Lange, Jarrod,
Service accessibility challenges faced by non-metropolitan South Australians aged 65 years and over.
Oral presentation accompanied by slides, given at Spatial Information Day (SID 2013), held on Friday 16 August, 2013 at the Adelaide Convention Centre.

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http://hdl.handle.net/2440/80260
Service accessibility challenges faced by non-metropolitan South Australians aged 65 and over

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Presentation Outline

1. Setting the scene
   a) Mobility/accessibility challenges faced by older people aged 65 and over in non-metropolitan South Australia
   b) Spatial indices and accessibility approaches

2. Development of the Service Accessibility/Transport Disadvantage Index (SATDI)
   a) Methodology
   b) Results/findings

3. Summary and concluding remarks
The movement of people, goods and services from one destination to another is a key component of everyday life.

Car travel in all western societies is not only the most common form of transportation, but also the most expected mode of transportation used.

In 2012, there were 12.7 million cars (passenger vehicles) registered in Australia – approx. 1.69 persons to every car (ABS, 2012).

This poses a challenge to the older generation who due to medical reasons or others, may no longer be able to own or operate a car.
Research indicates non-accessible transportation for older people can result in:

- Diminished physical/mental health and wellbeing
- Social isolation/exclusion
- Reduced quality of life

(Baster, 2012; Hess, 2009; Kim and Ulfarsson, 2004; Shergold and Parkhurst, 2012; Su, 2007; Ureta, 2008)

Older people tend to drive for longer and reluctantly surrender their drivers licence since alternative transport options are: (1) too expensive; (2) infrequent/limited services; (3) live too far from the nearest transit stop; (4) overcrowded services – lack of seating; and (5) crime/safety concerns when waiting for public transport

(Peck, 2010)
Mobility/accessibility in the context of this research has been defined as the ease with which people can reach locations providing required goods and service.

In Australia, the importance of developing a composite index of accessibility to different service types has been ongoing for some time.

Geographical Information Systems (GIS) have an important role to play in this area.
HABITABILITY MAP OF AUSTRALIA

After T. Griffith Taylor in "Limits of Land Settlement"

Coalfields shown in Black

N.B. The boundaries between regions represent lines of population density.
Accessibility/Remoteness Index Australia (ARIA) 2011

ARIA+ (and ARIA++), are indexes of remoteness derived from measures of road distance between populated localities and service centres. These road distance measures are then used to generate a remoteness score for any location in Australia.

ARIA+ (2011) 1km grid
- Highly Accessible (0 - 0.2)
- Moderately Accessible (0.2 - 2.4)
- Accessible (2.4 - 5.92)
- Remote (5.92 - 10.53)
- Very Remote (10.53 - 15)

Data Sources:
The University of Adelaide (APMRC - inc. GISCA),
Geoscience Australia, & Australian Bureau of Statistics
### Transportation Accessibility Approaches

<table>
<thead>
<tr>
<th>Indices</th>
<th>Studies</th>
<th>Incorporated Performance Measure(s)</th>
<th>Reflecting Transit Availability?</th>
<th>Reflecting Transit Comfort and Convenience?</th>
<th>Reflecting Travel Demand Distribution?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transit Level of Service Indicator</td>
<td>Kittelson &amp; Associates and URS, Inc. 2001</td>
<td>Service coverage, frequency, service span, population, jobs</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
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<tr>
<td>Transit Service Accessibility Index</td>
<td>Polzin et al. 2002</td>
<td>Service coverage, service span, frequency, travel demand</td>
<td>Yes</td>
<td>No</td>
<td>Total # of trips</td>
</tr>
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<td>Local Index of Transit Availability</td>
<td>Rood 1997</td>
<td>Frequency, capacity, route coverage</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Public Transportation Accessibility Level</td>
<td>Hillman 1997</td>
<td>Service frequency, service coverage</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
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<tr>
<td>Service Quality Index</td>
<td>Hensher et al. 2004</td>
<td>13 variables (i.e., travel time, frequency, etc.)</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Transit Travel Time</td>
<td>Dowling and Colman 1998</td>
<td>Transit travel time</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
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<tr>
<td>Transit Travel Speed</td>
<td>St. Jacques et al. 1997</td>
<td>Transit speed</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
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<td>Mobility Index</td>
<td>Galindez and Mireles-Cordov 1999</td>
<td>Travel speed, average vehicle occupancy</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Wait Assessment</td>
<td>MTA-NYCT 2001</td>
<td>Headway</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
</tr>
</tbody>
</table>

(Fu and Xin, 2007)

- Land Use and Public Transport Accessibility Indexing Model (LUPTAI), 2007
- Composite Index of Public Transport Accessibility, 2011
Development of the Service Accessibility/Transport Disadvantage Index (SATDI)

- Consists of two components:
  1. Accessibility to key services
  2. Public transport accessibility

The index has been designed for the Murray and Mallee Region of South Australia
The Murray and Mallee Region (SA3)

- Total area: 37,277 km²
- Total Population in 2011 was 67,698 (18.1% aged 65+)
- Largest populated centre is Murray Bridge (15,968) followed by Renmark (4,389)
- Smallest centre is Blanchetown (210)
- Average motor vehicles per dwelling 1.9

(ABS, 2011)
**SATDI Component 1: Service Accessibility**

- Subset of primary data collected from the ‘Linking rural older people through technology’ survey *(Hugo et al., 2010)* to determine key services for people aged 65+ in the Murray Mallee region.

- Responses to the survey question about accessing services outside of the home were re-coded into service categories:
  - Q: “List the name and location of any services that you use outside of your home?”

- Results to the above question were combined resulting in 2,174 individual responses.

- Each service category was then ranked in order from the highest to the lowest number of responses for that service category.
### SATDI Component 1: Service Accessibility

The top 5 category responses were used for this component of the index, representing over 60% of all the participant subset responses.

<table>
<thead>
<tr>
<th>Rank</th>
<th>Service Type</th>
<th>Response Count</th>
<th>% of Total Responses</th>
<th>% of Top 5 Responses</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Medical Clinic/GP</td>
<td>568</td>
<td>26.13</td>
<td>42.58</td>
</tr>
<tr>
<td>2</td>
<td>Groceries</td>
<td>350</td>
<td>16.10</td>
<td>26.24</td>
</tr>
<tr>
<td>3</td>
<td>General Shopping</td>
<td>196</td>
<td>9.02</td>
<td>14.69</td>
</tr>
<tr>
<td>4</td>
<td>Optometrist</td>
<td>122</td>
<td>5.61</td>
<td>9.15</td>
</tr>
<tr>
<td>5</td>
<td>Dentist</td>
<td>98</td>
<td>4.51</td>
<td>7.35</td>
</tr>
<tr>
<td></td>
<td><strong>Top 5 Responses</strong></td>
<td><strong>1,334</strong></td>
<td><strong>61.36</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Total Responses</strong></td>
<td><strong>2,174</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Address data was manually acquired for all 5 key service types within the Murray and Mallee, including those within a 20km buffer of this region:

- The Australian Yellow Pages
- Pitney Bowes, Australian MapInfo Business Points, 2011
- ABS Urban Centre/Localities dataset, 2011 (General Shopping)

- Land parcel dwelling centroids used to calculate distances to each service type
- A detailed road network (SA Dept. Planning, Transport & Infrastructure)
- ESRI ArcGIS 10.1 - Network Analyst tool used to calculate roads distances (Closest Facility)
SATDI Component 1: Service Accessibility

Legend
- Murray and Mallee (SA3) Region
- Dwelling Point Centroids

Data Sources:
Australian Bureau of Statistics, 2011;
SA Department of Planning, Transport & Infrastructure, 2011
SATDI Component 1: Service Accessibility

Calculation for a land parcel dwelling centroid near the town of Meningie (38659)

- 55.41km from the nearest Dentist;
- 55.54 km from the nearest General Shopping location;
- 2.88 km from the nearest General Practitioner (GP);
- 2.90 km from the nearest Grocery Shopping location;
- 77.86 km from the nearest Optometrist.

Divide by the average distance to each service category type:

- Dentist = 55.41 / 13.28 = 4.17 {exceeds threshold so score = 3.00}
- General Shopping = 55.54 / 19.62 = 2.83
- General Practitioner (GP) = 2.88 / 13.78 = 0.21
- Grocery Shopping = 2.90 / 11.56 = 0.25
- Optometrist = 77.86 / 22.99 = 3.39 {exceeds threshold so score = 3.00}

The Service Accessibility score = 3.00 + 2.83 + 0.21 + 0.25 + 3.00

Service Accessibility = 9.29
SATDI Component 2: Public Transport Accessibility

• Aims to quantify the degree of public transport accessibility available to people living in the Murray and Mallee region

• This component of the index is based on two aspects:
  1. Distance a person is likely to walk to access a public transit collection point (bus stop)
  2. Public transport services offered from each bus stop
To determine the degree of public transport accessibility, two key criteria were derived:

- The bus service must travel through the Murray and Mallee region and permit the collection and alighting of passengers along its route and be available to the public without restrictions (e.g. not for medical trips only)
- Each bus route must intersect one or more of the 5 key service categories and these services must be within a 400 metre walking distance of at least one bus stop along that route

Subsequent criteria developed to reflect the likelihood an older person would utilise available public transport
Frequency scores were then assigned to each bus stop.

All bus stops incorporated into a single bus stop layer, with duplicate stops and their frequencies combined.

Circular buffers with a 400 metre radius around each bus stop were created for the purpose of identifying the likely distance a person would walk to access a bus stop.

Overlapping buffers were assigned the highest bus frequency score for the overlapping buffer areas.
**SATDI: Combining Components 1 & 2**

- Weightings modify Component 1: Service Accessibility scores

<table>
<thead>
<tr>
<th>Bus Index Score</th>
<th>Description</th>
<th>Bus Frequency Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Very Infrequent - little to no services per week</td>
<td>0.00 to 0.50</td>
</tr>
<tr>
<td>1</td>
<td>Infrequent - up to one service per week</td>
<td>0.51 to 1.00</td>
</tr>
<tr>
<td>2</td>
<td>Frequent - one to three services per week</td>
<td>1.01 to 3.00</td>
</tr>
<tr>
<td>3</td>
<td>Regular - three to five services per week</td>
<td>3.01 to 5.00</td>
</tr>
<tr>
<td>4</td>
<td>Very Frequent - five to ten services per week</td>
<td>5.01 to 10.00</td>
</tr>
<tr>
<td>5</td>
<td>Highly Frequent - ten or more services per week</td>
<td>10.01 or greater</td>
</tr>
</tbody>
</table>

- ArcGIS ‘Extract Values to Points’ tool used to extract the unweighted bus frequency score for each land parcel dwelling centroid within the 400m circular buffer
SATDI Final Score

- Final scores derived by subtracting the Public Transport Accessibility score from the Service Accessibility score for each land parcel dwelling centroid in the Murray and Mallee region
  (Component 1 – Component 2);

- Final scores less than zero were reset to zero

- An interpolation method (similar to the one used for ARIA+) was used to create a 25 metre square grid surface across the Murray and Mallee region.
Influence of Public Transport Component

Legend

SATDI-25m Grid
- Low Accessibility
- High Accessibility

Murray and Mallee Region (SA3)

Urban Centres / Localities

Data Source: Australian Bureau of Statistics, 2011
### Generating Zonal Statistics (SATDI Categorisation)

<table>
<thead>
<tr>
<th>SA1 Code</th>
<th>Average</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Standard Deviation</th>
<th>Persons 65+</th>
<th>Total Pop</th>
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<tr>
<td>4115903</td>
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<td>0.00</td>
<td>4.80</td>
<td>1.18</td>
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<tr>
<td>4115906</td>
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<td>1.90</td>
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<td>0.32</td>
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<td>0.68</td>
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<td>0.44</td>
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<td>4115917</td>
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<td>0.69</td>
<td>2.85</td>
<td>0.46</td>
<td>70</td>
<td>429</td>
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<tr>
<td>4115918</td>
<td>2.12</td>
<td>0.00</td>
<td>3.26</td>
<td>0.63</td>
<td>30</td>
<td>198</td>
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<td>4115919</td>
<td>2.39</td>
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<td>2.44</td>
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<tr>
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<td>3.61</td>
<td>0.00</td>
<td>7.41</td>
<td>1.66</td>
<td>37</td>
<td>251</td>
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<tr>
<td>4115922</td>
<td>1.69</td>
<td>0.98</td>
<td>2.36</td>
<td>0.29</td>
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<td>2.07</td>
<td>0.59</td>
<td>3.93</td>
<td>0.62</td>
<td>33</td>
<td>265</td>
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<td>4115924</td>
<td>2.19</td>
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<td>435</td>
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<td>2.76</td>
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<td>0.30</td>
<td>19</td>
<td>268</td>
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<td>4116203</td>
<td>2.04</td>
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<td>5.04</td>
<td>0.90</td>
<td>15</td>
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<td>99</td>
<td>871</td>
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<td>5.33</td>
<td>1.16</td>
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<td>418</td>
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</table>
Assumptions & Limitations

• Assumes access to key services is based on the closest service which excludes any consideration of service quality/choice at an alternative location

• Index does not consider the ability to trip-chain and utilise more than one bus service to reach various service destinations

• Walking distance buffer (400m) does not take into account environmental barriers to access

• Key services were based on primary data not specifically designed to determine service usage by those aged 65+

• Assumes passengers board and alight from set bus stops
Data sources could have been more comprehensive – e.g. Yellow Pages?

Does not consider cost of travel beyond distance as a proxy measure for cost

Assumes a person living within walking distance (400 metres) of two bus stops would most likely access the more frequent bus stop

Does not consider other forms of available transportation services e.g. medical bus, hospital transportation services

Weighting system for the bus layer
Summary

- Issues facing older people (65+) in a car dependant society
- Accessibility issues and transport disadvantage (non-metro context)
- Spatial indices that have been developed
- Development of the SATDI and its purpose...
  ....a tool for use with other spatial and non-spatial datasets to assist with decision making
Thank you

• Questions?
References


• Clark, R. et al. 2011. Cardiac ARIA Index: Measuring Accessibility to Cardiovascular Services in Rural and Remote Australia via Applied Geographical Spatial Technology. Brisbane, Queensland: Queensland University of Technology


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- Peck, M. 2010. Barriers to Using Fixed-Route Public Transit for Older Adults. California, USA: Mineta Transportation Institute (MTI), College of Business, San José State University
References

- Taylor, T.G. 1946. Habitability Map of Australia. Online: National Archives of Australia

All photos courtesy of the Murray Mallee Aged Care Group (MMACG)