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Exposure-adjusted fatality rates for cycling and walking in European countries

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On behalf of the HEAT core group

http://www.heatwalkingcycling.org/#acknowl

Outline

- Background: PASTA and HEAT projects
- Introduction: Why are exposure-adjusted crash risk estimates needed?
- Methods: How did we estimate fatality rates across Europe?
- Results: What did we find (and not)?
- Discussion: outlook

Glossary

exposure = «amount of cycling»
exposure-adjusted = «taking into account the underlying amount of cycling»

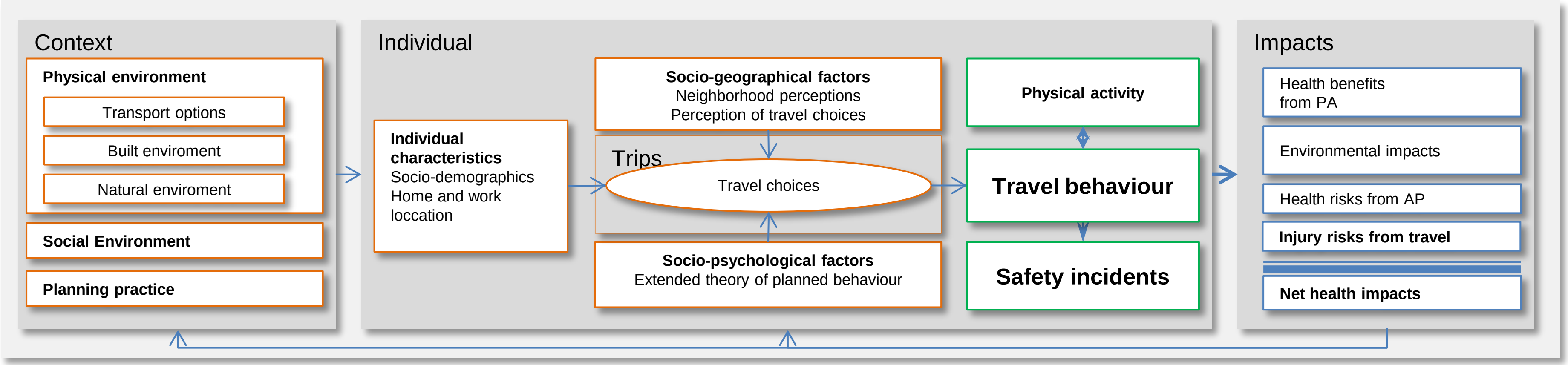
Background

PHYSICAL ACTIVITY THROUGH SUSTAINABLE TRANSPORT APPROACHES

What are the determinants of active travel?
What are effective measures to promote active travel?

What is the interrelation between active travel, physical activity and injury risk?

What are the health impacts of active travel?



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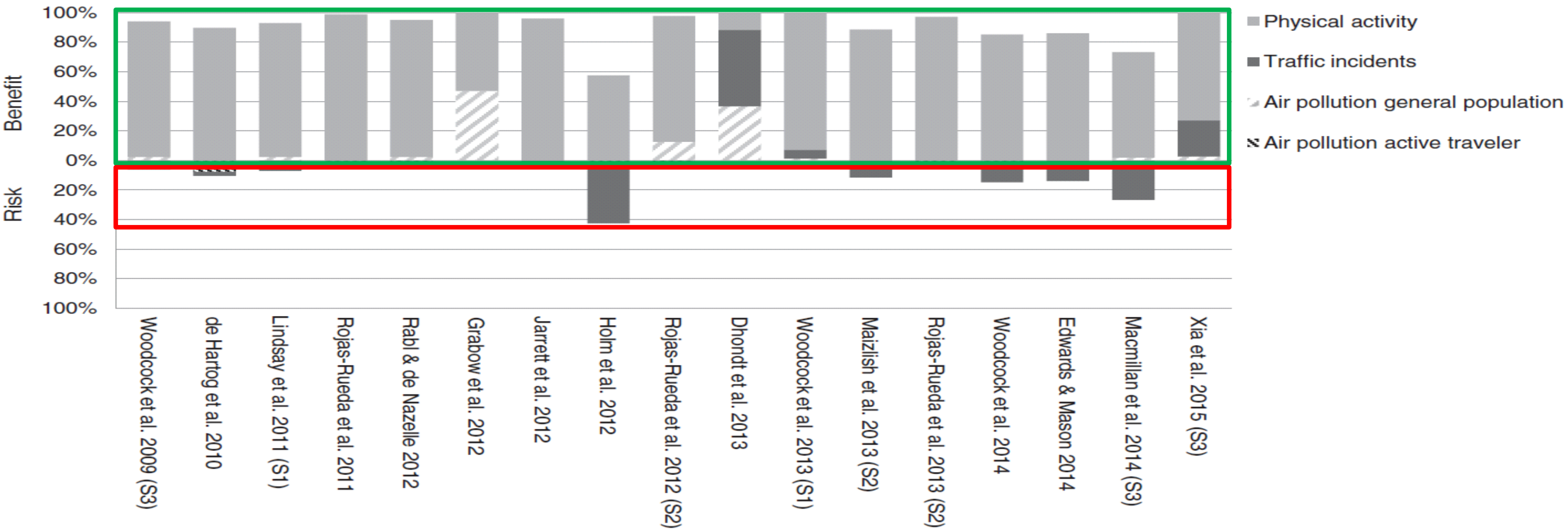
Health Benefits of Active Travel Outweigh Risks

N. Mueller et al. / Preventive Medicine 76 (2015) 103–114

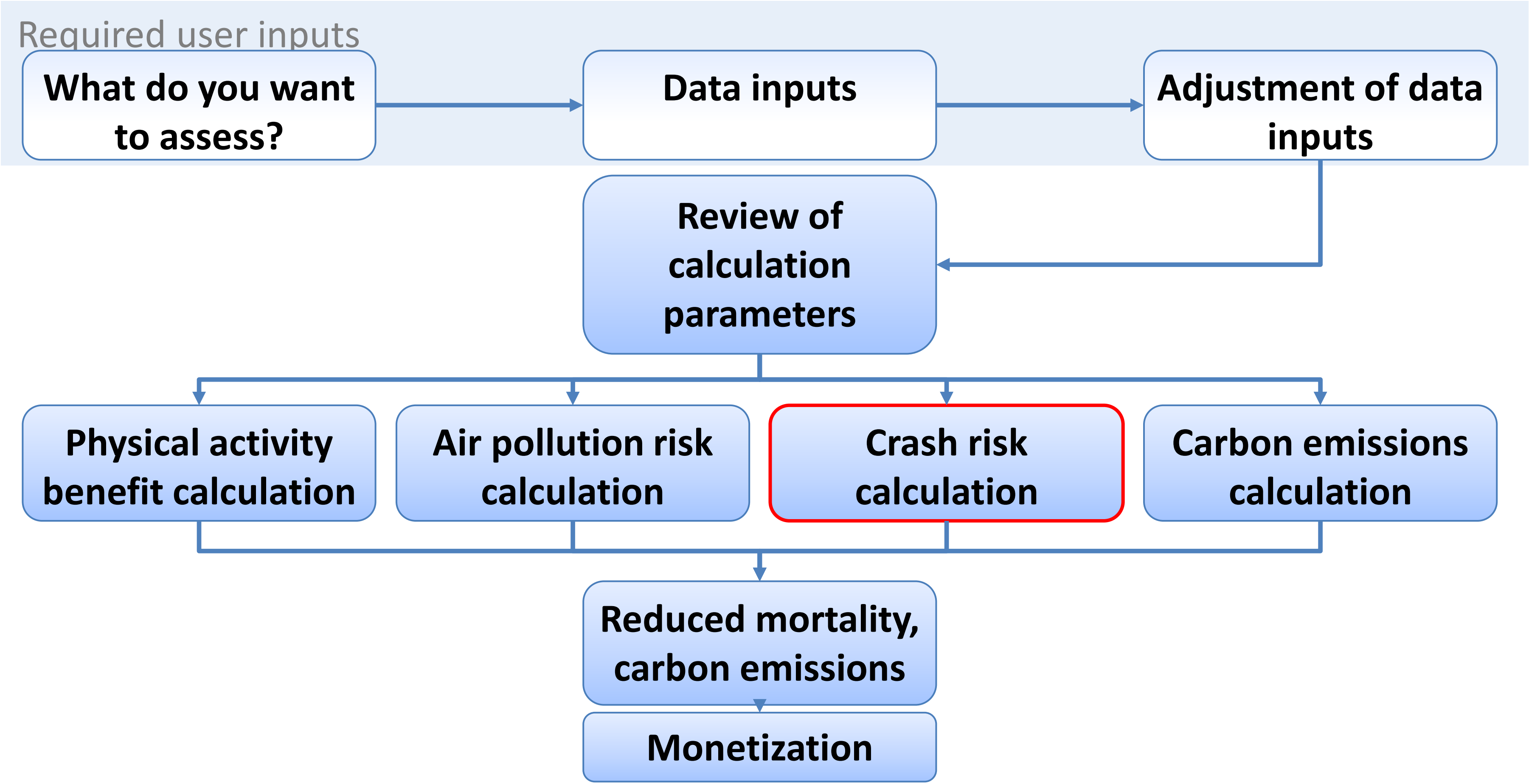


Health Economic Assessment Tool for walking and cycling (HEAT) by WHO

"For a given ***volume of walking or cycling*** *within a defined population what is the* ***economic value of the health benefits****?"*

- Online tool www.heatwalkingcycling.org
- Target audience "non-experts"
- Simple and quick "order of magnitude assessments"
- Focus on Europe (53 WHO member states)
- Approach based on core principles:
  - scientific evidence, transparent, conservative
- Development process:
  - iterative, modular, consensus-based

HEAT update 2017 (version 4.0)(as part of PASTA)

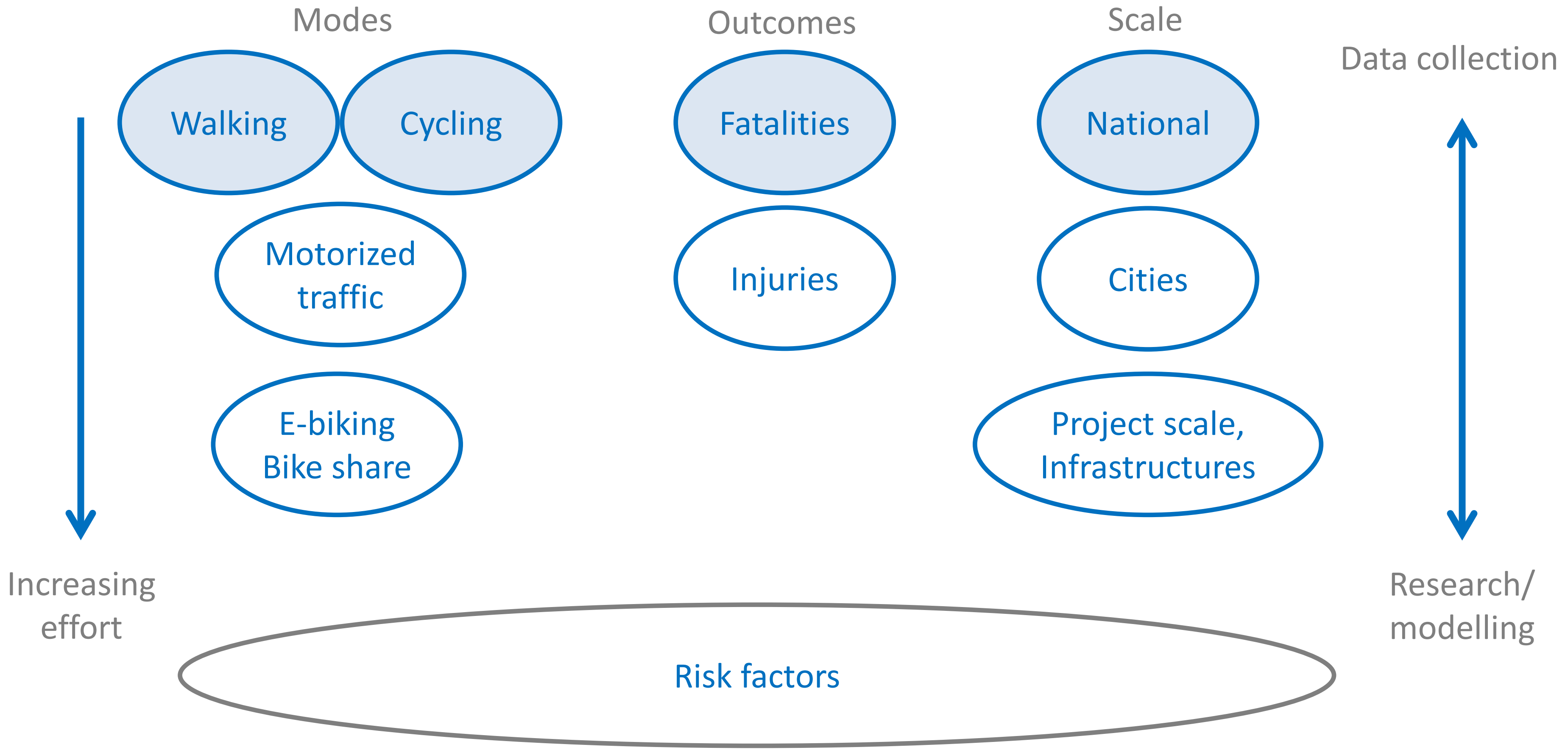


Introduction (the research challenge)

Impact assessment of traffic safety with HEAT tool in mind

Impact assessment of traffic safety

a research agenda (with HEAT in mind)



Key challenge: «exposure-adjusted risk estimates»

1. Impact assessment is always also about «**comparing**» (just like policy evaluation)
2. Comparisons are only valid if **adjusted for major determinants** (of crashes)
3. **Exposure** (volume of cycling) is the main determinant of number of crashes.
4. **Only exposure-adjusted crash risk estimates allow for valid comparisons**.

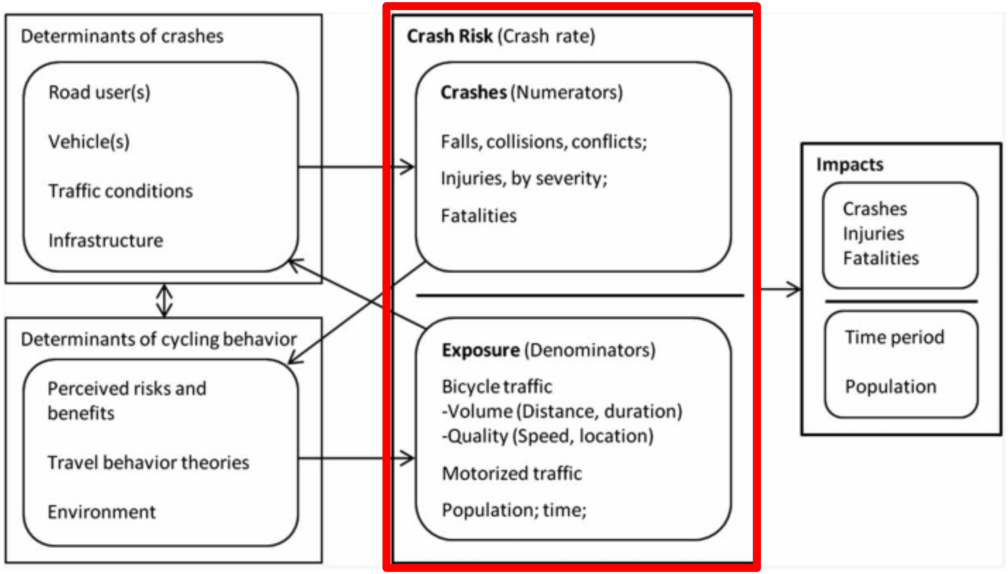


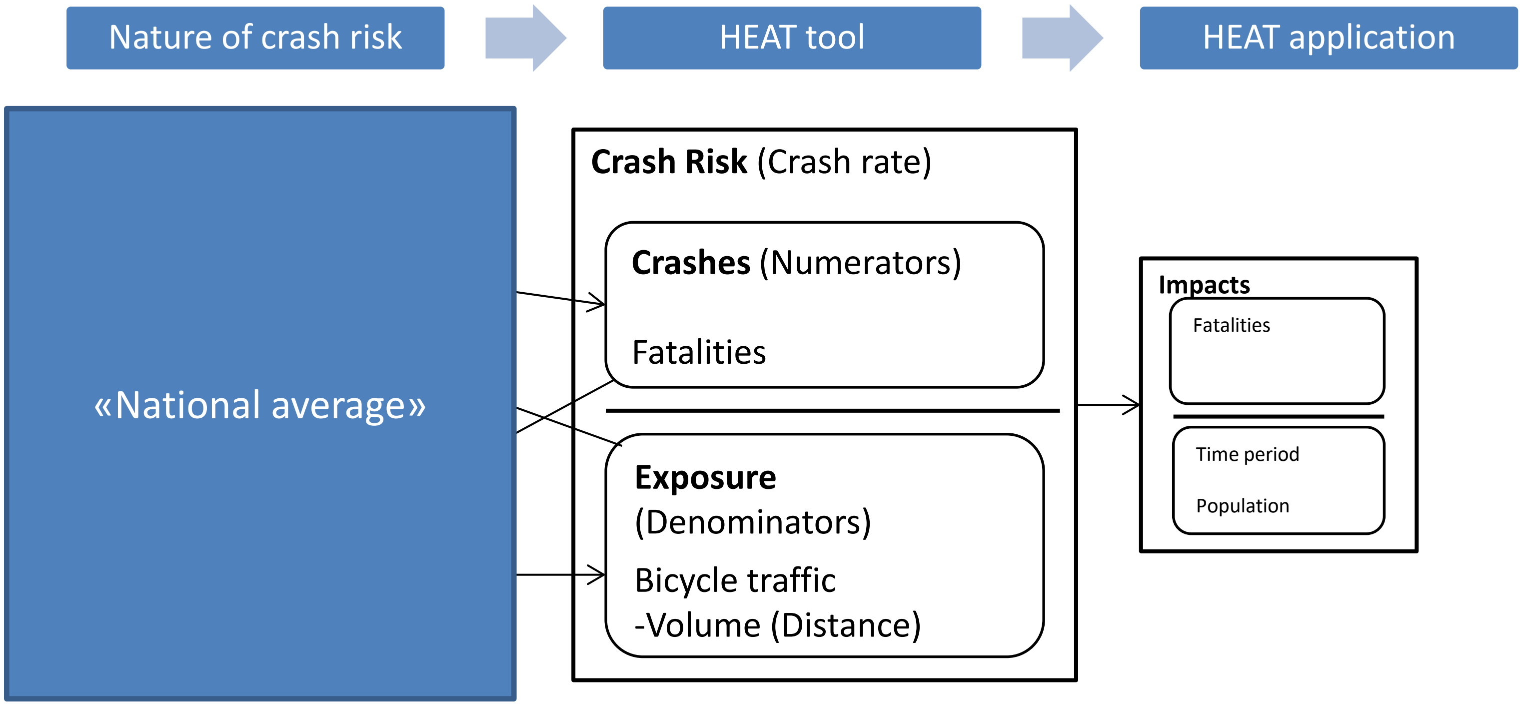
Figure 4. Conceptual framework of safety of cycling (adapted from Schepers et al., 2014).

Transport Reviews, 2015
http://dx.doi.org/10.1080/01441647.2015.1057877
Routledge Taylor & Francis Group

Cycling as a Part of Daily Life: A Review of Health Perspectives

THOMAS GÖTSCHI*§, JAN GARRARD** AND BILLIE GILES-CORTI†

How HEAT Looks at Crash Risk (for now)



Conceptual framework of safety of cycling. Crash risk is conceptualized as a crash rate, such as the ratio between adverse events and an exposure measure. Impacts refer to the number of adverse events occurring in a specific population over a defined period of time. Diagonal arrows indicate "feedback" mechanisms: "perceived safety", in large parts determined by absolute numbers of (severe) crashes, affects cycling behavior, and "exposure levels", such as the number of cyclists, affect determinants of crashes (safety), such as behavior of other road users, an effect known as safety in numbers. (adapted from (Schepers, Hagenzieker et al. 2014)).

Fatality Rates for HEAT Crash Module

Basic Implementation in HEAT Crash Module

Crash risk estimate × Volume of cycling = Bike crashes

From where?

Fatalities data

1. Average number of fatalities (2011-2015) were primarily calculated based on data from the ITF-IRTAD data set
2. For countries not included in this data set, 1-year data from the WHO-GHO were used

Source	*Year of data*	*Number of countries*
International Transport Forum (ITF) - International Traffic Safety Data and Analysis Group (IRTAD)	2005-2015 Time series	32
World Health Organization (WHO) - Global Health Observatory (GHO)	2013 One-year data	142

Exposure Data (total km, km/person*day)

1. National **travel survey**
2. *if no travel survey*, estimation based on:
   - **Mode share**:
     - Crude estimates by world regions produced by ITDP-ITS report (16% for Nordic countries, 7% European OECD countries, 2% for non-OECD countries and 3% for Middle Eastern countries)
   - **Number of trips**:
     - 3 trips by all-modes per person and day (assumption based on the WALCYNG report as well as PASTA data)
   - **Trip length**:
     - 4 km per bicycle trip and 1 km per walking trip (based on UK, NL, and PASTA)

TD = AMS * TT * TL * Pop	TD = Yearly travel distance by active mode (kilometres) AMS = Active mode share (active mode trips / trips by all modes) TT = Total number of trips by all modes (trips per person and day) TL = Average trip length (km per active mode trip) Pop = Population (inhabitants)

Data Quality

- Distinction of some data quality criteria results in **six reliability levels**
- Main contrast is availability of **travel survey vs. mode share estimate**

<table>
<tr><th colspan="2">Exposure data</th><th colspan="2">Fatality data</th><th colspan="2">Fatality rate</th></tr>
<tr><th>Original data</th><th>Used data</th><th>Original data</th><th>Used data</th><th colspan="2">Reliability level</th></tr>
<tr><td rowspan="3">National data</td><td>Original data (or combination thereof) without assumptions</td><td rowspan="5">Observed deaths</td><td rowspan="2">5-year average</td><td>1</td><td>Very high</td></tr>
<tr><td rowspan="5">Estimation with assumption[a]</td><td>2</td><td>High</td></tr>
<tr><td>Single year</td><td>3</td><td>Moderate</td></tr>
<tr><td rowspan="3">Mode share estimate for world region based on selected cities</td><td>5-year average</td><td>4</td><td rowspan="3">Low</td></tr>
<tr><td rowspan="2">Single year</td><td>5</td></tr>
<tr><td>Model estimation</td><td>6</td></tr>
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Availability of High Quality Data

- 13 countries for cycling
- 11 for walking

Reliability level of fatality rate	*Countries for cycling*	*Countries for walking*
Very high (1)	5	4
High (2)	8	7
Moderate (3)	1	1
Low (4-6)	33	n.a.*(a)*
Total	*47*	*12*

[a] regional mode share estimates were not available for walking

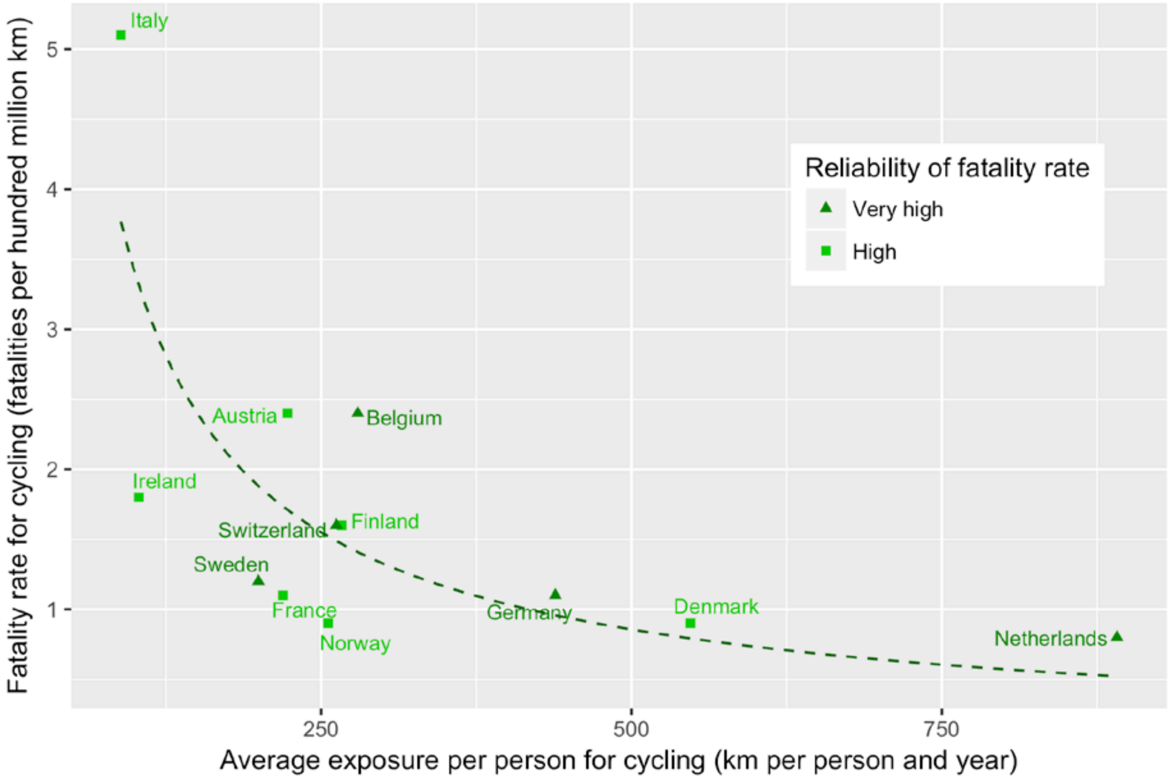
Results

Tables with values, sources and meta information of

- fatality data,
- exposure data and
- fatality rates

Country (a)	*Fatalities (cycling fatalities per year)*				*Exposure (million km travelled by bicycle per year)*				*Fatality rate (cycling fatalities per hundred million km)*	
	Value	*Year*	*Data*	*Source*	*Value*	*Year*	*Data*	*Source*	*Value*	*Reliability*
Albania	20.0	2013	E, 1y	[21]	260	2015	MS, A(d)	[27], [31]	7.7	Low
Armenia	2.0	2013	E, 1y	[21]	271	2015	MS, A(d)	[27], [31]	0.7	Low
Austria	45.8	2011-2015	O, 5y	[20]	1 898	2014(e)	N, A(f)(l)	[32, p. IV]	2.4	High
Azerbaijan	3.0	2013(b)	O(c), 1y	[21]	876	2015	MS, A(d)	[27], [31]	0.3	Low
Belarus	101.0	2013	O, 1y	[21]	853	2015	MS, A(d)	[27], [31]	11.8	Low
Belgium	74.0	2011-2015	O, 5y	[20]	3 033	2009	N, NA	[33, p. 17]	2.4	Very high

Fatality Rates for Cycling

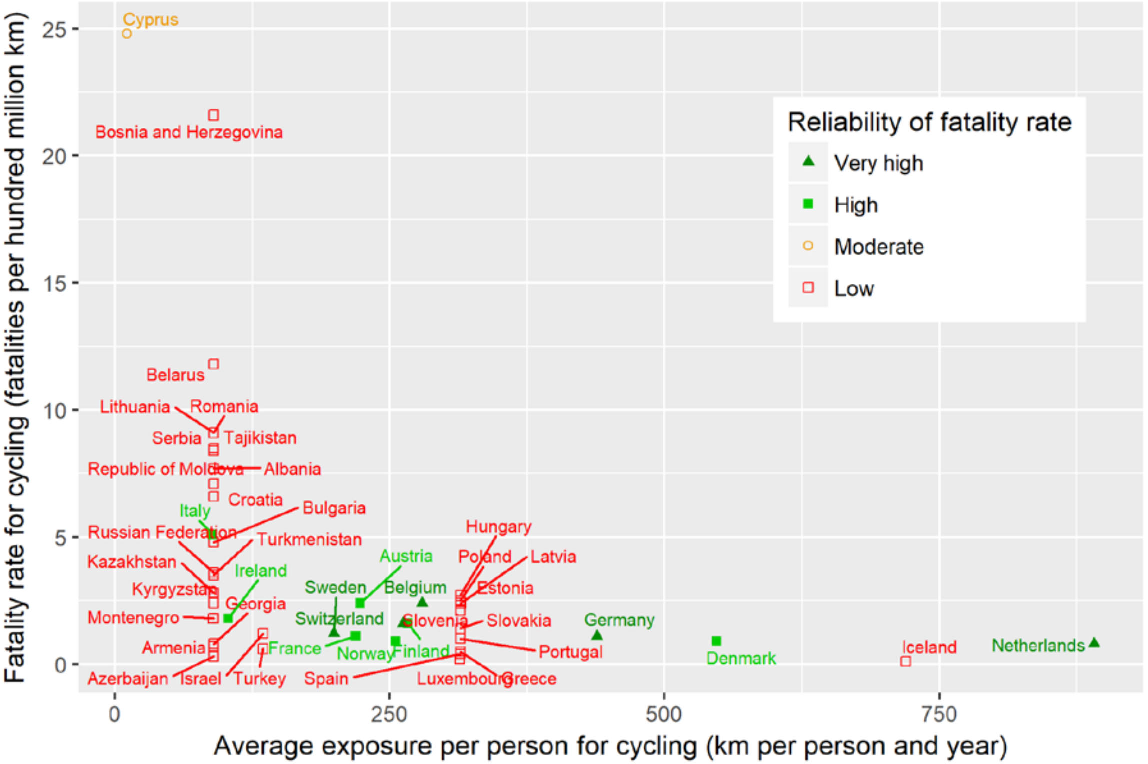


- Fatality rates range from 0.8 to 5.1
- Fatality rates are lower in countries with high exposure (cycling volume)

Fatality Rates for Walking

- Fatality rates range from 0.6 to 5.3
- Fatality rates are lower in countries with high exposure (walking volume)

Fatality Rates for Cycling (incl. low reliability figures)



- Clustering due to
  - Regional mode share estimates
  - Common extrapolation assumptions
- Several low reliability rates seem inflated

Discussion

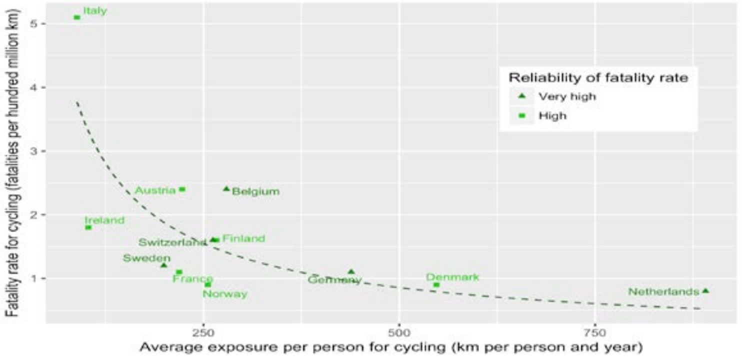
Strengths of HEAT crash module

- A rare effort of systematically compiling **exposure-adjusted fatality risk data** for active travel modes following a common methodology
- **Comparisons of fatality risks** across 12 European countries.
- **Comparisons of crash risks vs. health benefits** of cycling in assessments of multiple impact pathways as in HEAT, for approximately another 30 countries

Limitations of HEAT crash module

- Simplified approach within **constraints and scope of HEAT**
  - No motorized modes
  - No injuries
  - No sub-national scale, etc.
- High reliability fatality rates: No **harmonization of travel surveys**
  - Survey methods
  - Inclusion criteria, etc.
- Low reliability fatality rates : extrapolation likely inflates exposure in some places
  - Mode share depends on local/national factors – world region too crude
  - Trip distance depends on mode share – not reflected
  - is “best available” “good enough”?

Limitations beyond HEAT



- **Fatality rates provide an «incomplete picture»**
  - Risk and exposure are self-regulating:

    «**High levels of cycling**» and «**low fatality rates**» both indicate «**safety**»
  - **Injuries** are a substantial (equal/larger) issue
  - **National rates** are of limited value to inform **(sub-national) policy**

    (understanding the “why?”)

Considerations for Cycling Safety Research (bigger picture)

- **Scope**
  - within HEAT fairly narrow and clear.
  - Do we understand **needs of policy and practice** more broadly, and how they **align with safety research efforts**?

- **Spatial scale**: city level, project level
  - This is **where (most) policy happens**
  - **Major research gap/challenge**

- **Data** collection vs. research and **models**:
  - Where can «**collection of existing data**» suffice geographical scope and diverse use cases?
  - Where can/should «**prediction models**» step in?

Considerations for Cycling Safety Research (specific topics)

- **Travel surveys:**
  - Is harmonization worth the hassle?
  - How about a **publication standard for «indicators plus meta-data»**?
  - What is **plan B** for countries without travel surveys?
    - can smartphones, internet etc. lead to **supranational solutions**?
- “Exposure to **motorized modes**”
  - Is it worth pursuing “data collection” at the national level?
  - Can we learn something about bicycling?
- “Safety-in-numbers-in-safety-…“: nice to see (again), but:
  - How to establish **causality** and produce policy inputs?
  - Is there an opportunity at the national level?
- **Injuries**:
  - Same approach, equal effort - or ten-fold?

Conclusions: “…from iceberg to white paper…”

- Before we rush to conclusions, let’s do some basic home work:
  - Identification/alignment of **needs/gaps, objectives, and priorities**
    «which questions should be answered, which ones are being adressed, and are we setting the right priorities»
  - Definition of **roles** for practitioners, agencies, (supra)(national) organizations, and research (disciplines)
    «who can we expect to contribute what?»
  - **Alignment of methods and objectives**
    «which methods/approaches are suited to address which questions?»
  - **Produce more robust evidence**
    «cycling safety research merits more attention and funding»

Thank you for your attention

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