Investigation of traffic safety risks of vulnerable road users in selected EU countries

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Project InDeV

- Horizon 2020
- 7 European partners: Belgium, Denmark, Germany, the Netherlands, Poland, Spain, Sweden plus Canada
- Vulnerable road users (VRU): pedestrians, cyclists, motorcyclists and moped users
- Practical goals:
  - to develop an **integrated methodology** to study VRU accident causes
  - To improve **assessment of VRU-accident costs**
• InDeV main research focus:
  – Automated recording of traffic conflicts
  – Surrogate measures of safety
  – Mobile app for naturalistic walking/cycling

• Method:
  – Filming of intersection traffic in:
    • 6 cities for short term (3 weeks)
    • 3 cities for long term (1 year)
  – Automatic video detection of potential conflict situations (watchdog app)
  – Determination and analysis of road user trajectories (advanced tracking)
  – Development and validation of surrogate safety measures
First phase: analysis of VRU accident data

- Analysis of accident data from the EU CARE database
  - Goal: to determine the largest problems with VRU safety and identify locations and situations where these accidents occur
- Vulnerable accident victims in 7 InDeV countries, 5 years: 2009-2013

<table>
<thead>
<tr>
<th>Road users</th>
<th>Fatally injured</th>
<th>Severely injured</th>
<th>Slightly injured</th>
<th>Victims</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pedestrians</td>
<td>12 482</td>
<td>73 481</td>
<td>220 585</td>
<td>306 547</td>
</tr>
<tr>
<td>Cyclists</td>
<td>5 158</td>
<td>88 427</td>
<td>377 460</td>
<td>471 045</td>
</tr>
<tr>
<td>Moped riders</td>
<td>1 639</td>
<td>32 797</td>
<td>152 968</td>
<td>187 404</td>
</tr>
<tr>
<td>Motorcyclists</td>
<td>7 392</td>
<td>70 692</td>
<td>202 304</td>
<td>280 388</td>
</tr>
<tr>
<td>Total VRU</td>
<td>26 671</td>
<td>265 397</td>
<td>953 317</td>
<td>1 245 384</td>
</tr>
</tbody>
</table>
Accident victims in 7 EU countries 2009-13

Fatalities

Severe injuries

- Cars + taxi: 47%
- Pedestrians: 21%
- Motorcycles: 13%
- Goods vehicles: 5%
- Other: 2%
- Pedal cycles: 9%
- Mopeds: 3%

- Cars + truck: 44%
- Pedestrians: 14%
- Motorcycles: 14%
- Mopeds: 6%
- Goods vehicles: 3%
- Other: 2%
Fatally injured VRU in InDev countries 2009-13

- Belgium: 34% Pedestrians, 39% Cyclists, 33% Moped riders, 21% Motorcyclists
- Denmark: 39% Pedestrians, 28% Cyclists, 5% Moped riders, 13% Motorcyclists
- Germany: 33% Pedestrians, 24% Cyclists, 5% Moped riders, 14% Motorcyclists
- Netherlands: 21% Pedestrians, 48% Cyclists, 14% Moped riders, 4% Motorcyclists
- Poland: 66% Pedestrians, 7% Cyclists, 10% Moped riders, 18% Motorcyclists
- Spain: 46% Pedestrians, 7% Cyclists, 10% Moped riders, 39% Motorcyclists
- Sweden: 39% Pedestrians, 18% Cyclists, 7% Moped riders, 36% Motorcyclists
Fatality rates (killed/mln population/year) in 7 InDev countries 2009-2013
Injury rates (severely injured/mln pop/year) in 7 InDeV countries 2009-2013

Important note: Definitions of severe injury in different countries are not the same!
Trend in VRU fatalities in 7 InDeV countries

- Reduction in the number of killed in 5 years:
  - Pedestrians 18%
  - Cyclists 17%
  - Moped riders 39%
  - Motorcyclists 21%
  - Non-VRU 32%
Statistical modelling with accident data

- Poisson regression of accident frequencies
  - Determining the exposure is a problem
- Logistic regression of accident severity
  - Effect of different contributory factors can be examined for different countries
  - Factors considered: urban or non-urban area, location at junction or not, traffic signal yes-no, light condition: daylight, twilight, darkness
- Seasonal trend decomposition
  - Done using STL (Seasonal Time Series Decomposition Using Loess) algorithm
Odds ratios of a fatal accident outcome in non-urban vs. urban area
Odds ratios of a fatal accident outcome for darkness vs. daylight

Pedestrians

Cyclists

<table>
<thead>
<tr>
<th>Country</th>
<th>Odds ratio of fatality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Belgium</td>
<td>2.0</td>
</tr>
<tr>
<td>Denmark</td>
<td>3.5</td>
</tr>
<tr>
<td>Germany</td>
<td>4.0</td>
</tr>
<tr>
<td>Netherlands</td>
<td>3.0</td>
</tr>
<tr>
<td>Poland</td>
<td>2.5</td>
</tr>
<tr>
<td>Spain</td>
<td>1.5</td>
</tr>
<tr>
<td>Sweden</td>
<td>1.0</td>
</tr>
</tbody>
</table>
Accidents with pedestrians - seasonal decomposition

- Eliminating seasonal variations shows the long-term time trend
Accidents with cyclists - seasonal decomposition

- Worrying trends emerge in Poland and Spain

Belgium

Poland

Spain
Conclusions

• Among VRU fatalities most were pedestrians (47%) and motorcyclists
• Severely injured VRU were mostly cyclists (33%) and pedestrians
• In EU countries there are still problems with accident data quality:
  – Underreporting of accidents by the police
  – Difficulty in classifying severe injuries
  – No clear definition of injury to distinguish “slight injury” and “property damage only”
• To improve police accident data quality these should be combined with data registered by hospitals
• VRU fatality numbers in EU do not decrease as fast as for non-VRU
• Seasonal decomposition shows the true long-term accident trends
Thank you very much for your attention

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