Using HEAT in the context of research: Selected examples from a systematic review

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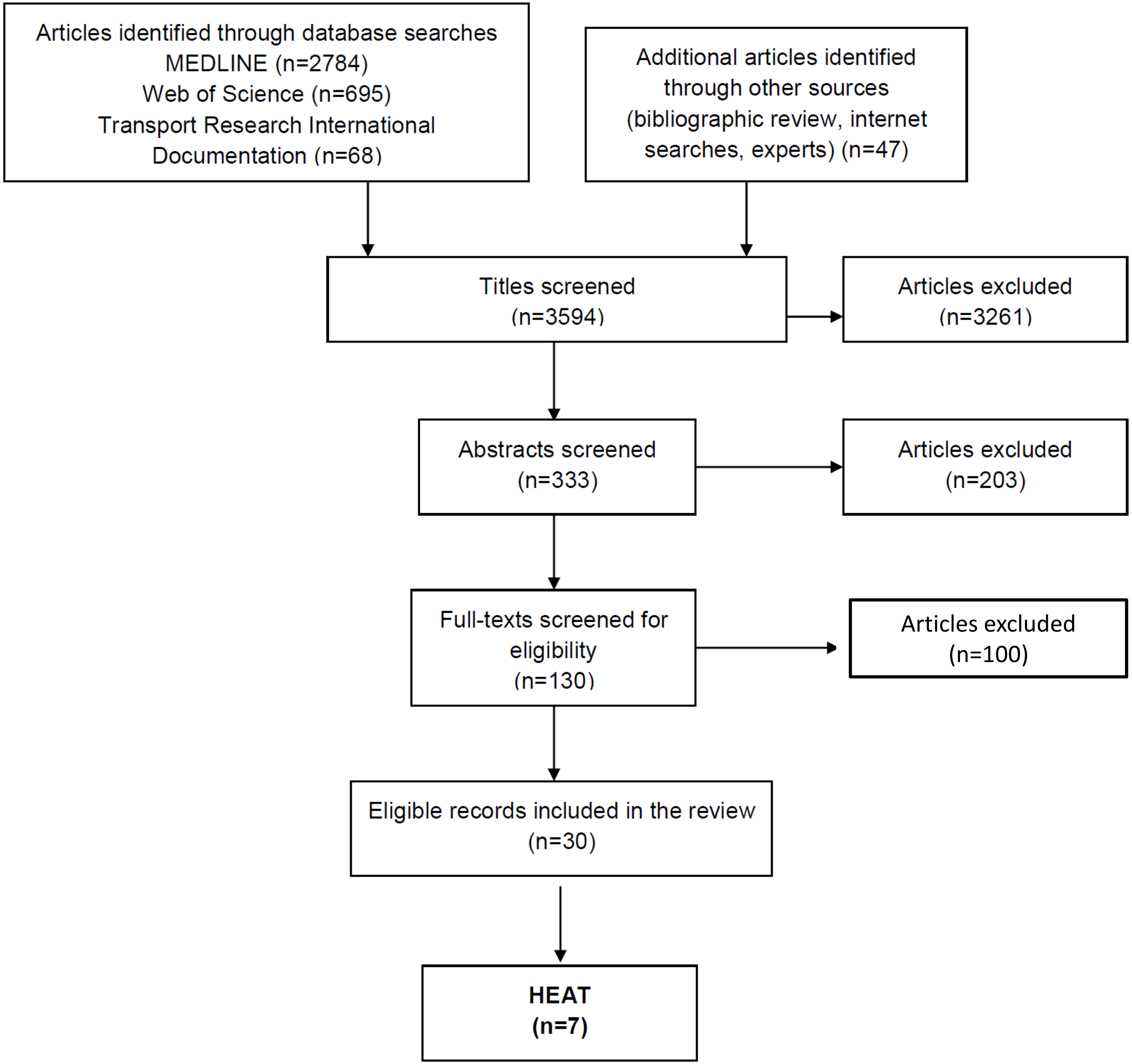
April 14, 2015 Washington DC

Systematic Review

- MEDLINE, Web of Science, and Transportation Research International Documentation.
- Peer-reviewed studies.
- English, Spanish, French, German, or Dutch.
- February 2015.


Articles identified through database searches
MEDLINE (n=2784)
Web of Science (n=695)
Transport Research International Documentation (n=68)
Additional articles identified through other sources (bibliographic review, internet searches, experts) (n=47)
Titles screened (n=3594)
Articles excluded (n=3261)
Abstracts screened (n=333)
Articles excluded (n=203)
Full-texts screened for eligibility (n=130)
Articles excluded (n=100)
Eligible records included in the review (n=30)
HEAT (n=7)

PUBLICATIONS

- 2011 – 2014
- Transport mode
  - 4 HEAT *Cycling*
  - 2 HEAT *Walking*
  - 1 HEAT *Cycling + Walking*
- Country
  - 3 USA
  - 3 Europe
  - 1 New Zealand

INPUT VARIABLES

- 3 Physical Activity Only
- 1 Physical Activity + Air Pollution (all inhabitants)
- 1 Physical Activity + Air Pollution (all inhabitants) + Traffic Hazards
- 2 Physical Activity + Air Pollution (all inhabitants) + Traffic Hazards + Noise (all inhabitants)

SCENARIOS

- 4 *Hypothetical* shift from car to bike
- 1 *Hypothetical* shift from car to walk
- 1 Increased cycling infrastructure investment
- 1 Decreased public transport investment (↓walk)

CYCLING – DEENIHAN (2014)

Dublin, Ireland

Cost-benefit analysis

Exposure: Physical activity

Scenario	Cycling rate
Baseline	2%
A	3%
B	5%
C	10%

Deenihan G, Caulfield B. Estimating the health economic benefits of cycling. *J Transp Heal*. 2014;1(2):141–149.

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Cycling – Deenihan (2014)

Data sources: Survey in Dublin work places

Cyclist Summary from HEAT.

Summary of cycling data	**2.5% Modal shift**
Pre-intervention cycling data	
Average number of cycling trips per person per year	96
Average distance cycled per cycling trip (km)	8
Average distance cycled per person per year (km)	803
This level of cycling is likely to lead to a reduction in the risk of mortality of	16%
Total number of individuals regularly doing this amount of cycling	2443
Note: Reduction in risk of mortality calculated from number of cycling trips per year and distance cycled	
Post-intervention cycling data	
Average number of cycling trips **per person** per year	156
Average distance cycled **per cycling trip** (km)	12
Average distance cycled **per person** per year (km)	1,933
This level of cycling is likely to lead to a reduction in the risk of mortality of	34%
Total number of individuals regularly doing this amount of cycling	**3,544**

Deenihan G, Caulfield B. Estimating the health economic benefits of cycling. *J Transp Heal*. 2014;1(2):141–149.

Cycling – Deenihan (2014)

	3% modal shift	5% modal shift	10% modal shift
Deaths avoided	3.3	8.1	17.9
Annual benefit (€)	5.3 million	12.8 million	28.2 million
Benefit-cost ratio	2.2:1	5.3:1	11.7:1

Deenihan G, Caulfield B. Estimating the health economic benefits of cycling. *J Transp Heal*. 2014;1(2):141–149.

WALKING – OLABARRIA (2012)

Catalonia, Spain

Exposure: Physical activity

Achieve the WHO recommendations for ***physical activity*** by substituting short motorized trips with walking trips.

Olabarria M, Pérez K, Santamariña-Rubio E, Novoa AM, Racioppi F. Health impact of motorised trips that could be replaced by walking. *Eur J Public Health*. 2012;23(2):217–22

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WALKING – OLABARRIA (2012)

Data sources: Catalonian daily mobility survey

Time spent walking

	0 min (%)	<30 min (%)	30–59 (%)	>60 (%)
Men (years)				
18–29	66.6	19.0	9.1	5.4
30–64	65.2	16.7	8.2	9.9
>65	27.8	19.3	16.2	36.7
Total	59.6	17.6	9.6	13.1
Women (years)				
18–29	56.8	22.9	12.5	7.8
30–64	44.2	24.2	15.9	15.6
>65	22.9	30.0	19.9	27.2
Total	42.6	25.1	16	16.2

Olabarria M, Pérez K, Santamariña-Rubio E, Novoa AM, Racioppi F.
Health impact of motorised trips that could be replaced by walking. *Eur J Public Health*. 2012;23(2):217–22

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WALKING – OLABARRIA (2012)

	People who made short motorized trips (%)[a]		Number of people who could achieve recommendations[b]	
	%	95% CI	*N*	95% CI
Total				
Men	15.6	15.2–16.1	326 557	313 373–339 740
Women	13.9	13.5–14.4	252 509	240 855–264 163

Olabarria M, Pérez K, Santamariña-Rubio E, Novoa AM, Racioppi F. Health impact of motorised trips that could be replaced by walking. *Eur J Public Health*. 2012;23(2):217–22

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Walking – Olabarria (2012)

	Number of deaths per year that are prevented by this level of walking[c]		Total benefits accumulated over 1 year in EUROS[d]	
	N	95% CI	*N*	95% CI
Total				
Men	108.40	104.47–112.34	124 216 000	120 182 000–128 250 000
Women	79.23	75.94–82.54	84 927 000	81 774 000–88 079 000

Olabarria M, Pérez K, Santamariña-Rubio E, Novoa AM, Racioppi F. Health impact of motorised trips that could be replaced by walking. *Eur J Public Health*. 2012;23(2):217–22

WALKING (TRANSIT) – JAMES (2014)

Boston, USA

Exposures:

- Physical Activity
- Air Pollution
- Traffic Hazards
- Noise

James P, Ito K, Buonocore JJ, Levy JI, Arcaya MC. A Health Impact Assessment of Proposed Public Transportation Service Cuts and Fare Increases in Boston, Massachusetts (U.S.A). *Int J Environ Res Public Health*. 2014;11(8):8010–24.

WALKING (TRANSIT) – JAMES (2014)

Scenario 1: Fares increase by 43%, Service reductions affecting 34–48 million trips each year

Scenario 2: Fares increase by 35%, Service reductions affecting 53–64 million trips each year

James P, Ito K, Buonocore JJ, Levy JI, Arcaya MC. A Health Impact Assessment of Proposed Public Transportation Service Cuts and Fare Increases in Boston, Massachusetts (U.S.A). *Int J Environ Res Public Health*. 2014;11(8):8010–24.

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WALKING (TRANSIT) – JAMES (2014)

Data sources:

- Massachusetts Bay Transport Authority Plan
- Metropolitan transport records

8.3 min walking / public transport trip

James P, Ito K, Buonocore JJ, Levy JI, Arcaya MC. A Health Impact Assessment of Proposed Public Transportation Service Cuts and Fare Increases in Boston, Massachusetts (U.S.A). *Int J Environ Res Public Health*. 2014;11(8):8010–24.

WALKING (TRANSIT) – JAMES (2014)

	Scenario 1 (fare increased by 43% with smaller services cut)	Scenario 2 (fare increased by 35% with bigger services cut)
Deaths per year (increase)	+ 9	+ 14
Mortality costs	$74.9 million	$116 million

James P, Ito K, Buonocore JJ, Levy JI, Arcaya MC. A Health Impact Assessment of Proposed Public Transportation Service Cuts and Fare Increases in Boston, Massachusetts (U.S.A). *Int J Environ Res Public Health*. 2014;11(8):8010–24.

HEAT in Research

- Scenarios
  - Increasing / Decreasing - Bike / Walking trips
    - Cars / Motorbikes
    - Public transport (walk)
- Data Sources
  - Transport surveys/records/counts
- Population
  - Adults
  - Urban / Rural
  - Local / National

HEAT in Research

HEAT can be used for research:

- Mortality and economic evaluation
- Physical activity
- Complement with Air Pollution – Traffic Hazards - Noise

Thank you

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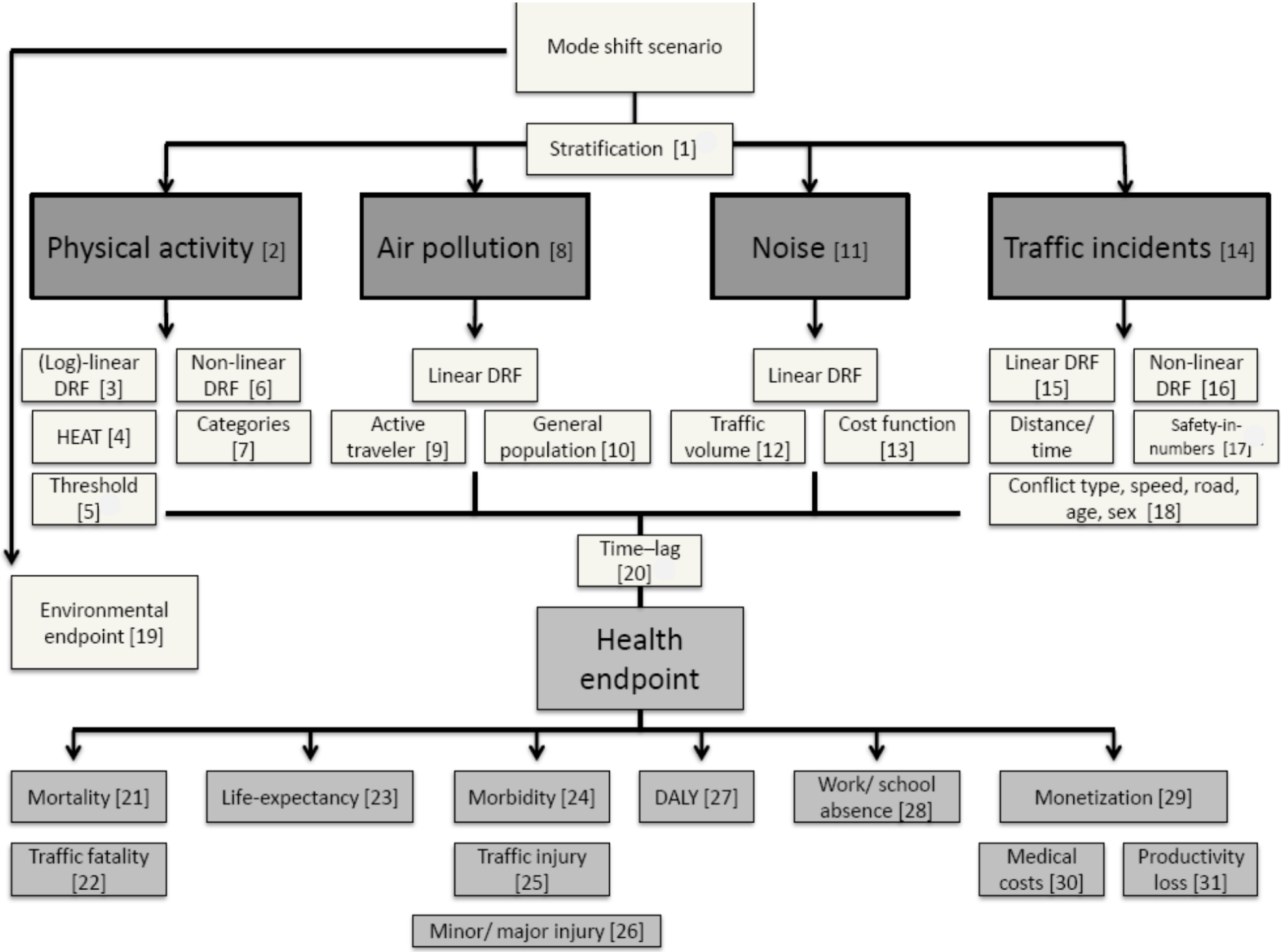
LIMITATIONS

- More complex models exist
  - Other exposures / outcomes
- Linearity of physical activity benefits
- Adults

LIMITATIONS



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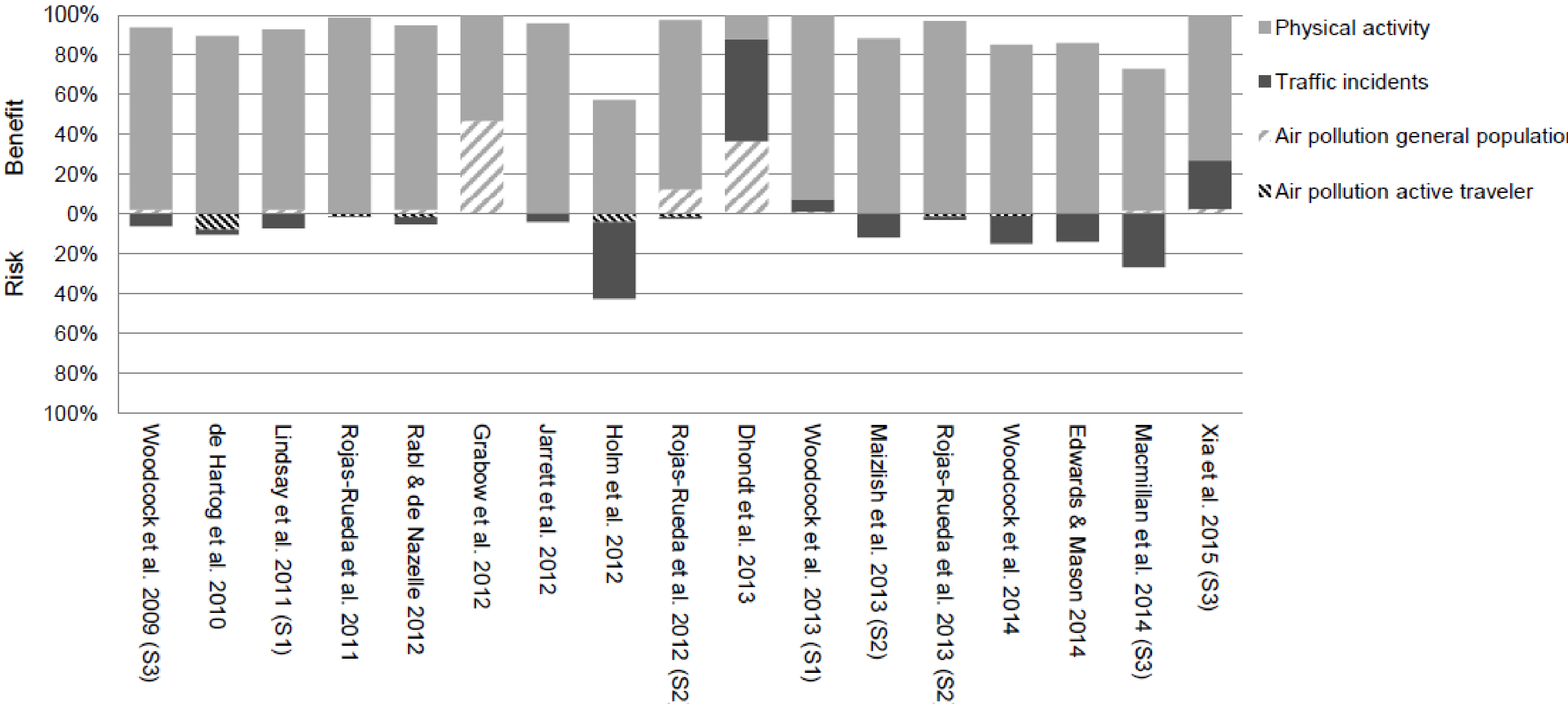
STRENGTHS

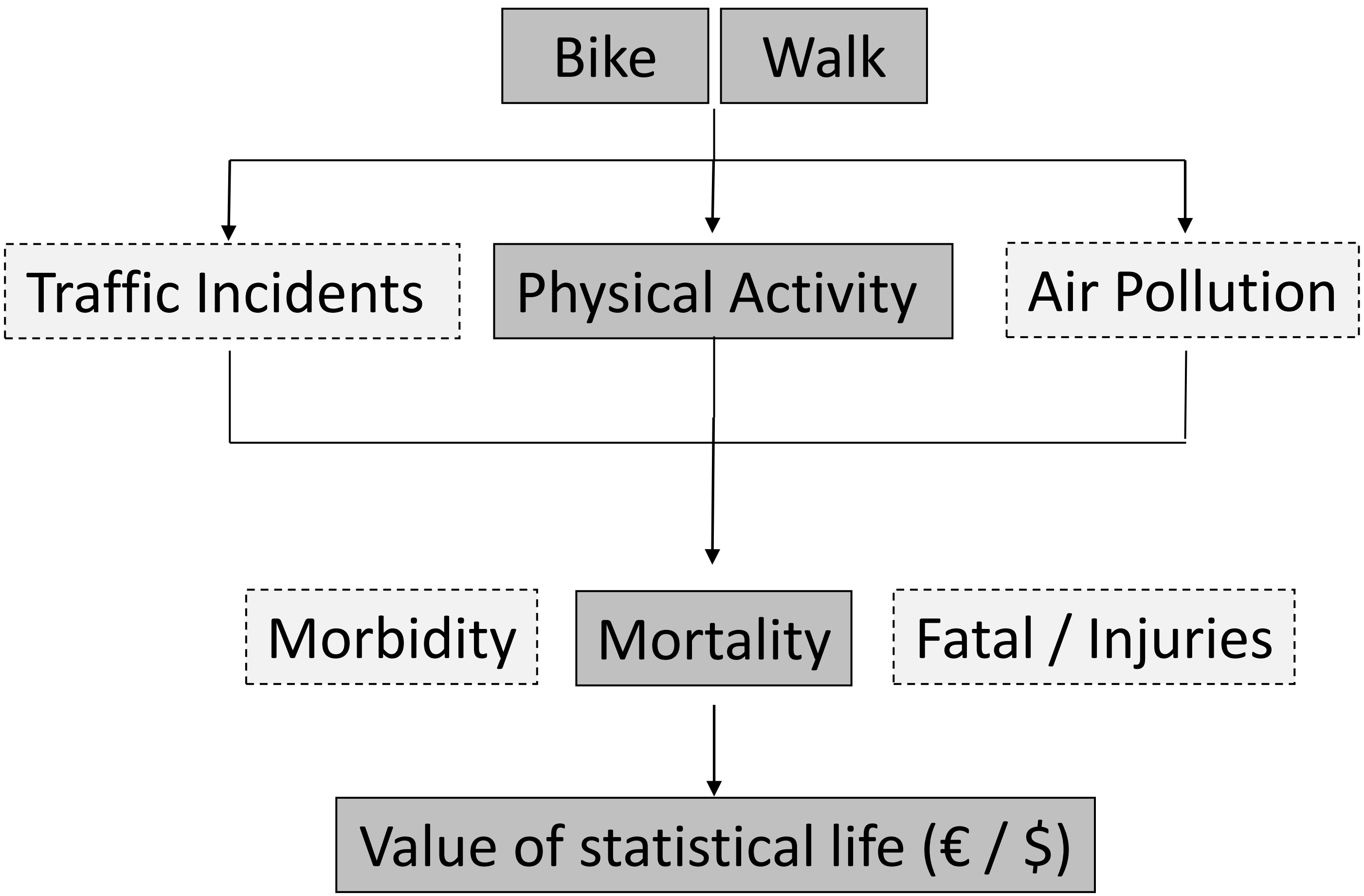
- Simplicity – input data
- Evidence-based
- Outcomes – mortality and costs

STRENGTHS

FIGURE 2. HEALTH PATHWAY CONTRIBUTION TO ESTIMATED HEALTH IMPACT OF ACTIVE TRANSPORT POLICIES



FUTURE HEAT



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CYCLING – GOTSCHI (2011)

Table 1 Key Figures and Results for 3 Investment Plans for Bicycling in Portland (Dollar Figures are in Millions of 2008 Dollars)

	Basic	80%	World Class
Investment costs (after discounting; incl. past)	$138	$296	$605
Projected mode share by 2030	15%	20%	25%
Max. annual bike miles (2030–2040)	86M	116M	145M
Max. daily bike trips (3km trip length)	60,000	80,000	100,000
Cumulative bike miles 1991–2040	2200M	2800M	3400M
Cumulative health care savings 1991–2040	$388	$491	$594
Cumulative fuel savings 1991–2040	$143	$180	$218
Cumulative net benefits 1991–2040	$394	$375	$207
Year to break even	2015	2015	2032
Annual lives saved (1991–2040 average)	42	55	68
Annual value of statistical lives saved (1991–2040 average)	$147	$196	$245
Cumulative value of statistical lives saved (1991–2040)	$7350	$9800	$12,250
Benefit-cost ratio for health care + fuel savings	3.8	2.3	1.3
Benefit-cost ratio for value of statistical lives saved	53.3	33.1	20.2

Gotschi T. Costs and benefits of bicycling investments in Portland, Oregon. *J Phys Act Health*. 2011;8 Suppl 1(Suppl 1):S49–58.