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A road safety assessment model for the Netherlands

A feasibility study using disaggregation by traffic mode and age

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Outline

- Introduction
- Design of the general model
- Model used in the feasibility study
- Mobility
- Risk results
- Conclusions and future research

Modelling: Why?

Data influenced by chance
Many data are available

→ Filter the 'real' signal

Goal of a road safety assessment model:

- Interpret developments in the past
- Obtain predictions for the future
- Study the effect of road safety measures

Scope of the model

- National data (number of victims)
- Road safety modelled in terms of risk
- Necessary input: mobility
- Factors influencing road safety e.g. age, gender, traffic mode, infrastructural properties, ….
- Safety measures

Data used

- Road safety data: number of killed and/or seriously injured
- Mobility data: from survey called MON (Mobility Research Netherlands)
- Population numbers

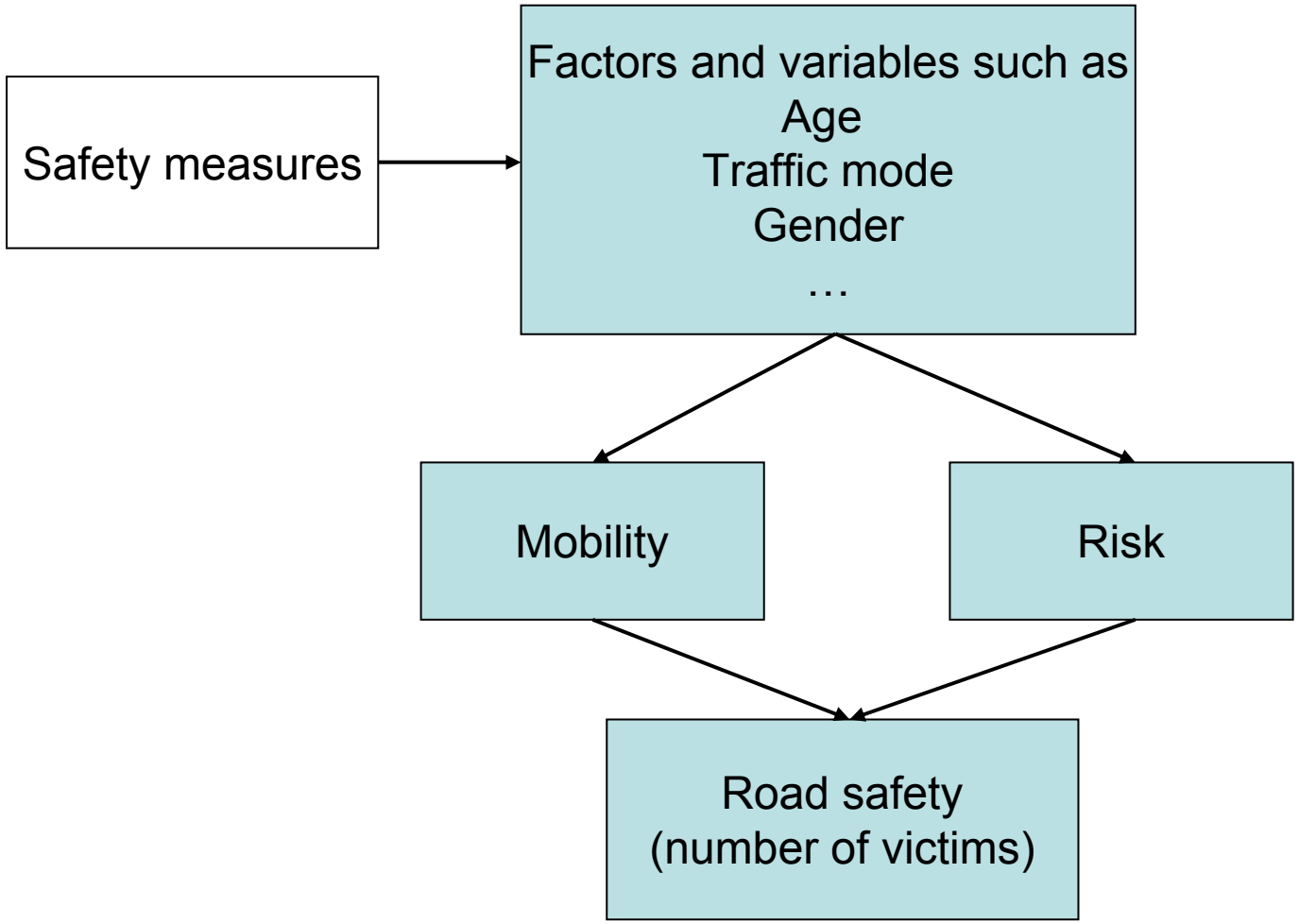
What is ‘a model’?

Mathematical formula: y = f(x1, x2, x3,..)

As an example:

- Dependent variable (y): risk
- Independent variables (x1, x2,…): traffic mode, age, gender, speed limit, …

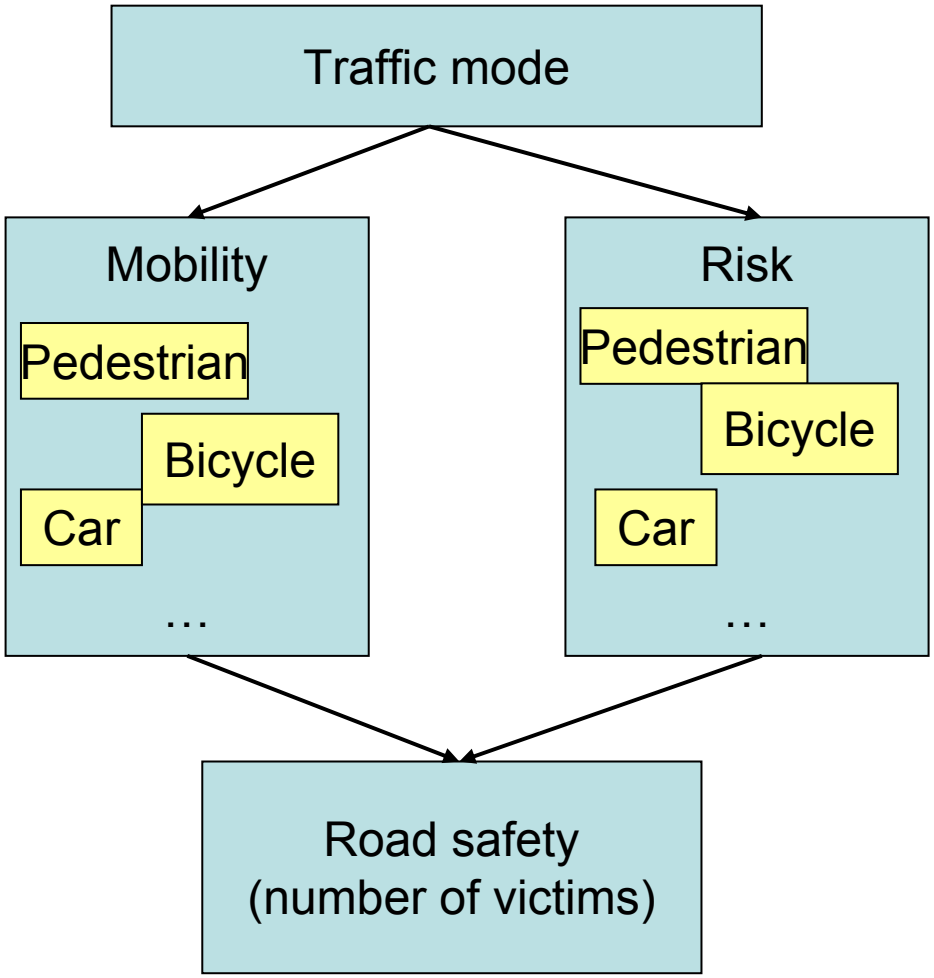
Model outline



Disaggregation (1)

- What?: Analysis in subgroups
- Why?: to be able to see if (risk)-developments are different in different subgroups
- How?: analyse subgroups with its interrelations

Disaggregation (2)



Definition of risk: single vehicle accidents

Single vehicle accidents:

$$N = r * M$$

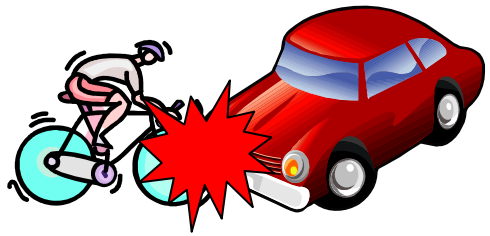
where N = number of victims

r = risk

M = mobility

Definition of risk: two-vehicle accidents

Two vehicle accidents:

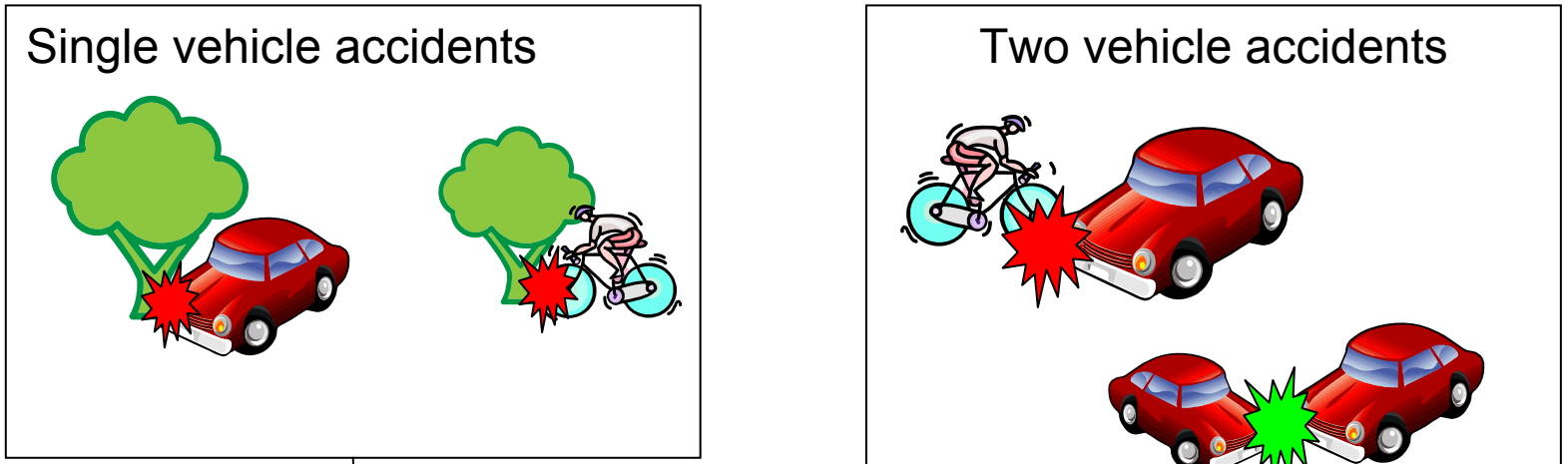


$$N = \rho * M1 * M2$$

Mobility victim	M1
Mobility opponent	M2
Risk density	ρ
Victim risk	$r1 = \rho * M2$
Opponent risk	$r2 = \rho * M1$

General model

Number of victims:



$$N \approx \sum_{\bullet} N_{\bullet} + \sum_{\bullet|\circ} N_{\bullet\circ} = \sum_{\bullet} r_{\bullet} M_{\bullet} + \sum_{\bullet|\circ} \rho_{\bullet\circ} M_{\bullet} M_{\circ}$$

Feasibility study

- Disaggregation by traffic mode and age only
- Car and bicycle only

- **Goal**: demonstrate feasibility (computability) of the model

Mobility: assumptions

- Basic idea:

  - For each traffic mode separately

  - Mobility = population number * mobility per capita

- Mobility per capita:

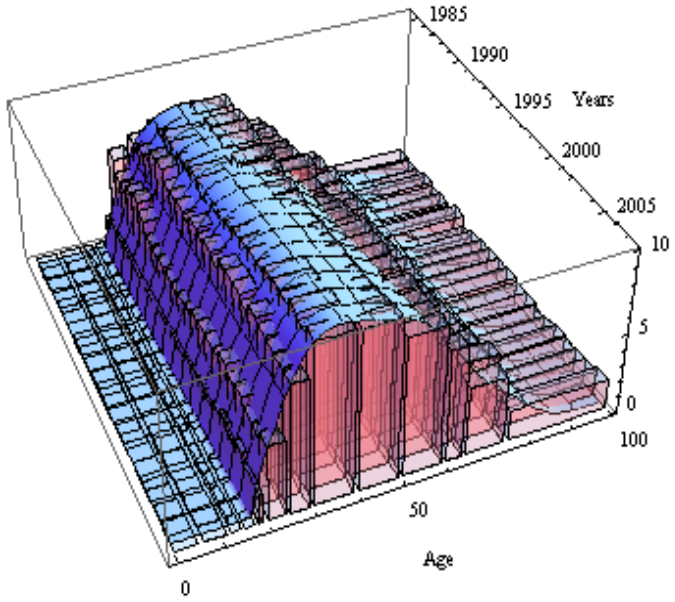
  - linear in time

  - smooth over ages

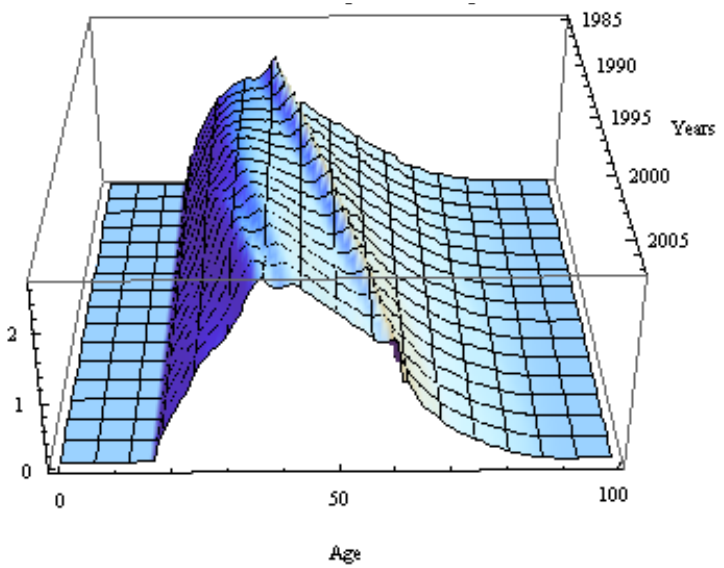
- Mobility per capita estimated using weighted least squares method

Mobility results: Car

Mobility per capita



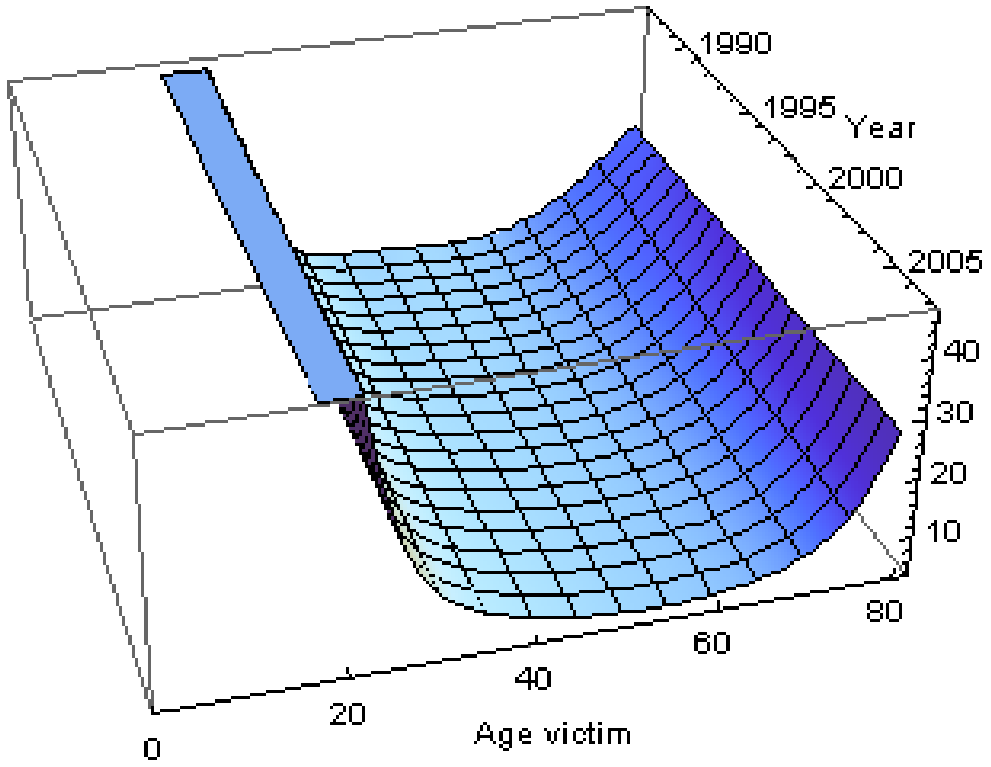
Mobility



Risk model: assumptions

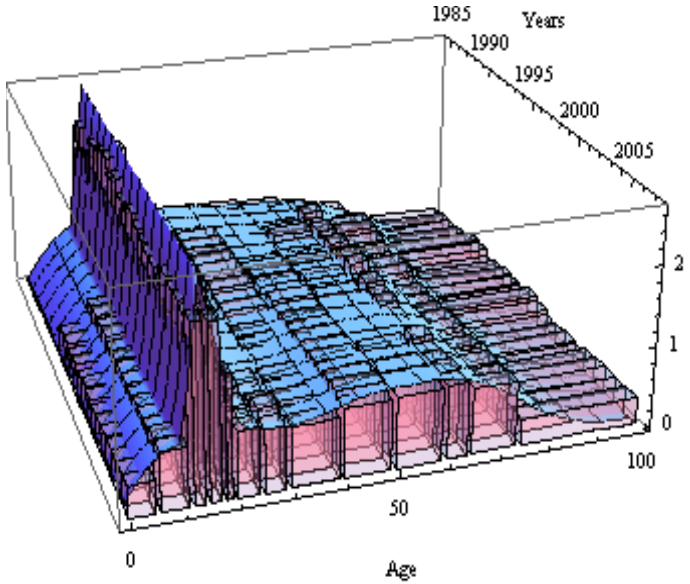
- Risk ‘data’ derived from victim numbers and mobility results
- Risk for victim and opponent derived from the risk density (for two vehicle accidents)
- Risk (density) is assumed to be:
  - smooth over ages
  - exponential in time
- Risk estimated by maximum likelihood

Risk results: single car accidents

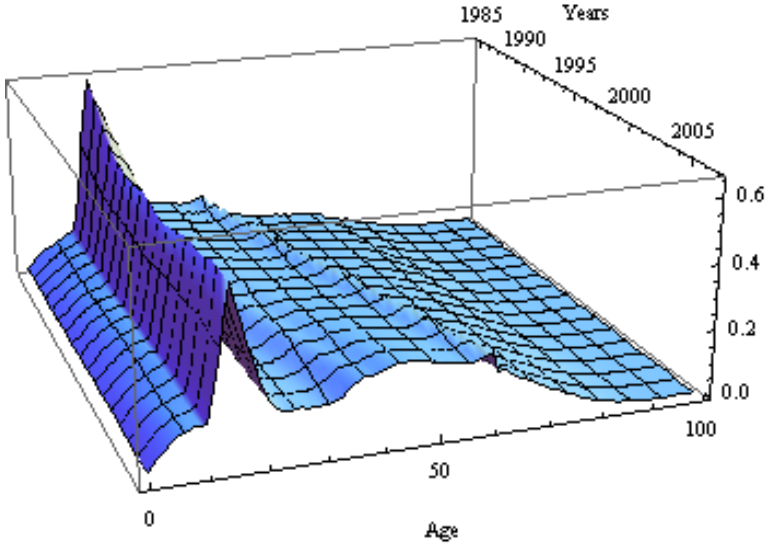


Mobility results: bicycle

Mobility per capita

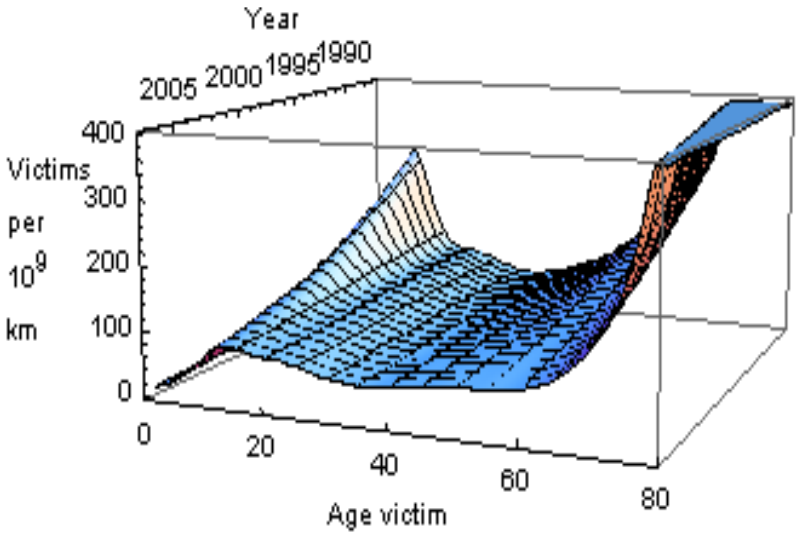


Mobility

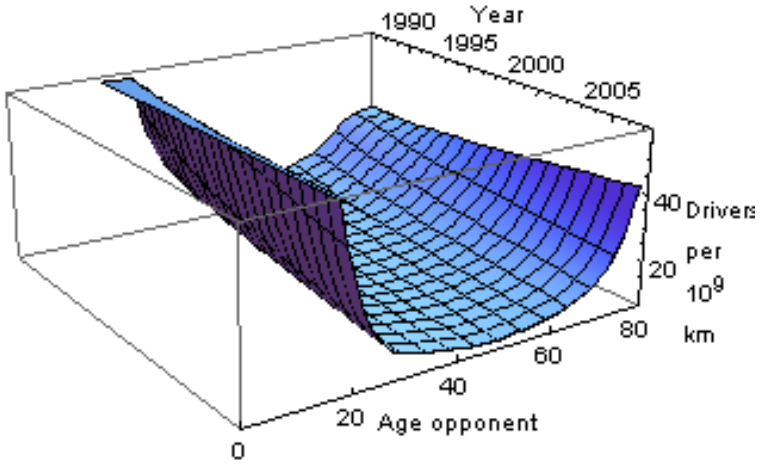


Risk results: bicycle-car accidents

Victim risk



Opponent risk



Conclusions

- We obtain plausible mobility estimates
- We obtain plausible risk estimates for victim and opponent
- The risk model is numerically feasible
- Results obtained so far are a justification for applying disaggregations

Future research

- Extend model to other traffic modes and collision types
- Add other disaggregations as well
- Add statistical tests
- Use parametrizations to keep the model computable
- Incorporate safety measures
- Develop forecasting model

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Thank you for your attention!

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A road safety assessment model

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