International Transport Forum
IRTAD
International Traffic Safety Data and Analysis Group
OECD

Analyzing road safety indicator data across Europe: describing, explaining and comparing

Authors: B. Wilmots, E. Hermans, T. Brijs & G. Wets
Presenter: Dr. E. Hermans

Session 8

4th IRTAD CONFERENCE
Road safety data: collection and analysis
for target setting and monitoring performances and progress

Seoul, 16-17 September 2009

Overview

1. Introduction
2. Data description
3. Method and results:
    - 3.1. Regression
    - 3.2. Clustering
    - 3.3 Footprint methodology

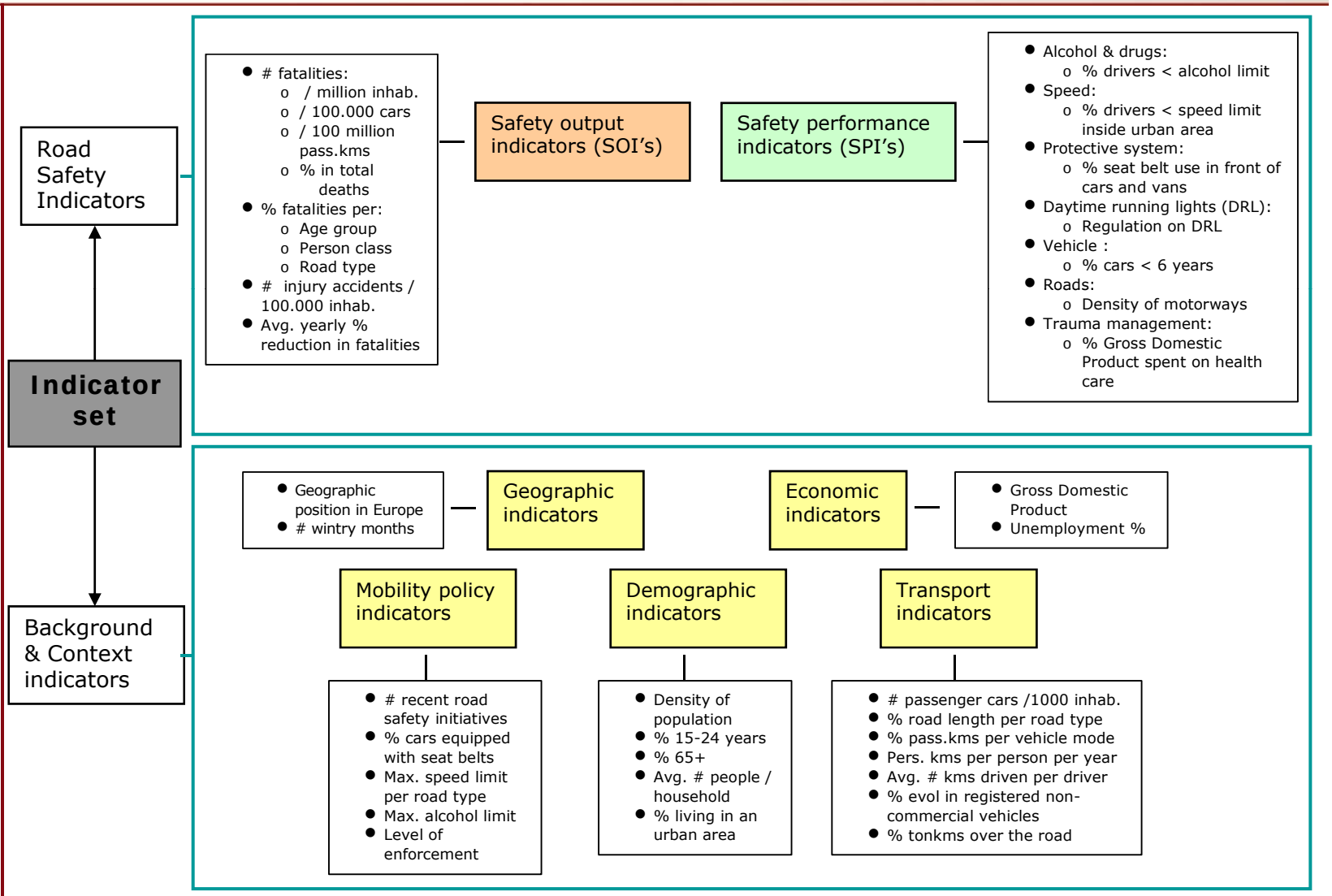
Detailed look at Belgium

4. Conclusion

1. Introduction

- The road safety problem (WHO, 2009):
  - 1.3 million people killed
  - 20 to 50 million injured
- How to improve the level of road safety in a country?
  - Studying various influencing indicators:
    - Understand the current road safety situation
    - Compare the road safety situation with other countries
    - Formulate policy recommendations
  - Here, we formulate indicators, collect indicator data and perform analyses to describe, explain and compare countries

2. Data description



2. Data description (2)

- 60 indicators
- Data collected from publications & online databases
- 2003
- 21 European countries
- Missing values: mainly for Switzerland, Hungary, Cyprus and Estonia
- For some analyses indicator data were standardized

3.1. Regression

- Goal: Determine the indicators that explain the number of road fatalities per million inhabitants
- Methodology:
  1: Standardizing the indicator data set
  2: Determining approaches (3) to enter variables in the model (=> generating 3 models) and performing the linear multiple regression analyses
  3: Testing each model on the assumptions concerning the error term
  4: Studying the statistical significance of each model and the degree of multicollinearity
  5: Assessing the explanatory power of each model
  6: Interpreting the regression results

3.1. Regression (2) Results

Model 1:	
FATAL = 0.183 – 0.774 E1 – 0.440 ALC + ε	$R^{2'}$: 78 %
Model 2:	
FATAL = 0.046 – 0.378 E1 - 0.376 PS + 0.413 D4 + 0.284 T1 - 0.264 T12 + ε	$R^{2'}$: 83.9 %
Model 3:	
FATAL = 0.109 – 0.336 PS - 0.369 VEH + 0.535 D4 + ε	$R^{2'}$: 71 %

Legend:

- **FATAL**: number of road fatalities per million inhabitants
- **E1**: GDP
- **ALC**: % drivers < alcohol limit
- **PS** : % seat belt use in front of cars or vans
- **VEH**: % cars < 6 years
- **D4** : Avg. # people / household
- **T1**: # passenger cars /1000 inh.
- **T12**: Avg. # kms driven per driver

3.1. Regression (3) Conclusion

- The final models contain:
  - 3 SPI's
    - share of drivers respecting the legal alcohol limit
    - seat belt wearing rate in front of cars or vans
    - share of cars < 6 years
  - 4 background and context indicators
    - gross domestic product (E)
    - average number of persons within a family (D)
    - number of passenger cars per 1000 inhabitants (T)
    - average number of kilometers travelled by a driver (T)
- These indicators affect the road safety output level
- Background and context indicators are less controllable
- Improving the scores on the SPI's will have a direct effect on the number of road fatalities per million inhabitants

3.2. Clustering

- Goal: Identify similarly performing countries
- Methodology:
  - 1: Standardizing the indicator data set
  - 2: Determining the algorithm(s)
    - ➢ Here, first Ward's algorithm to determine the ideal number of groups; then, k-means algorithm
  - 3: Performing the cluster analyses
    - ➢ Hierarchical clustering based on Ward's algorithm
    - ➢ Non-hierarchical k-means clustering
  - 4: Interpreting the clustering result

3.2. Clustering (2)
Identifying groups based on SOI's

3.2. Clustering (3)
Interpreting groups based on SOI's

- Group 1: SUN-countries, Denmark, Germany, Finland, France and Ireland

  \+ Best performing countries
- Group 2: Belgium, Austria, Spain, Italy, Portugal, Slovenia and Estonia

  +/- Average performing countries
- Group 3: Czech Republic, Greece, Hungary and Poland

  \- Worst performing countries

3.2. Clustering (4) Identifying groups based on SPI's

3.2. Clustering (5) Interpreting groups based on SPI's

- Group 1: Czech Republic, Hungary, Poland and Estonia
  + 'alcohol and drugs'
  - 'vehicle' and 'protective systems'
- Group 2: Belgium, Spain, Italy and Portugal
  +/- 'roads', 'trauma management' and 'vehicle'
  - 'alcohol and drugs' and 'speed'
  -/0 'protective systems'
- Group 3: Switzerland, Germany, France and Netherlands
  + 'trauma management', 'roads' and 'protective systems'
- Group 4: Austria, Denmark, Finland, Ireland, Sweden, Slovenia and United Kingdom
  + all risk domains except 'trauma management' and 'roads'

3.2. Clustering (6) Conclusion

- Countries were also grouped with respect to background and context indicators
- Belgium resembles the Netherlands on some background and context indicators but has a lower road safety level due to differences in SPI's
- The SUN-countries perform best and show some similarities concerning SPI's, economic and transport background

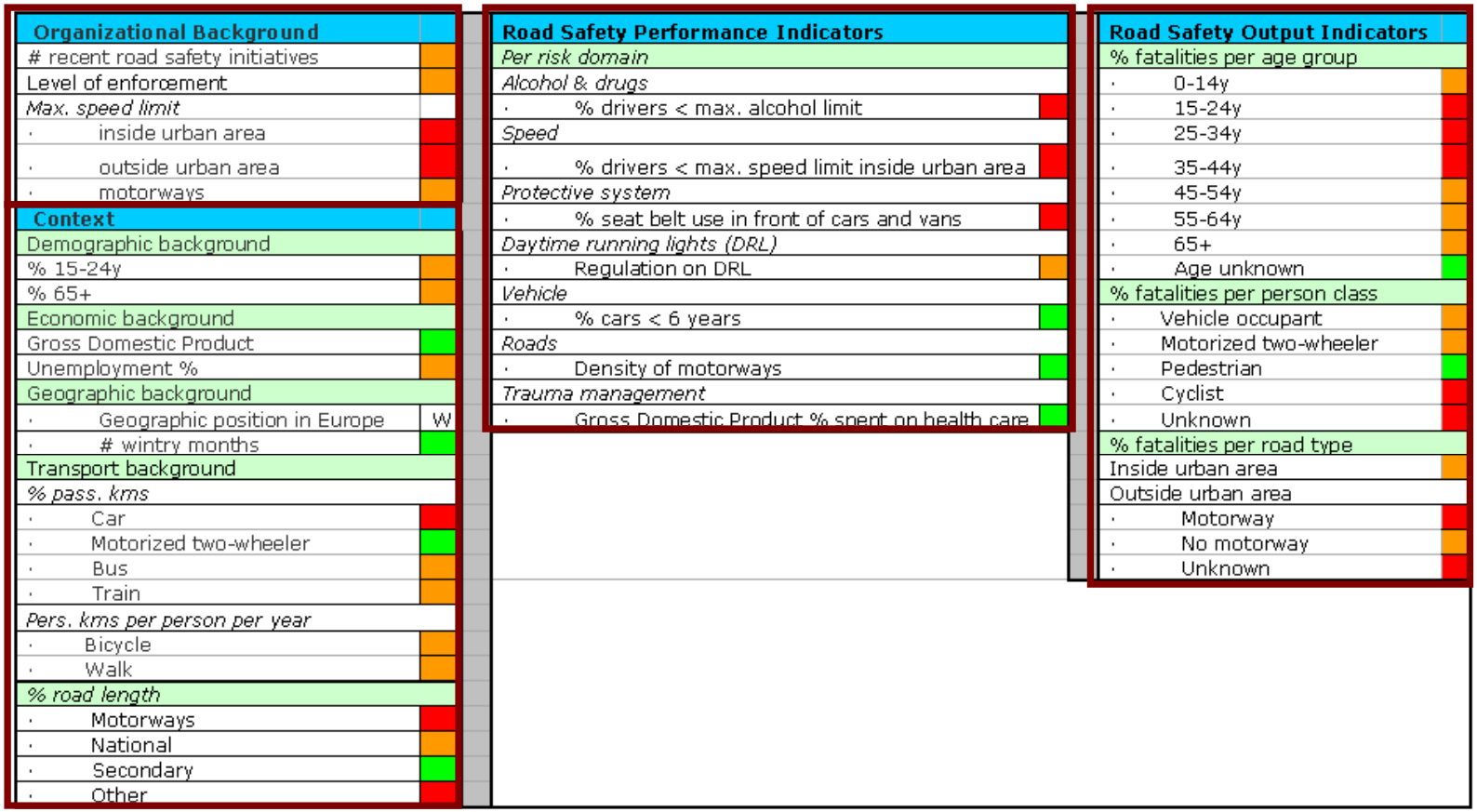
3.3. Footprint methodology

- Footprint (Morsink et al., 2005):
  - A schematic overview, valuable for describing and comparing countries
  - Provides a quick summary view on the road safety situation in a country
- 2 summary footprints for Belgium:
  - Comparing Belgium to the European average *('general footprint')*
  - Comparing Belgium to the average of the SUN-countries *('detailed footprint')*
- How?

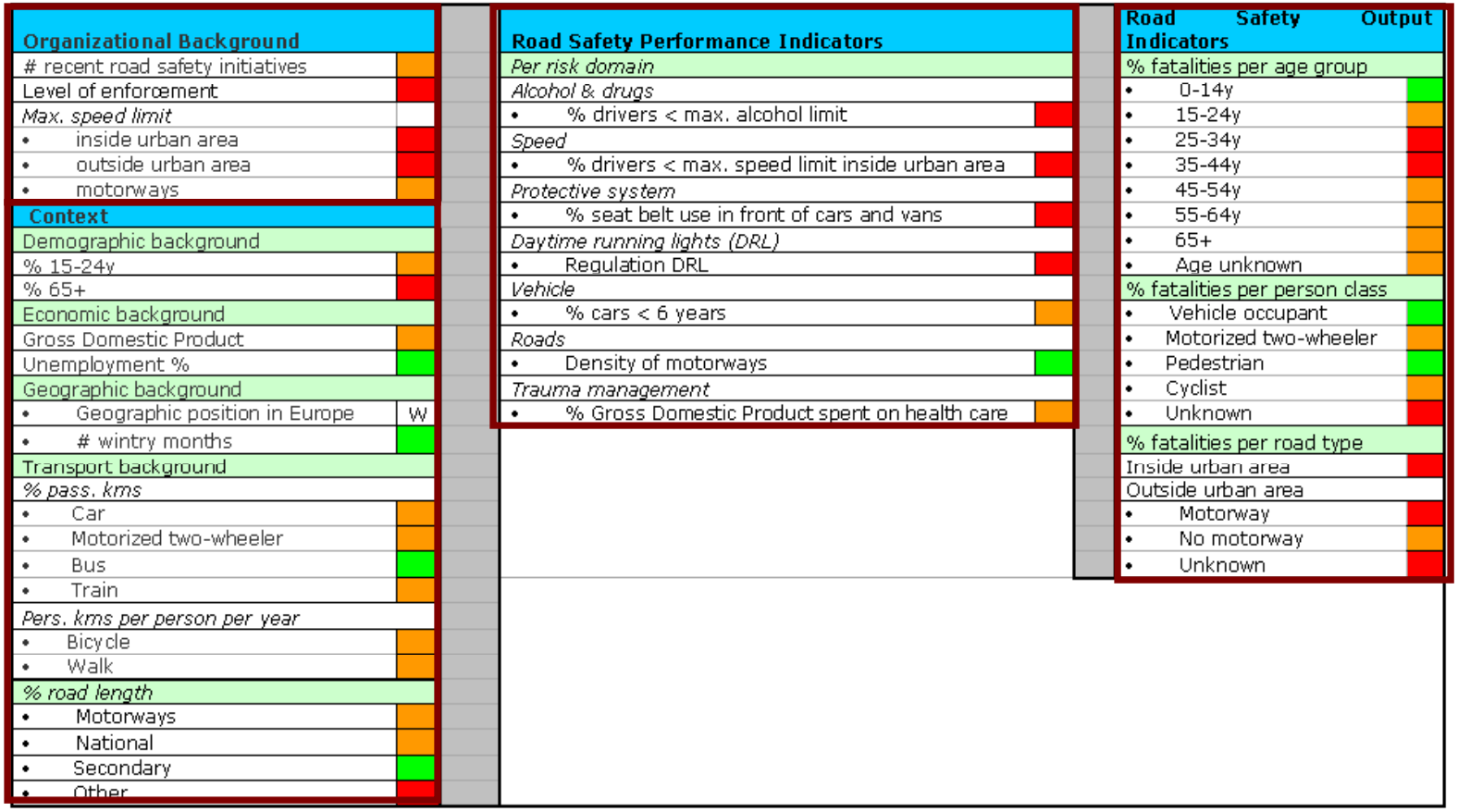
  1: Determine boundaries for the colouring

  2: Visualize relative scores by red, orange and green

3.3. Footprint methodology (2)
General footprint



3.3. Footprint methodology (3)
Detailed footprint



3.3. Footprint methodology (4)
Conclusion

- Belgium underperforms in many areas
- <-> the EU average:
  - Concerning the SPI's: 'protective systems', 'alcohol and drugs' and 'speed'
  - Concerning the SOI's: 'share of fatalities between 15 and 44 years' and 'share of fatalities on motorways'
- <-> the SUN-average:
  - Concerning the SPI's: on all risk domains except 'roads'
  - Concerning the SOI's: 'share of fatalities between 25 and 44 years', 'share of fatalities inside urban areas' and 'share of fatalities on motorways'
- The footprint methodology can be applied to every country revealing its best and worst characteristics

4. Conclusion

- A data set of RS indicators was analysed using:
  - Regression analysis
  - Cluster analysis
  - Footprint methodology
- Indicators explaining the number of road fatalities per million inhabitants:
  - ‘alcohol and drugs’ (% drivers < alcohol limit)
  - ‘protective systems’ (% seat belt use in front of cars & vans)
  - ‘vehicle’ (% cars < 6 years)
  - ‘average number of persons within a family’
  - ‘gross domestic product’
  - ‘average number of kilometers traveled by a driver’
  - ‘number of passenger cars per 1000 inhabitants’

4. Conclusion (2)

- Clustering:
  - Belgium is often grouped with South-European countries
  - The SUN-countries show apart from their similar road safety level some resemblances concerning their economic and transport background
- The footprints revealed Belgium's most important problem areas and are a valuable instrument for policy makers and other users
- Future research:
  - Take more indicators into account
  - Gathering data for more countries
  - Impute missing data

universiteit hasselt
imob
INSTITUUT VOOR MOBILITEIT

Thank you for your attention!
Questions?