Prevalence and risk of driving under influence of psychoactive substances: Results from epidemiological studies

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Prevalence and risk of driving under influence of psychoactive substances: Results from epidemiological studies

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\[ P(i|V) = \frac{\partial \ln G(e^V)}{\partial V_i} \]

DTU Transport
Department of Transport

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Objectives:

- To assess the situation in Europe regarding the problem of alcohol and/or other psychoactive substances in relation to road safety
  
  • Prevalence in the driving population
  • Prevalence in seriously injured drivers
  • Prevalence in killed drivers
  • Risk of injury for drink and/or drug drivers
Participating countries

Studies of seriously injured drivers
Studies of killed drivers
Prevalence in the driving population

• Alcohol and other psychoactive substances in drivers in the general traffic (Report D 2.2.3)

Aim of the roadside surveys:
To estimate the prevalence of psychoactive substances, including alcohol in the general driving population

Method:
Roadside surveys in 13 countries by means of a uniform protocol in all countries
Prevalence in the driving population

- Alcohol and other psychoactive substances in drivers in the general traffic

Data collection:

Blood and/or saliva collected

Information on age, gender, place, time of the sampling ….

In total app. 50,000 drivers of passenger cars and vans

Participating countries
BE, CZ, DK, ES, FI, HU, IT, LT, NL, NO, PL, PT and SE

Samples weighted by traffic in 8 periods of the week
Psychoactive substances

The following drugs were analysed for:

- Alcohol
- Illicit drugs
  - Amphetamines
  - Cocaine
  - Cannabis
  - Illicit opiates
    - mainly morphine
- Medicinal drugs
  - Benzodiazepines
  - Z-drugs
  - Medicinal opioids

Positive concentrations were based on the same cut-offs in all studies
# Equivalent cut-offs

<table>
<thead>
<tr>
<th>Substance</th>
<th>Recommended equivalent cut-off in whole blood (ng/mL)</th>
<th>Recommended equivalent cut-off in oral fluid (ng/mL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ethanol</td>
<td>0.1 (g/L)</td>
<td>0.082 (g/L)</td>
</tr>
<tr>
<td>6-AM</td>
<td>10</td>
<td>16¹</td>
</tr>
<tr>
<td>Alprazolam</td>
<td>10</td>
<td>3.5</td>
</tr>
<tr>
<td>Amphetamine</td>
<td>20</td>
<td>360</td>
</tr>
<tr>
<td>Benzoylecgonine</td>
<td>50</td>
<td>95</td>
</tr>
<tr>
<td>Clonazepam</td>
<td>10</td>
<td>1.7</td>
</tr>
<tr>
<td>Cocaine</td>
<td>10</td>
<td>170</td>
</tr>
<tr>
<td>Codeine</td>
<td>10</td>
<td>94</td>
</tr>
<tr>
<td>Diazepam</td>
<td>140</td>
<td>5.0²</td>
</tr>
<tr>
<td>Flunitrazepam</td>
<td>5.3¹</td>
<td>1.0²</td>
</tr>
<tr>
<td>Lorazepam</td>
<td>10</td>
<td>1.1</td>
</tr>
<tr>
<td>MDA</td>
<td>20</td>
<td>220¹</td>
</tr>
<tr>
<td>MDEA</td>
<td>20</td>
<td>270³</td>
</tr>
<tr>
<td>MDMA</td>
<td>20</td>
<td>270¹</td>
</tr>
<tr>
<td>Methadone</td>
<td>10</td>
<td>22</td>
</tr>
<tr>
<td>Methamphetamine</td>
<td>20</td>
<td>410</td>
</tr>
<tr>
<td>Morphine</td>
<td>10</td>
<td>95</td>
</tr>
<tr>
<td>Nordiazepam</td>
<td>20</td>
<td>1.1</td>
</tr>
<tr>
<td>Oxazepam</td>
<td>50</td>
<td>13</td>
</tr>
<tr>
<td>THC</td>
<td>1.0</td>
<td>27</td>
</tr>
<tr>
<td>Zolpidem</td>
<td>37</td>
<td>10²</td>
</tr>
<tr>
<td>Zopiclone</td>
<td>10</td>
<td>25¹</td>
</tr>
<tr>
<td>Tramadol</td>
<td>50</td>
<td>480</td>
</tr>
<tr>
<td>7-amino-clonazepam</td>
<td>1.0</td>
<td>3.1¹</td>
</tr>
<tr>
<td>7-amino-flunitrazepam</td>
<td>8.5¹</td>
<td>1.0²</td>
</tr>
</tbody>
</table>

Body fluid collected:
1. Saliva
2. Blood
3. Both
Alcohol is still the most prevalent substance in the driving population - but most of the drink driving was with concentrations below 0.5 g/L.
Prevalence in the driving population

Illicit and medicinal drugs

Illicit drugs are most prevalent in southern and western Europe
Driving with medicinal drugs was observed all over Europe
Prevalence in accident involved drivers

- Alcohol and other psychoactive substances in seriously injured and killed drivers (Report D 2.2.5)

Aim of the studies on injured drivers:

To estimate the prevalence of psychoactive substances, including alcohol in seriously injured drivers and in killed drivers from traffic accidents

Method:

Studies of patients from traffic accidents in 6 countries and studies of killed drivers in 4 countries by means of a uniform protocol in all countries
Prevalence in accident involved drivers

• Alcohol and other drugs in seriously injured and killed drivers

Data collection:

Blood was collected

Information on age, gender, time of accident and blood sampling, place, injury severity, medical treatment.

In total
- App. 2,600 seriously injured drivers
- App. 1,000 killed drivers of passenger cars and vans

Participating countries
- Seriously injured drivers from BE, DK, FI, IT, LT and NL
- Killed drivers from FI, NO, PT and SE
Prevalence in accident involved drivers

Alcohol

Among the alcohol positive drivers – both seriously injured and killed, the majority had a blood alcohol concentration equal to or above 0.5 g/L.

Combined use of alcohol and other drugs is considerable in a number of countries.
Prevalence in accident involved drivers

Illicit and medicinal drugs

For most illicit and medicinal drugs, the percentage of combined drug use exceeded that of single drug use.
Risk studies

• Risk of injury by driving with alcohol and other drugs (Report D 2.3.5)

Method:

Case-control study based on
- Data from seriously injured/killed drivers (cases)
- Data from road side surveys (controls)

Assessment of the risk for drivers of passenger cars and vans
- Alcohol
- Illicit and medicinal drugs
- Alcohol combined with drugs
- Multiple drug use

I. Risk of serious injury
- BE, DK, FI, IT, LT and NL

II. Risk of fatality
- FI, NO, PT and SE
Risk studies

**Case-control design**

**Cases I**
Drivers of passenger cars/vans
Seriously injured (MAIS ≥ 2)
Blood samples, N = 2,490

**Cases II**
Drivers of passenger cars/vans
Killed in traffic
Blood samples, N = 1,112

**Controls**
Drivers of passenger cars/vans
Stratified sample
Checked at random
Blood and saliva samples,
N = 15,832 (I)
N = 21,917 (II)
Risk studies

Case-control design

The event for a driver is
- Getting injured in a road accident (acc=1) while positive (subst=1)
- Getting injured in a road accident (acc=1) while negative (subst=0).

<table>
<thead>
<tr>
<th></th>
<th>Cases (acc=1)</th>
<th>Controls (acc=0)</th>
<th>Sum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exposed (subst=1)</td>
<td>a</td>
<td>b</td>
<td>a+b</td>
</tr>
<tr>
<td>Non-exposed (subst=0)</td>
<td>c</td>
<td>d</td>
<td>c+d</td>
</tr>
</tbody>
</table>

The odds ratio is a ratio between two odds
1. The odds of having the event among subjects who were positive for a given substance group (subst=1) - \( \frac{a}{b} \)
2. The odds of having the event among non-exposed subjects (subst=0) - \( \frac{c}{d} \)

Results are based on logistic regression and adjusted for age, gender and country
Drivers’ risk of getting seriously injured

Odds ratios based on data from six countries (DK, FI, LT, IT, BE, NL)
Drivers’ risk of getting killed

Odds ratios based on data from four countries (FI, NO, SE, PT)

0 10 20 30 40 50 60 70 80 90 100
Alcohol 0.1-0.5 g/L Alcohol 0.5-0.8 g/L Alcohol 0.8-1.2 g/L Alcohol 1.2+ g/L All illicit drugs All medicines All multiple drugs All alcohol drugs
Detailed risk results based on all countries

Overall risk levels
Hatching - results must be handled with care

- Risk levels:
  - Slightly increased risk
  - Medium increased risk
  - Highly increased risk
  - Extremely increased risk

- Substance categories:
  - Alcohol (Alc)
  - Cannabis
  - Alc 0.1-0.5g/L
  - Alc 0.5-0.8g/L
  - BZE
  - Cocaine
  - Illicit opiates
  - BZD+Z-drugs
  - Med. Opioids
  - Alc 0.8-1.2g/L
  - Amphetamine
  - Multiple drugs
  - Alc 1.2+ g/L and drugs

Risk levels:
- 0
- 10
- 20
- 30
- 40
- 50
- 60
- 70

350

Extremely increased risk
## Risk studies

### In conclusion -

<table>
<thead>
<tr>
<th>Risk level</th>
<th>Risk</th>
<th>Substance group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Slightly increased risk</td>
<td>1-3</td>
<td>0.1 g/L ≤ alcohol in blood &lt; 0.5 g/L Cannabis</td>
</tr>
<tr>
<td>Medium increased risk</td>
<td>2-10</td>
<td>0.5 g/L ≤ alcohol in blood &lt; 0.8 g/L</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Benzoylcegonine</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cocaine</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Illicit opiates</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Benzodiazepines and Z-drugs</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Medicinal opioids</td>
</tr>
<tr>
<td>Highly increased risk</td>
<td>5-30</td>
<td>0.8 g/L ≤ alcohol in blood &lt; 1.2 g/L</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Amphetamines</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Multiple drugs</td>
</tr>
<tr>
<td>Extremely increased risk</td>
<td>20-200</td>
<td>Alcohol in blood ≥ 1.2 g/L</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Alcohol in combination with drugs</td>
</tr>
</tbody>
</table>
Thank you for your attention

For more information, see www.druid-project.eu