

# **The use of GIS in the analysis of fatal fall and burn injuries in older adults**

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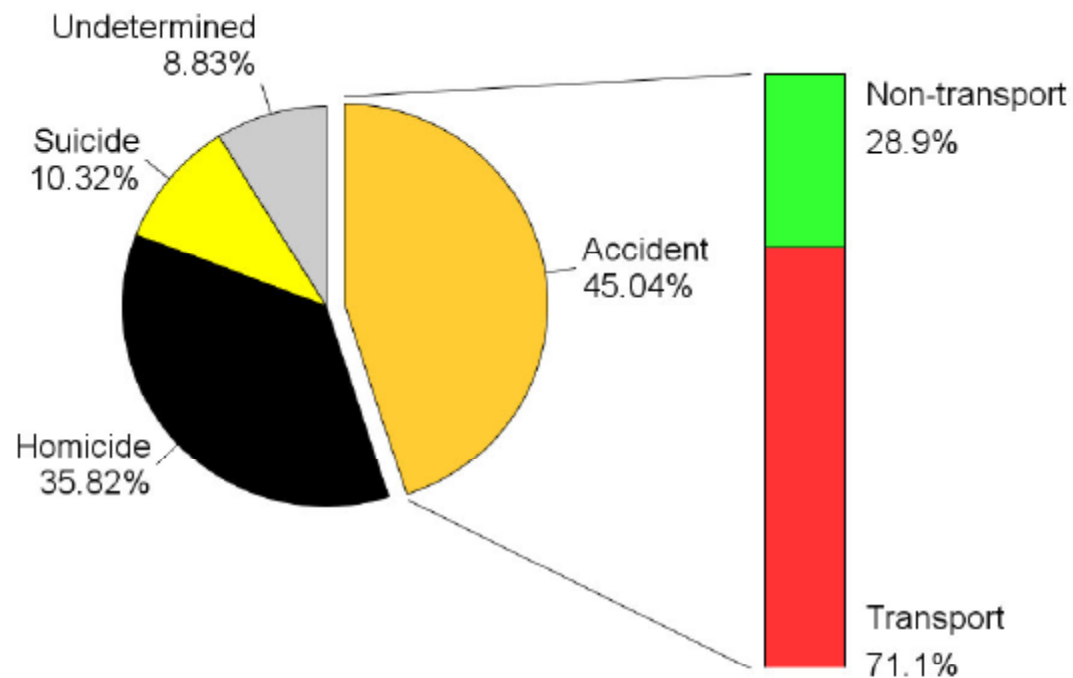


# Fatal injuries in South Africa

- Homicide is a significant cause of death (2007)
- Emphasized by recent reports by the Centre for the Study of Violence and Reconciliation (CSV)
- Annual SAPS crime statistics judged in terms of proportions of violent deaths
- Road traffic crashes a major cause of death
- Other injuries pales somewhat into insignificance

# Fatal injuries in South Africa

- Homicide is a significant cause of death (2007)



Source: NIMSS, 2008

# Manner of death by age

The average age of the victims was 33.2 ( $\pm$  16.3 years). The leading manner of death(s) amongst the:

- **0-14** age group was other unintentional (36%) followed by transport (33.8%);
- **15-24** age group was violence (48.3%);
- **25-34** age group was violence (43.6%) followed by transport (30.7%);
- **35-44** age group was violence (36.4%) followed by transport (35.3%);
- **45-54** age group was transport (36.2%);
- **55-64** age group was transport (37.4%); and
- **65+** age group was transport (33%).

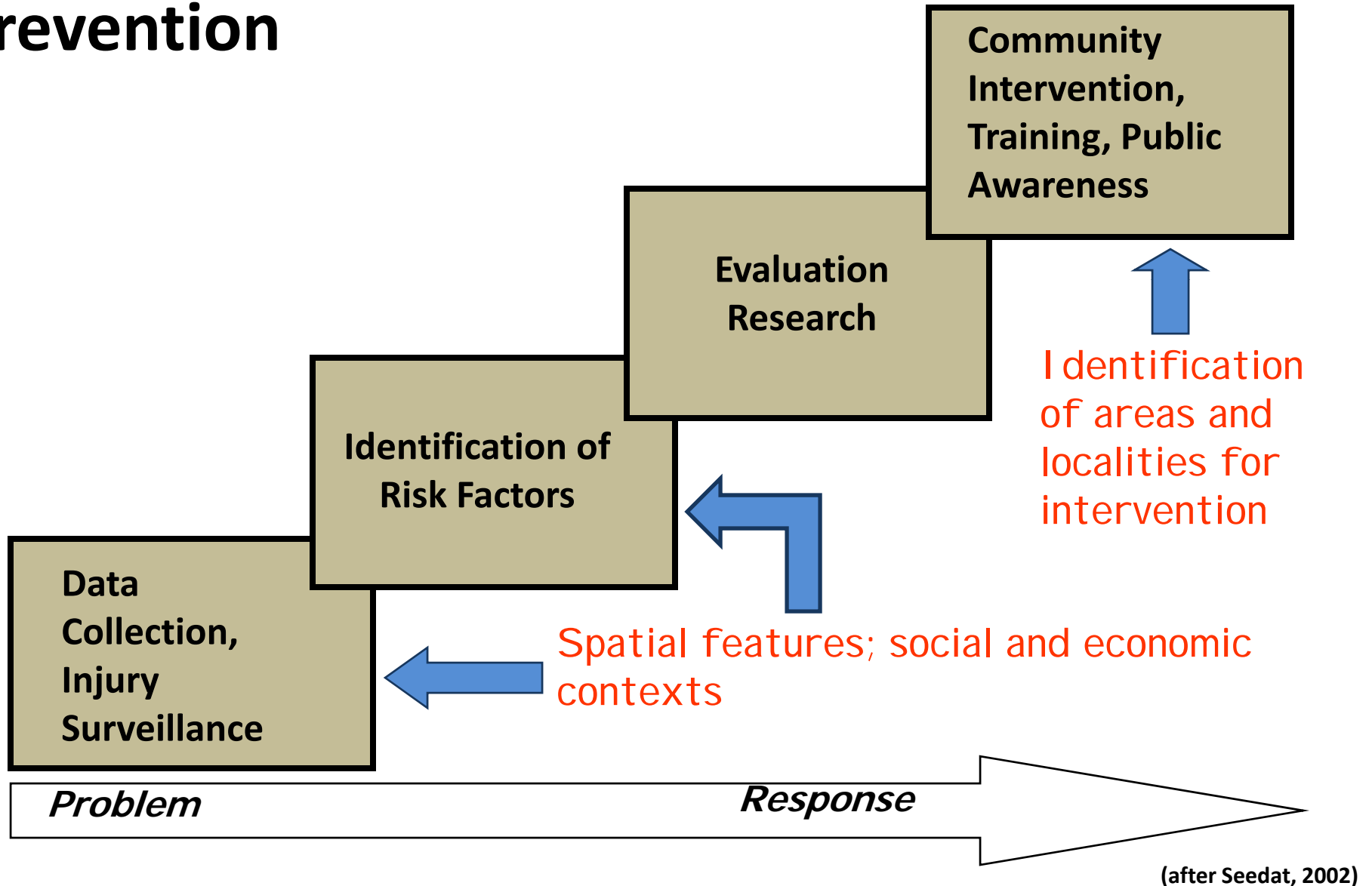
# **Aim of the project**

To establish a Geographical Information System (GIS) database for fatal injuries on victims 50 years and older, from geographical elements recorded by the National Injury Mortality Surveillance System (NIMSS) in South Africa.

# Objectives of the project

- Extract geographical elements from NIMSS data
- Edit geographical element names to match those in place-name databases available from Statistics South Africa (Stats SA)
- Assign Stats SA place-names to NIMSS cases
- Aggregate the available NIMSS data - for burns and falls - to individual geographical or mapping units
- Link the aggregated injury data to geographical units to create a basic GIS database on injury in older adults
- Create sample outputs on the geographical distribution of injury

# Spatial analysis in injury research – the Public Health Approach to Injury Prevention

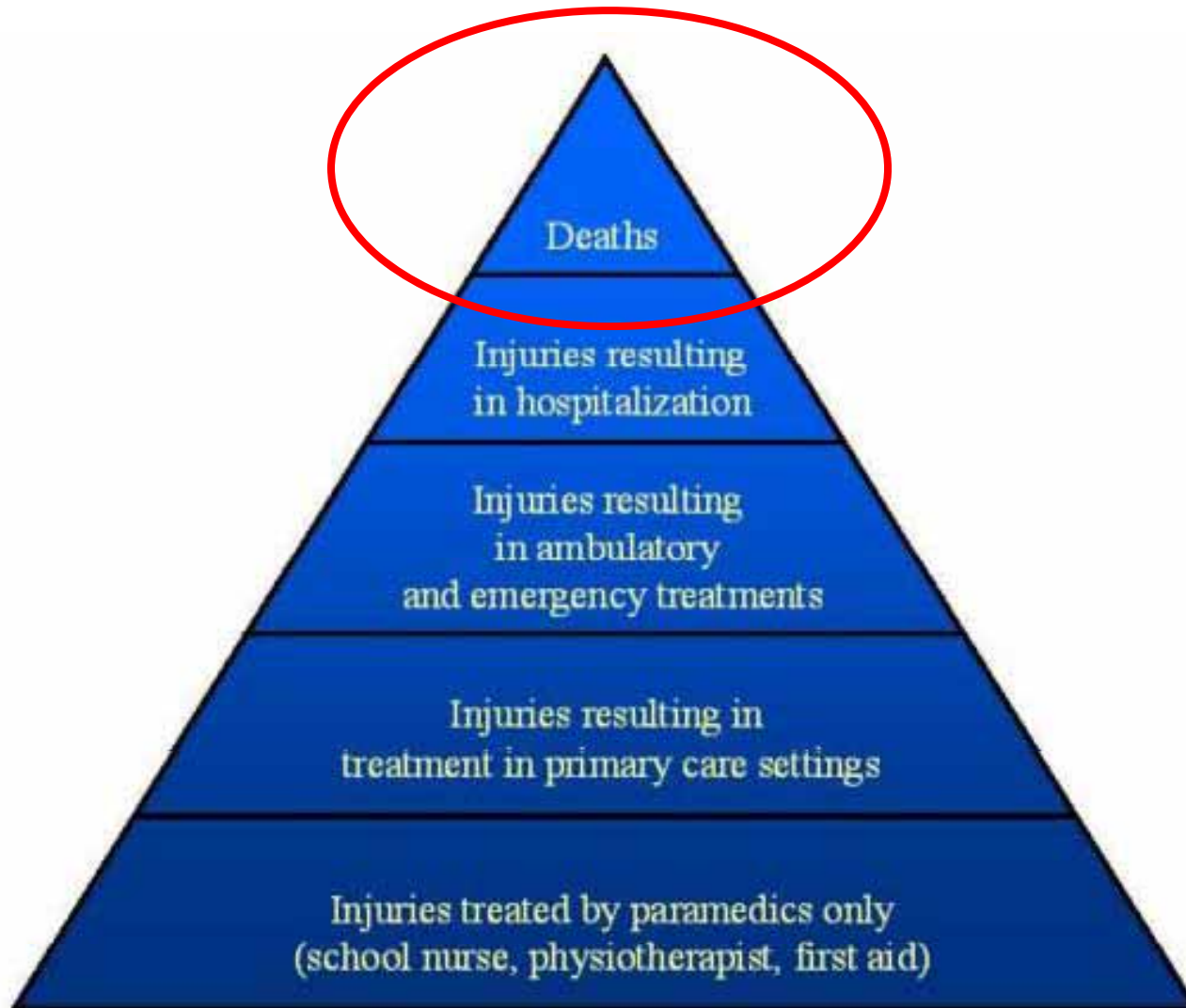


# National Injury Mortality Surveillance System (NIMSS) - South Africa

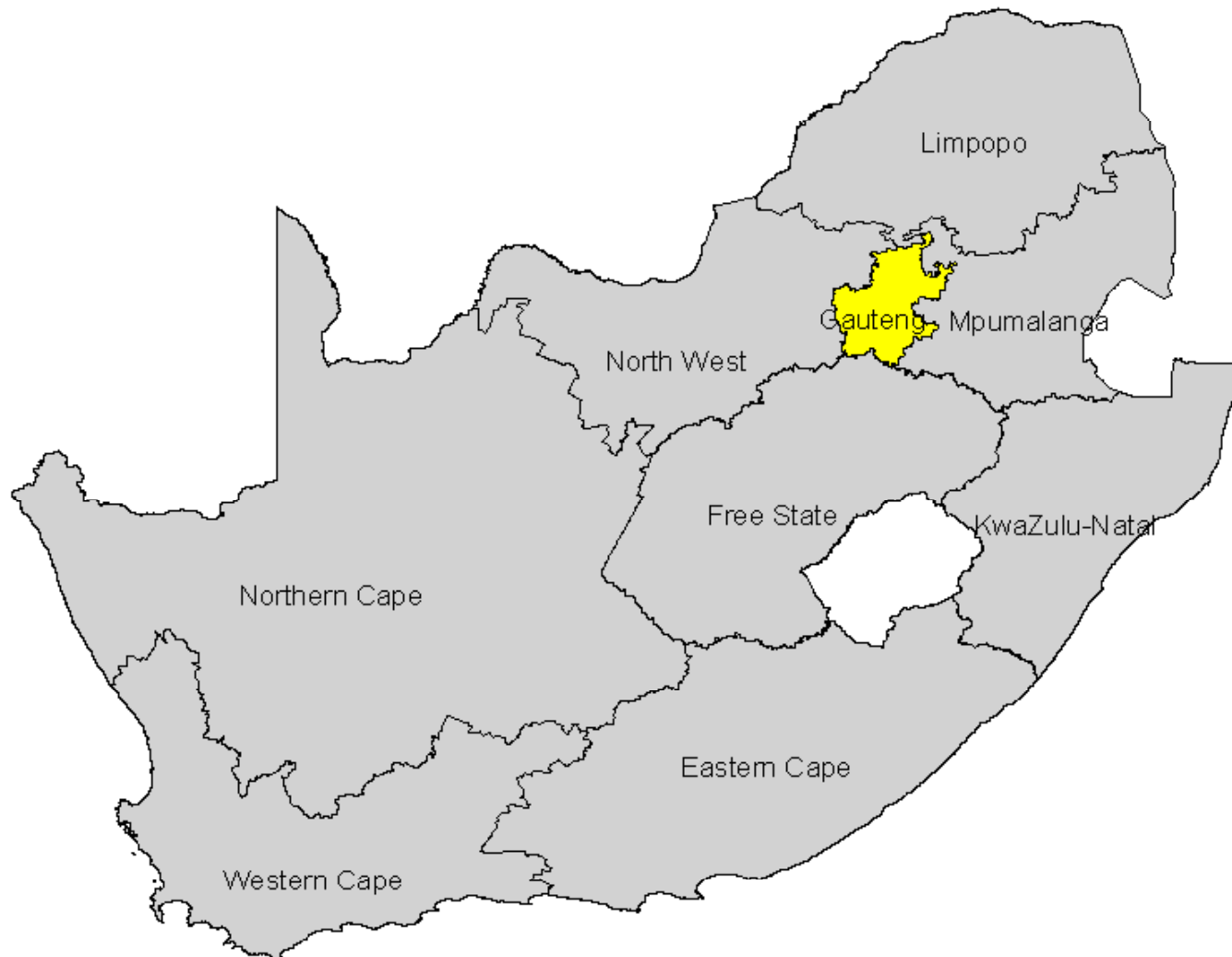
- NIMSS is the only 'who, what, where, when and how' fatal injury surveillance system
- The first NIMSS report included 14897 injuries for 1999, at 10 mortuaries across five provinces
- Second NIMSS: 2000, 18876 injuries, 15 mortuaries, five provinces
- Third NIMSS: 2001, 25361 injuries, 32 mortuaries, six provinces
- Current NIMSS is the ninth report: 33513 injuries in 2007: 39 mortuaries, seven provinces
- Data for 2001 & 2002 was available and was used for this study



# The Injury Pyramid



# South African provinces



## NIMSS Data for Gauteng

- NIMSS data collection form lists 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**

### NIMSS DATA COLLECTION FORM

Mortuary \_\_\_\_\_ Police No. \_\_\_\_\_ Officer collecting body (Surname) \_\_\_\_\_

PM no. \_\_\_\_\_ PM Date [ ][ ]-[ ][ ]-[ ][ ][ ][ ] Pathologist (Surname) \_\_\_\_\_

Date & Time of Injury [ ][ ][ ][ ][ ][ ][ ][ ]- [ ][ ]- [ ][ ] Race A B C W U Sex M F U

Date & Time of Death [ ][ ][ ][ ][ ][ ][ ][ ]- [ ][ ]- [ ][ ] Age [ ][ ] [ ][ ] Male Female

Medical treatment of injury prior to death (check only ONE)  1 None  2 Emergency care at scene  3 Hospital care

Province of injury (may differ to province of death)  1 Gauteng  7 Mpumalanga  1 Private house & yard (inc. pool)  8 Medical service area

2 W. Cape  8 Northern Province  2 Residential Institute  10 Industrial & construction area, mine

3 K.Z. Natal  9 North West  16 Informal settlement/squatter camp  11 Farm, primary production area

4 E. Cape  10 Unknown  3 Bar, shebeen, N.Cub., disco  12 Sea, lake, river, dam

5 N. Cape  11 Other (specify) \_\_\_\_\_  4 Amusement park, sports area  13 Open land, beach

6 Free State \_\_\_\_\_  5 Restricted highway  14 Countryside

Town of injury \_\_\_\_\_  6 Railway track, station  15 In custody, prison

Suburb or district \_\_\_\_\_  7 Shop, bank, retail area  16 Place unknown

Closest police station to injury scene \_\_\_\_\_  8 School, educational area  17 Other (specify) \_\_\_\_\_

#### External Cause or Circumstance of Injury

<input type="checkbox"/> 1 Firearm Discharge <input type="checkbox"/> 2 Sharp Object <input type="checkbox"/> 3 Blunt Object <input type="checkbox"/> 4 Strangulation, suffocation, asphyxia <input type="checkbox"/> 5 Hanging <input type="checkbox"/> 6 Poisoning, ingestion <input type="checkbox"/> 7 Poisoning, gassing <input style="border: 1px solid yellow; border-radius: 50%; padding: 2px;" type="checkbox"/> 8 Bath	<input style="border: 1px solid yellow; border-radius: 50%; padding: 2px;" type="checkbox"/> 9 Falls (over fence height) <input type="checkbox"/> 10 Other fall/squaring <input type="checkbox"/> 11 Choking <input type="checkbox"/> 12 Choking, aspiration <input type="checkbox"/> 13 Drowning, immersion <input type="checkbox"/> 14 Lightning <input type="checkbox"/> 15 Motor vehicle Pedestrian <input type="checkbox"/> 16 Motor vehicle Passenger	<input type="checkbox"/> 17 Motor vehicle Driver <input type="checkbox"/> 18 Motor vehicle Unoccupied <input type="checkbox"/> 19 Railway casualty <input type="checkbox"/> 20 Bicycle, motor cycle <input type="checkbox"/> 21 Aviation casualty <input type="checkbox"/> 22 Medical Procedure <input type="checkbox"/> 23 Sudden Infant Death <input type="checkbox"/> 24 Abortion, still birth	<input type="checkbox"/> 24 Abandoned baby <input type="checkbox"/> 25 Electrocution <input type="checkbox"/> 26 Explosive blast <input type="checkbox"/> 27 Natural cause <input type="checkbox"/> 28 Struck <input type="checkbox"/> 29 Other Specific Cause
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Apparent Manner of Death  1 Homicide  2 Suicide  3 Accident  4 Natural  5 Undetermined

Samples Taken (check all)  1 None  2 Blood  3 Tissue  4 Other fluid

Alcohol and Other Substances (for completion by surveillance consortium staff)

Blood Alcohol Level [ ][ ][ ][ ] Eye Fluid Alcohol [ ][ ][ ][ ] Other Substances (Specify) \_\_\_\_\_

For completion following court investigation: Homicides and suicides only

<h4>Type of Intentional Violence</h4> <table border="0" style="width: 100%;"> <tr> <td style="width: 50%; vertical-align: top;"> <input type="checkbox"/> 1 Interpersonal  <input type="checkbox"/> 2 Self Directed  <input type="checkbox"/> 3 Legal Intervention  <input type="checkbox"/> 4 Gang, Syndicate  <input type="checkbox"/> 5 Warlike Intimidation           </td> <td style="width: 50%; vertical-align: top;"> <input type="checkbox"/> 6 Rape, Sexual  <input type="checkbox"/> 7 Child Abuse  <input type="checkbox"/> 8 Unknown  <input type="checkbox"/> 9 Other (specify) _____           </td> </tr> </table>	<input type="checkbox"/> 1 Interpersonal <input type="checkbox"/> 2 Self Directed <input type="checkbox"/> 3 Legal Intervention <input type="checkbox"/> 4 Gang, Syndicate <input type="checkbox"/> 5 Warlike Intimidation	<input type="checkbox"/> 6 Rape, Sexual <input type="checkbox"/> 7 Child Abuse <input type="checkbox"/> 8 Unknown <input type="checkbox"/> 9 Other (specify) _____	<h4>Perpetrator - Victim Relationship</h4> <table border="0" style="width: 100%;"> <tr> <td style="width: 50%; vertical-align: top;"> <input type="checkbox"/> 1 Spouse, Partner  <input type="checkbox"/> 2 Parent  <input type="checkbox"/> 3 Other relative  <input type="checkbox"/> 4 Unrelated Caregiver           </td> <td style="width: 50%; vertical-align: top;"> <input type="checkbox"/> 5 Friend  <input type="checkbox"/> 6 Official/Legal Authority  <input type="checkbox"/> 7 Stranger  <input type="checkbox"/> 8 Acquaintance           </td> </tr> </table>	<input type="checkbox"/> 1 Spouse, Partner <input type="checkbox"/> 2 Parent <input type="checkbox"/> 3 Other relative <input type="checkbox"/> 4 Unrelated Caregiver	<input type="checkbox"/> 5 Friend <input type="checkbox"/> 6 Official/Legal Authority <input type="checkbox"/> 7 Stranger <input type="checkbox"/> 8 Acquaintance
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9 Unknown  
 10 Other Specified Person(s)

Context of Violent Attack (Code from court record)

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**Province** →

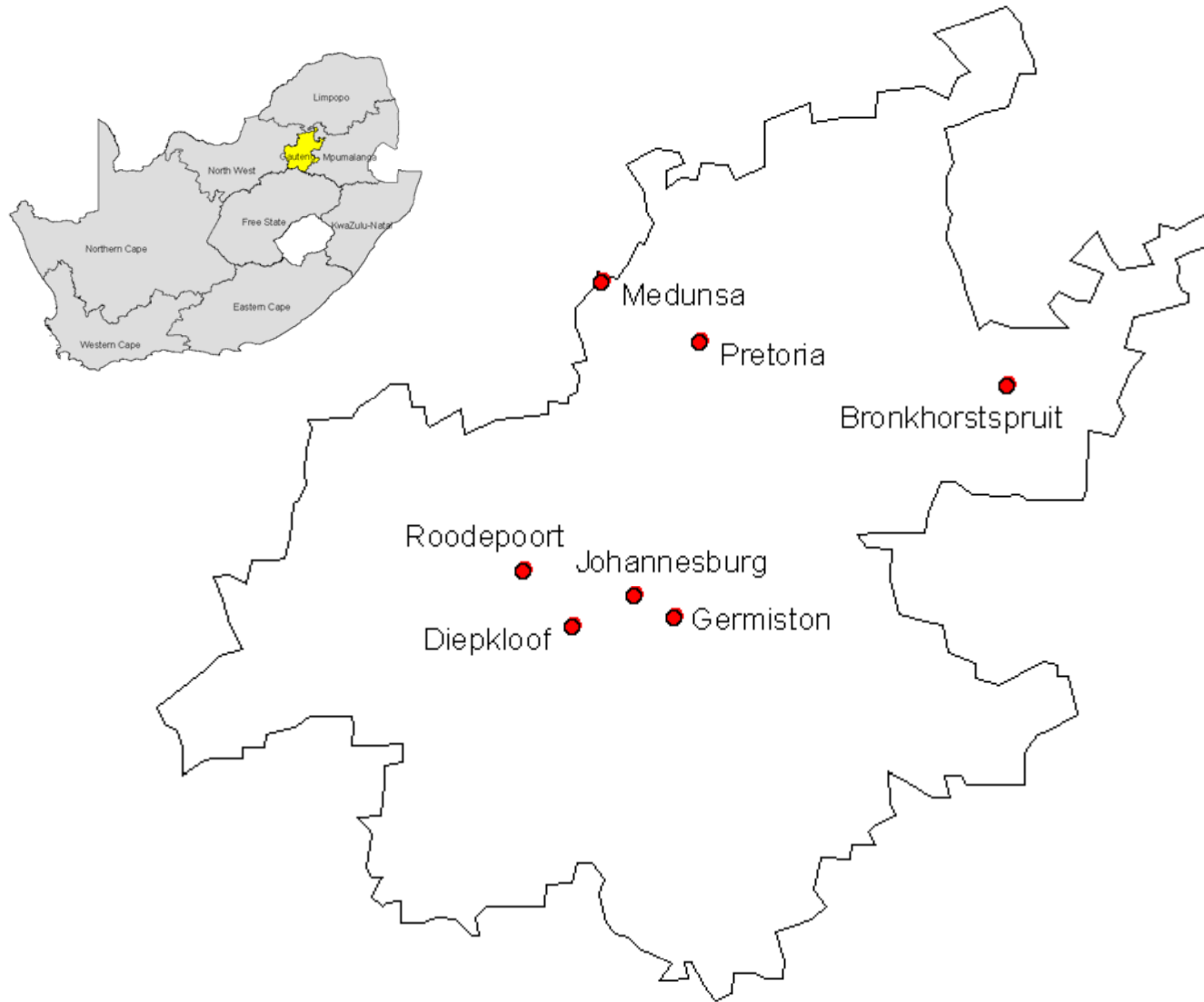
**Town, suburb, district, police area** →

**Age** →

**External Cause of Injury**

8 - Burns;  
9 - Falls

# NIMSS Mortuaries in Gauteng – 2001/2

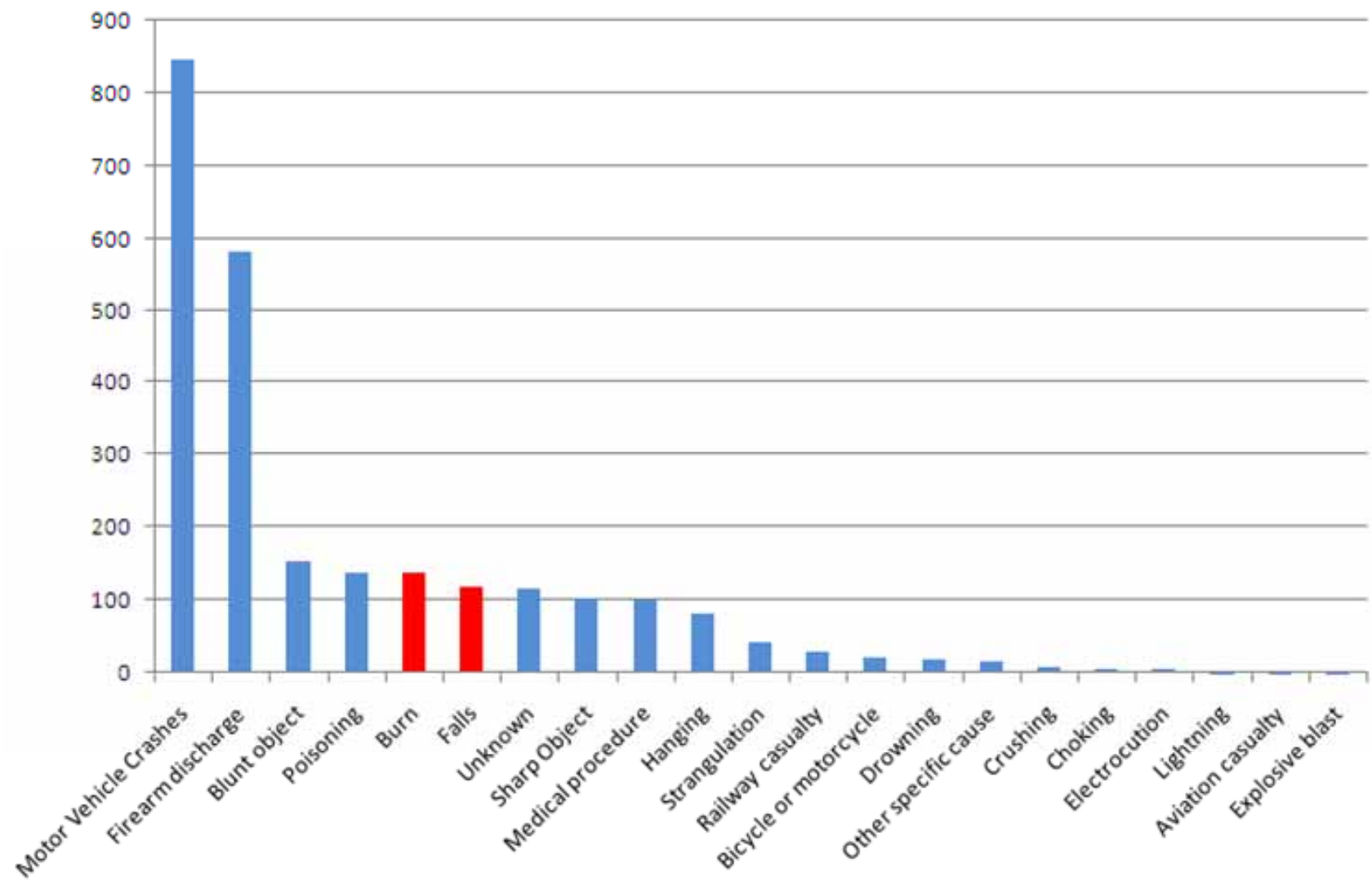


## NIMSS Data for Gauteng (All): 2001/2

<b>Apparent Manner of Death</b>	<b>Frequency</b>	<b>Percentage</b>
Homicide	9300	38.0%
Suicide	2542	10.4%
Accident	8664	35.4%
Natural	2031	8.3%
Undetermined	1955	8.0%
<b>Total:</b>	<b>24492</b>	<b>100.0%</b>

# External causes of non-natural deaths (Gauteng)

## Persons 50 years & older (n=2511)



## Race & Gender of burn and fall victims (>=50 years) – 2001/2 (Gauteng)

<b>Race/ Gender</b>	<i>Unknown</i>	<i>Asian</i>	<i>Black</i>	<i>Coloured</i>	<i>White</i>	<b>Total</b>
<i>Female</i>	0	0	55	1	46	<b>102</b>
<i>Male</i>	0	1	93	5	38	<b>137</b>
<i>Unknown</i>	1	0	0	0	2	<b>3</b>
<b><i>Total</i></b>	<b>1</b>	<b>1</b>	<b>148</b>	<b>6</b>	<b>86</b>	<b>242</b>

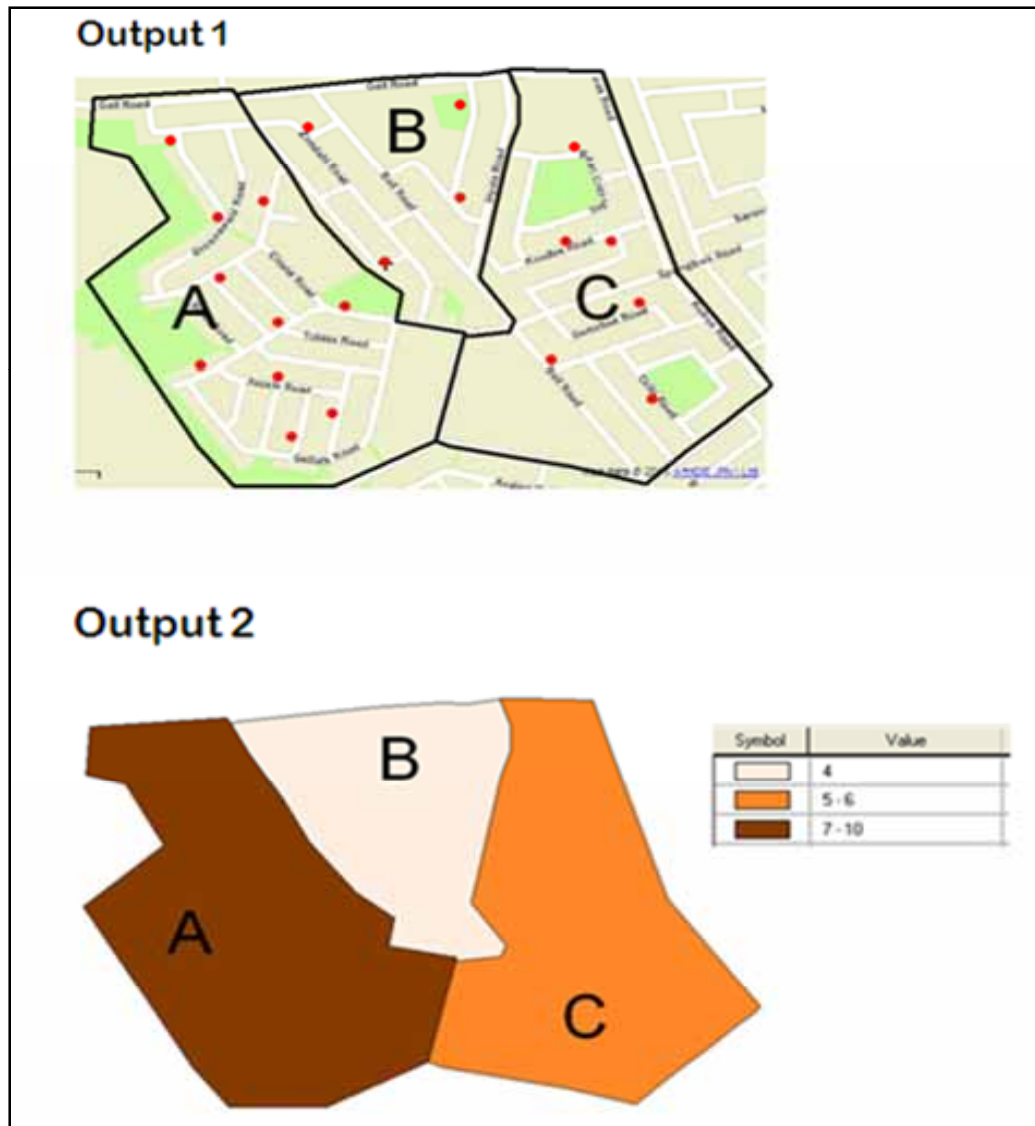
- There was a distinct gender and racial profile amongst victims
- Fifty seven percent (57%) were men
- Greatest number recorded were Black/African men (38.4%), followed by Black/African women (22.6%)



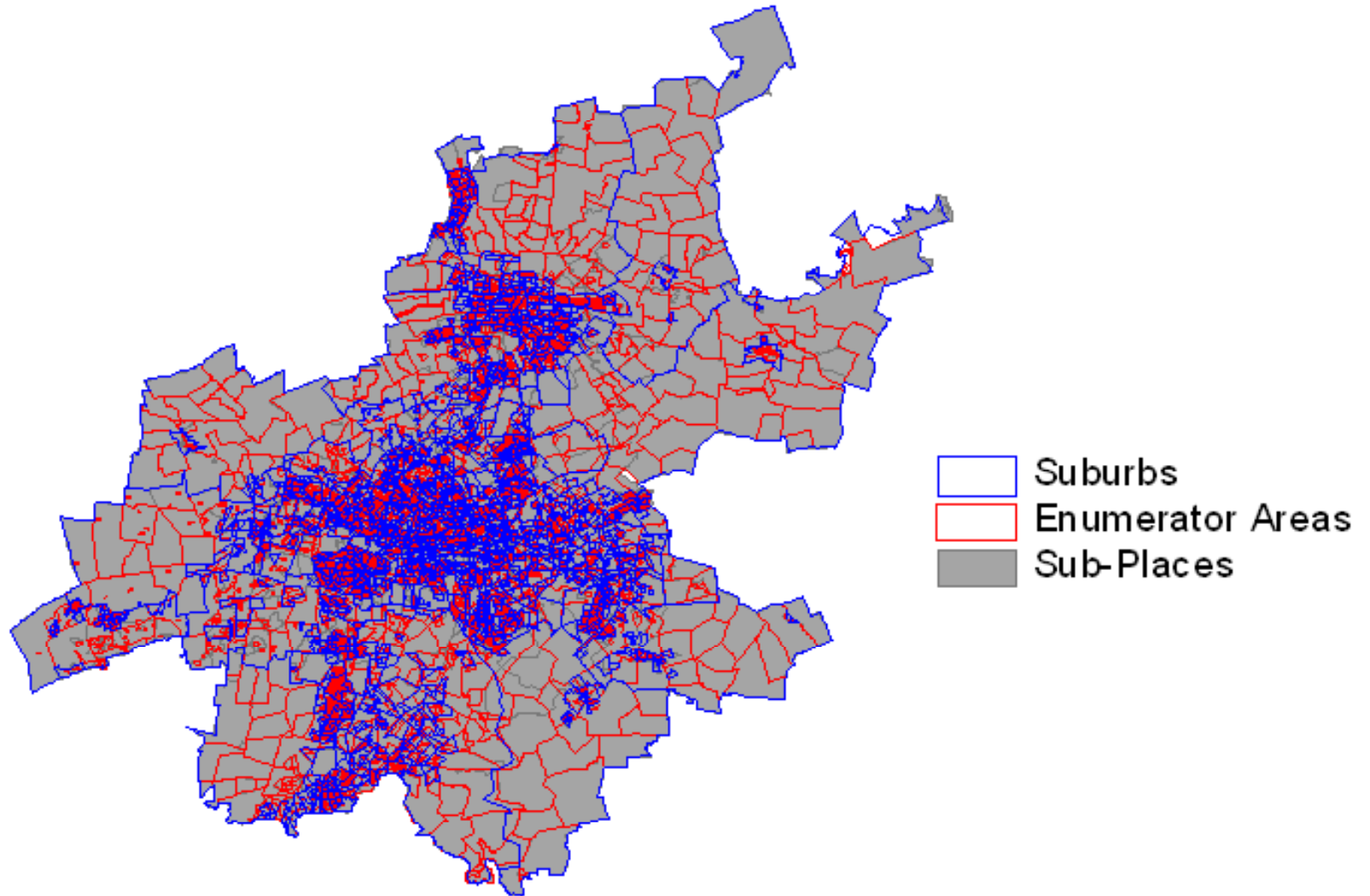
## Age categories of burn and fall victims ( $\geq 50$ years) (2001/2)

Age group	Frequency
50-54	53
55-59	42
60-64	35
65-69	30
70-74	23
75-79	17
80-84	22
85-89	14
$\geq 90$	6
<b>Total</b>	<b>242</b>

# Example output (fictitious data)



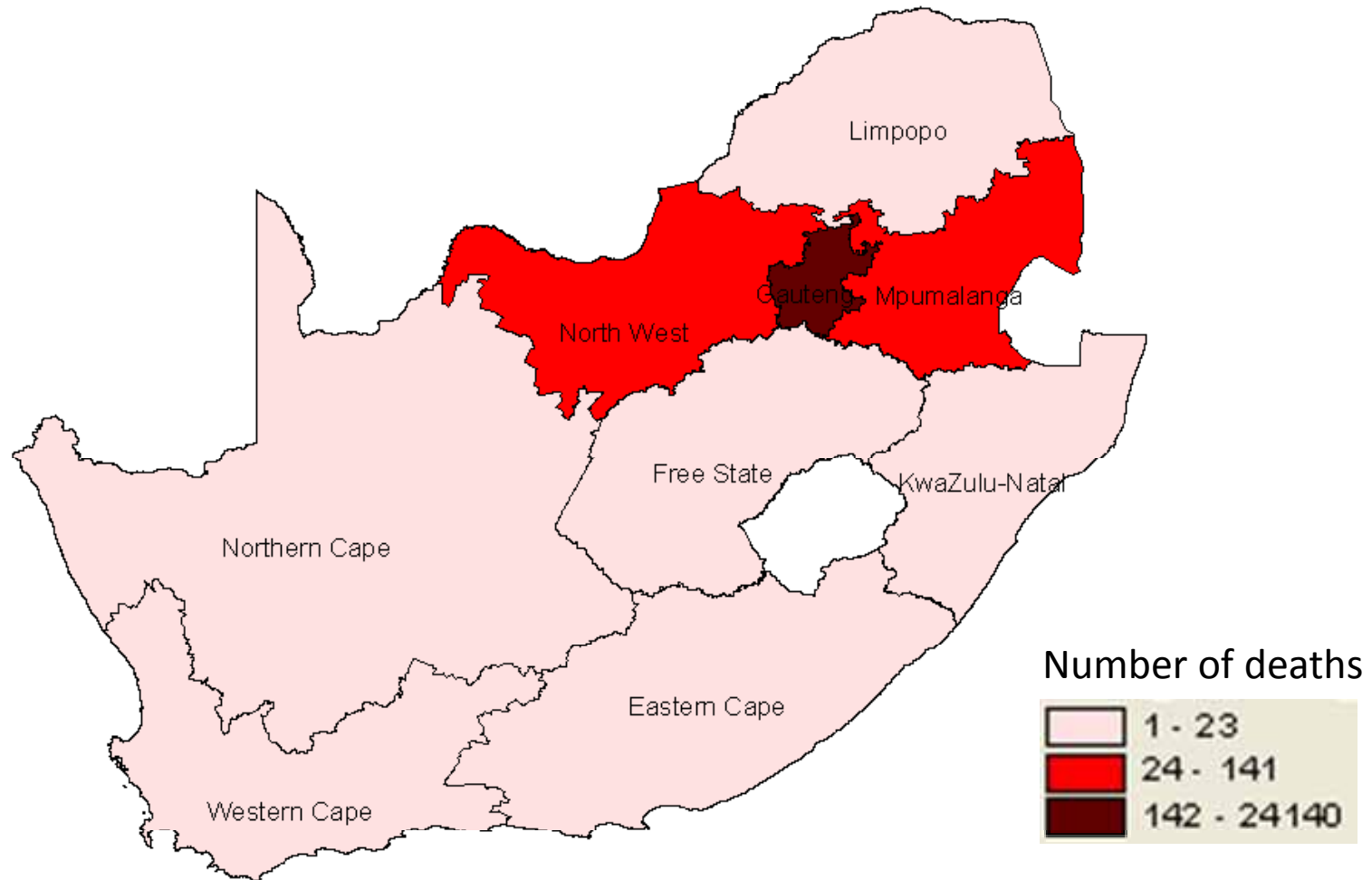
# The web of mapping units - Gauteng



# Potential of mapping units for spatial analysis of (fatal) injuries

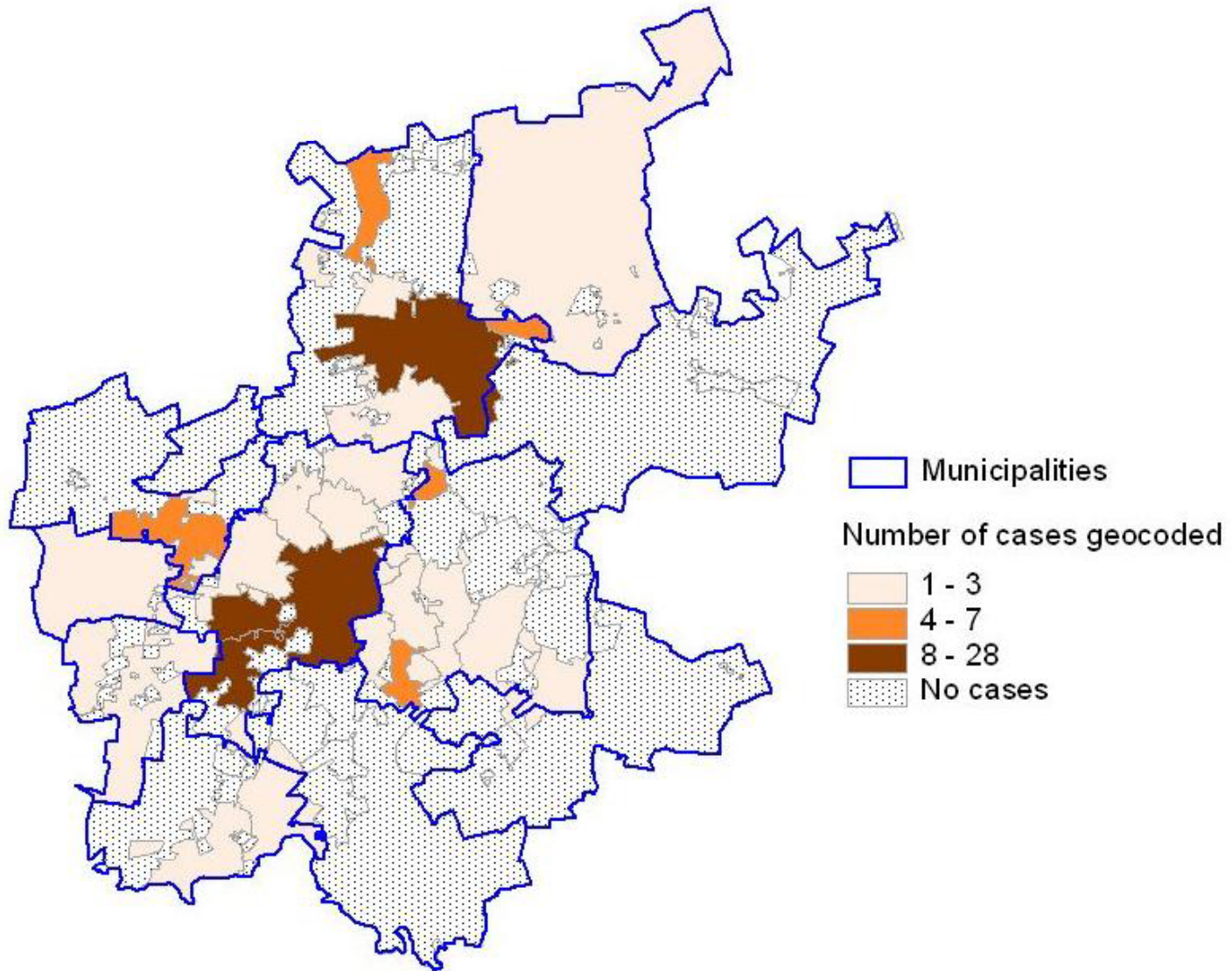
- **Suburbs** – no standing in terms of the population census; has cadastral and property marketing value
- **Enumeration areas (EAs)** – extensive population data, but only published for 1996 census; has numerical identifiers only
- **Subplaces** – output areas for the 2001 census, five provinces, generalized population data, aligned to Main Places of Census 2001
- **Datazone geography** – deprivation at local level; ranking of indices of deprivation

# Province of injury: Gauteng Mortuaries (All cases: 2001/2)

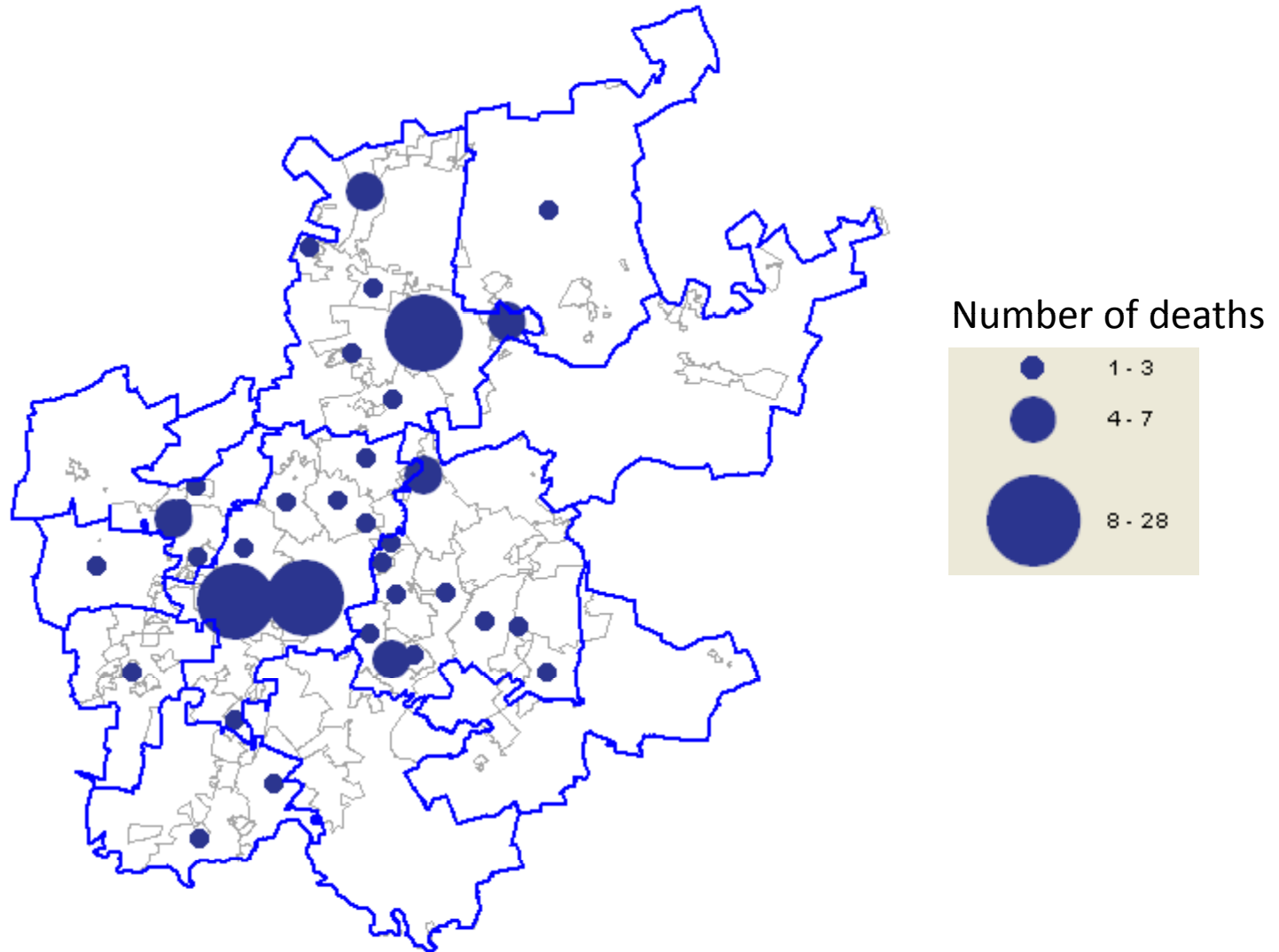


98.6% of injuries originate in Gauteng

# Deaths by falls and burns (>=50 years)



# Deaths by falls and burns (>=50 years)



# Towards 'Small area analysis' – spatial autocorrelation



Figure 2 Neighborhoods of residence for patients hospitalized from an assault injury between March 2001 and March 2006.

Source: N Bell, N Schuurman and S M Hameed (2008)



# The way forward

- **Most recent data on fatal injuries** - access to longitudinal data from NIMSS for 2001-2007; search for a national picture ; with inter-city comparisons
- **Denominator data** – suitable population data at an appropriate spatial level will be sought; calculation of rates for comparison
- **Identification of socio-economic risks factors** – housing types, income, age, overall deprivation indices at small area levels; what are the links?
- **Does geography matter?** – are older adults living or working in some areas more at risk of a fatal injury through burns and falls than elsewhere?

## **Acknowledgements**

- NIMSS data contributors – pathologists and their staff at participating mortuaries
- MRC and NDoH for making the data available
- The PHASA conference organisers - conference bursary for fees and accommodation costs
- HSRC for funding the rest of my conference costs