



# INJURY EPIDEMIOLOGY

YEAR

1439-1440 Hijri

2018 - 2019 Gregorian

session Description	Objectives
Topics covered	<ul style="list-style-type: none"><li>• Describe the concepts of injuries, why do they occur and their epidemiology</li><li>• Describe important differences between various types of injuries (what is meant here? Intentional and unintentional?)</li><li>• Understand principles of injury prevention and control</li><li>• Appreciate the burden of injuries in KSA</li></ul>



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## HEADLINES

- Injuries: concepts and definitions
- Classification of injuries
- Magnitude of the problem
- Prevention and control efforts
- Application to road traffic incidents





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# CONCEPTS & CLASSIFICATIONS





## 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)



## Definitions - 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, maldevelopment or deprivation”

(WHO, 1996)





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## Epidemiologic Triad of Injuries

- **Host** (person)
- **Agent** (that injures: energy)
- **Environment** (vector / vehicle that conveys the agent / energy)





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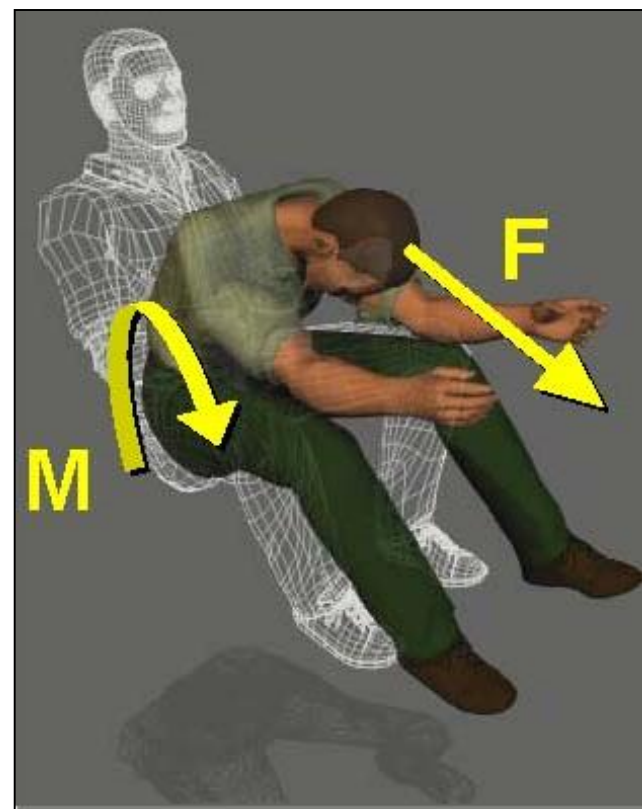
# Nature of Energy

- Mechanical
- Thermal / Chemical
- Electrical
- Asphyxiation



## Nature of Energy: Mechanical 1

- If a person must stop suddenly, as in a crash of a vehicle, that **energy must be dissipated** in the vehicle, environment, or individual's tissues
- When the vehicle stops, the occupant will continue to move at the **pre-crash speed** into interior structures, or into the materials in the exterior environment if ejected.





# Nature of Energy: **Mechanical 1**

**Stresses:** contact with energy source generates forces counter to the load.  
**tension** (pulling molecules apart),  
**compression** (pushing molecules together),  
**shear** (from a tangential force)

Compression



Tension



Shear





## Nature of Energy: **Mechanical 2**

- **Strain**: extent of deformation, resulting from tension, compression, shear
- The **shape and elasticity** of the materials struck will determine the damage to the tissue.
- Devices as **seat-belts, air bags and child restraints** reduce the severity of injury by reducing contact with less flexible structures (**second collision**)





## Nature of Energy: **Thermal & Chemical 1**

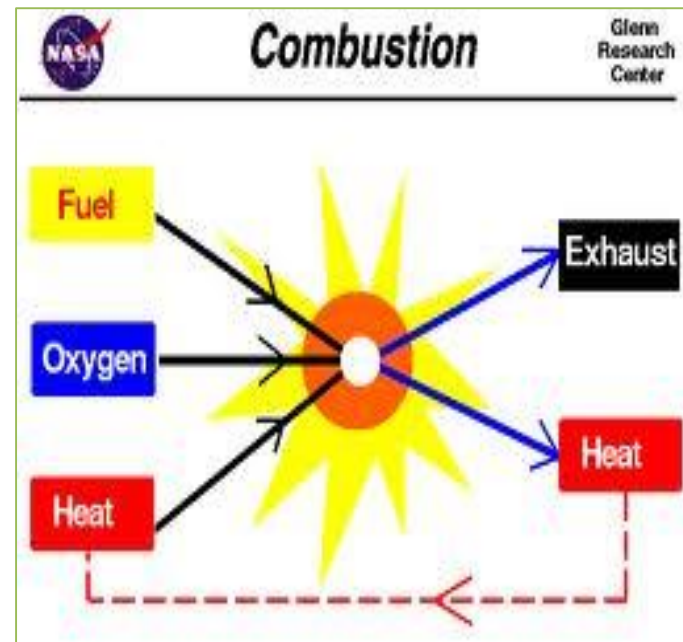
Deaths and injuries associated with **fires, heat & smoke** are the result of **ignition sources, flammable materials** and of the **heat and chemical energies** generated by burning or heating materials (e.g. cigarettes, matches, gas stoves, electrical circuits / appliances)



## Nature of Energy: Thermal & Chemical 1

- **Physics / chemistry of combustion** vary by:

- Concentration and type of heat source
- Shape / size of a combustible
- Oxygen concentration
- Vaporization of gases
- Presence or absence of catalysts



## Nature of Energy: Thermal & Chemical 2

- Chemicals may be **breathed / inhaled** (as in a fire); **ingested**; **injected**; **absorbed**



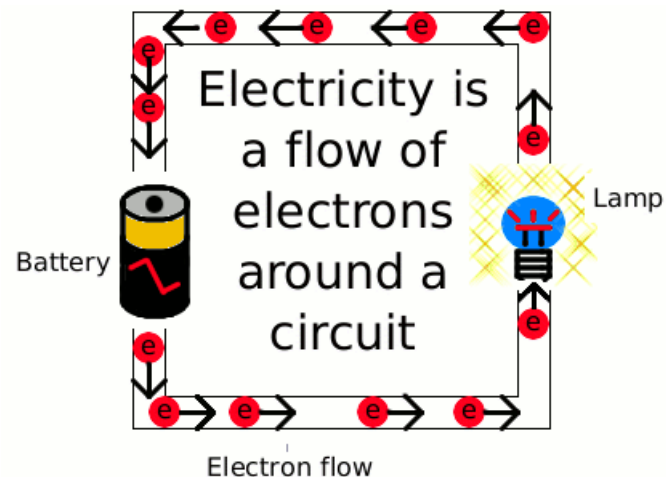
**Harms of chemicals** are divided into 3 phases:

- exposure** (poisoning);
- toxo-kinetic** (chemical's absorption through the organism's membranes: GIT, lungs' air sacs);
- toxo-dynamic** (interaction of chemical with receptors in target tissues)



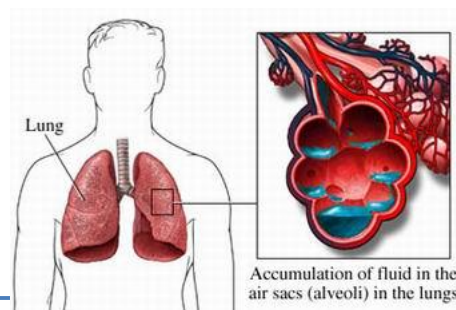
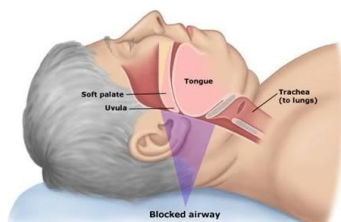
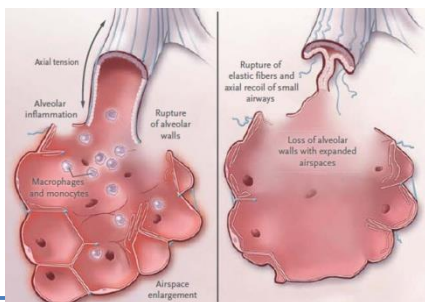
## Nature of Energy: **Electrical**

- Atoms are made up of electrons, protons and neutrons
- The flow of electrons is “electrical current”
- The extent of damage of human tissues in contact with electrical energy increases with amperage.
- Skin sensitivity varies 100-fold as a function of wetness (100,000 ohms when dry; 100 ohms when wet)



## Nature of Energy: **Asphyxiation**

- **Humans cannot function with too little energy**
- **Asphyxiation:** absence of oxygen to sustain endogenous energy conversion, which causes essential cells (in brain / heart) to be damaged within minutes
- **Possible causes:** objects blocking nose / mouth / trachea; mechanical blow to the trachea; constriction of the trachea; lung obstruction; **water in lungs** (drowning); lung congestion (endogenous fluids as in pneumonia / congestive heart failure)





## Types of Injuries

- **Intentional:** e.g. violence, suicide, homicide, intentional fire-arm injuries, etc
- **Non-intentional (accidental):** e.g. road-traffic injuries, fires, falls, poisoning, drowning-asphyxia, burns, sports, accidental fire-arm injuries, etc







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# MAGNITUDE OF THE PROBLEM





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## Magnitude

**Every six seconds someone in the world dies as a result of an injury**

**Every day more than 14 000 people die as a result of an injury**







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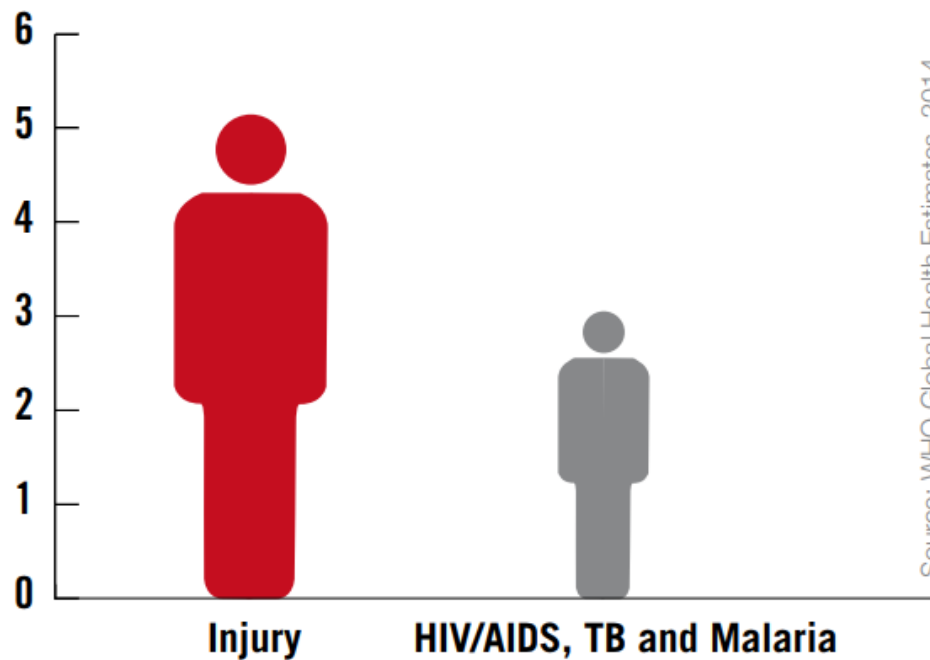
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# Magnitude

## The scale of the problem

Injury deaths compared to other leading causes of mortality, world, 2012.

Deaths per year  
(millions)



Source: WHO Global Health Estimates, 2014

Injury Epidemiology



## 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 morbidity** and mortality burden in Eastern Mediterranean Region
- **Road traffic “incidents”** are the leading cause of injury deaths worldwide, which strongly applies to GCC/KSA

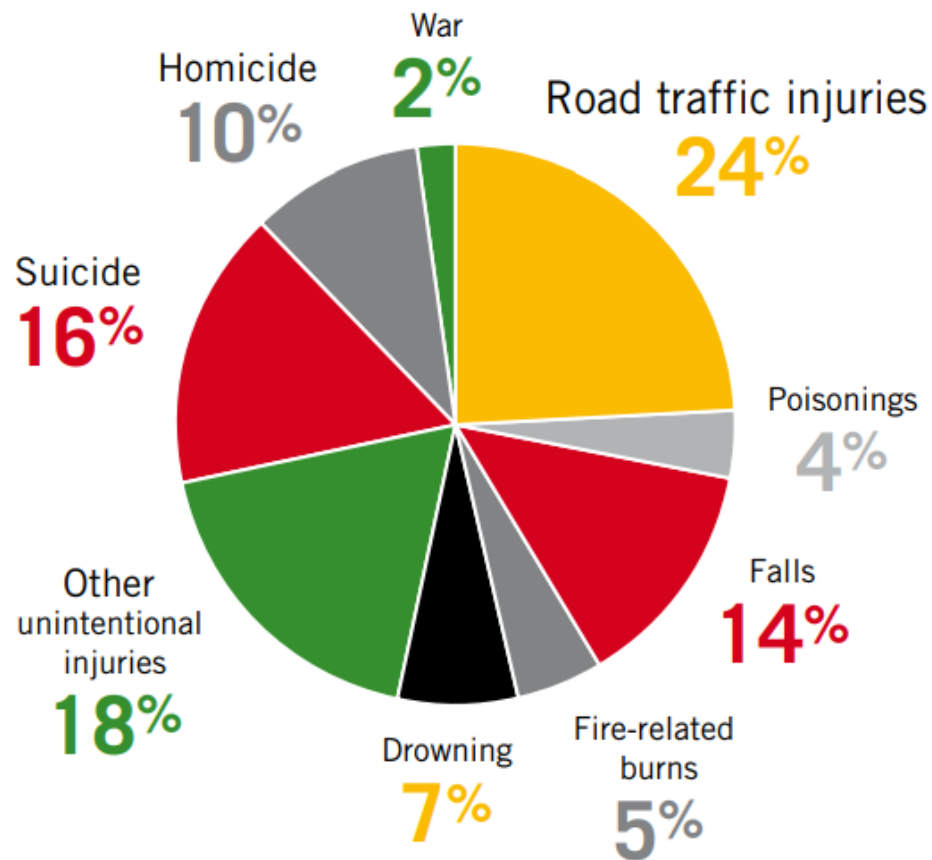




# Causes of Injury Deaths

## How injuries and violence claim lives

Causes of injury deaths, world, 2012.



Source: WHO Global Health Estimates, 2014





Predicted to  
rise

## Injury deaths rise in rank

Leading causes of death, 2012 and 2030 compared.

### Total 2012

1	Ischaemic heart disease
2	Stroke
3	Chronic obstructive pulmonary disease
4	Lower respiratory infections
5	Trachea, bronchus, lung cancers
6	HIV/AIDS
7	Diarrhoeal diseases
8	Diabetes mellitus
9	Road traffic injuries
10	Hypertensive heart disease
11	Preterm birth complications
12	Cirrhosis of the liver
13	Tuberculosis
14	Kidney diseases
15	Suicide
16	Birth asphyxia and birth trauma
17	Liver cancer
18	Stomach cancer
19	Colon and rectum cancers
20	Alzheimer's disease and other dementias
21	Falls

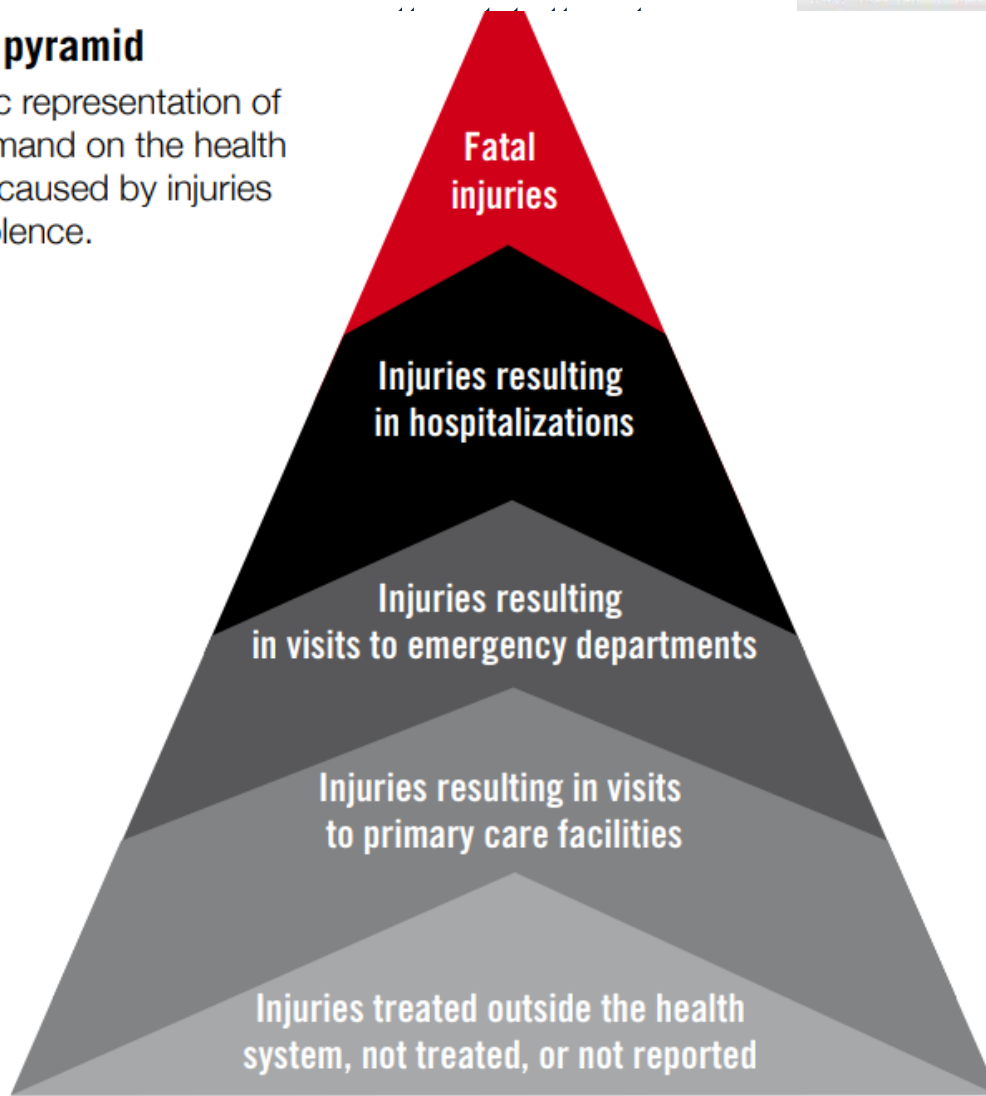
### Total 2030

1	Ischaemic heart disease
2	Stroke
3	Chronic obstructive pulmonary disease
4	Lower respiratory infections
5	Diabetes mellitus
6	Trachea, bronchus, lung cancers
7	Road traffic injuries
8	HIV/AIDS
9	Diarrhoeal diseases
10	Hypertensive heart disease
11	Cirrhosis of the liver
12	Liver cancer
13	Kidney diseases
14	Stomach cancer
15	Colon and rectum cancer
16	Suicide
17	Falls
18	Alzheimer's disease and other dementias
19	Preterm birth complications
20	Breast cancer
21	Endocrine, blood, immune disorders

### Injury pyramid

Graphic representation of the demand on the health sector caused by injuries and violence.

# Injury Pyramid



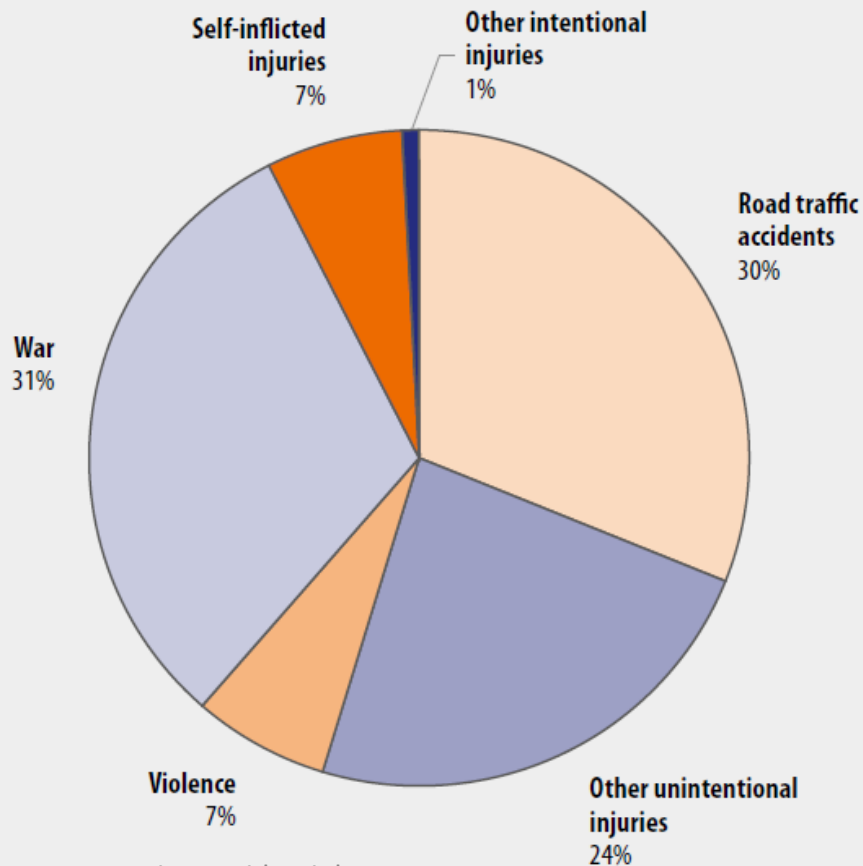
Source: WHO, 2014





# EMRO data

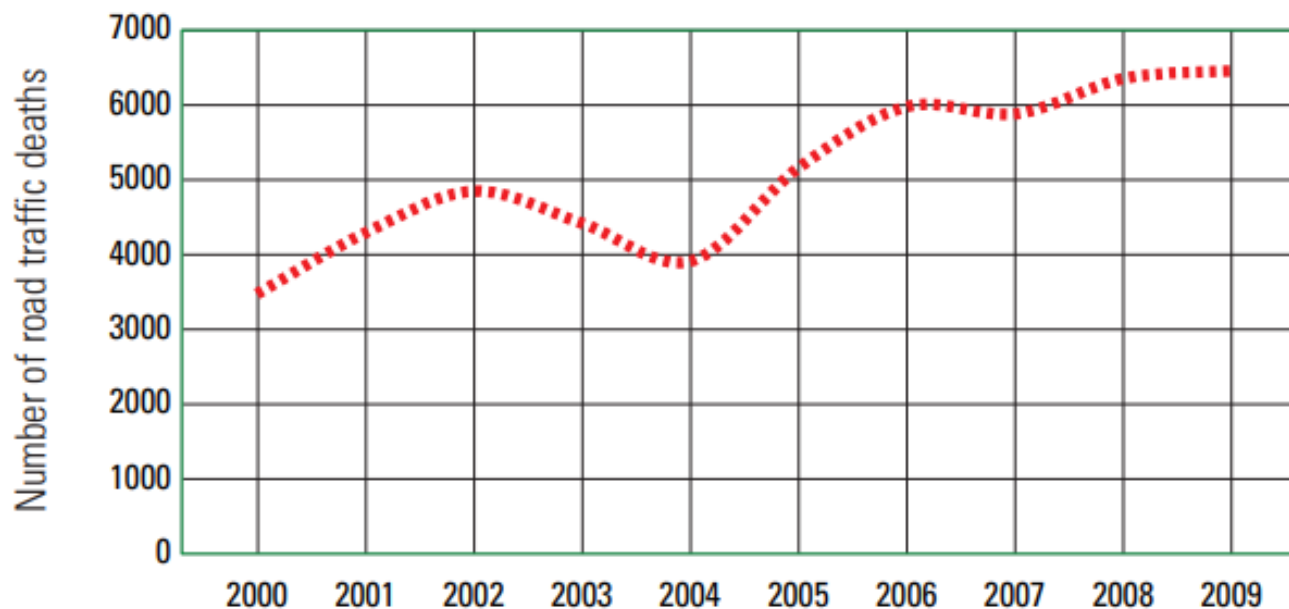
Figure 10: Causes of injury deaths among men aged 15–59 years, Eastern Mediterranean Region, 2004





## Saudi Arabia – RTA death numbers

### TRENDS IN ROAD TRAFFIC DEATHS

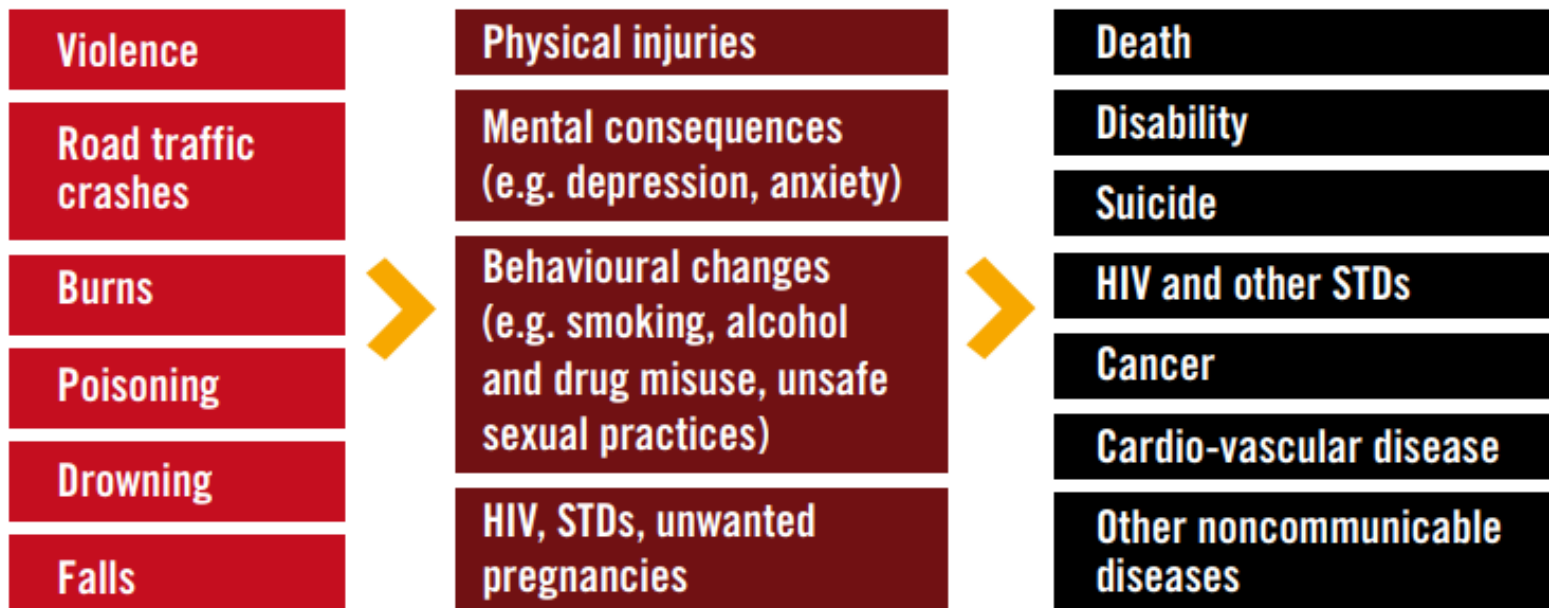


Source: 2010, Annual statistical reports from the General Administration of Traffic (Ministry of Interior)



# Possible consequences

## Consequences of injuries and violence



Source: WHO, 2014

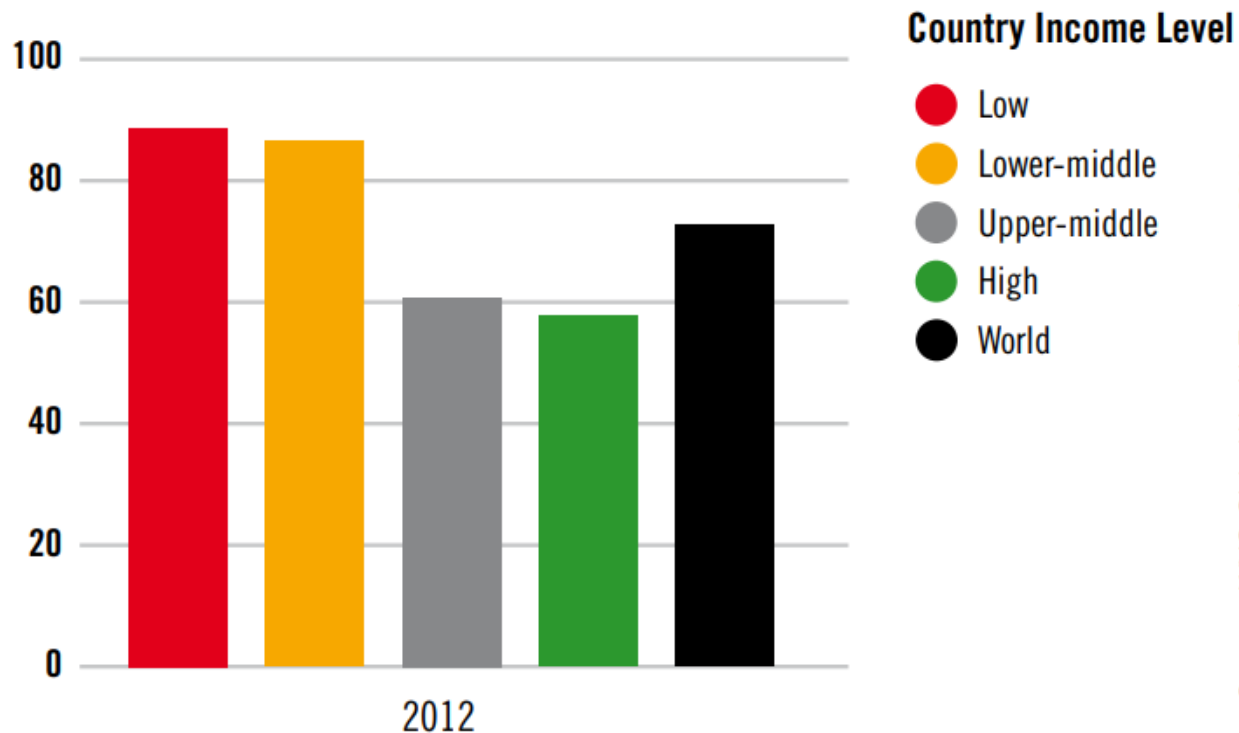


# Inequality

## Poorer countries are worst-affected by injuries and violence

Injury death rates by country income level, world, 2012.

Injury deaths per 100 000 population



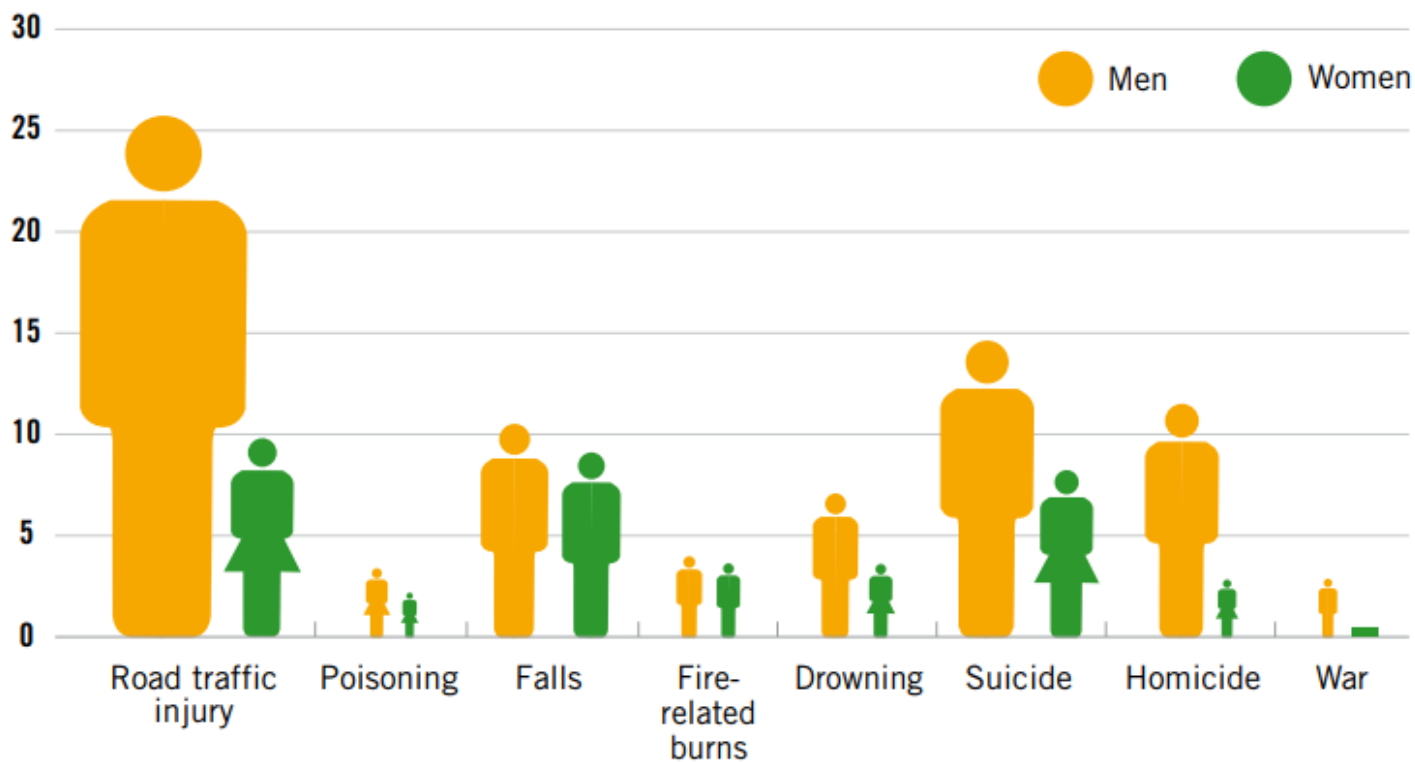
Source: WHO Global Health Estimates, 2014





## Men are more at risk of death from injuries and violence

Death rates per 100 000 population, by cause of injury and sex, world, 2012.



Source: WHO Global Health Estimates, 2014



## Types of Data & Potential Sources of Information



### Mortality

- Death certificates
- Reports from mortuaries



### Morbidity and Health-related

- Hospitals
- Medical records



### Self Reported

- Surveys
- Media



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### Community-based

- Demographic records
- Local government records



### Law enforcement

- Police records
- Prison records



### Economic-social

- Institutional or agency records
- Special studies

Source: adapted from Krug et al., eds., 2002



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# 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:**

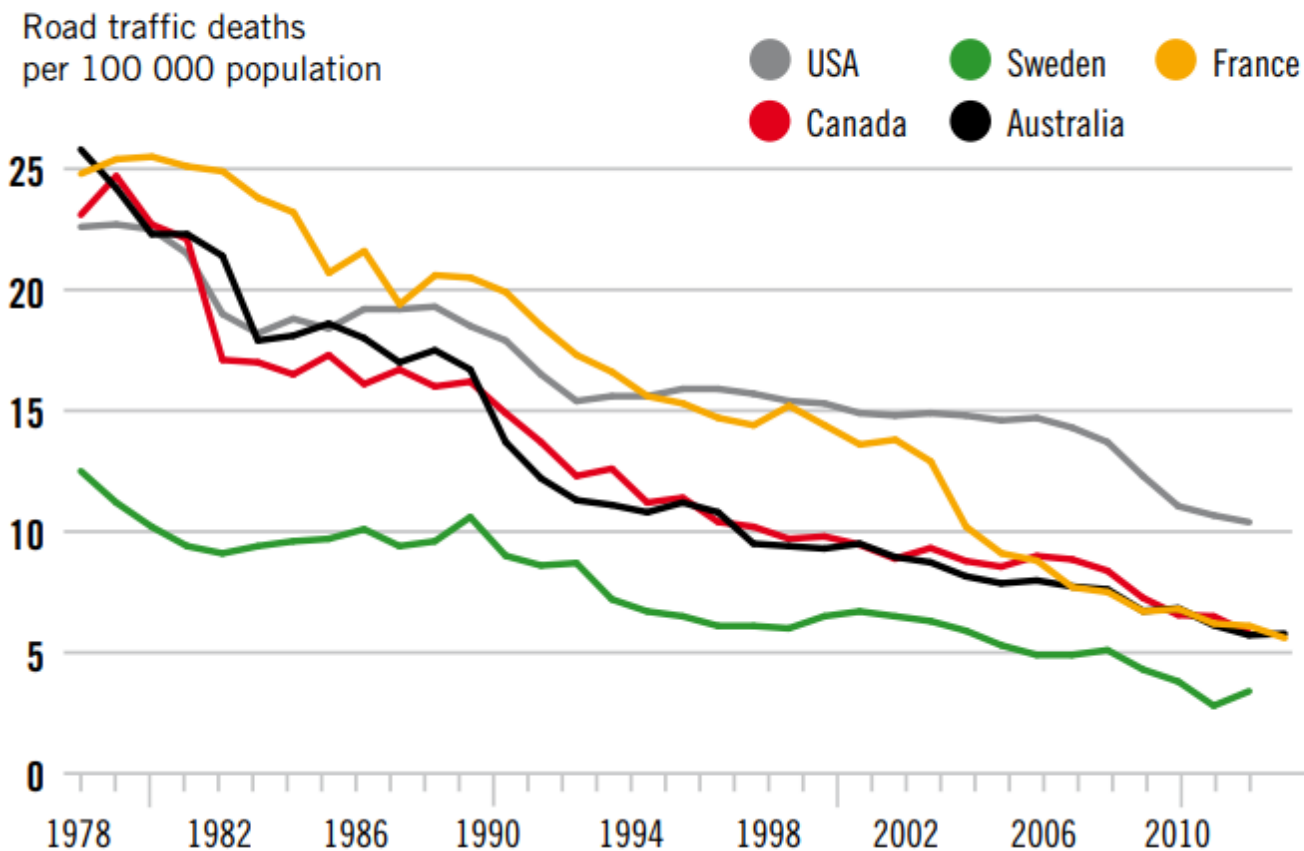
Management of **complications of injuries**, especially disabilities, including rehabilitative measures and approaches, improvement of quality of life of injury victims, as well as palliative care, when needed



# Prevention and Control

## Rich countries reduce road traffic deaths

Reported trends in road traffic deaths in selected high-income countries.



Sources: Australia: <http://tinyurl.com/mu3xk87>  
 Canada: <http://tinyurl.com/n7kv7dl>  
 France: <http://tinyurl.com/k26cnah>  
 Sweden: <http://tinyurl.com/qcjc7vf>  
 United States: <http://tinyurl.com/42tb7ja>



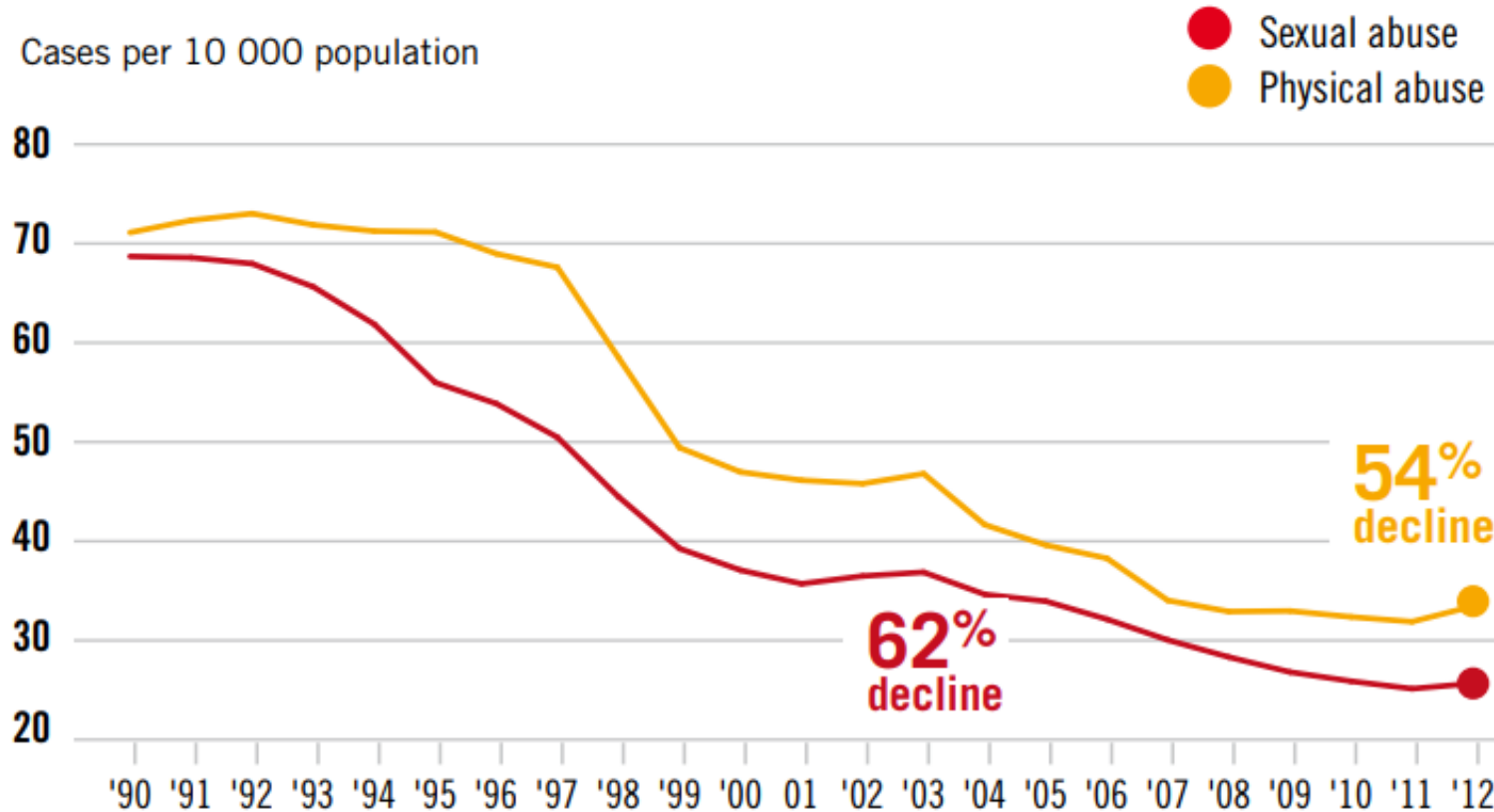


# Prevention and Control

## United States reduces child abuse

Trends in child sexual and physical abuse in the USA.

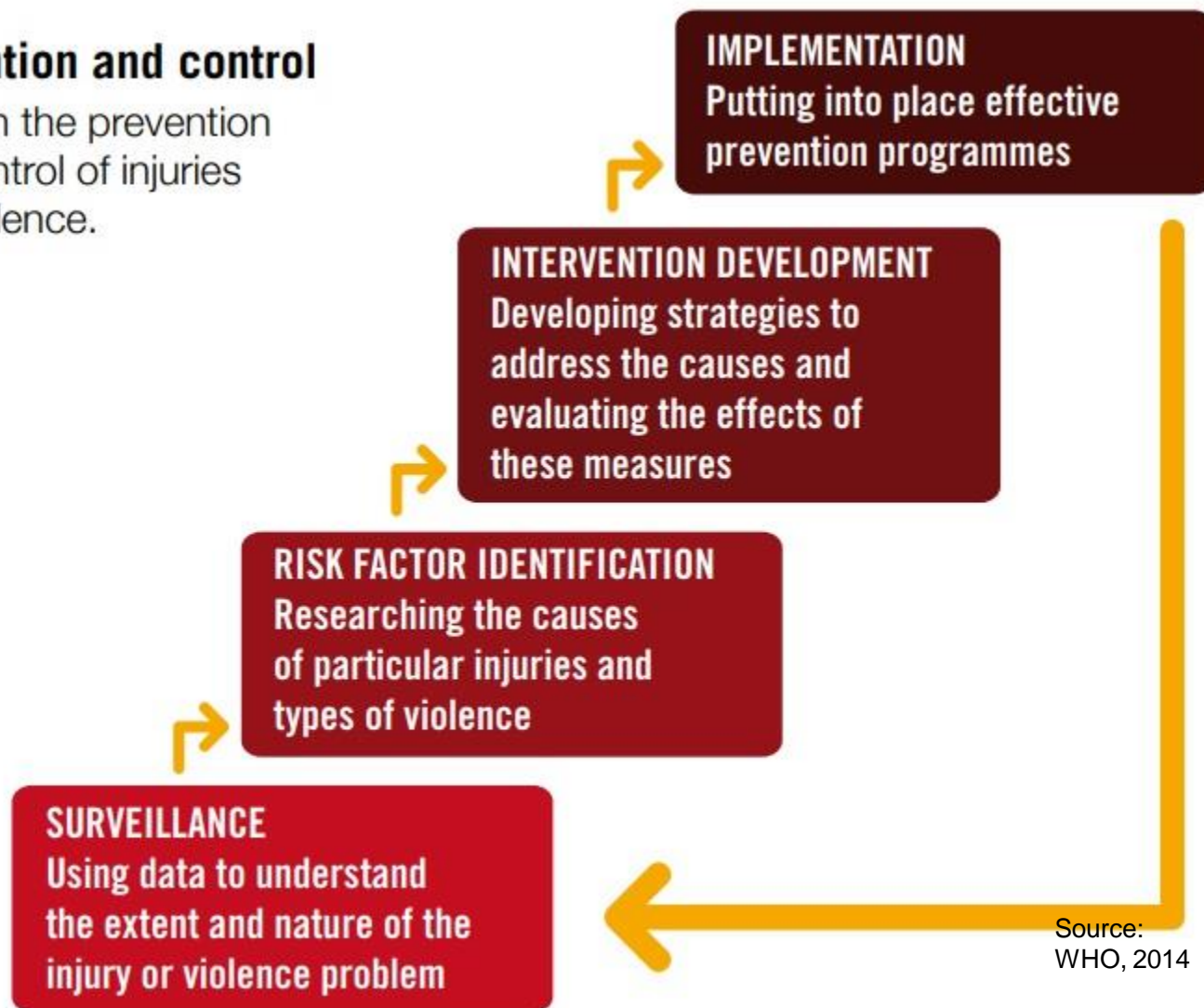
Cases per 10 000 population





## Prevention and control

Steps in the prevention and control of injuries and violence.



## Measures - Road traffic crashes

- Setting and enforcing **laws** on **speeding**
- Setting and enforcing **laws** on **drinking** and driving
- Setting and enforcing **laws** on **motorcycle helmets**
- Setting and enforcing **laws** on **seat-belts**
- Setting and enforcing **laws** on **child restraints**
- Developing safer roadway **infrastructure**, including engineering measures to reduce speeds in urban areas and separate different types of road users
- **Implementing vehicle and safety equipment standards**
- Setting and enforcing **laws** on **daytime running lights** for motorcycles
- Introducing a **graduated driver licensing system** for novice drivers



Source: WHO, 2014



## Measures - Burns

- Setting and enforcing **laws** on **smoke detectors**
- Setting and enforcing **laws** on **hot tap water temperatures**
- Developing and implementing a standard for **child-resistant lighters**
- **Treating burns patients** in a dedicated burns center



Source: WHO, 2014



Source: WHO, 2014

## Measures - Drowning

- Installing **barriers** controlling access to water
- Providing **capable child care** for pre-school children in safe places away from water
- **Teaching** school-age children **basic swimming**, water safety and safe rescue skills
- **Training bystanders** in safe rescue and resuscitation
- **Wearing** of personal flotation devices



## Measures - Falls



- Setting and enforcing **laws** requiring **window guards** for tall buildings
- **Redesigning furniture** and other products
- Establishing standards for playground equipment

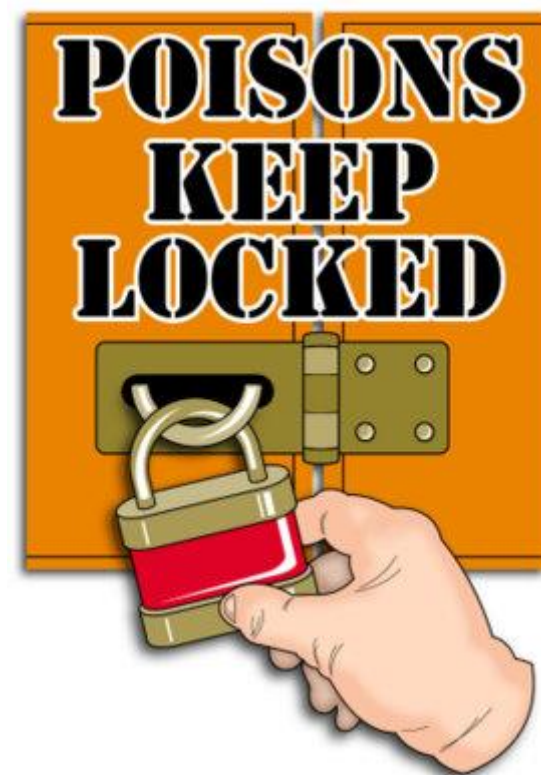






## Measures - Poisoning

- Setting and enforcing **laws** for child **resistant packaging** of medicines and poisons
- **Removing toxic products**
- **Packaging drugs in non-lethal quantities**
- **Establishing poison-control centers**



Source: WHO, 2014



## Measures – Interpersonal violence

- Developing safe, stable and nurturing relationships between children and their parents or caregivers
- Developing life skills in children and adolescents
- Reducing the availability and harmful use of alcohol
- Reducing access to guns and knives
- Changing cultural and social norms that support violence
- Reducing violence through victim identification, care and support programmes



Source: WHO, 2014





## Measures - Suicide

- **Reducing access** to common means, such as firearms, pesticides and certain medications
- Implementing policies and interventions to reduce the harmful use of **alcohol**
- Ensuring **early detection** and effective treatment of **mental disorders**, particularly depression and alcohol use disorders
- Ensuring management of **people who have attempted suicide** or are at risk, including assessment and appropriate follow-up
- **Training primary health care workers** and other 'gatekeepers' who are likely to interact with people at risk of suicide
- Adoption of responsible reporting of suicide by the **media**

Source: WHO, 2014





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KSA EFFORTS



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



برنامج الوقاية من الإصابات والحوادث  
Injuries and Accidents Prevention Program

الرئيسية | فعاليات المناطق | مكتبة الصور | مكتبة الفيديو | الأخبار | مواقع تهمك | الإحصائيات | اتصل بنا | English >>

أحدث الاخبار | لنهج التعليمي لطلاب وطالبات كلية الطب بجامعة الملك سعود | تطبيق تجربة التدريب على كتيب سلامة الاطفال في المرحلة التمهيديّة | المملكة تشارك في اطلاق عقد

برنامج الوقاية من الإصابات والحوادث  
injuries and accidents prevention program

سلامة يتمنى  
لكم السلامة

المكتبة الإلكترونية

التقرير العالمي عن حالة الصحة على

مرحبابكم في موقعنا

يسعدنا زيارتكم لموقع برنامج الوقاية من الاصابات والحوادث. والذي تم اطلاقه عام 2011 من قبل وزارة الصحة ايمانا منها بالدور الاساسي والهام للقطاع الصحي في الوقاية من الاصابات جنبا بجنب ويد بيد مع القطاعات الحكومية والاكاديمية والخاصة الاخرى. منطلق عمل البرنامج مبني على الشراكة والعمل الجماعي على مختلف المستويات عاليا واقليةيا ومحليا. وفيما يلي ملخص بسيط عن البرنامج : 1. تعريف : هو برنامج وقائي مجتمعي تدخل للوقاية ( وقاية اولية ... المزيد

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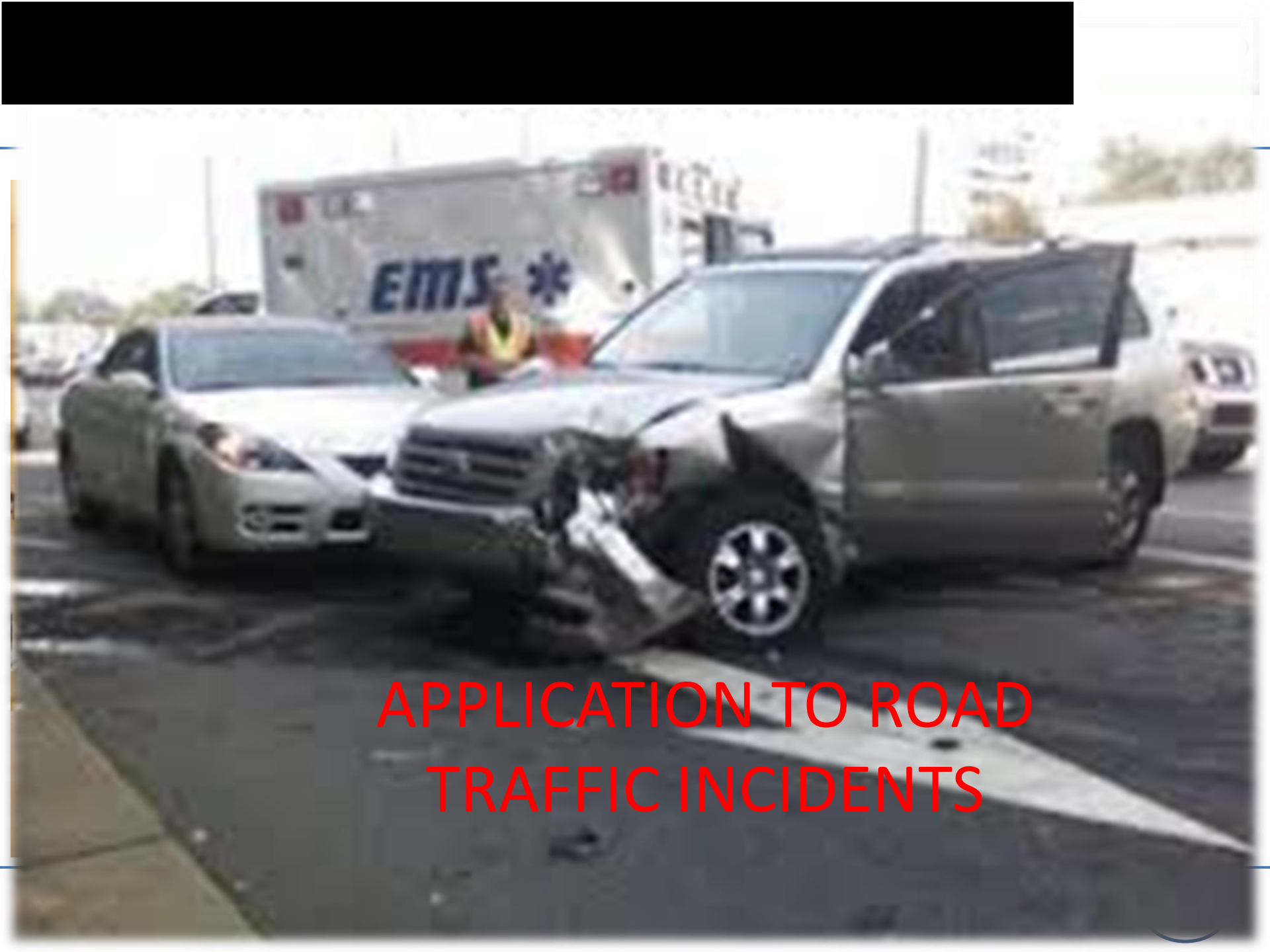
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برنامج الوقاية من الإصابات والحوادث  
Injury and Accidents Prevention Program

- Surveillance System
- Education
- Capacity Building





APPLICATION TO ROAD  
TRAFFIC INCIDENTS





## APPLICATION TO RTI - 1

- **Host:** victim: e.g. driver, passenger, pedestrian, etc
- **Agent:** mechanical / thermal energy
- **Environment:** vehicle(s) of incident





## APPLICATION TO RTI - 2

- If a person must stop suddenly, as in a crash of a vehicle, that **energy must be dissipated** in the vehicle, environment, or individual's tissues
- When the vehicle stops, the occupant will continue to move at the **pre-crash speed** into interior structures, or into the materials in the exterior environment if ejected.
- **Stresses**: contact with energy source generates forces counter to the load. Types: **tension** (pulling molecules apart), **compression** (pushing molecules together), **shear** (from a tangential force)





## APPLICATION TO RTI - 3

- **Strain**: extent of deformation, resulting from tension, compression, shear
- The **shape and elasticity** of the materials struck will determine the damage to the tissue.
- Devices as **seat-belts, air bags and child restraints** reduce the severity of injury by reducing contact with less flexible structures (**second collision**)





## APPLICATION TO RTI - 4

- **Primary prevention:**

Raising awareness of the community, at its different levels, as to methods of avoiding RTI. 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 rehabilitative and physiotherapy measures





## National strategic plan to reduce RTI:

- National strategic plan that covers the 4Es:
- **Education:** annual traffic weeks.
  - Saudi Society Organization for Traffic Safety  
<http://www.salamh.org.sa>
- **Engineering:** road infrastructure and vehicles
- **Enforcement:** seatbelt rule, speed limit law
- **Emergency:** Saudi Red Crescent Society (SRCS)



# “Prevention is the Vaccine for the Disease of Injury”





## References

- Robertson LS. Injury epidemiology. Research & control strategies. 3<sup>rd</sup> edition. Oxford, New York: Oxford University Press, 2007
- WHO. World report on violence and health. Geneva: World Health Organization, 2002
- Rivara FP. Injury control: a guide to research and program evaluation. Cambridge, New York: Cambridge University Press, 2001
- WHO Global Consultation on Violence and Health, Violence: a public health priority. Geneva: World Health Organization, 1996

