Spatial frameworks for the analysis of road traffic injuries

Adlai Davids

The Soweto Hotel, Kliptown, Johannesburg

24 May 2010
What is meant by a spatial framework?

• Not a policy context such as in the National Spatial Information Framework (NSIF) of Department of Land Affairs

• Rather an essential element in the generic description/definition of a geographical information system (GIS)
  – To collect, input, manage, analyse and output **georeferenced** data
  – Using computer software and hardware
  – Within an organisational context
• Utilising a grid reference such as latitude and longitude
• Representing the location of real world features as one of at least three features, e.g.
  – Polygons (Municipal boundaries)
  – Lines (Roads, rivers)
  – Points (Trigonometric beacons)
when using a 1: 250 000 map as data input source and spatial reference
Why the interest in a spatial framework for the analysis of road traffic injuries?

- Injury surveillance
- Safety promotion
Definition of Surveillance:

The ongoing, systematic collection, analysis, and interpretation of health data essential to
* planning, implementation, and evaluation of health practice,
* timely dissemination of these data
* the final link …the application of these data to prevention and control.
Public Health Approach to Injury Prevention [after Seedat (2002)]

- Data Collection, Injury Surveillance
- Identification of Risk Factors
- Evaluation Research
- Community Intervention, Training, Public Awareness

Spatial and Temporal Features; social and economic contexts
Identification of areas and localities for intervention
Sources of Injury Data in South Africa

• National Injury Mortality Surveillance System (NIMSS)
  – Launched in 1998; MRC/UNISA Crime, Injury and Violence Lead Programme
  – In 2007, 39 participating mortuaries in seven provinces (excluding Free State & Limpopo)

• Road Traffic Management Corporation (RTMC) – agency of the NDoT
  – Categorised by vehicle drivers, vehicle passengers, pedestrians & cyclists/motorcyclists
NIMSS Data for Gauteng

- **Seven mortuaries:** Pretoria Academic Hospital, Medunsa, Bronkhorstspruit, Diepkloof, Roodepoort, Johannesburg
- List 29 options for **External Cause or Circumstance of Injury**
- Based on the International Classification of Diseases (**ICD-10**)
- The smallest spatial unit recorded on the NIMSS Data Collection Form is a **Suburb** or **District**
Gauteng: Fatal injuries due to road traffic injuries

<table>
<thead>
<tr>
<th>Mortuary</th>
<th>MVA_01</th>
<th>Total_01</th>
<th>MVA_02</th>
<th>Total_02</th>
<th>MVA_all</th>
<th>Grand Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bronkhorstspruit</td>
<td>88</td>
<td>205</td>
<td>74</td>
<td>199</td>
<td>162</td>
<td>404</td>
</tr>
<tr>
<td>Diepkloof</td>
<td>442</td>
<td>1807</td>
<td>357</td>
<td>1778</td>
<td>799</td>
<td>3585</td>
</tr>
<tr>
<td>Germiston</td>
<td>577</td>
<td>2404</td>
<td>589</td>
<td>3064</td>
<td>1166</td>
<td>5468</td>
</tr>
<tr>
<td>Johannesburg</td>
<td>674</td>
<td>2732</td>
<td>690</td>
<td>3468</td>
<td>1364</td>
<td>6200</td>
</tr>
<tr>
<td>Medunsa</td>
<td>166</td>
<td>492</td>
<td>202</td>
<td>658</td>
<td>368</td>
<td>1150</td>
</tr>
<tr>
<td>Pretoria</td>
<td>558</td>
<td>2076</td>
<td>560</td>
<td>2390</td>
<td>1118</td>
<td>4466</td>
</tr>
<tr>
<td>Roodepoort</td>
<td>405</td>
<td>1359</td>
<td>360</td>
<td>1368</td>
<td>765</td>
<td>2727</td>
</tr>
<tr>
<td><strong>Totals:</strong></td>
<td><strong>2910</strong></td>
<td><strong>11075</strong></td>
<td><strong>2832</strong></td>
<td><strong>12925</strong></td>
<td><strong>5742</strong></td>
<td><strong>24000</strong></td>
</tr>
</tbody>
</table>

MVAs as % of Totals

<table>
<thead>
<tr>
<th></th>
<th>2001</th>
<th>2002</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>26.28%</td>
<td>21.91%</td>
</tr>
</tbody>
</table>
NIMSS Data for Gauteng
(Road traffic injury deaths)

• 89 suburbs listed as the ‘Suburb or District’ where a fatal injury occurred due to a road traffic injury
  – Ermelo in Mpumalanga also listed
• Data cannot be linked to the suburbs as these are not universal census areas with population data
• Subplaces seems to be an option, although a name is non-unique
## Example of Non-Unique Names (Suburbs vs Subplaces)

<table>
<thead>
<tr>
<th>NIMSS Suburb</th>
<th>Sub-Place</th>
<th>Sub-Place Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>BARAGWANATH</td>
<td>Boksburg</td>
<td>77305008</td>
</tr>
<tr>
<td>BELLAVISTA</td>
<td>Boksburg Central</td>
<td>77305009</td>
</tr>
<tr>
<td><strong>BOKSBURG</strong></td>
<td><strong>Boksburg Ext 1</strong></td>
<td><strong>77305010</strong></td>
</tr>
<tr>
<td>BOOYSENS</td>
<td>Boksburg North</td>
<td>77305011</td>
</tr>
<tr>
<td>CARLTONVILLE</td>
<td>Boksburg Oos</td>
<td>77305012</td>
</tr>
<tr>
<td>CHIAWELO</td>
<td>Boksburg South</td>
<td>77305013</td>
</tr>
</tbody>
</table>

265 Subplace names identified from 89 suburb names
Spatial framework options: Gauteng municipalities (2006)

Municipal boundaries [n=12]

- Municipal Demarcation Board
- Demographic data as available from Statistics South Africa data (Stats SA) – 2001 and later
Road traffic injury deaths - Distribution of subplaces with RTI deaths by municipalities: Gauteng 2001 & 2002

Source:
National Injury Mortality Surveillance System (NIMSS)
Spatial framework options for Gauteng: Subplaces Census 2001

Subplace boundaries [n=2243]

- Statistics South Africa (2001 output areas)
- Larger spatial units, demographic data dependent on what is published by Stats SA
Road traffic injury deaths - Distribution of subplaces: Gauteng 2001 & 2002

Source:
National Injury Mortality Surveillance System (NIMSS)
Benefits of using subplaces

• The subplaces identifies the actual denominator population, i.e. the population affected by road traffic injuries

• Identifies those Gauteng subplaces where road traffic deaths occur
  – Useful in focusing injury prevention and safety promotion

Local government wards \( [n=423] \)

- Municipal Demarcation Board - 2006
- Independent Electoral Commission (IEC) data from the Voters’ roll, 18 years and older – 2011
- Known, local political representative
Spatial framework options for Gauteng: Road networks
Future Research

- Broad suburbs names will remain in NIMSS records
- Analysis of individual injury categories (pedestrian vs vehicle occupant deaths)
- Can be investigated using a defined denominator population, with age cohorts, socio-economic profiles, etc.
- More localised recording of events – ‘hot spots’; with links to societal actions, norms, etc.
- Spatial analysis – cluster analysis, accessibility analysis, etc.