# Injuries epidemiology and prevention

- **Objectives :**

1- Describe  the concepts of injuries, why do they occur and their epidemiology

2- Describe important differences between various types of injuries (Intentional and unintentional)

3- Understand principles of injury prevention and control

4- Appreciate the burden of injuries in KSA

**Done by :** Nourah Alhassan - Majd Albarrak - Alanoud Almansour - Haifaa Taleb

**Team leader:** Afnan Almustafa & Saif Almeshari

**Reviewed by:** Yazeed Al-Dossare

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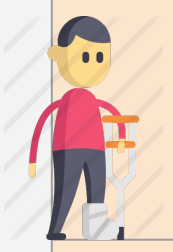
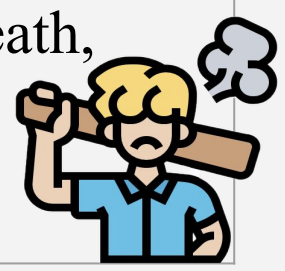
- **Resources :**
  Slides.
  Doctor’s notes.

[Colors index : Important | Notes | Note | Slides | Extra]  [ Editing file | Share note ]

# Definitions

| | |
|---|---|
| Injury | "Acute exposure to agents such as mechanical energy, heat, electricity, chemicals, and ionising radiation interacting with the body in amounts or at rates that exceed the threshold of human tolerance. In some cases, injuries result from the sudden lack of essential agents such as oxygen or heat." (Source: Gibson, 1961; Haddon, 1963) |
| | Physical damage due to;<br>● transfer of energy ( kinetic=movement , thermal, chemical, electrical, or radiant).<br>● Absence of oxygen or heat over a period of time, exposure that is either acute or chronic. |
| Violence | The intentional use of physical force or power, threatened or actual, against oneself, another person, or against a group or community, that either results in or has a high likelihood of resulting in injury, death, psychological harm, mal-development or deprivation"(WHO, 1996) |





# Types of Injuries

- **Intentional:**

e.g. violence, suicide, homicide, intentional fire-arm injuries.

- **Non-intentional (accidental):**

e.g. Motor Vehicle Crashes (RTA), fires, falls, poisoning, drowning-asphyxia, burns, sports, accidental fire-arm, Occupational Injuries.

# Nature of Energy

Mechanical
E.g. RTA

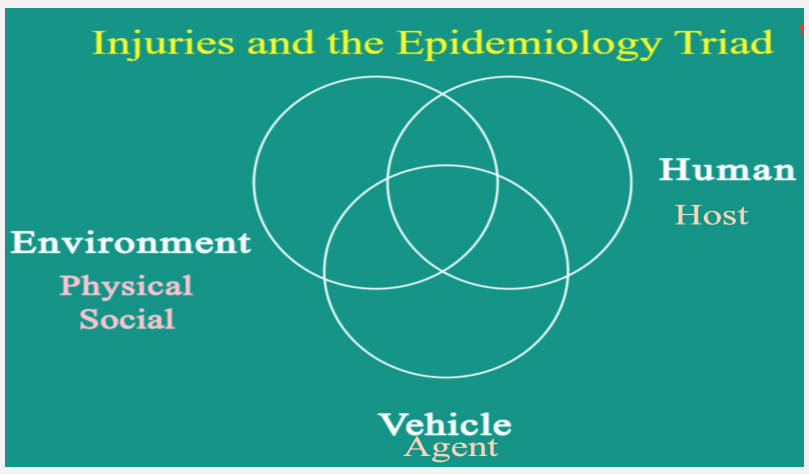
Thermal (burns) /
Chemical e.g. inhalation of chemical substances

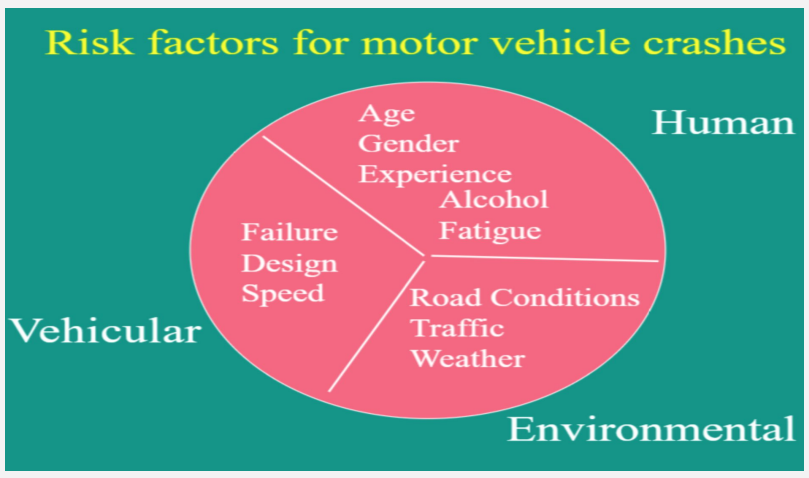
Electrical

Asphyxiation

# Epidemiological Triad

- Host (driver)
- Agent (car)
- Environment (road)


# Causative factors

| Human factors | Vehicle factors | Environmental factors |
|---|---|---|
| • Over speeding<br>• Over taking<br>• Not wearing helmet<br>• Drunken driving<br>• Sudden road crossing<br>• Driving under the influence | • Poor safety features<br>• Faulty design<br>• Poor condition<br>• Poor visibility<br>• Loss of balance<br>• Brake failure<br>• Problem with head or tail light<br>• Overloaded vehicles | • Absence of reliable public transport system<br>• Poorly designed roads<br>• Poor lighting<br>• Obstacle on road<br>• Absence of traffic system<br>• Lack of pedestrian footpath |

# Other risk factors:

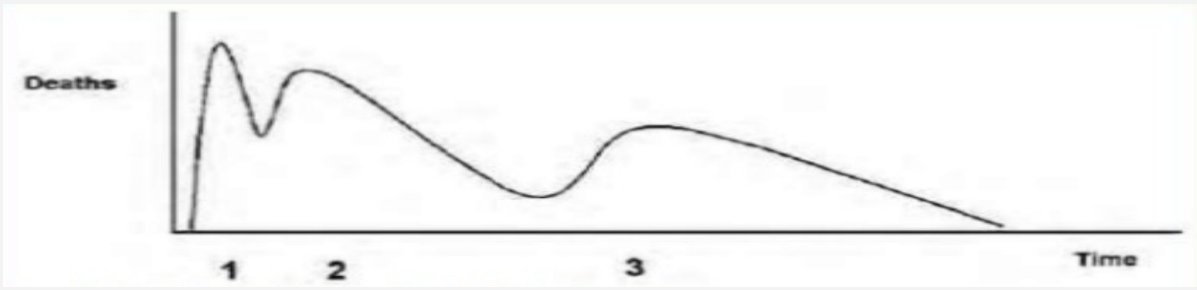
| | |
|---|---|
| Factors influencing exposure to risk | • Rapid motorization<br>• Demographic factors<br>• Transport, land use and road network planning<br>• Increased need for travel<br>• Choice of less safe forms of travel |
| Risk factors influencing crash involvement | • Speed<br>• Pedestrians and cyclists<br>• Young drivers and riders<br>• Alcohol<br>• Medicinal and recreational drugs<br>• Driver fatigue<br>• Handheld mobile telephones<br>• Inadequate visibility |
| Risk factors influencing Injury severity | • Lack of in-vehicle crash protection<br>• Non-use of crash helmets by two-wheeled vehicle users<br>• Non-use of seat-belts and child restraints in motor vehicles<br>• Roadside objects |
| Risk factors influencing Post-crash injury outcome | • Pre-hospital factors<br>• Hospital care factors |

# Patterns of death due to trauma

Road death occur in 3 peaks:

1. Early death (within minutes) - primary prevention
2. Intermediate death (within 1 or 2 days) - secondary prevention
3. Late death (over days or weeks) - tertiary prevention

- First hour after the accident is the most important hour



# Trauma Energy

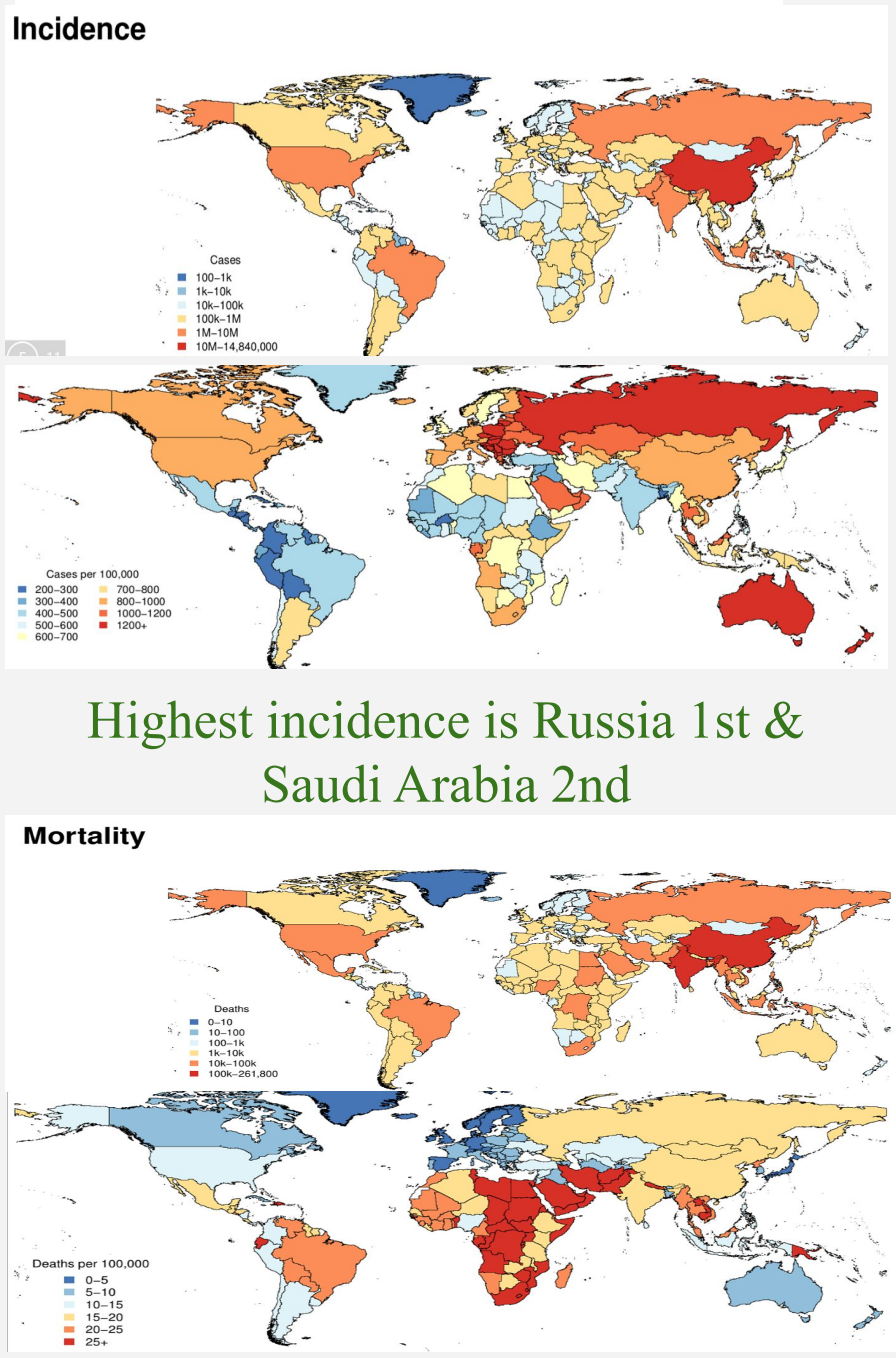
- Stresses: contact with energy sources generates forces counter to the load.

| **Tension:** pulling molecules apart | **Compression:** pushing molecules together | **Shear:** from tangential force |
|---|---|---|

- Strain: extent of deformation (stresses resultant)

# Magnitude of the problem

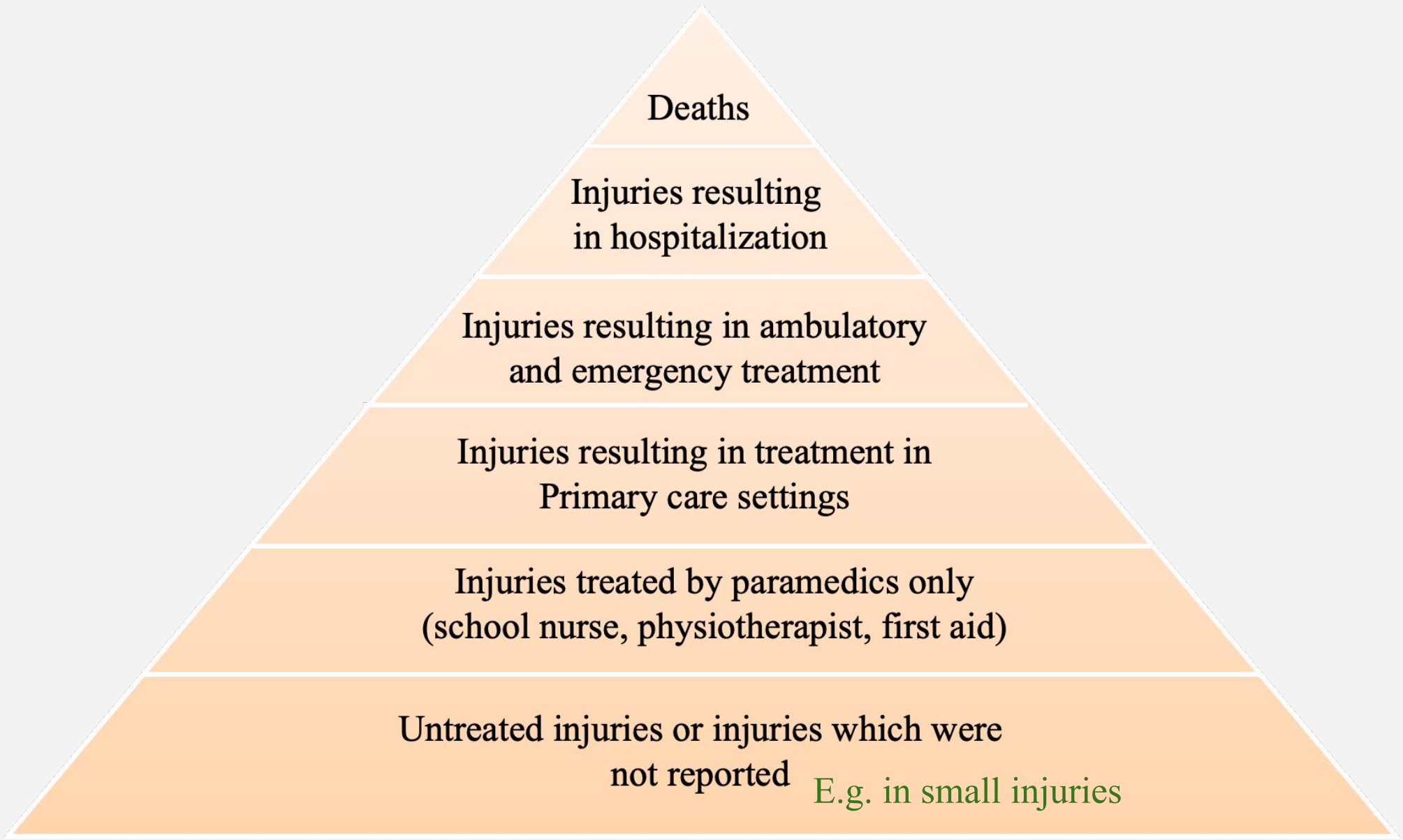

Road injuries are the 8th cause of death worldwide, and the 2nd cause of death in KSA




Highest incidence is Russia 1st & Saudi Arabia 2nd

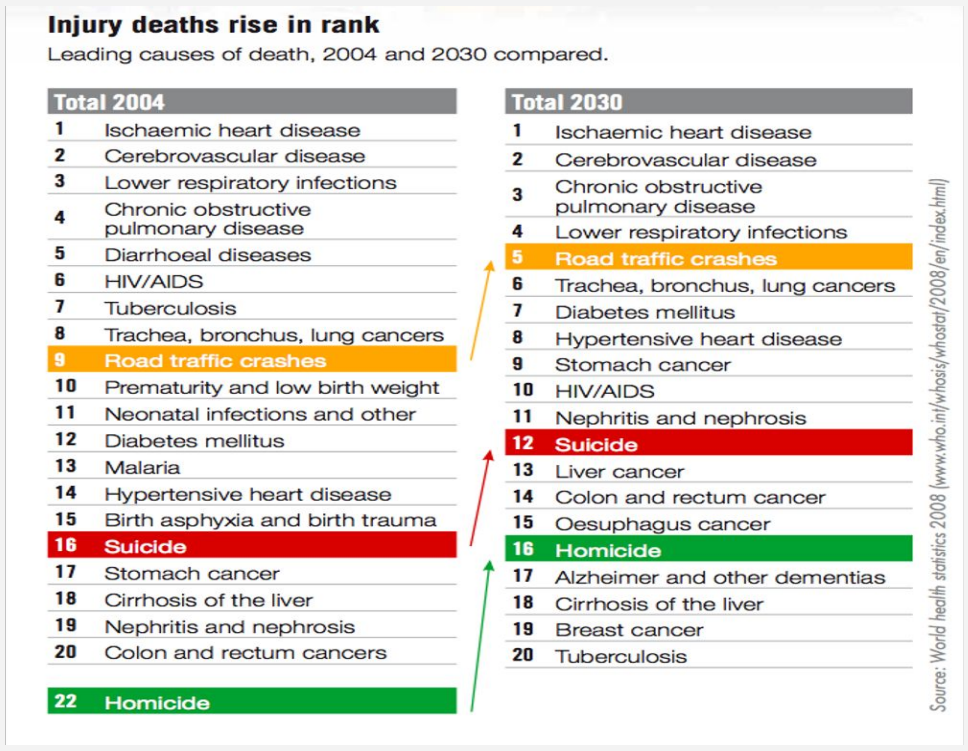
US and Canada share the same incidence rate but the mortality rate is higher in the US bc they don't have a comprehensive national health insurance system, unlike Canada where healthcare is available for all

# Pyramid of Injury

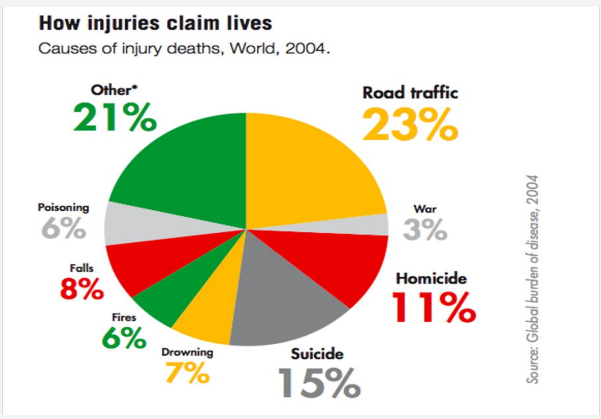


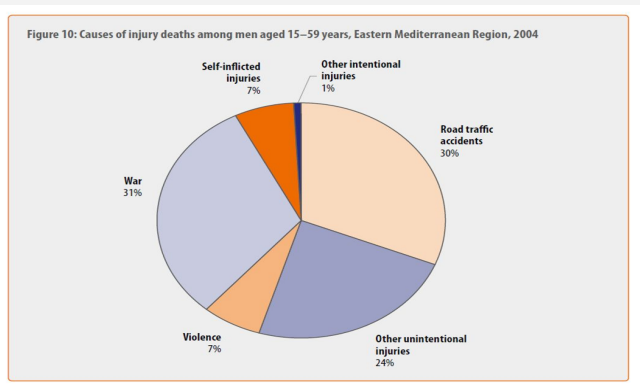

# Global & Regional Burden

- 12% of global burden of disease.
- More than 90% of injury deaths occur in low -and middle- income countries.
- Leading causes of M&M burden in Eastern Mediterranean Region.
- Road traffic "incidents" are the leading cause of injury deaths worldwide, which strongly applies to GCC/KSA.




Why would RTA move up the list in 2030? Because the healthcare system will become better in dealing with non-communicable diseases



# Global status report on road safety 2015.

**Table 1 -** Key features of studies (full text) on road traffic accident (RTA) in the Kingdom of Saudi Arabia (KSA) (n=8).

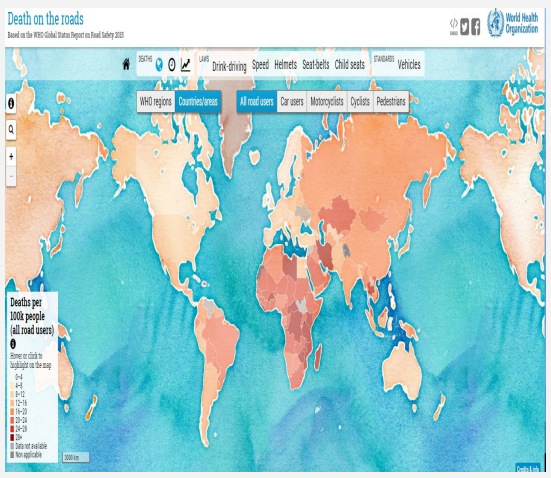
| Study, year of publication | Type, year | Sample size | Place of study | Most common identified cause of RTA | Outcome measure | Preventive strategy proposed |
|---|---|---|---|---|---|---|
| Barrimah et al, 2012[16] | Both, 2010 | 835 | Hospitals and PHC in Buraydah, Al-Qassim region | High speed | Type of accident, injury, deaths, health versus police records RTA, non-fatal injury rate | Good surveillance, improvement in quality of data |
| Khan et al, 2010[22] | Primary, 2005-2006 | 1513 | Armed Forces Hospital Southern Al-Aseer region, KSA | Non use of seat belts | Cause of injuries | Primary prevention of road injuries emphasized |
| Al-Naami et al, 2010[20] | Secondary | --- | - | Driver errors | Magnitude of RTAs | Establishment of trauma care system |
| Bendak, 2005[24] | Both, 2001 | 900 | Drivers and FSP in Riyadh | NA | Compliance to seat belt law and types of injuries | Trends in use of seat belts |
| Elshinnawey et al, 2008[13] | Secondary, 1997-2002 | -- | Mortality records of MOH and General Statistics Authority, KSA | NA | PYLL | Health education |
| Ansari et al, 2000[8] | Secondary | -- | -- | High speed | General and specific causes of RTA economic impact | Use of seat belts, developing RTA database |
| Qayed, 1998[21] | Secondary, 1994-1995 | -- | Al-Ahsaa Hospitals and Traffic Department | NA | Injury, deaths, no. of vehicles and accidents and causes | Primary, secondary, and tertiary prevention of road injuries |
| Batouk et al, 1996[23] | Primary, 1989-1994 | 303 dead victims | Abha (Al-Aseer region) | NA | Dead on arrival, site of injury, time of accident | Legislation on seat belt and pre-hospital emergency system |

PHC - primary health care, FSP - front seat passenger, MOH - Ministry of Health, PYLL - potential productive years life lost, NA - not available

**Table 3 -** Causes of road traffic accidents as implicated in various years according to studies from Saudi Arabia.

| Study | Drivers' faults | | | | | Vehicle's condition | Environmental conditions |
|---|---|---|---|---|---|---|---|
| | Excess speed | Violation of rules | Non use of seat belts | Substance abuse | Improper turning, or stopping | Tire condition | Increased number of vehicles |
| | (%) | | | | | | |
| Central Department of Statistics and Information[16] | 43.1 | 1.7 | - | 0.0 | 42.2 | 12.2 | 12.2 |
| Al-Naami et al[20] | 65.0 | 50.0 | - | - | - | | |
| Kahn et al[22] | 29.0 | 26.6 had no license | 29.2 | - | - | - | - |
| Bendak[24] | - | - | 40.0 | - | - | - | - |
| Ansari et al[8] | 65.0 | 65.0 | - | - | - | 20.0 | 20.0 |
| Batoul et al[23] | 70.0 | 12.0 | - | - | 1.8 | | |

A study done in KSA showing that more than 40% of RTA are because of the drivers' fault

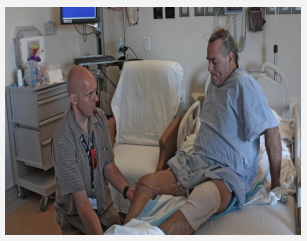



| Country/area | General Information | | | Road traffic deaths | | | |
|---|---|---|---|---|---|---|---|
| | Population numbers[a] for 2013 | GNI per capita[b] for 2013 in US dollars | Income level[c] | Reported number of road traffic deaths[d] | Modelled number of road traffic deaths[e] | | Estimated road traffic death rate per 100 000 population[e] |
| | | | | | Point estimate | 95% Confidence Interval | |
| Qatar | 2 168 673 | 86 790 | High | 204[f] | 330 | — | 15.2 |
| Republic of Korea | 49 262 698 | 25 920 | High | 5 092 | 5 931 | — | 12.0 |
| Republic of Moldova | 3 487 204 | 2 470 | Middle | 302 | 437 | — | 12.5 |
| Romania | 21 698 585 | 9 060 | Middle | 1 861 | 1 881 | — | 8.7 |
| Russian Federation | 142 833 689 | 13 850 | High | 27 025 | 27 025 | — | 18.9 |
| Rwanda | 11 776 522 | 630 | Low | 526 | 3 782 | 3 022 – 4 541 | 32.1 |
| Saint Lucia | 182 273 | 7 060 | Middle | 30 | 33 | — | 18.1 |
| Saint Vincent and the Grenadines | 109 373 | 6 460 | Middle | 9 | 9 | — | 8.2 |
| Samoa | 190 372 | 3 970 | Middle | 17 | 30 | 27 – 33 | 15.8 |
| San Marino | 31 448 | 51 470 | High | 1 | 1 | — | 3.2 |
| Sao Tome and Principe | 192 993 | 1 470 | Middle | 33 | 60 | 47 – 73 | 31.1 |
| Saudi Arabia | 28 828 870 | 26 260 | High | 7 661 | 7 898 | 7 002 – 8 795 | 27.4 |
| Senegal | 14 133 280 | 1 050 | Middle | 356 | 3 844 | 3 214 – 4 474 | 27.2 |
| Serbia | 9 510 506 | 6 050 | Middle | 650 | 735 | — | 7.7 |
| Seychelles | 92 838 | 13 210 | Middle | 8 | 8 | — | 8.6 |
| Sierra Leone | 6 092 075 | 660 | Low | 220 | 1 661 | 1 334 – 1 988 | 27.3 |
| Singapore | 5 411 737 | 54 040 | High | 159 | 197 | — | 3.6 |
| Norway | 5 042 671 | 102 610 | High | 187 | 192 | — | 3.8 |

# Types of Data & Potential Sources of Information

- Mortality
- Death certificates
- Reports from mortuaries

- Morbidity and Health-related
- Hospitals
- Medical records



- Self Reported
- Surveys
- Media


- Community-based
- Demographic records
- Local government records


- Law enforcement
- Police records
- Prison records


- Economic-social
- Institutional or agency records
- Special studies

# PREVENTION & CONTROL

**Levels & Concepts**

- **Primary prevention:** raising awareness of the community, at its different levels, as to methods of avoiding injuries. This includes health promotion / health education activities and applying preventive measures accordingly
- **Secondary prevention:** early detection, proper evaluation and management of injuries at different levels of healthcare delivery (primary, secondary and tertiary facilities)
- **Tertiary prevention:** management of complications of injuries, especially disabilities, including rehabilitative measures and approaches, improvement of quality of life of injury victims, as well as palliative care, when needed e.g. Saudi Red Crescent

# KSA Efforts

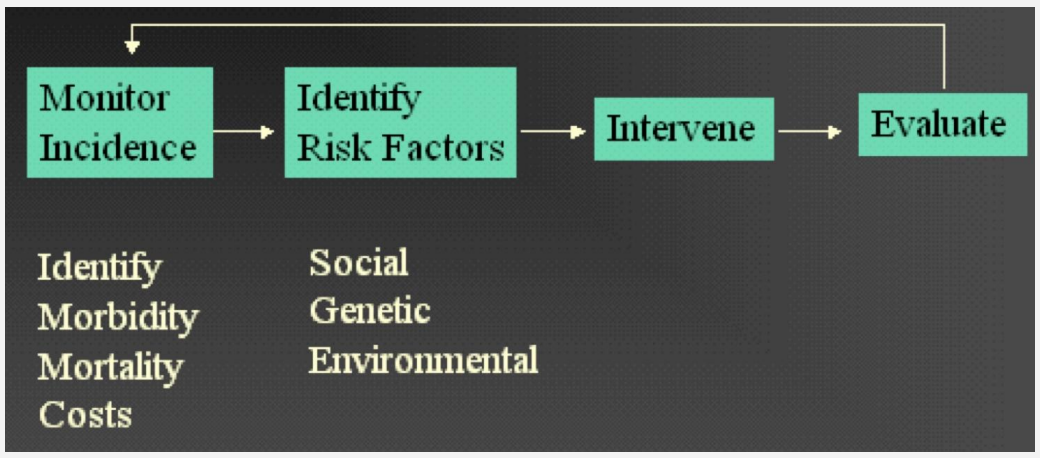


- Surveillance System
- Education
- Capacity Building

http://moh-ncd.gov.sa/injury/index.php

# Applications

**General Model for Injury Control:**



# Applications

- **Host**: victim: e.g. driver, passenger, pedestrian..
- **Agent**: mechanical / thermal energy
- **Environment**: vehicle, road, social

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- **Primary prevention:** This includes legislations, health promotion activities and applying preventive measures (seat-belts, child restraints, air-bags, good roads, following traffic rules, etc)
- **Secondary prevention:** Early detection, proper evaluation and management of RTI at different levels of healthcare delivery (especially tertiary facilities: e.g. emergency /trauma facilities and related services)
- **Tertiary prevention:** Management of complications of RTI, especially disabilities, on medical / social / economic levels, including rehabilitation and physiotherapy measures

# Prevention

| Primary Prevention | Secondary Prevention | Tertiary Prevention |
|---|---|---|
| • Road<br>• Vehicle<br>• People<br>• System | • Pre-trauma care<br>• Acute emergency trauma care system | • Hospital care<br>• Rehabilitation |

# The Haddon Matrix

- Added factor of time to previous models to address causes of injury
- The host, agent, and environment interact over time to cause injury and correspond to:
  - Pre-event
  - Event
  - Post-event
- Matrix uses nine components to analyze the injury
  - Encourages creative thinking
- Injury prevention requires broad and innovative thinking to be most successful.

# The Haddon Matrix

- Use for planning, resource allocation, strategy identification

| | Human | Vehicle | Environment |
|---|---|---|---|
| Pre-event | | | |
| Event | | | |
| Post-event | | | |

| | Human | Vehicle | Environment |
|---|---|---|---|
| Pre-event | Alcohol | | Night, rain |
| Event | No seat belt | No air bag | Tree too close to road |
| Post-event | | | Slow emergency response |

- Crash injury prevention strategies for the international traveler

| | Traveler | Vehicle | Environment |
|---|---|---|---|
| Pre-event | Avoid alcohol | Choose safe cars | Avoid night driving |
| Event | Use seat belts | | |
| Post-event | | | Know local medical system |

# The Haddon Matrix for RTA


★ The most important slide in the lecture

| **Phase** | **Nature of Intervention** | **Factors** | | |
|---|---|---|---|---|
| | | *Human* | *Vehicles & equipment* | *Environment* |
| Pre-crash | Crash prevention | Information Attitude Impairment Police Enforcement | Road Worthiness Lighting Braking Handling Speed Management | Road Design Road Layout Speed limit Pedestrian Facility |
| Crash | Injury Prevention during crash | Use of Restraint Impairment | Occupant Restraints Other Safety devices Crash protective Design | Forgiving Roadsides (i.e. Crash Barriers) |
| Post Crash | Life Sustaining | First Aid Skills Access to | Ease of Access Fire Risk | Rescue Facilities |

# The Haddon Matrix; cont'

| | Pre-Crash | Crash | Post-Crash |
|---|---|---|---|
| **Human Factors** | • Education and licensing<br>• Driver impairment<br>• Crash avoidance maneuvers (braking, turning, etc.) | • Health at time of crash<br>• Sitting properly in restraint<br>• Impairment | • Response to EMS<br>• Severity of injury<br>• Type of injury |
| **Vehicle/ Equipment Factors** | • Crash avoidance equipment and technology (lights, tires, collision avoidance, etc.)<br>• Vehicle design<br>• Vehicle load | • Speed of travel<br>• Functioning of safety equipment (seat belts, air bags, child restraints)<br>• Energy absorption of vehicle | • Ease of extraction from vehicle<br>• Integrity of fuel systems and battery systems |
| **Physical Environment** | • Road hazards<br>• Distractions<br>• Weather conditions | • Roadside features<br>• Guardrails<br>• Type and size of object struck | • Distance of EMS personnel<br>• Notification of EMS personnel<br>• Accessibility to crash victims |
| **Social/ Economic** | • Enforcement activities<br>• Insurance incentives<br>• Social norming<br>• Ability to use safety equipment appropriately | • Laws concerning use of safety equipment | • Trauma system equipment, personnel, training<br>• Information sharing |

# Special Interventions for Road Safety

- Education
- Drinking & driving
- Helmet
- Seat Belt
- Speed management
- Trauma Care

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**Education:**

*Principles:*

- Informed people will take necessary action to reduce the risk.
- Educating people decreases the activity that result in injuries, and
- The educator has the means available to provide information and build skills and bring changes regarding emotions and values.

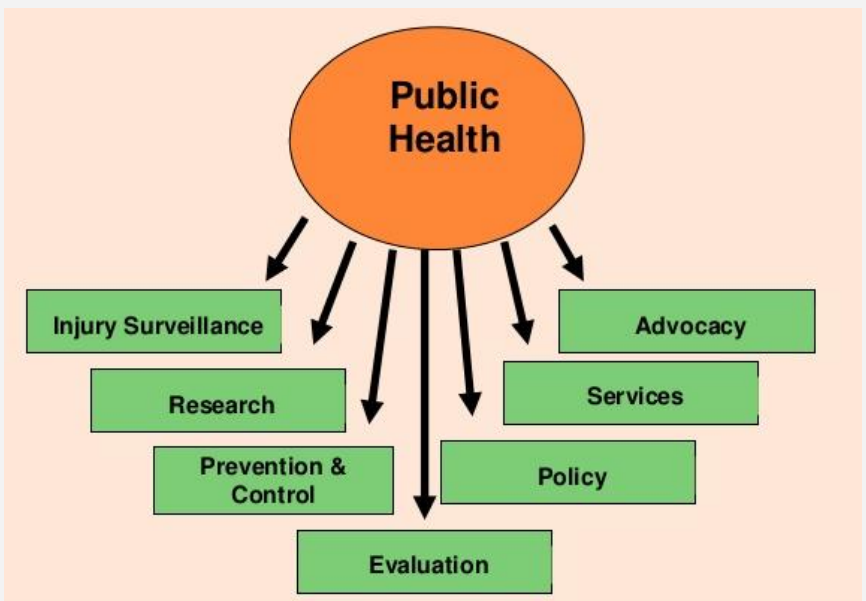
**Approaches:**

- Banner, posters and slogans
- General education programmer
- Training programmers
- Campaign
- Driver education programme
- School health education

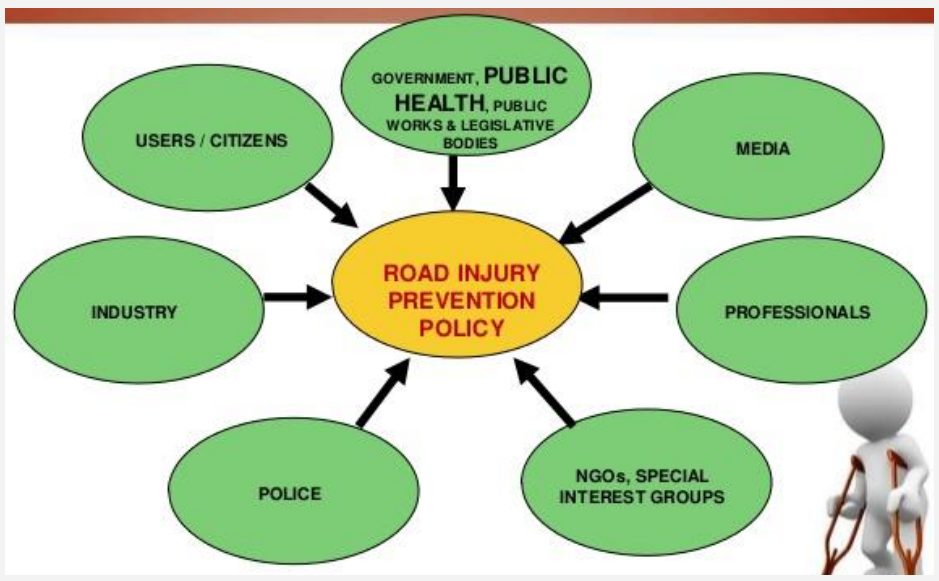
# Speed Management

- Excessive and inappropriate speed has been recognized as one of the major contributing factors for increasing road crashes.


- Road traffic accidents: Public health issue




- Conclusion: Road safety; shared societal responsibility




**“Prevention is the vaccine for the diseases of injury”**

# Injury Surveillance

- Assess status
- Program evaluation
- Define priorities
- Stimulate research
- Standard classification to compare data

**Surveillance Types:**

- Passive:
  - Routine data collection for dual (original + surveillance) limited resources, by front-lines HCPs
- Active:
  - Seeking injury cases, large resources, by PH services, different data sources
- Nature, trends, size, source, clusters, hazards, risks.
- Core:
  - Detection, registration, confirmation, reporting, analytics, feedback.
- Support:
  - Communication, training, supervision, resource provision

# MCQs

**1. Acute exposure to agents such as mechanical energy, heat, electricity, chemicals, and ionising radiation interacting with the body in amounts or at rates that exceed the threshold of human tolerance. In some cases, injuries result from the sudden lack of essential agents such as oxygen or heat is the definition of what?**

A. attack
B. injury
C. event
D. violence

**2. Occupational Injuries are example of which of the following?**

A. Intentional
B. Accidentenal

**3. Poor visibility is which of the following causative factors?**

A. human factors
B. vehicle factor
C. environmental factors

**4. legislations, health promotion activities are which type of prevention ?**

A. tertiary
B. secondary
C. primary
D. all of the above

**5. Routine data collection is which type of surveillance?**

A. passive
B. active
C. core
D. all of the above.

1 - B
2 - B
3 - B
4 - C
5 - A