
</tr>
</thead>
<tbody>
<tr>
<td>Walk</td>
<td>136</td>
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<tr>
<td>Bike</td>
<td>125</td>
</tr>
<tr>
<td>Skate</td>
<td>407</td>
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<tr>
<td>Car</td>
<td>75</td>
</tr>
<tr>
<td>Bus</td>
<td>76</td>
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<tr>
<td>Other</td>
<td>103</td>
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</table>

### BMI, age and mode

#### Age Group vs BMI

<table>
<thead>
<tr>
<th>Age Group</th>
<th>BMI</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>10</td>
</tr>
<tr>
<td>6</td>
<td>15</td>
</tr>
<tr>
<td>7</td>
<td>20</td>
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<td>8</td>
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<td>45</td>
</tr>
<tr>
<td>13</td>
<td>50</td>
</tr>
<tr>
<td>14</td>
<td>55</td>
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</table>

### BMI vs Mode of Transport

#### Unstandardized and Standardized Coefficients

<table>
<thead>
<tr>
<th>Model</th>
<th>Unstandardized Coefficients</th>
<th>Standardized Coefficients</th>
<th>Sig.</th>
<th>95.0% Confidence Interval for B</th>
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<tbody>
<tr>
<td>Walk</td>
<td>.468</td>
<td>.048</td>
<td>.019</td>
<td>.076 860</td>
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<tr>
<td>Bike</td>
<td>.842</td>
<td>.040</td>
<td>.049</td>
<td>.005 1.679</td>
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<tr>
<td>Skate</td>
<td>-1.372</td>
<td>-.057</td>
<td>.005</td>
<td>-2.326 -418</td>
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<tr>
<td>Car</td>
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<td>-.104</td>
<td>.000</td>
<td>-1.396 -616</td>
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<tr>
<td>Bus</td>
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<td>.084</td>
<td>.000</td>
<td>.559 1.559</td>
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</tbody>
</table>

### Active vs passive transport

#### Exclusively active vs exclusively passive transport

- North Island
- NZ’s 5th most populated city, 150,000
  - 69.5% Pākehā/European
  - 21.1% Māori
  - 13.8% Asian
  - 5.1% Pacific Peoples
  - 2.0% Other
- Dairy farming
- Chiefs (Rugby) and WBOP Magic (Netball)
- Hamilton identified as an area of obesity concern
Hamilton City Analysis

- Geospatial Analysis of obesogenic environments
- NZHS children aged 5-14 (N=70)
- NZHS data variables: Age, Ethnicity, Social Deprivation, Nutrition, Mode of Transport, Food Security, Body Mass Index (BMI)
- Exposure to obesogenic (& non-) environment and BMI
- BMI and Transport Mode

Food Environment
- Takeaways
- Dell/Eating houses
- Dairies
- Bakeries

Physical Environment
- Green space

Network Route Analysis
- Closest Facility Network
  - Schools
  - Pop weighted Centroids
- Match the NZHS child to the nearest age/gender appropriate school

Neighbourhood Environment – Home and School Buffer
- 5-14 NZ Health Survey Meshblocks
- Full Primary School and home
- 200m Buffer Zone round both

Neighbourhood Environment – Route Buffer
- Food environment vs Physical environment
- 200 metre buffer round school & home
- 30 metre buffer round route
- 100 metre buffer round route
- Non obesogenic environment
Neighbourhood Environment

- Food environment vs Physical environment
- Closest Facility Network Analysis
- 30 metre buffer zone
- 100 metre buffer zone
- Obesogenic environment

Hamilton City Geospatial analysis results

- Food environment = the number of fast food outlets within the participants route buffer
- Physical environment = the amount of greenspace within the participants route buffer

BMI vs Environment

Regression Analysis: BMI and Food Environment

<table>
<thead>
<tr>
<th>Model</th>
<th>R</th>
<th>R Square</th>
<th>Adjusted R Square</th>
<th>Std. Error of the Estimate</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>.130</td>
<td>.017</td>
<td>.002</td>
<td>4.12</td>
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</table>

Regression Analysis: BMI and Physical Environment

<table>
<thead>
<tr>
<th>Model</th>
<th>R</th>
<th>R Square</th>
<th>Adjusted R Square</th>
<th>Std. Error of the Estimate</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>.115</td>
<td>.013</td>
<td>.001</td>
<td>2.875</td>
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</table>

No statistical significance – low R Squared values

Transport Mode vs Food Environment

<table>
<thead>
<tr>
<th>Model</th>
<th>R</th>
<th>R Square</th>
<th>Adjusted R Square</th>
<th>Std. Error of the Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Walk</td>
<td>-1.15</td>
<td>0.03</td>
<td>-0.01</td>
<td>2.875</td>
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<td>Bike</td>
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<td>-1.115</td>
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<tr>
<td>Skate</td>
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</tr>
<tr>
<td>Bus</td>
<td>-0.967</td>
<td>0.881</td>
<td>-1.19</td>
<td>328</td>
</tr>
</tbody>
</table>

Key Findings

- No significant connection between a participants environment and BMI status
- Mode of transport does not have a significant bearing on BMI status
- Social Indicators are far more effective at predicting BMI status (Social Deprivation)

Limitations

- Geospatial assumptions about NZHS participants – most likely route to school.
- Hamilton City – small sample size
Conclusion

• No connection found between obesogenic environments and increased BMI status

• Use of GIS to develop a method for estimating home, school and journey to school environmental exposure

Questions