

The Epidemiology, Prevention and Control of Trauma

MJM

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Resources for your reference

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2. Road Traffic Report March 2008
3. WHO. Global Status Report on Road Safety. Time for Action (accessible on www.who.int/publications)
4. WHO. Drinking and Driving. A road safety manual for decision makers and practitioners (accessible on www.who.int/publications)
5. Crime Research Statistics SA Police Services 2011/12 Report
6. Seedat M et al. Violence and Injuries in South Africa: prioritising an agenda for prevention. Lancet; 2009; 374: 1011-1022
7. Pinchevsky GM & Wright EM. Trauma Violence & abuse. 2012;13:112

Perspectives of the Impact of Trauma

1. Health Perspective
2. Social Perspective
3. Economic Perspective
4. Developmental Perspective
5. Human Rights Perspective

Dealing with the Effects of Trauma

Trauma has significant immediate & long term health effects

- Physical outcomes
 - Immediate intervention – decreased morbidity & mortality
- Emotional & Psychological outcomes
 - Require prolonged counseling & support
- Social outcomes
 - Require long lasting structural changes and support

Health care workers can only deal effectively with short term physical outcomes

Epidemiology - Worldwide

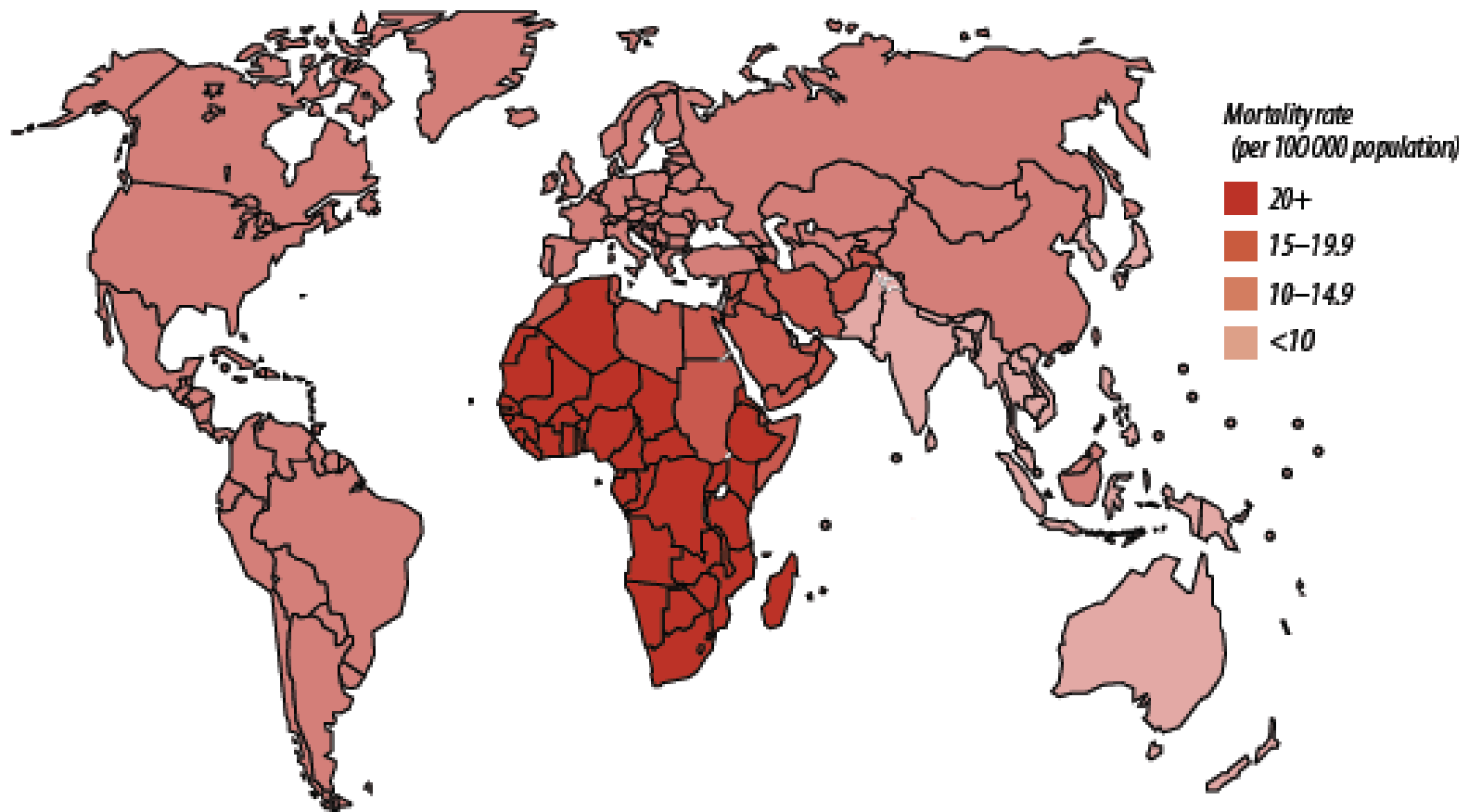
- Trauma - a major cause of mortality and morbidity world wide
 - Affects all ages groups and both sexes
 - Occurs in both high- and low-income countries
- > 90% of global deaths from injury are from Low- and Middle-income countries
- Takes the three forms:
 - Accidents
 - Violence and
 - Natural disasters

Global Violence-related Deaths in 2000

(WHO Global burden of disease project for 2000)

Types of violence	Number	Rate per 100 000 population	Proportion of total (%)
Homicide	520 000	8.8	31.3
Suicide	815 000	14.5	49.1
War-related	310 000	5.2	18.6
<u>Total</u>	<u>1 659 000</u>	<u>28.8</u>	<u>100.0</u>
Low- & Middle-income countries	1 510 000	32.1	91.1
High-income countries	149 000	14.4	8.9

Geographic variation in Road Traffic Mortality rates/100 000 population among those <25yrs (2002)



How the Effects of Trauma are Measured

- Potential Years of Life Lost (PYLL):
 - a measure of premature mortality due to early deaths (before age of 65) caused by injuries
- Disability Adjusted Life Years (DALYs):
 - a measure of PYLL + Years of Health Life Lost (YHLL) due to being in a state of poor health caused by non-fatal injuries.

Classification of Trauma

- Based on whether or not there was intent
- Based on mechanism by which trauma was inflicted
- Based on the form/nature or injury sustained

Typology: Classification Based on Intent

- **Intentional**
 - Violence
 - **Self directed violence**
 - **Interpersonal violence**
 - Intimate partner violence
 - Youth violence
 - Child abuse
 - Neglect & abuse of the aged parents,
 - **Collective violence**
- **Unintentional injuries**
 - Accidents
 - Transport-related road traffic accidents (RTAs),
 - Burns, Drowning, Falls, Machinery, etc
 - Environmental & Natural phenomena

Typology:

Classification based on Mechanism

- Transport-related
 - MVA
 - Other modes of transport
- Machinery
- Gunshot
- Stab wounds
- Burns (fire/heat, scalds and chemical burns)
- Drowning
- Falls
- Others

Major causes of Injuries in RSA

- Interpersonal Violence
- Road traffic Accidents
- Together these two categories account for over 75% of all the fatal injuries in RSA
- Alcohol is the main risk factor for each of these

Ref. Lancet 374:1011-1032

Percent of injury-deaths by cause: RSA 2000

(Source NIMMS, MRC)

Males n = 45 237			Females n = 14 698		Persons n = 59 935	
Rank	Cause of injury death	%	Cause of injury death	%	Cause of injury death	%
1	Homicide/interpersonal violence ^a	50.9	Road traffic injuries	32.6	Homicide/interpersonal violence ^a	46.0
2	Road traffic injuries	24.8	Homicide/interpersonal violence ^a	30.8	Road traffic injuries	26.7
3	Suicide/self-inflicted violence	9.3	Fire ^b	12.5	Suicide/self-inflicted violence	9.1
4	Fire ^b	5.1	Suicide/self-inflicted violence	8.6	Fire ^b	6.9
5	Drowning	2.4	Surgical/medical misadventure	4.3	Drowning	2.3
6	Other transport injuries	1.7	Falls	2.6	Surgical/medical misadventure	2.0
7	Falls	1.4	Drowning	2.2	Falls	1.7
8	Other unintentional injuries	1.3	Other unintentional injuries	1.7	Other transport injuries	1.7
9	Surgical/medical misadventure	1.2	Poisoning	1.7	Other unintentional injuries	1.4
10	Poisoning	0.8	Other transport injuries	1.5	Poisoning	1.1
11	Mining injuries	0.5	Suffocation and foreign bodies	0.9	Suffocation and foreign bodies	0.4
12	Suffocation and foreign bodies	0.3	Natural and environmental factors	0.4	Mining injuries	0.4
13	Natural and environmental factors	0.3	Mining injuries	0.0	Natural and environmental factors	0.3
14	War ^c	0.0	War ^c	0.0	War ^c	0.0
	All injuries	100.0	All injuries	100.0	All injuries	100.0

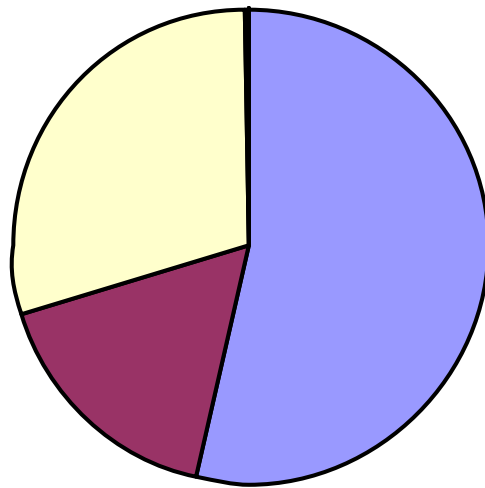
Rates/100 000 population of Injuries in RSA compared to Global rates

- RSA Interpersonal violence rates are **5-8 times those of the global rate** – rates for males much more than that of females
- RSA suicide rates **for males is slightly higher than the global rate**
- Rate of Road Traffic Accidents in RSA is **twice the global rate**

Global leading causes of death by age

RANK	0-4 YRS	5-14 YRS	15-29 YRS	30-44 YRS	45-69 YRS	70+ YRS	TOTAL
1	Perinatal causes	Lower respiratory infections	Road traffic injuries	HIV/AIDS	Ischaemic heart disease	Ischaemic heart disease	Ischaemic heart disease
2	Lower respiratory infections	Road traffic injuries	HIV/AIDS	Tuberculosis	Cerebrovascular disease	Cerebrovascular disease	Cerebrovascular disease
3	Diarrhoeal diseases	Malaria	Tuberculosis	Road traffic injuries	HIV/AIDS	Chronic obstructive pulmonary disease	Lower respiratory infections
4	Malaria	Drownings	Violence	Ischaemic heart disease	Tuberculosis	Lower respiratory infections	Perinatal causes
5	Measles	Meningitis	Self-inflicted injuries	Self-inflicted injuries	Chronic obstructive pulmonary disease	Trachea, bronchus, lung cancers	Chronic obstructive pulmonary disease
6	Congenital anomalies	Diarrhoeal diseases	Lower respiratory infections	Violence	Trachea, bronchus, lung cancers	Diabetes mellitus	Diarrhoeal diseases
7	HIV/AIDS	HIV/AIDS	Drownings	Lower respiratory infections	Cirrhosis of the liver	Hypertensive heart disease	HIV/AIDS
8	Whooping cough	Tuberculosis	Fires	Cerebrovascular disease	Road traffic injuries	Stomach cancer	Tuberculosis
9	Meningitis	Protein-energy malnutrition	War and conflict	Cirrhosis of the liver	Lower respiratory infections	Colon and rectum cancers	Trachea, bronchus, lung cancers
10	Tetanus	Fires	Maternal haemorrhage	Poisonings	Diabetes mellitus	Nephritis and nephrosis	Road traffic injuries

Causes of non-fatal trauma in hospitals



- Interpersonal violence
- Traffic
- Other "accidents"
- Attempted suicide

**Violence
IPV**

**Self-
directed**

**Inter-
personal**

Collective

Suicide

**Self
abuse**

Child

Partner

Elder

Social

Political

Economic

Table 2. Estimated South African and global self-inflicted, interpersonal violence and road traffic injury mortality rates by age and sex for 2000

Age group (years)	Males			Females		
	South African rate (per 100 000)	Global rate (per 100 000) ^a	Ratio SA rate: global rate	South African rate (per 100 000)	Global rate (per 100 000) ^a	Ratio SA rate: global rate
Homicide/interpersonal violence^b						
0–4	14.0	5.9	2.4	11.7	5.1	2.3
5–14	5.6	2.3	2.5	2.6	2.1	1.3
15–29	184.0	19.8	9.3	22.5	4.5	5.0
30–44	180.2	19.1	9.4	31.7	4.5	7.1
45–59	107.7	15.2	7.1	21.0	4.6	4.6
≥60	85.2	13.3	6.4	32.3	4.7	6.9
All ages^c	113.4	13.9	8.2	21.0	4.2	5.0
Suicide/self-inflicted violence						
0–4	0.0	0.0	–	0.0	0.0	–
5–14	2.1	1.7	1.2	0.8	2.0	0.4
15–29	26.3	15.6	1.7	6.5	12.2	0.5
30–44	29.4	21.5	1.4	8.7	12.4	0.7
45–59	35.0	28.4	1.2	7.7	12.5	0.6
≥60	38.1	44.9	0.8	10.9	22.1	0.5
All ages^c	23.3	18.6	1.2	6.1	10.6	0.6
Road traffic injury						
0–4	26.7	13.4	2.0	21.3	11.3	1.9
5–14	21.4	11.2	1.9	9.9	8.4	1.2
15–29	51.9	35.7	1.5	16.8	9.2	1.8
30–44	84.2	37.6	2.2	24.4	9.8	2.5
45–59	79.9	39.6	2.0	27.0	12.9	2.1
≥60	81.9	49.0	1.7	44.7	19.0	2.4
All ages^c	59.4	32.1	1.8	22.6	11.1	2.0

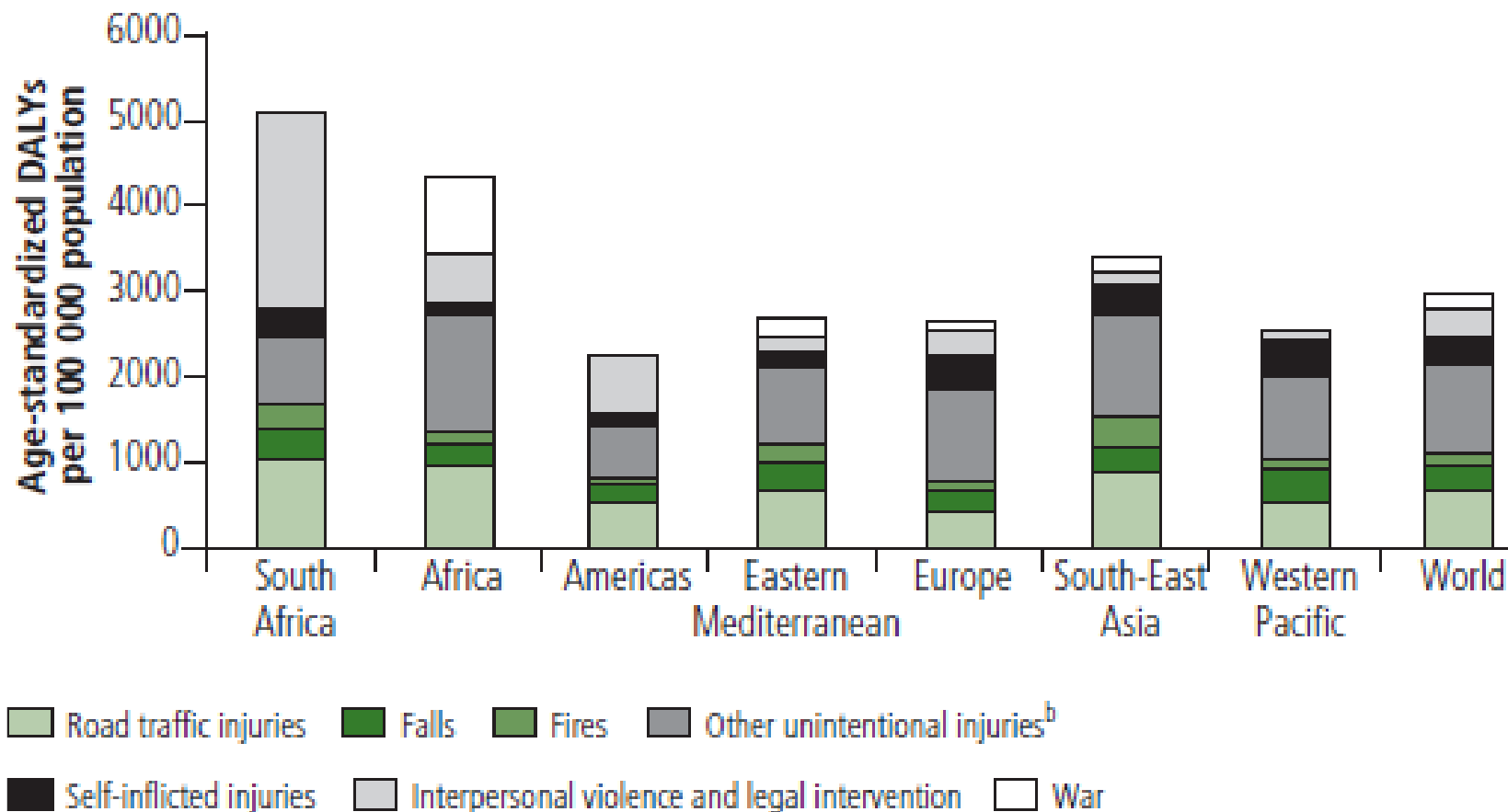
Injuries in Tshwane/Pretoria: 2001-2004

Table I. Age standardised* injury mortality rates for Tshwane/Pretoria, 2001- 2004								
Year	2001		2002		2003		2004	
Population [#]	2 893 247		2 939 810		2 981 898		3 024 589	
	Total deaths ^s	Rate/ 100,000 pop.	Total deaths	Rate/ 100,000 pop.	Total deaths	Rate/ 100,000 pop.	Total deaths	Rate/ 100,000 pop.
Violence	653	29.6	629	28.5	549	24.2	596	26.4
- firearm violence	398	17.8	384	16.9	320	13.8	329	14.1
Suicide	308	15.2	278	13.3	293	13.5	341	15.7
- firearm suicide	124	6.4	118	5.7	122	5.9	121	5.6
- hanging	84	3.8	76	3.6	89	3.8	110	4.8
Transport	716	40.3	677	35.8	694	34.4	779	37.8
- road traffic	684	33.6	646	32.1	657	32.1	738	35.8
<i>pedestrian</i>	238	11.9	237	11.7	231	11.9	250	12.4
<i>Driver</i>	95	4.5	106	5.3	118	5.4	135	6.6
- railway deaths	31	1.6	27	1.2	37	1.6	41	1.9
Unintentional	240	13.0	183	10.2	213	11.3	237	11.6
- burns	56	2.8	48	2.6	72	3.9	76	3.9
- drowning	37	1.9	30	1.6	30	1.5	31	1.5
ALL INJURIES^{&}	2235	110.4	2035	99.9	2028	97.7	2266	107.6

Forms of Interpersonal Violence (IPV)

- Physical
- Sexual
- Deprivation or Neglect

Fig. 1. Age-standardized DALY rates for persons by cause for South Africa and WHO regions in 2000^a



(Report for the 5 year period April 2004 - March 2009)

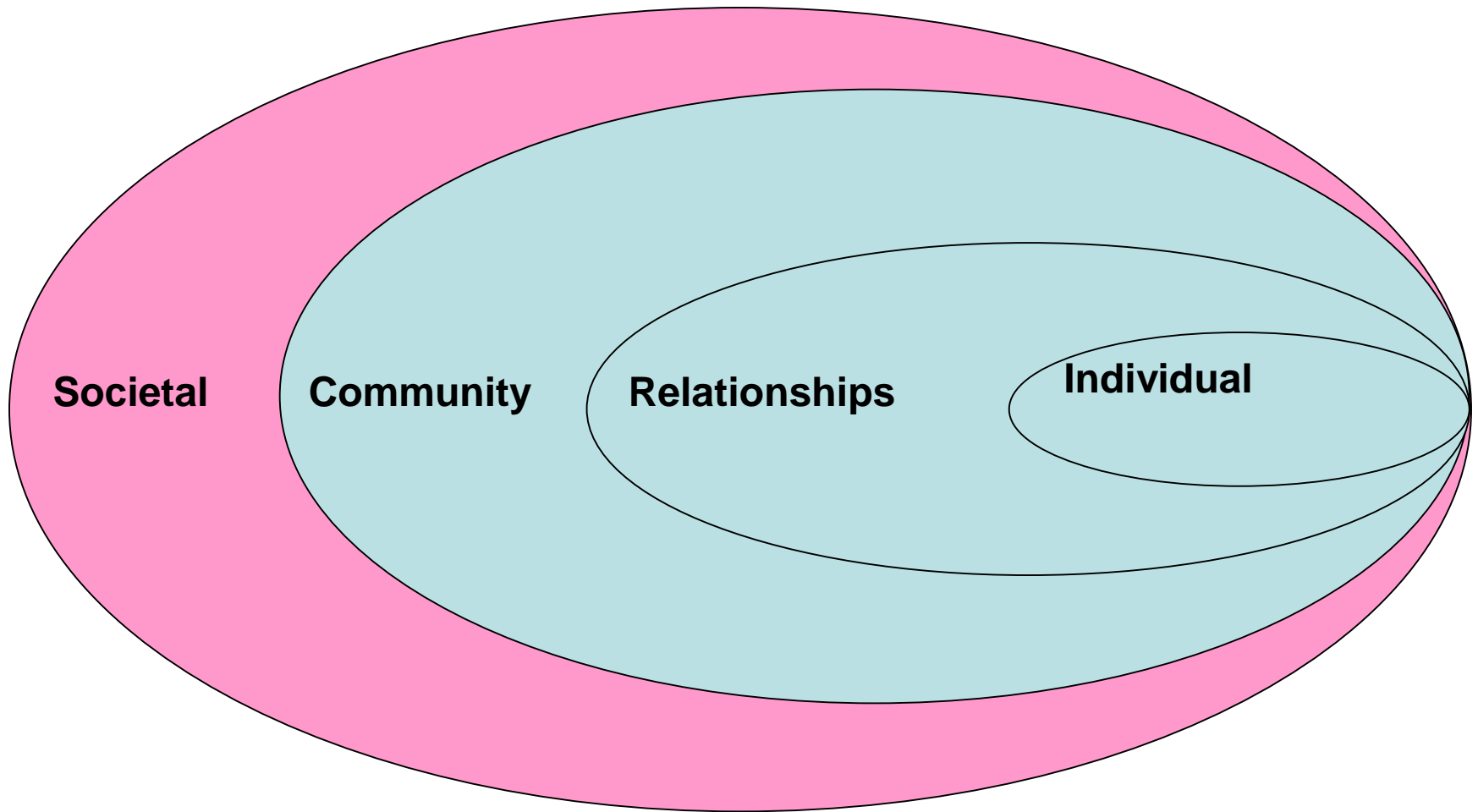
Table 3: Murder ratios

PROVINCE	2008/09 Baseline	2009/10	2010/11	2011/12	Deviation 08/09 – 11/12	Deviation 10/11 – 11/12
Eastern Cape	49.5	48.4	47.3	48.0	-3.0%	1.5%
Free State	31.6	31.4	34.1	34.9	10.4%	2.3%
Gauteng	37.9	32.7	29.1	26.6	-29.8%	-8.6%
KwaZulu-Natal	47.0	40.4	35.2	31.6	-32.8%	-10.2%
Limpopo	14.2	14.6	12.2	13.2	-7.0%	8.2%
Mpumalanga	25.1	24.3	20.0	19.9	-20.7%	-0.5%
North West	25.1	21.5	23.2	24.7	-1.6%	6.5%
Northern Cape	36.5	33.2	31.0	33.6	-7.9%	8.4%
Western Cape	44.6	42.4	44.2	43.5	-2.5%	-1.6%
RSA	37.3	34.1	31.9	30.9	-17.2%	-3.1%

GBH = Grievous Bodily Harm;

Source: SAPS 2008/09 Report

Ecological model for Understanding Violence



Risk Factors for Interpersonal violence: Multi-factorial

Interaction of:

1. Individual level factors
2. Relationship level factors
3. Community level factors (*environmental factors*)
4. Societal level factors (*environmental factors*)

Risk factors for Interpersonal Violence

1. Individual level

- Personal factors: Age, education, income
- Substance abuse
- History of experiencing or observing abuse
- Psychological/personality disorder

2. Relationship level

- Nature of the relationship with family, peers & intimate partner
- Harsh physical punishment of children
- Lack of affection & bonding
- Association with delinquent peers
- Marital or parental conflict

3. Community level

- Characteristics of neighbourhood, school or workplace which increase risk:
 - Poverty, high density,
 - High level of residential mobility,
 - Existence of local drug trade

4. Societal level

- Prevailing societal norms
- Economic, educational & social policies that increase and maintain high levels of inequalities between groups

Road Traffic Accidents



Comparison of RSA & France 2007

RSA: Population = 48.8m

France: Population = 61.6m

DATA
Reported road traffic fatalities (2007) 14 920^f (76% males, 24% females)
Reported non-fatal road traffic injuries (2007) 219 978^g
Costing study available Yes (deaths and injuries)

DATA
Reported road traffic fatalities (2007) 4 620^e (76% males, 24% females)
Reported non-fatal road traffic injuries (2007) 77 007^f
Costing study available Yes (deaths and injuries)

^f Road Traffic Management Corporation data, defined as died within 7 days of the crash.

^g Road Traffic Management Corporation and Medical Research Council data.

^e *Observatoire national interministériel de sécurité routière (ONISR)* data, defined as died within 30 days of the crash.

^f *Observatoire national interministériel de sécurité routière (ONISR)* data.

Comparison of RSA & Uganda 2007

RSA: Population= 48.8m

Uganda: Population = 30.9m

DATA
Reported road traffic fatalities (2007) 14 920^f (76% males, 24% females)
Reported non-fatal road traffic injuries (2007) 219 978^g
Costing study available Yes (deaths and injuries)

DATA
Reported road traffic fatalities (2006–2007) 2 838^b (78% males, 22% females)
Reported non-fatal road traffic injuries (2006–2007) 12 058^c
Costing study available Yes (deaths and injuries)

^f Road Traffic Management Corporation data, defined as died within 7 days of the crash.

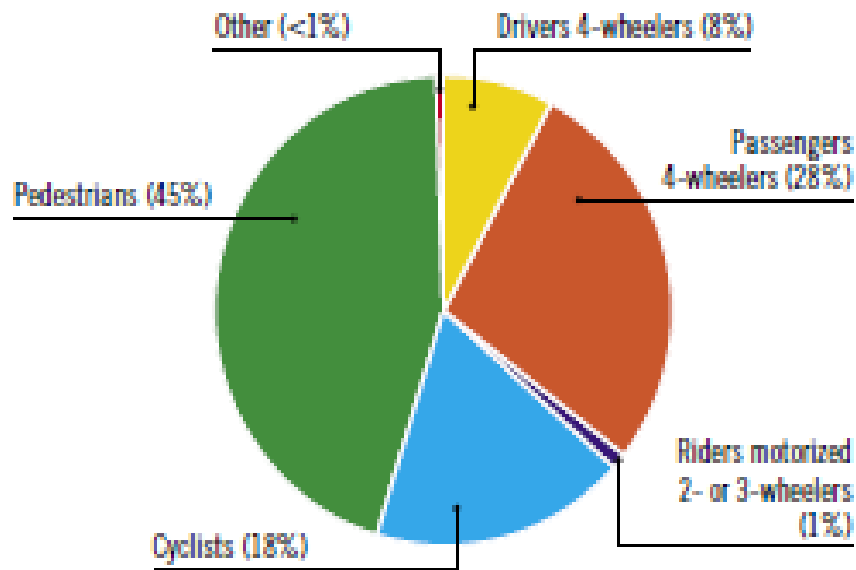
^g Road Traffic Management Corporation and Medical Research Council data.

^b Police data, defined as died within 30 days of the crash. Data collected by financial year.

^c Police data, collected by financial year.

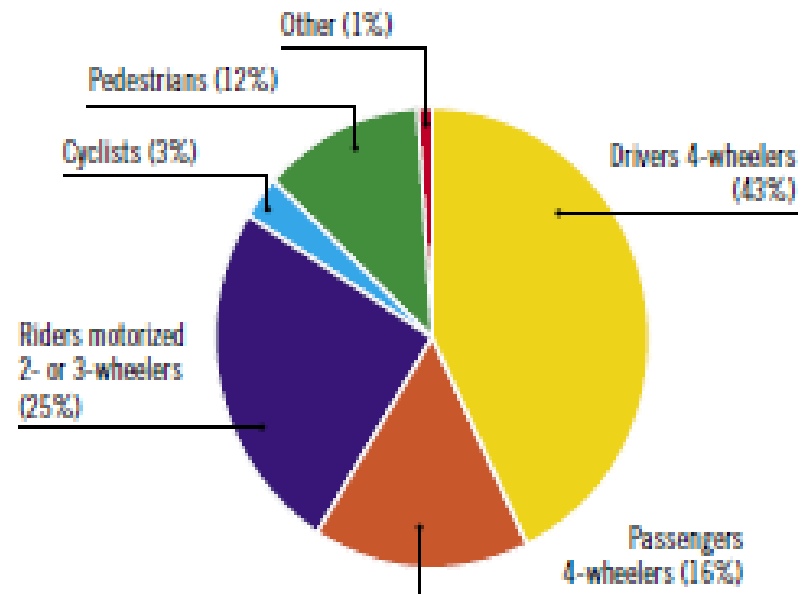
Malawi

DEATHS BY ROAD USER CATEGORY



France

DEATHS BY ROAD USER CATEGORY



Source: WHO, *Global road status report 2013* (http://www.who.int/tb/publications/2013/07)

Major Determinants of RTAs in RSA

Person-related factors

- Use of alcohol:
 - by drivers and pedestrians alike
- Lack of knowledge of roads safety
 - especially among young children
 - also among recent arrivals from rural backgrounds
- Disregard of road safety behaviour
 - high speed driving
 - lack of courtesy for other road users
 - un-licensed or poorly trained drivers
 - driver's lack of attention (due to various factors e.g. tiredness, preoccupation with other activities like cell phone use, etc)
 - Close following distance

Major Determinants of RTAs in RSA (continued)

External Factors

- Poor state of roads
 - lack of traffic control road signs, non-visible road signs/markings and poorly maintained roads
 - lack of safe pedestrian crossings
 - unrestricted animal crossing
- Poor condition of vehicle
 - tyres threads, brakes, steering mechanism
 - non-functioning brake or indicator lights
- Other conditions
 - poor visibility
 - slippery roads

BAC (g/100ml)	Effects of different Blood Alcohol Levels on the Body
0.01–0.05	<ul style="list-style-type: none"> ➤ Increase in heart and respiration rates ➤ Decrease in various brain centre functions ➤ Inconsistent effects on behavioural task performances ➤ Decrease in judgment and inhibitions ➤ Mild sense of elation, relaxation and pleasure
0.06–0.10	<ul style="list-style-type: none"> ➤ Physiological sedation of nearly all systems ➤ Decreased attention and alertness, slowed reactions, impaired coordination, and reduced muscle strength ➤ Reduced ability to make rational decisions or exercise good judgment ➤ Increase in anxiety and depression ➤ Decrease in patience
0.10–0.15	<ul style="list-style-type: none"> ➤ Dramatic slowing of reactions ➤ Impairment of balance and movement ➤ Impairment of some visual functions ➤ Slurred speech ➤ Vomiting, especially if this BAC is reached rapidly
0.16–0.29	<ul style="list-style-type: none"> ➤ Severe sensory impairment, including reduced awareness of external stimulation ➤ Severe motor impairment, e.g. frequently staggering or falling
0.30–0.39	<ul style="list-style-type: none"> ➤ Non-responsive stupor ➤ Loss of consciousness ➤ Anaesthesia comparable to that for surgery ➤ Death (for many)
0.40 & greater	<ul style="list-style-type: none"> ➤ Unconsciousness ➤ Cessation of breathing ➤ Death, usually due to respiratory failure

Catching up with a friend? Is it worth risking lives?

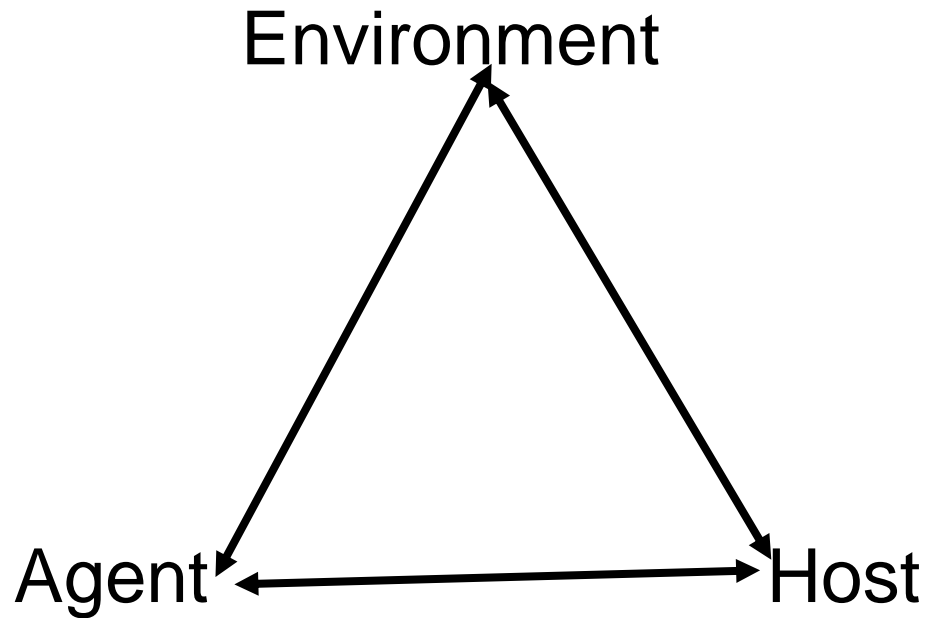


Levels of Intervention for Trauma

- Before the injury ➤ 1⁰ prevention
- During the "golden hour" ➤ 2⁰ prevention
- In the aftermath ➤ 3⁰ prevention

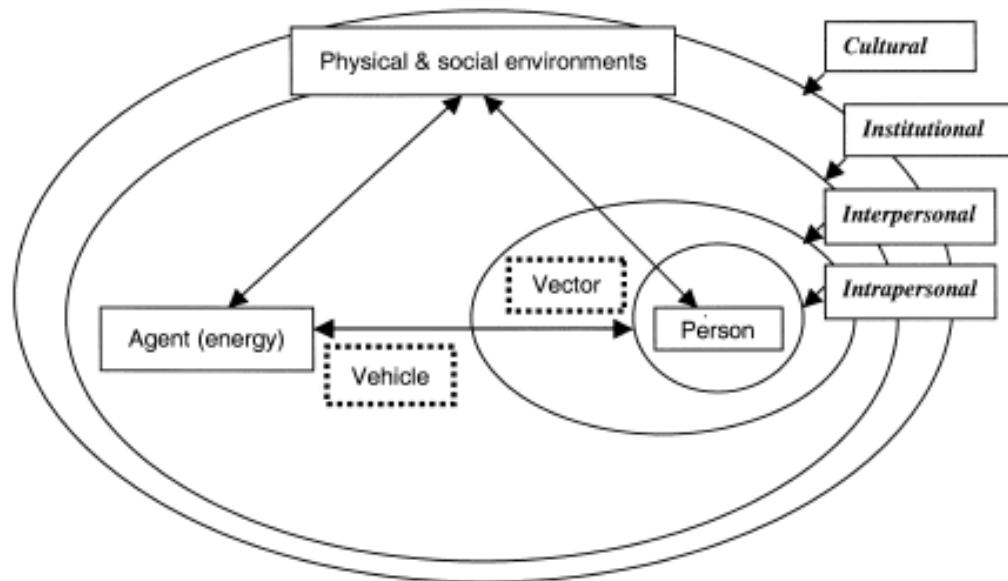
1. Primary Prevention

Prevention (i.e. RTA)

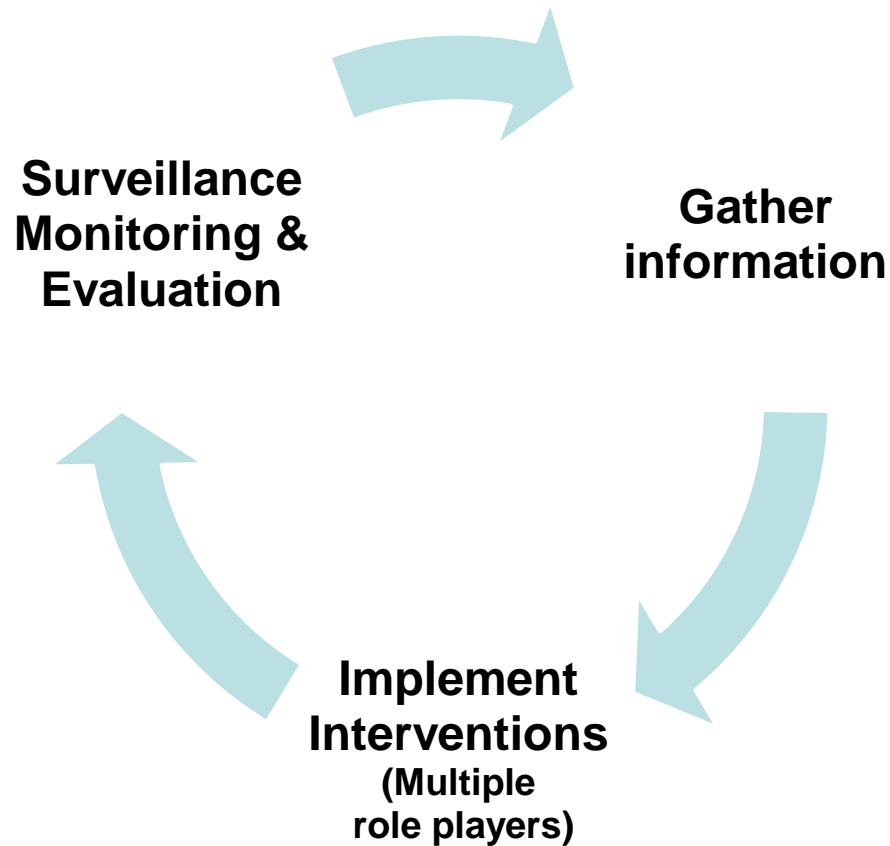


RTA = Road Traffic Accidents

Application of Haddon's Model for the control of Injuries



Public Health Approach to the Prevention of Trauma



Prevention & Control of RTA: The Public Health Approach

The PH approach entails:

- Using data to identify nature & magnitude of the problem
- Identifying causes of the problem (risk factors)
- Developing & testing interventions
- Implementing the appropriate interventions
- Surveillance, Monitoring & Evaluating the effectiveness
- Adapting the interventions according to information derived from the Monitoring & Evaluation

RTA Prevention –

1.1 Host Factors

- Social marketing and public education on behaviour change regarding Alcohol or Drug use and RTAs
- Promotion of the use of Seat Belts and Child Restraints
- Avoidance of Speeding
- Promote the correct use of the road and responsiveness to road signs
- Avoid driving while fatigued
- Use of Helmets - cyclists
- Attention to Medical conditions – vision, stress, epilepsy, CHD etc.

Use a Restraint Consistently & Correctly



Responsible parents do this at all times all before getting the car to move



Teach children road safety behaviour: Children learn from Examples

Source: WHO. Youth Road Safety



1.2. Environmental Factors

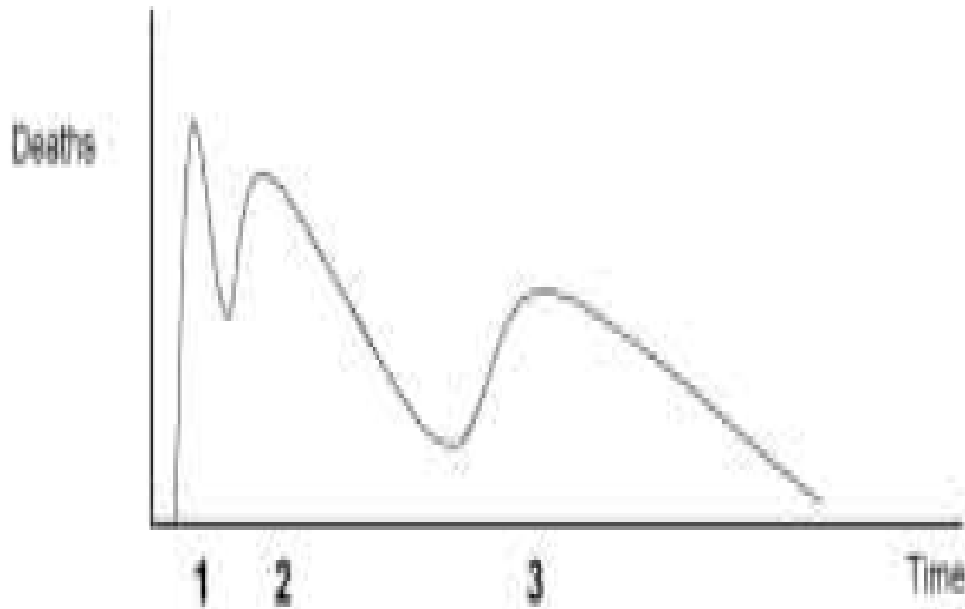
- Condition of roads
 - Road surface
 - Clearly marked & convenient Pedestrian crossings
- Pedestrian bridges for very busy roads
- Clear visibility
- Road signage
- Adequate lighting
- Control of animals
- Enforcement of traffic regulations in all areas & at all times (not only speed traps)

1.3. Agent Factors

- Road-worthy condition of the vehicles
- Road-worthy cycles

2. Secondary Prevention

Trimodal distribution of Death from RTAs



- 1. Immediately**
Unavoidable Fatal injury
- 2. Within hours:**
Usually treatable condition
- 3. Delayed stage death**
Infection, Multi system failure or complications

2.1 Pre-hospital Trauma Care

- Basic First Aid
 - Aim:
 - To plan and implement measures to reduce mortality soon after the trauma (i.e reduce the peak 2 of mortality shown in the previous slide)
 - Should be the competence and attitude of all persons
 - Stop to help
 - Call for help
 - Asses the scene and the victim
 - Start the breathing
 - Stop the Bleeding

2.2 Advanced pre-hospital care:

Access to services of Trained paramedics – within an hour of sustaining an injury



4. Health Services

- Adequate coverage by Emergency services with short response times (≤ 30 minutes)
- Appropriate qualified and staff manning EMS
- Adequate staffing of and resource allocation for EMS
- Clear referral policies
- Adequately resourced hospitals District Hospital & Regional hospitals

Impact of Fatal & Non-fatal Injuries in RSA

- Fatal injuries from Interpersonal Violence and Road Traffic Accidents are 2nd to HIV as the major causes of Years of Potential Life Lost (YPLL) and contribute to the high Disability Adjusted Life Years (DALYs)
- Approx 3.5 million people seek medical assistance for non-fatal injuries annually
 - 50% of these due to interpersonal violence

Cost of Trauma

- Proportion of the health budget
 - Ambulance service
 - Hospital services
 - Rehabilitation services
- Cost to society
 - Individual if they survive (loss of income, emotional and psychological)
 - The family and community who have to take care of survivor

Summary

RSA has the highest rates per 100 000 population of injuries (especially IPV & RTA) in the world

IPV In RSA:

- Violence & injuries are the 2nd leading causes of death (after AIDS) and lost disability-adjusted life years (DALYs)
- Interpersonal violence > traffic > other
- Young men aged 15-29 are predominantly perpetrators of violence and disproportionately affected as victims of violent crimes
- Alcohol a major risk factor for IPV > traffic > other
- The social factors driving the problem are poverty, unemployment, extremely wide disparity in wealth, childhood experience of violence, widespread access to firearms, alcohol and drug use and weak law enforcement mechanism

Summary (continued)

RTA

- Social marketing & Education of all categories of road users on alcohol & RTA and on safe use of the road
- Rigorous punitive sanctions for drinking-and-driving offences
- Expansion and rigorous enforcement of road-side alcohol & drug monitoring for drivers and pedestrians by law enforcement agents
- Laws against drinking-and-walking on public roads and their enforcement
- Use of safety belts & child restraints at all times
- Enforcement of Road Traffic Laws & Regulations
- Improving and maintaining condition of roads, road markings and visible signage
- Providing safe pedestrian crossings – scholar patrols, demarcated pedestrian crossings in the streets, pedestrian bridges etc
- Fencing-off the roads to prevent stray animals on the roads
- Corporate responsibility in ensuring safe public transport and commercial vehicles on roads & safe practices by the drivers of these
- Application of the public health approach in the control of RTAs and other forms of injuries

Summary (continued)

The Health Care Services:

- Strengthening the capacity of the PHC services, the District and Regional Hospitals
- Shortening of the response times for the Emergencies
- Adequate training of and resource allocation for the EMS
- Effective patient care in the 1st “golden” hour following an injury
- Building capacity within communities to handle emergencies while awaiting trained EMS staff
- Applying the Public Health Approach in monitoring and evaluating the effectiveness of the emergency health care system

THE END