"Where have all the ambulances gone?"

The Role of GIS in Injury Surveillance

Adlai S Davids

[adavids@hsrc.ac.za]

HSRC
GIS Centre

Surveys, Analyses, Modelling and Mapping

"Where have all the ambulances gone?"

The Role of GIS in Injury Surveillance

Adlai S Davids

HSRC GIS Centre

Surveys, Analyses, Modelling and Mapping

Why GIS and Injury Surveillance?

"But much work still needs to be done to improve capacities to collect and analyze data on the scope, causes and consequences of violence."

"Across the board, research still needs to be conducted on several aspects of violence, including non-fatal health consequences and economic and social costs."

Dr Gro Harlem Brundtland, Director-General, WHO
Global Launch of the World Report on Violence and Health
Brussels, 3 October 2002

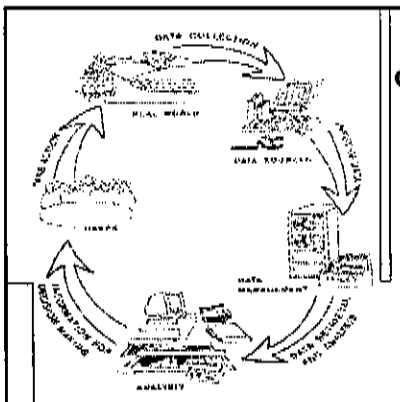
Opening definitions

- **Geographical Information System (GIS):** A computer-based system for the input, management, analysis and output of georeferenced data
- **Injury:** A bodily lesion at the organic level due to acute exposure to energy interacting with the body in amounts or rates that exceed the threshold of physiological tolerance.

Opening definitions (continued)

Surveillance: the ongoing, systematic collection, analysis, and interpretation of health data essential to

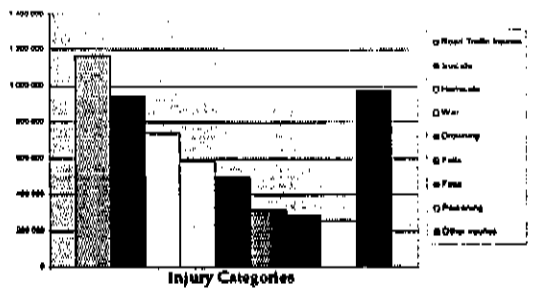
* planning, implementation, and evaluation of health practice,
* timely dissemination of these data
* the final link ...the application of these data to prevention and control.



Geographical Information and the Planning Process

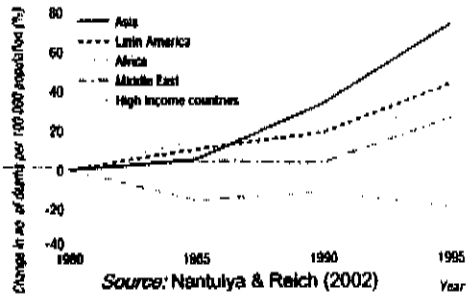
Source:
Aronoff (1989)

Causes of Injury-related Deaths World-Wide: 1998



Injury Categories

Changes in Road Traffic Accident Fatalities



Source: Nantulya & Reich (2002)

Cover Photograph:

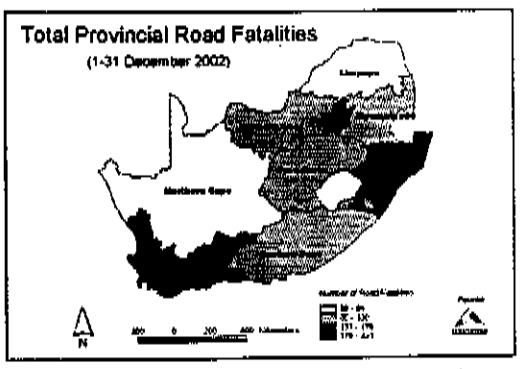
British Medical Journal (2001)

Road Traffic Deaths in South Africa

- Increase in South African road fatalities over December 2002/January 2003 was a cause of major concern
- Political ramifications and massive media attention
- Increased and focused data collection during Christmas and Easter holidays though
- Extent of the problem not confined to major holiday seasons only

Road Traffic Deaths in SA (continued)

- On average there are between **756** (1998) and **833** (2001) road traffic deaths ***per month*** in South Africa
- 20 people killed for every 10 000 vehicles on the road (1995)
- "...(The RAF) has no control over the accident rate." (2002)



(Total: 1 101) **Recorded: 2/3 January 2003 @ 12.45**

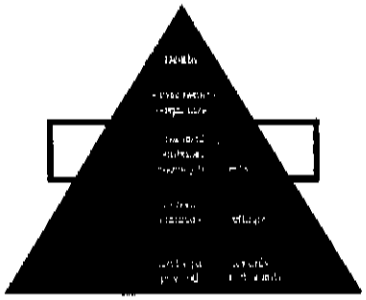
Why focus on Injuries at the local scale?

- A public health approach *(to injury prevention)* starts with defining the problem and progresses to identifying associated risk and protective factors, developing and evaluating interventions, and implementing interventions into programmes.
- Defining the problem requires the determination of the *temporal* and *geographic* features of the incident; it is here where GIS can contribute
- Suburbs are the smallest spatial unit recorded in routinely collected data in Tshwane

Why Ambulance Data?

- Reports on violent injuries in developing countries are mostly based on police data
- Police data are regarded as incomplete and unreliable (Chotani *et al*, 2002)
- A major ambulance service in Karachi, Pakistan transport injury victims to hospitals (or morgues!)
- Ambulance data would give a more reliable overview of injury as public health problem in Tshwane

The Injury Pyramid



Source: WHO

Tshwane Ambulance Data

- Tshwane Metro operates computer-based Emergency Services System (ESS)
- Emergency ambulance requests recorded on a coding system for each call-out type
- Data was extracted and provided in MS Excel format
- **4 875 calls** (± 80 per day) received from 1 November to 31 December 2002
- **2452** cases *(50.2%)* could be assigned to a suburb

Injury Categories in Pretoria

(November & December 2002)

Intentional Injuries [*2907 (59.63%)*]

040 - Assault	Homicide & Interpersonal Violence
044 - Gun Shot	Homicide & Interpersonal Violence
068 - Rape	Homicide & Interpersonal Violence
200 - Jump Of A Structure	Self-inflicted Injuries
201 - Overdose	Self-inflicted Injuries
202 - Gassing	Self-inflicted Injuries
203 - Gun	Self-inflicted Injuries
204 - Slit Wrists	Self-inflicted Injuries
205 - Poisoning	Self-inflicted Injuries
206 - Hanging	Self-inflicted Injuries

Injury Categories in Pretoria

(November & December 2002)

Unintentional Injuries [1684 *(34.5%)*]

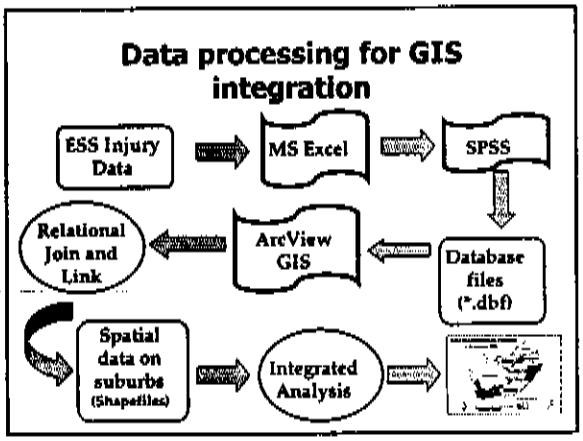
030 - Pedestrian	Road Traffic Injury
031 - Motor	Road Traffic Injury
032 - Taxi	Road Traffic Injury
033 - Bus	Road Traffic Injury
035 - Heavy Vehicle	Road Traffic Injury
036 - Department Vehicle	Road Traffic Injury
038 - Fell From A Train	*Falls/Self Inflicted/Interpersonal Violence*
039 - Motorbike/Bicycle	Road Traffic Injury
041 - Domestic Accident	Falls (Majority)
045 - Burns	Fires
057 - Drowning	Drownings

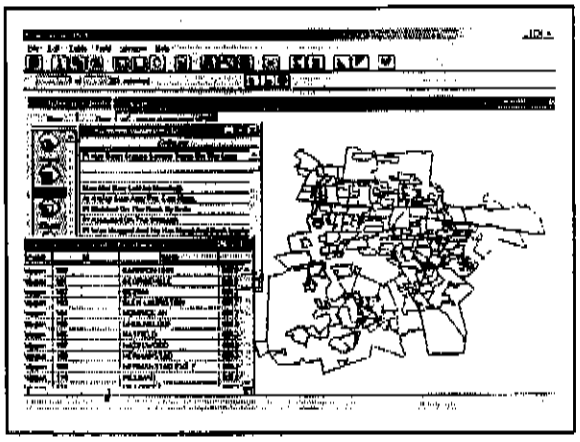
Injury Categories in Pretoria

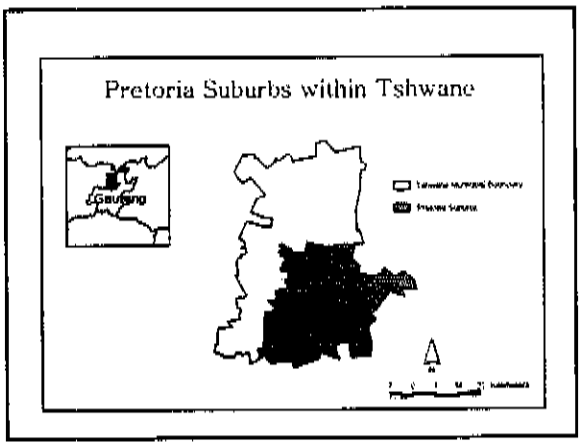
(November & December 2002)

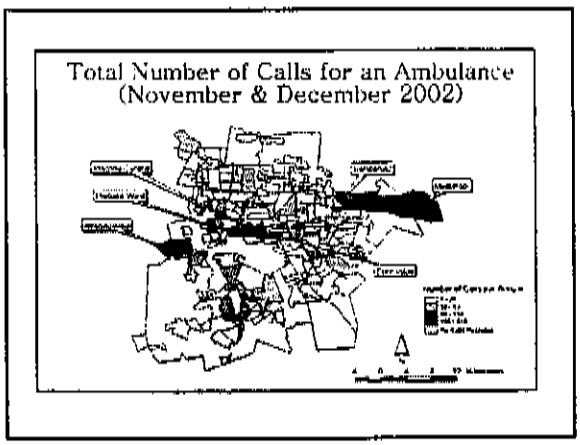
'Uncategorised' Injuries [*284 (5.83%)*]

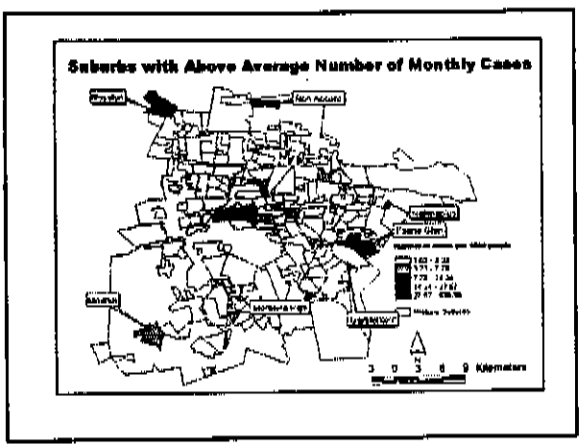
042 - Industrial Accident
048 - Animal Attack
060 - Asphyxia
067 - Suffocation

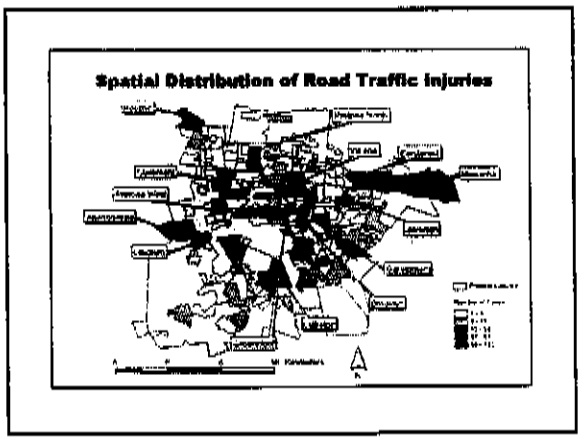

Data processing for GIS integration
ESS Injury Data
MS Excel
SPSS
Database files (*.dbf)
ArcView GIS
Relational Join and Link
Spatial data on suburbs (Shapefiles)
Integrated Analysis



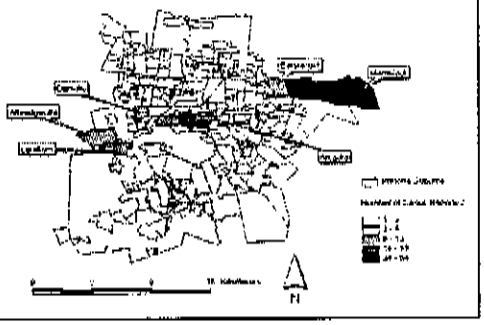

Pretoria Suburbs within Tshwane
Gauteng


Total Number of Calls for an Ambulance
(November & December 2002)


Suburbs with Above Average Number of Monthly Cases
Kilometers


Spatial Distribution of Road Traffic Injuries

Spatial Distribution of Self Inflicted Injuries



Mode of Self Inflicted Injury

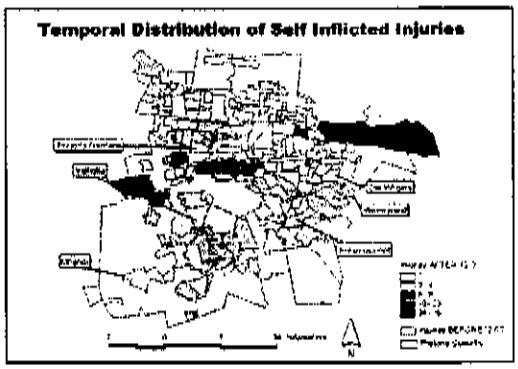
November and December 2002

Suburb	Jump	Overdose	Gassing	Gun	Slit Wrists	Poison	Hanging	TOTAL
Mamelodi	1	25			1	36	1	64
Pretoria Central	4	14	1		1	12	1	33
Sunnyside	4	14		1	3	5		27
Atteridgeville		5				8		13
Arcadia	1	7			1	1		10
Danville	1	6			2		2	10
Pretoria West	2	5			3	2		10
Eersterust		7			1	1		9
Laudium		1		1	1	6		8

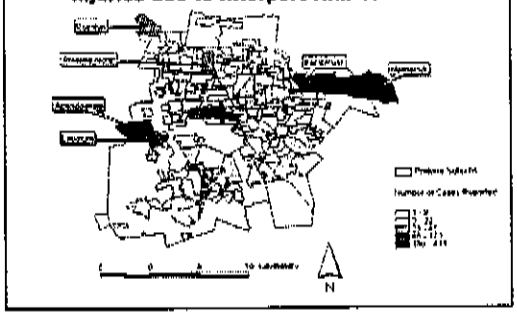
Timing of Self Inflicted Injuries

Time of Day	*Frequency*	*Percent*
00:01-06:00	48	16
06:00-12:00	53	17
12:01-18:00	86	28
18:01-24:00	122	39
Total	309	100

Temporal Distribution of Self Inflicted Injuries



Spatial Distribution:
Injuries due to Interpersonal Violence

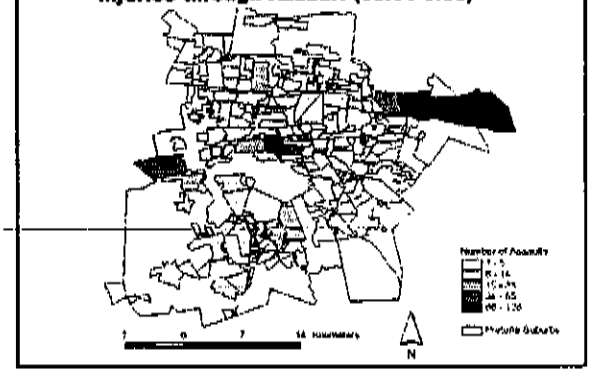


Mode of Violent Injury

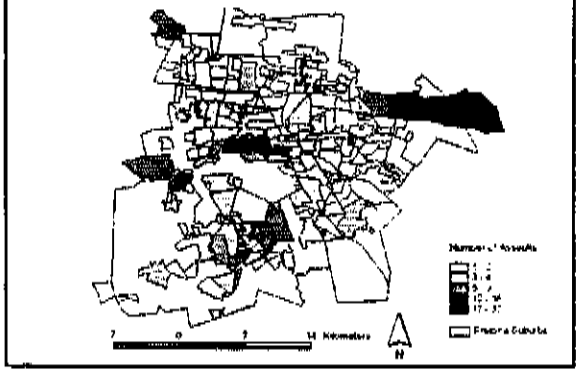
November and December 2002

Suburb	Assault	Gun Shot	Rape	*Total*
Mamelodi	357	56		*413*
Pretoria Central	170	9		*179*
Atteridgeville	73	16	1	*90*
Eersterust	85	2		*87*
Sunnyside	79	5		*84*
Rosslyn	43	2		*45*
Natmaplus	38	3	1	*42*
Pretoria West	38	2		*40*
Pretoria North	31	3	1	*35*
Laudium	28	2		*30*

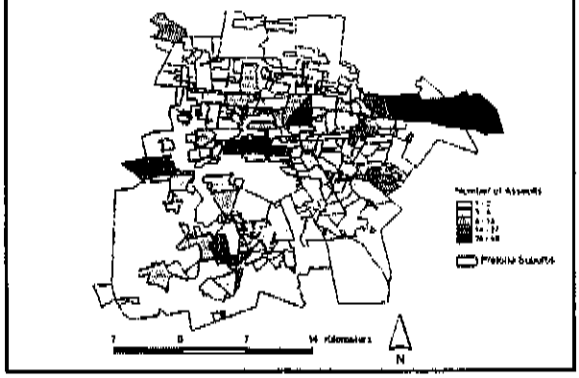
Temporal Distribution:
Injuries through Assault (00:01-6:00)



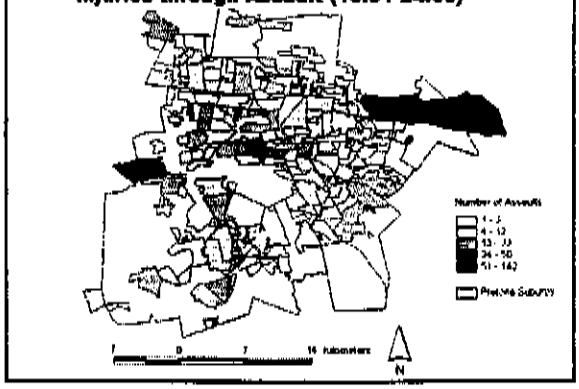
Temporal Distribution:
Injuries through Assault (6:01-12:00)



Temporal Distribution:
Injuries through Assault (12:00-18:00)



Temporal Distribution:
Injuries through Assault (18:01-24:00)



Suggested Future Research

- **Access and geocode additional data sources identified in Injury Pyramid**
  - Trauma Centres of Public and Private Hospitals (victims transported by private cars)
  - Data for Private Ambulance Services
  - Hospitalised Victims in Public and Private hospitals

Extension of the GIS approach using public data sources

- More monthly records of injury data
- Integration of other injury data sources *(NIMSS, TrafMAN, SAPS, etc.)*
- Location specific recording of events *(relative location, Global Positioning Systems, cadastral maps)*
- Sub-local GIS analysis in areas like Mamelodi
- Monitoring and mapping the impact of interventions and "Life Line" calls
- Evaluation of injury prevention resource allocation
- Mapping and Dissemination of injury data through Web-GIS

[illegible] Seminar Series 2003