المركز الوطني لسلامة الطرق
National Road Safety Center

Supporting Services for the Establishment and Operation of the
National Centre for Road Safety
in the Kingdom of Saudi Arabia



# Human Factors

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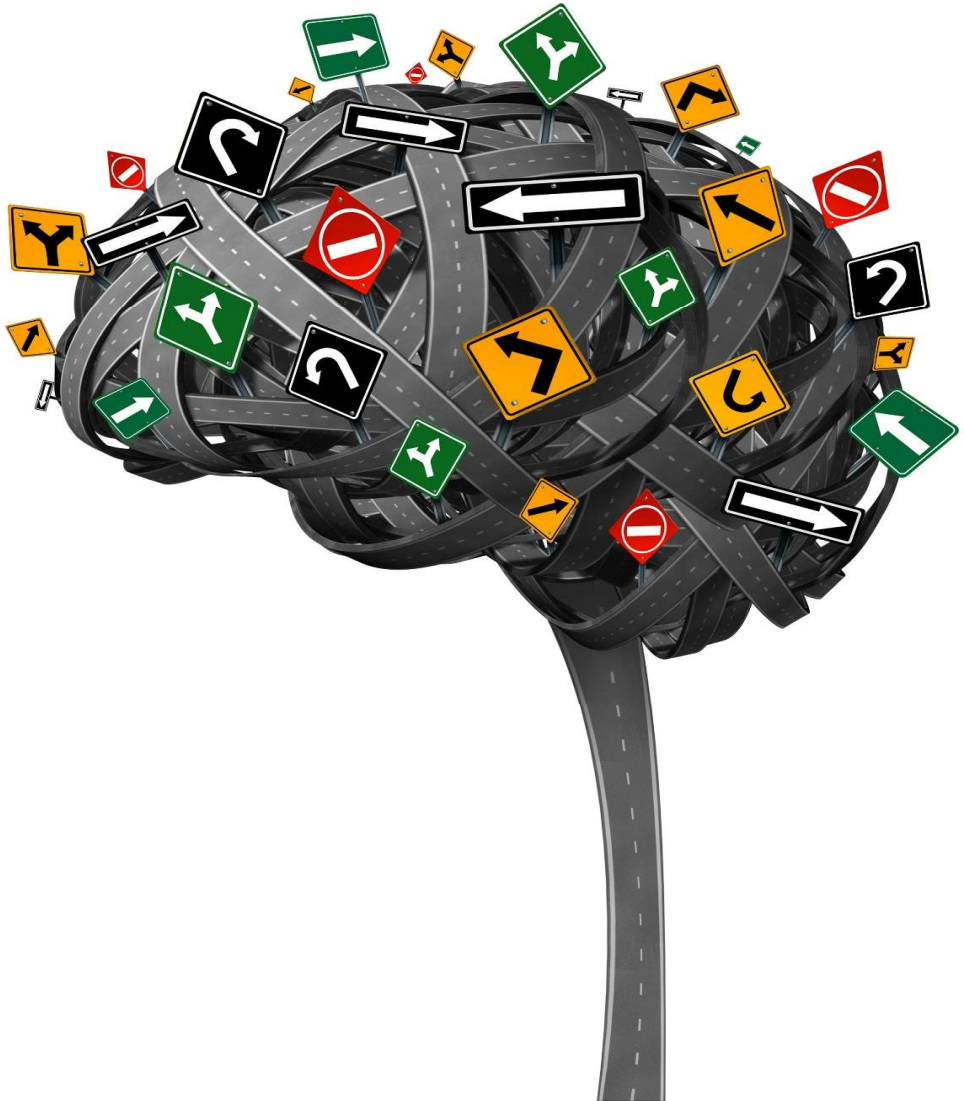
F3

# Intended Learning Outcomes Module (F3)

- **Understand the human factors that contribute to crash causation**

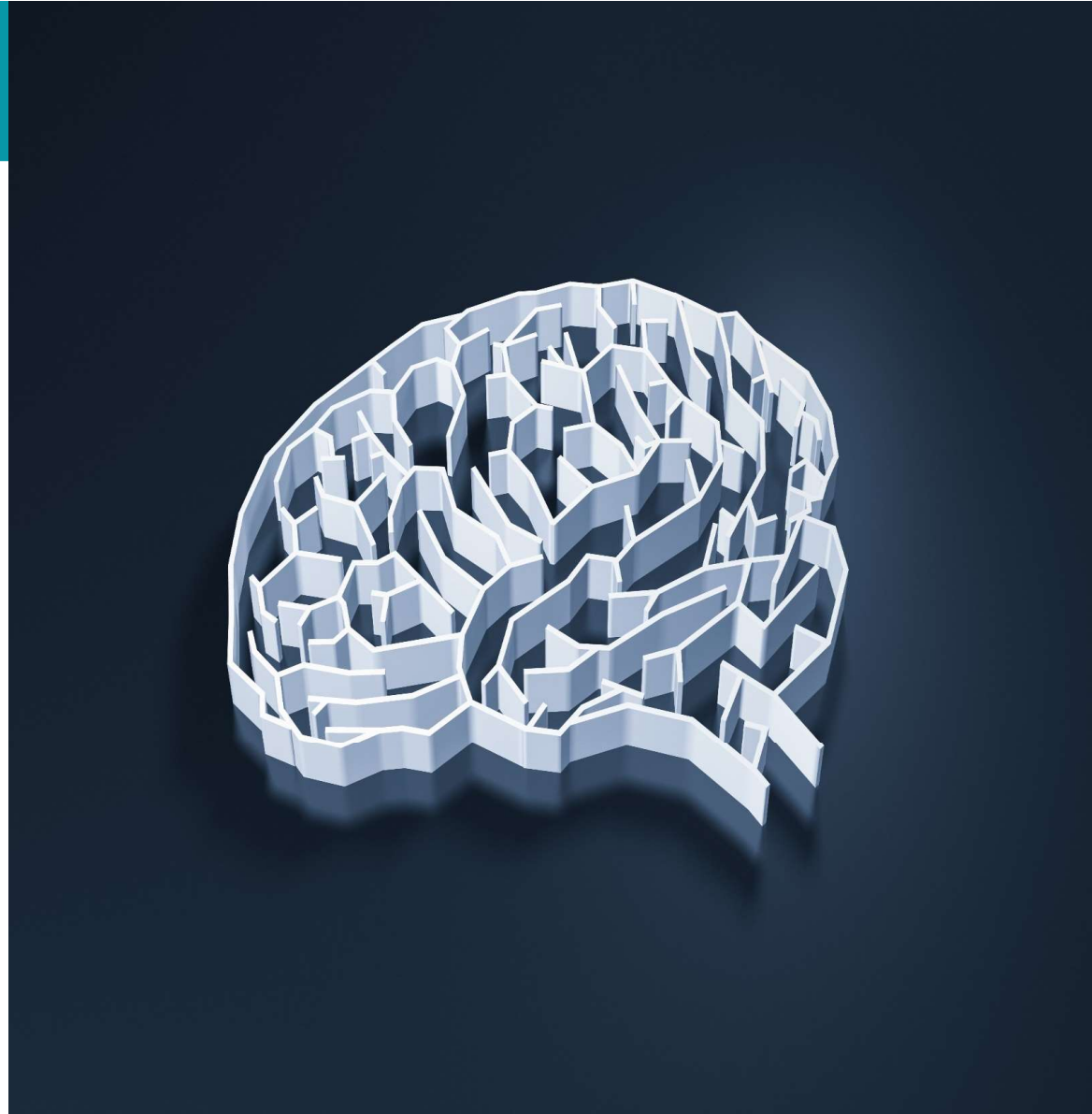
# Human Factors

- **Demographic Factors**
  - Age
  - Gender
  - Racial and Ethnic Groups
- **Behavioral Factors**
  - Aggressive driving
  - Impaired driving
  - Occupant protection
  - Illegal Driving
  - Driver Inattention



# Human Factors

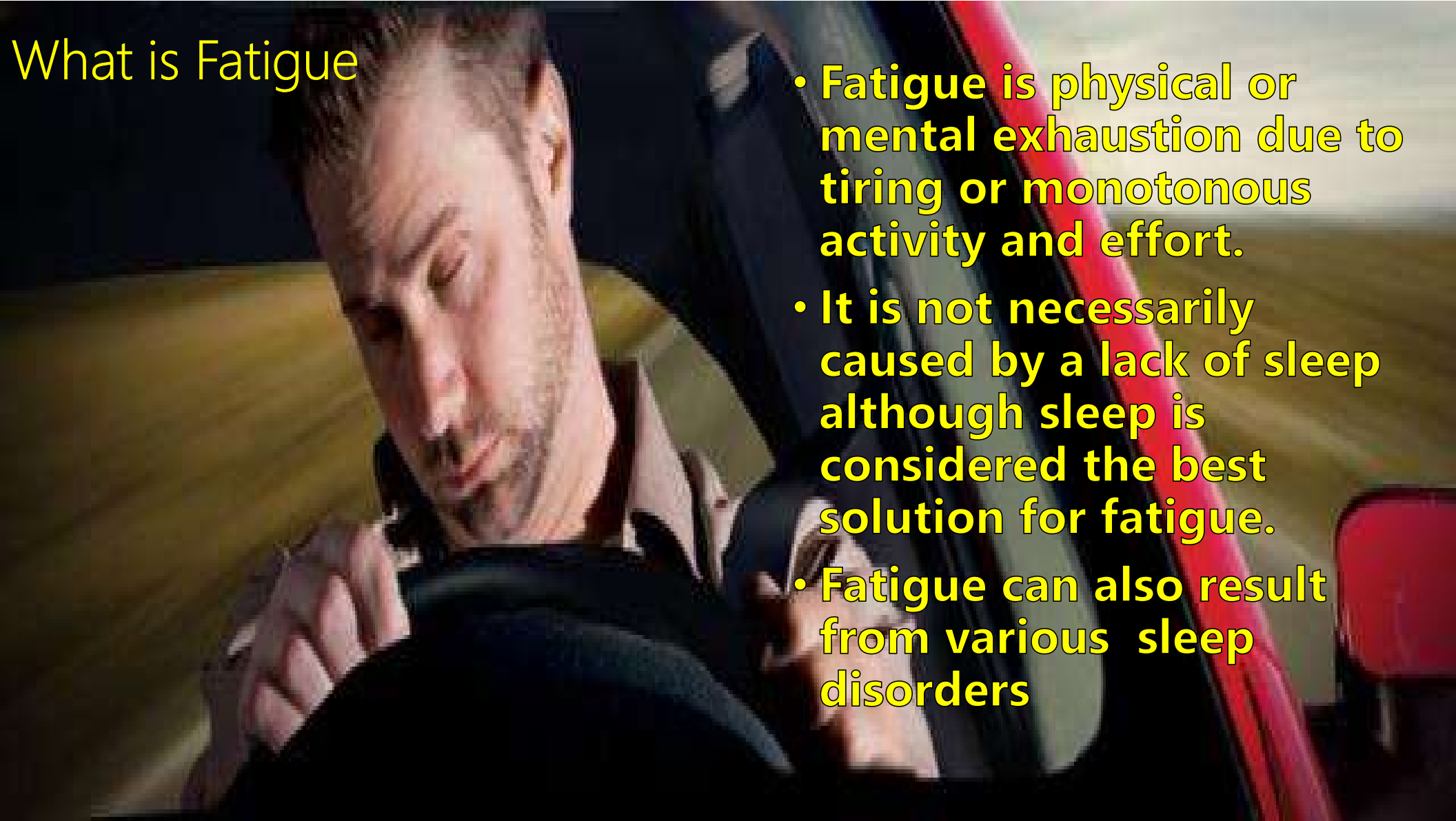
- Substantial insight can be gained from "Personality Tests" – certain personality traits have been shown to be related to risky driving, crash involvement, style etc.
  - **Sensation seeking**
  - **Impulsiveness**
  - **Thrill and adventure seeking**
  - **Emotional instability**
  - **Anti-social**
  - **Aggressive**
  - **Being stressed**



# Human Factors - Fatigue

- Driver fatigue is a significant factor in **~20% of commercial road transport crashes.**
- Estimated that **over 50%** of long-haul drivers have fallen asleep at the wheel
- **Increased crash-risk at night** (peak levels at night can be 10X daytime levels)

# What is Fatigue



- Fatigue is physical or mental exhaustion due to tiring or monotonous activity and effort.
- It is not necessarily caused by a lack of sleep although sleep is considered the best solution for fatigue.
- Fatigue can also result from various sleep disorders

# Sleep and circadian rhythms

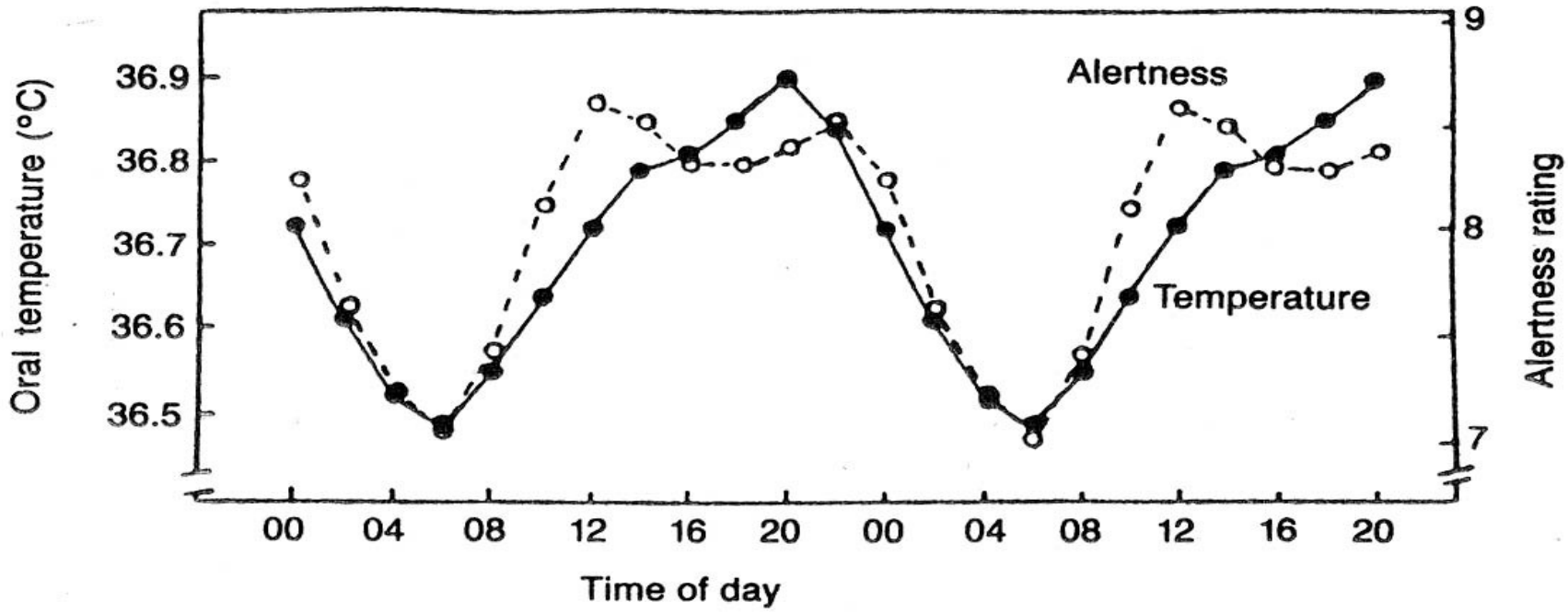
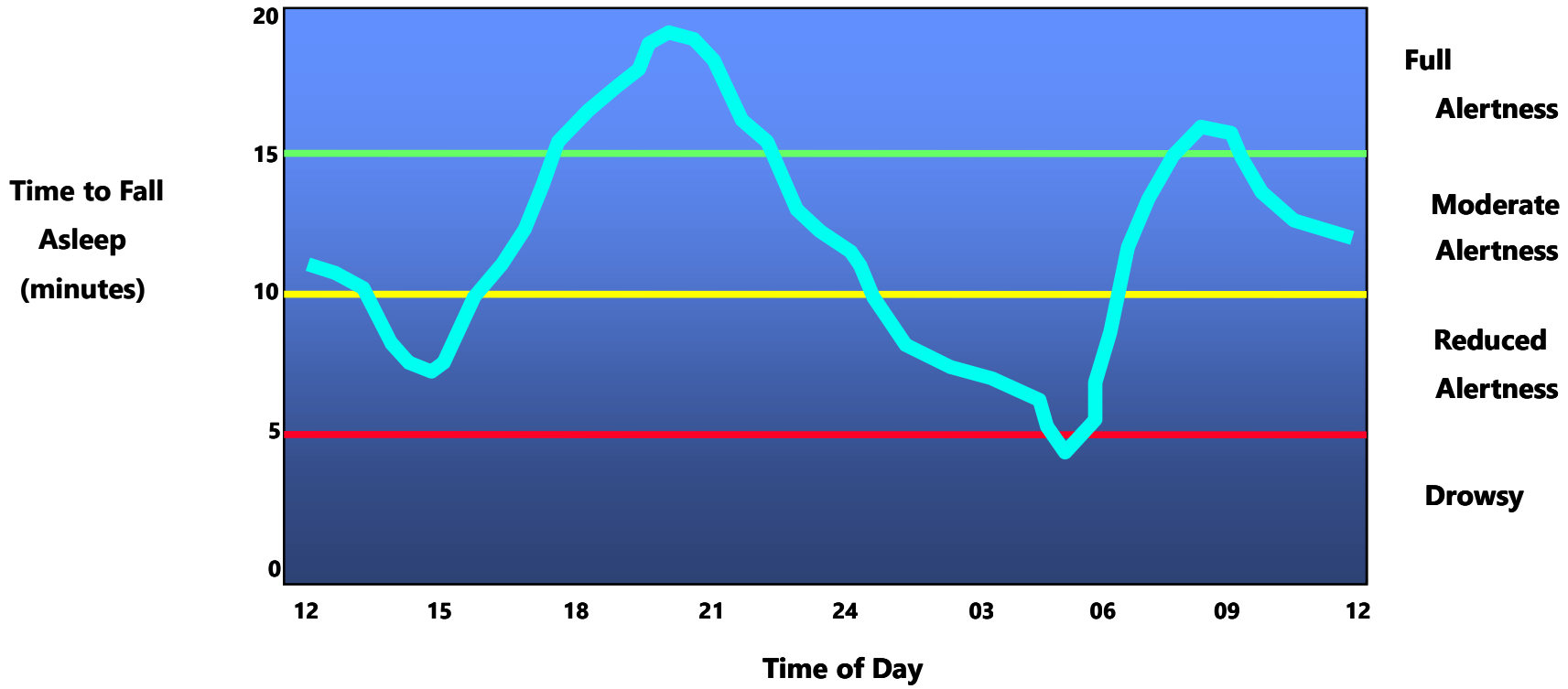



*Figure 8.2 Circadian rhythms in oral temperature and subjective alertness in a group of six rapidly rotating shift workers studied over a month. Readings were only taken while at work (after Monk and Embrey, 1981).*

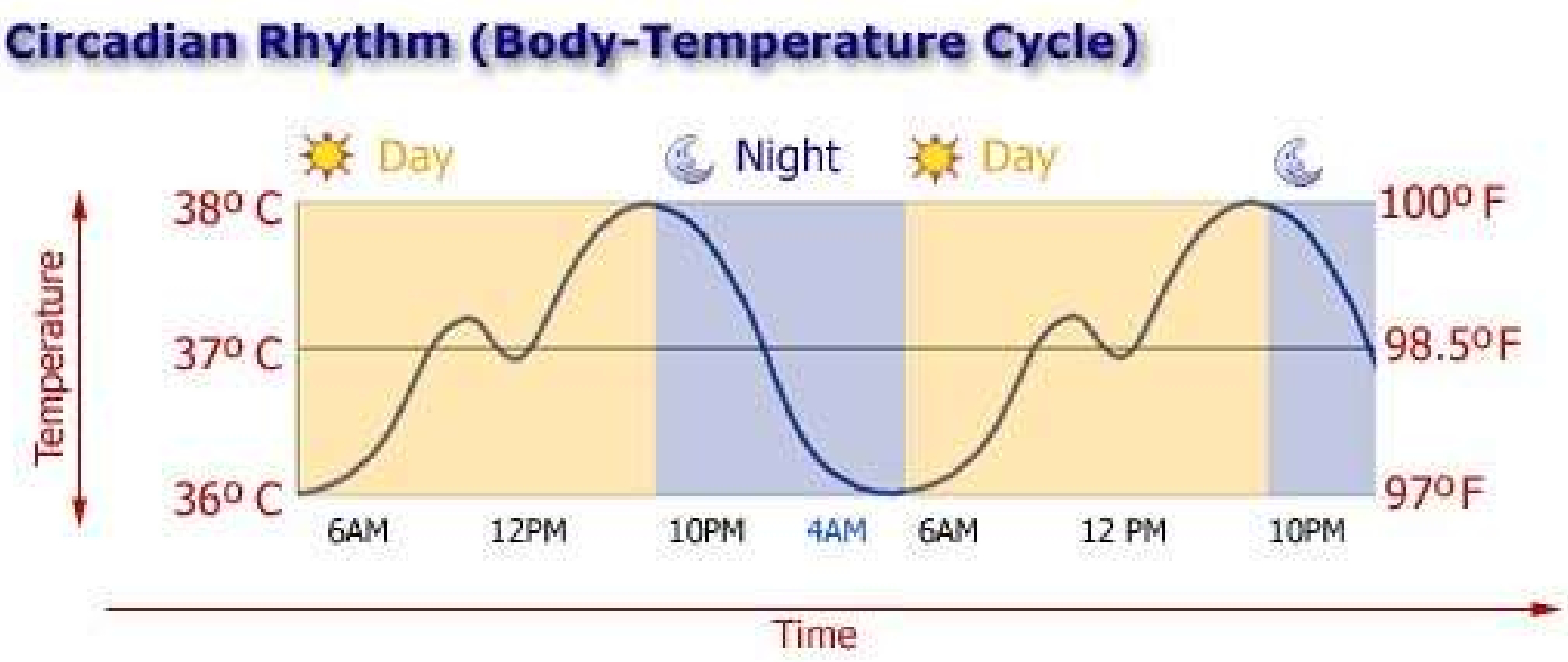
# Alertness and drowsiness

**Drowsiness and the circadian rhythm**



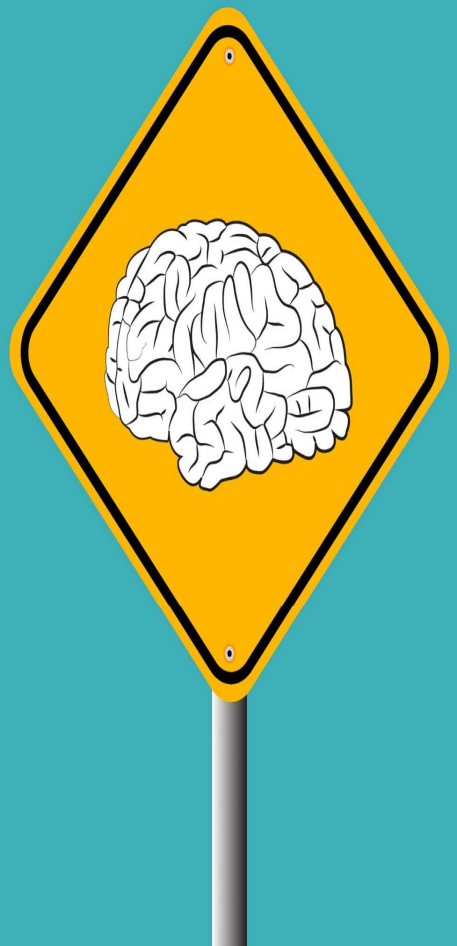
# Human Factors - Fatigue

## Sleep and circadian rhythms



# Human Factors -Impact of fatigue on driving

- **Cognitive impairment**
- **Slower reaction times**
  - (emergency braking)
- **Reduced vigilance**
  - (detecting slowing traffic ahead)
- **Reduced information processing**
  - (remembering to cancel indicators etc.)
- **Steering**
  - After 2 -3 hours continual driving steering on (straight) roads deteriorates
- **Speed choice**
  - Some drive faster others drive slower



# Human Factors – Characteristics

- The problem occurs during late night/early morning or mid-afternoon
- The crash is likely to be serious
- A single vehicle leaves the roadway
- The crash occurs on a high-speed road
- The driver does not attempt to avoid a crash
- The driver is alone in the vehicle.

# Human Factors – groups at highest risk

- **Young people** (ages 16 to 29), especially males. drivers younger than 30
- **Shift workers** whose sleep is disrupted by working at night or working long or irregular hours.
- People with **untreated sleep apnoea syndrome** (SAS) and narcolepsy.

# Human Factors – Alcohol

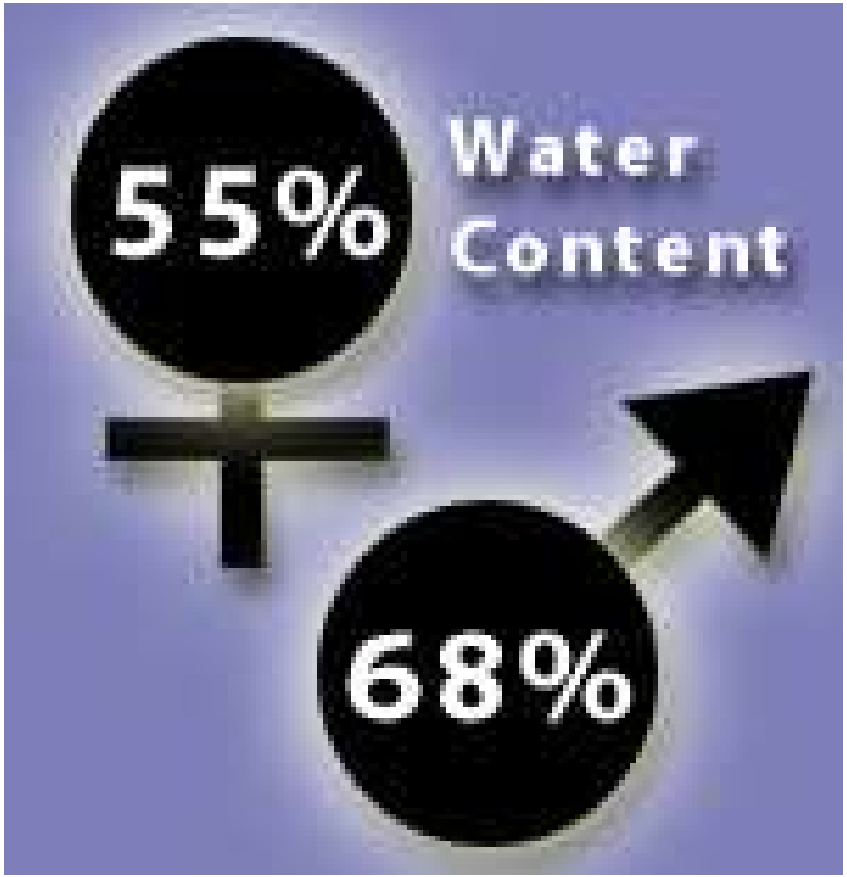
- **Basic facts**
  - 25% of EU accidents are alcohol related even
  - Crash rate at 0.08% BAC is 2.7 times that of sober drivers
  - At 1.5% the rate is 22 times as great
- Alcohol is a **major Central Nervous System (CNS)** depressant that effects all levels of driving performance
  - **Manoeuvre - Tracking**, reaction time and visual detection
  - **Tactical** – Overtaking, giving way
  - **Strategic** – Should I drive or take a cab?

# Alcohol Impairment

- Basic facts - continued
  - Effects are detectable at relatively low levels of consumption
  - Impact is significantly stronger with younger drivers (<24 years)
- Impact is increased when illicit drugs are also used such as opiates and cannabis

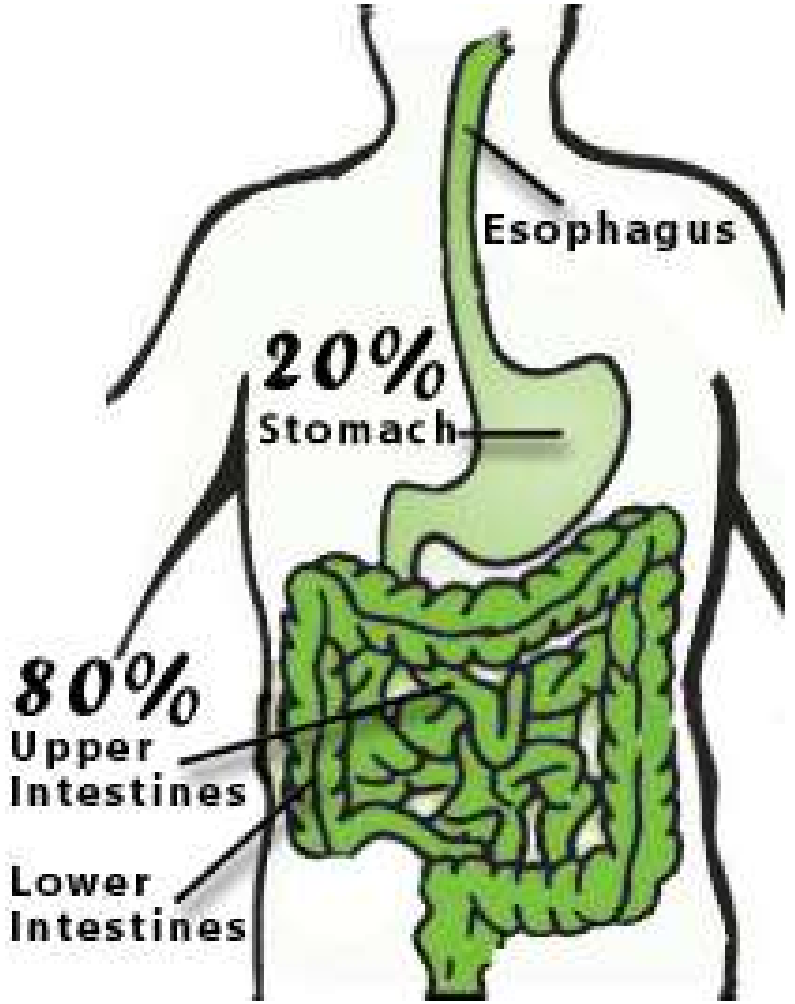
# Alcohol Metabolism

- **Maximum BAC** occurs around 1hr after consumption under normal drinking
- **Blood and breath tests** measure alcohol already in the bloodstream
- Alcohol concentration affected by body mass and body water content
  - water content higher for men than women
  - lower content means higher BAC

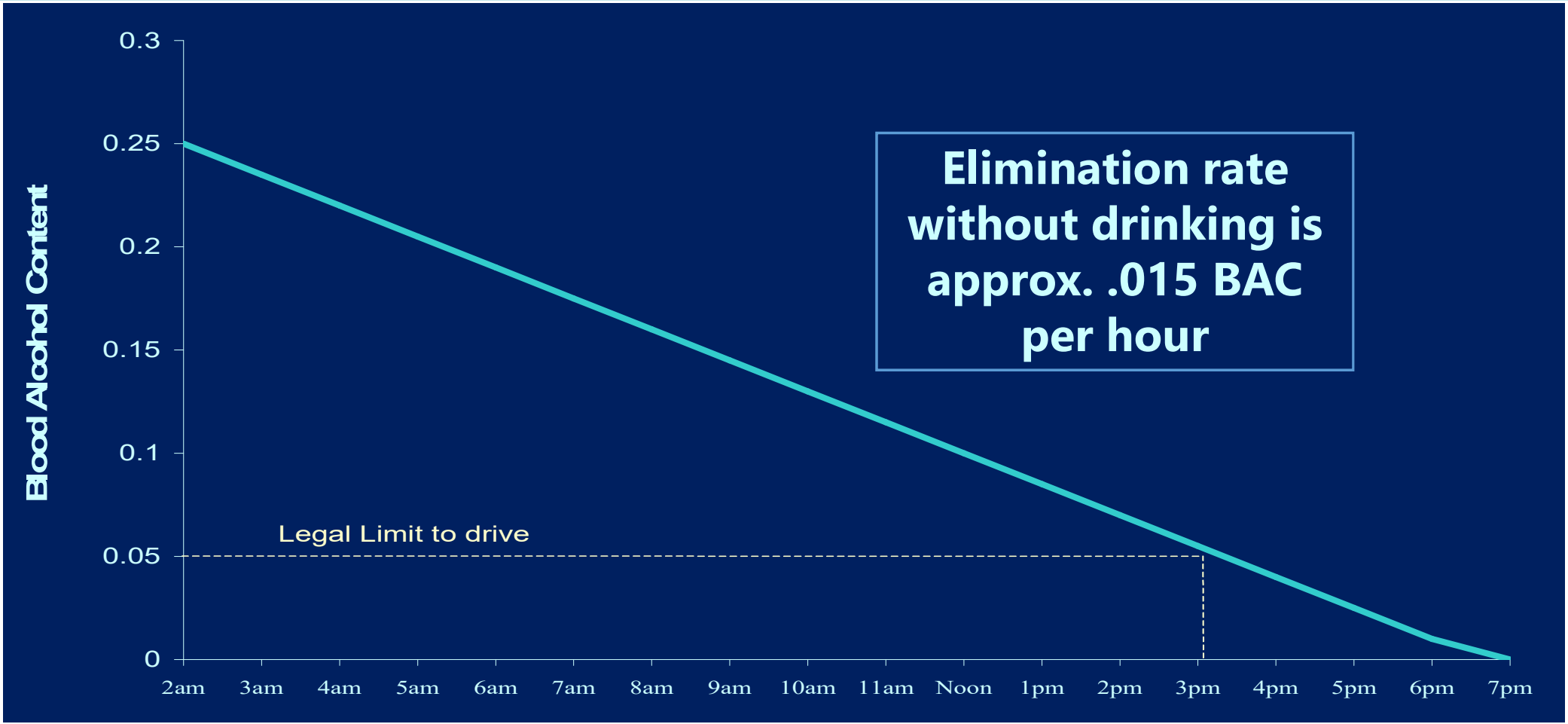


# The Solution!

- Only time can lower your BAC - nothing else!
- A person who had a BAC of 0.08 at midnight and stopped drinking would still be 0.065 at 1am
- Elimination rate is around 0.015 per hour (1 unit of alcohol, 1 glass of wine)



# BAC Elimination Rate



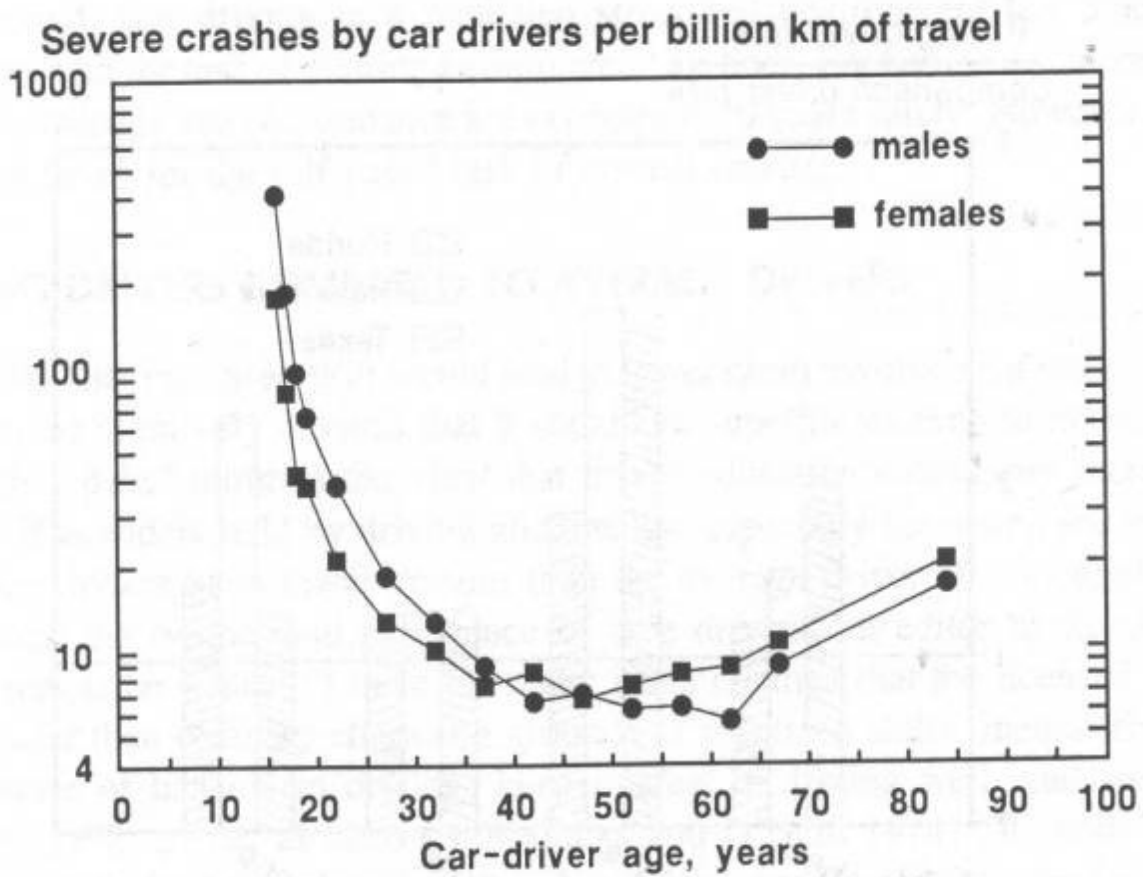
# Human Factors – Alcohol EU statistics

- 1 in 3 road traffic fatalities are due to alcohol.
- 15,000 male deaths compared to 2,000 deaths for females
- 2%-3% of all journeys in the EU15 have a drinking driver (European Transport Safety Council 2003)
- Significant variations between countries and changes over time

# Human Factors – Age factor / Old

- **Specific cognitive abilities**: attention, perceptual speed, short term memory
- **Sensory capabilities** – especially vision
- **Musculoskeletal strength** and flexibility; progressive loss of muscle mass
- **General health**
  - especially cardio-vascular

# Human Factors – Age factor

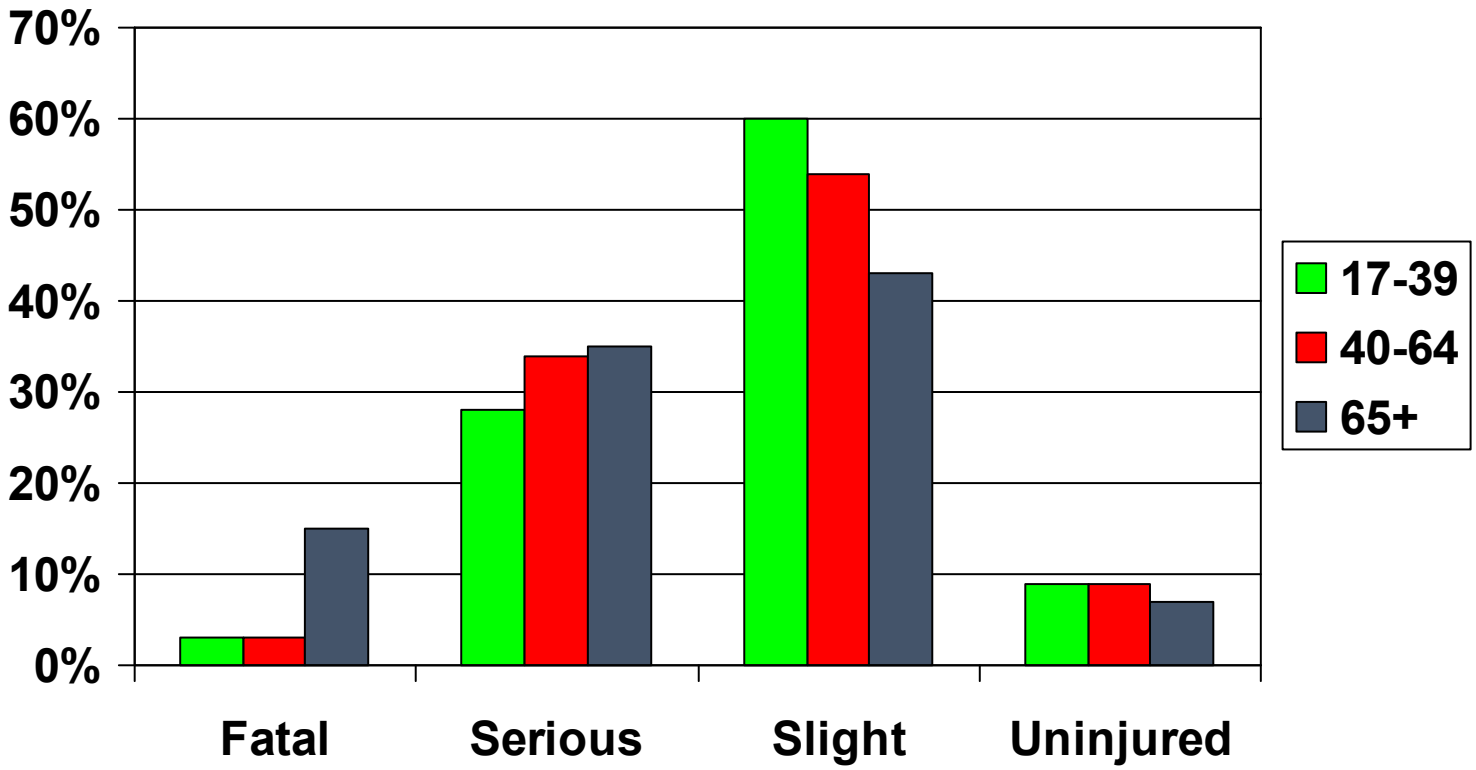



**Young, novice drivers have a much higher accident risk than older drivers**

# Human Factors – Age factor

**Frontal Crashes**

Older drivers are very much over-represented in this category
(statistical analysis supports this observation)



| Characteristic | Change | Driving related example |
|---|---|---|
| **Reaction time** | Increase from 20s onwards | Emergency braking |
| **Perception of angular movement** | Gradually declines | Judging speed of traffic, gap acceptance |
| **Divided attention** | Reduced ability to multi-task | Tendency to attend to one task at a time, incr problems with distraction and complex situations e.g. Busy roundabouts |
| **Problem solving** | Ability improves to 40-50 then declines | More time required to interpret complex information; traffic signals and signage |
| **Learning & memory** | Good memory for facts, reduced ability with new information and procedures | Problems with new routes, new situations, new systems |

# Human Factors – Age factor / Young

- Over estimation of competence
- Poor at identifying distant hazards
- Take longer to respond to hazardous situations
- Recognise less risk in traffic situations
- Are less likely to be able to stop within limits of forward visibility
- Drive too fast for conditions (although this may be within the posted limit)

# THANK YOU!

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