Technical discussion about the hazard and risk involved in driving

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## Audience

- **Technical people in US (2014)**

<table>
<thead>
<tr>
<th>Education</th>
<th>Age 25 and over</th>
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</thead>
<tbody>
<tr>
<td>Bachelor’s degree</td>
<td>31.96%</td>
</tr>
<tr>
<td>Master's and/or doctorate and/or professional degree</td>
<td>11.77%</td>
</tr>
<tr>
<td>Doctorate and/or professional degree</td>
<td>3.27%</td>
</tr>
<tr>
<td>Doctorate</td>
<td>1.77%</td>
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</tbody>
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Source: https://www.census.gov
Objectives

– Convey the difference between Hazard and Risk

– Convey the idea of Prevention, Mitigation and Response

– Discuss the concept of Layer of Protection Analysis (LOPA)
Hazard vs. Risk

**Hazard**
- A source of danger\(^1\)
- The potential for having an accident

**Risk**
- A possibility that something bad or unpleasant will happen\(^1\)
- A measure of accident in terms of likelihood and magnitude of an accident

Source: http://www.merriam-webster.com/dictionary
Examples of hazards of driving
Can hazard be eliminated?

- Yes! But prohibitively expensive and not very practical
  - Can we ban all cars?
  - Will we build concrete tunnels for walkers to cross every street?
Why do we still drive a car?

- Hazard
- Transportation Value
Benefits

- Expand your range of activity
- Save time wasting in walking
- Provide a cool atmosphere in summer and warm feeling in winter
- Enhance your personal relationship with others
Why do we still drive a car?

*Throw away the apple because of the core?*
Examples of unsafe driving

- Driving without wearing a seat belt
- Excess speed limit
- Driving under the influence of alcohol
- Driving under bad weather condition (e.g. frozen road, fog, etc.)
- Failure to take properly maintain our vehicles
- Driving on roads with a high accident rate
Measures to reduce risk

- Prevention
  - The actions to reduce the possibility of accident

- Mitigation
  - The actions to reduce the severity of accident consequence

- Response
  - The actions to reduce the injury and loss of an accident
Measures to reduce risk

Prevention:
- Training and driver license requirement
- Road and driving rule
- Routine car maintenance

Mitigation:
- Seat belt
Measures to reduce risk

- Seat belt use is on the rise. Laws, education, and technology have increased seat belt use from 11% in 1981 to nearly 85% in 2010.

Seating Belts Have Saved an Estimated 255,000 Lives Since 1975

Source: http://www.cdc.gov
Measures to reduce risk

Risk reduction measures

- Seat belt
- Air bag
- Roadside assistance
- Ban all cars

Graph showing risk percentage reduction with each measure.
Measures to reduce risk

- **Prevention**
  - Require a driver license
  - Road/driving rules and regulations
  - Police enforcement of the rules and regulations
  - Automobile maintenance regularly
  - Driving at a lower speed
  - Improve vehicle safety systems (e.g. eyesight driver assist, automated braking, etc.)
  - Good road design and maintenance

Source: http://www.cdc.gov
Measures to reduce risk

- **Mitigation**
  - Vehicle safety systems (e.g. seatbelt, bumper, air bags, etc.)
  - Vehicle crashing test standard: Euro NCAP or IIHS-HLDI
  - Highway guardrail & road shoulders
Measures to reduce risk

- Response
  - Roadside assistance
  - Trained emergency responders
  - Call 911
Making the brochure with the help from TEES

HAZARD VS. RISK
Learn from Driving a Car

PMR
PREVENTION
The actions to reduce the possibility of an accident

MITIGATION
The actions to reduce the severity of accident consequence

RESPONSE
The actions to reduce the injury and loss of an accident

HAZARD
The potential for having an accident

Examples
- Cars
- Snow/Fog/Heavy Rain
- Bad Road Condition
- Overspeed
- Under Influence of Alcohol

RISK
A measure of accidents in terms of likelihood and magnitude of an accident

BENEFITS OF DRIVING

1. Expand your range of activity
2. Save time wasting in walking
3. Provide a cool atmosphere in summer and warm feeling in winter
4. Enhance your personal relationship with others

Applying risk reduction measures can lower the risk involving driving.

The number of risk reduction measures applied depends on people’s tolerance.

If people cannot accept any risk involving driving, the only measure is banning all cars.

Banning all cars is not practical.
Layer of Protection Analysis (LOPA)

- Definition

  - LOPA is a semi-quantitative tool for analyzing and assessing risk
  - LOPA is used to characterize the consequences and estimate the frequencies
  - Various layers of protection are added to lower the likelihood of undesired consequence
Layer of Protection Analysis (LOPA)

- How does LOPA work
  - The existing layers of protection are tested for their ability to achieve risk tolerance criteria
  - If unacceptable, addition layers of protection are required
Layer of Protection Analysis (LOPA)

Fig 2. LOPA diagram for driving a car
Questions

Q: Based on the information given in this course, please provide one example of risk and hazard?
A: Risk: using the knife to cut food in the kitchen
    Hazard: the knife in the kitchen

Q: Based on the example that you give, please name the possible prevention, mitigation and response measures that can be taken.
A: Prevention: place the knife on where children can not reach.
Questions

A: Mitigation: do not make the knife too sharp
    Response: prepare band aid at home

Q: Considering the hazard and risk, why are you still willing to use the items in your example?

Q: Apply LOPA to analysis the barrier layers to reduce the risk of the example item that you mentioned.
3. https://www.census.gov
Thank You!

Questions & comments are welcome