HEALTH ECONOMIC ASSESSMENT OF A SCENARIO OF INCREASED BICYCLING

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OBJECTIVES

Aims:

1. Firstly, conduct a cost-effectiveness analysis by comparing planned investments costs in bicycle infrastructure with expected changes in health care costs as a result of a proportional increase of bicyclists.
2. Secondly, conduct an economic assessment including expected changes in mortality using value of statistical life measure.

SETTING

- Sustainable Development Goals Agenda 2030
  - Three pillars: Economic, Environmental and Social

- Currently in Stockholm County
  - Number of inhabitants 2.2 million, out of which 6 % commute by bicyle and 38 % by car daily.

- Cost-effectiveness analysis compares the investment costs against the expected health benefits.
- In Sweden the accepted threshold for determining the effectiveness of an intervention is 500,000 SEK per DALY averted.

CREATING THE SCENARIO – HEALTH BENEFITS

- According to a scenario created by Sommar et al. (2018) 111,000 individuals currently commuting by car were identified to have the physical capacity to bicycle instead between home and work in ≤30 minutes.
- Health impacts were estimated due to resulting changes in:

  - Increased physical activity

  - Air pollution exposure change among bicyclists, current bicyclists and the general population.

  - Increased risk of accidents among new cyclists (Nilsson,2016)

- Disability Adjusted Life Years (DALYs)* was used as the measure of impact.

** DALY weights were retrived from the Global Burden of Disease study.*

INVESTMENT COSTS

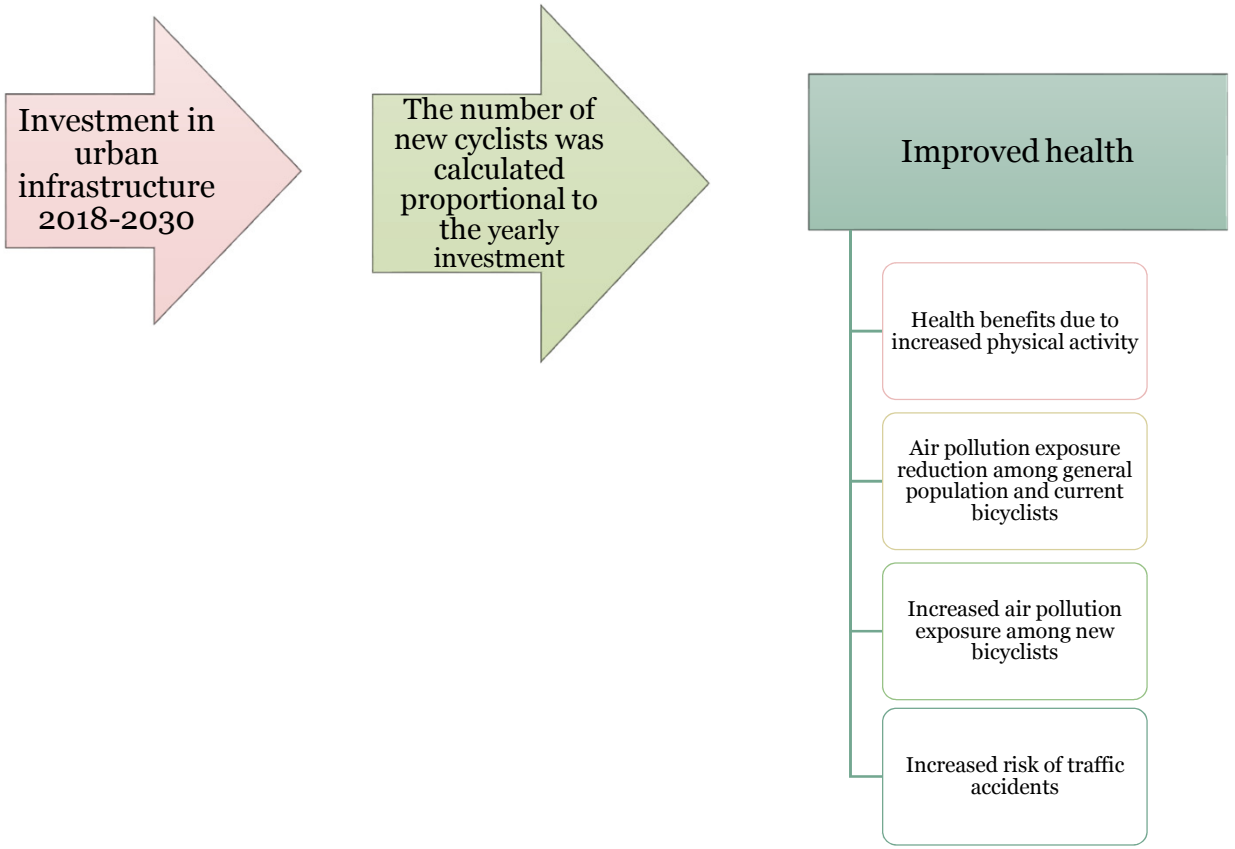
- The Stockholm Traffic Planning Office has an ambitious plan to increase the number of every day bicyclists by 15% from currently 6-7% within the coming 12 years. Main measure to increase bicyclists is to invest into physical infrastructure change. The estimated investment into infrastructure was calculated to be 153€ million.

  - Yearly planned investment costs were obtained and based on the current number of bicyclists we calculated the investment cost per bicyclist to achieve the goal. Resulting in 908€ per bicyclist.
  - Timeline for the investment: 2018-2030
  - **CONSOLIDATED HEALTH ECONOMIC EVALUATION REPORTING STANDARDS (CHEERS) STATEMENT**

HEALTH CARE COSTS AND VALUE OF A STATISTCAL LIFE

- A literature review using *Pubmed* and *Web of Science was used* to obtain lifetime costs for the following chronic diseases:
  - Myocardial infarction
  - Stroke
  - Diabetes type II
  - Dementia
  - Breast cancer
  - Lung cancer
  - Asthma
- Example of a search term: diabetes AND ("lifetime costs" OR "health care costs" OR "cost-of-illness")
- For mortality a Value of Statistical Life of 3.6 million € was used
  - Based in a OECD meta-estimate of willingness-to-pay studies in 27 EU countries

CALCULATING EXPECTED YEARLY HEALTH IMPACTS



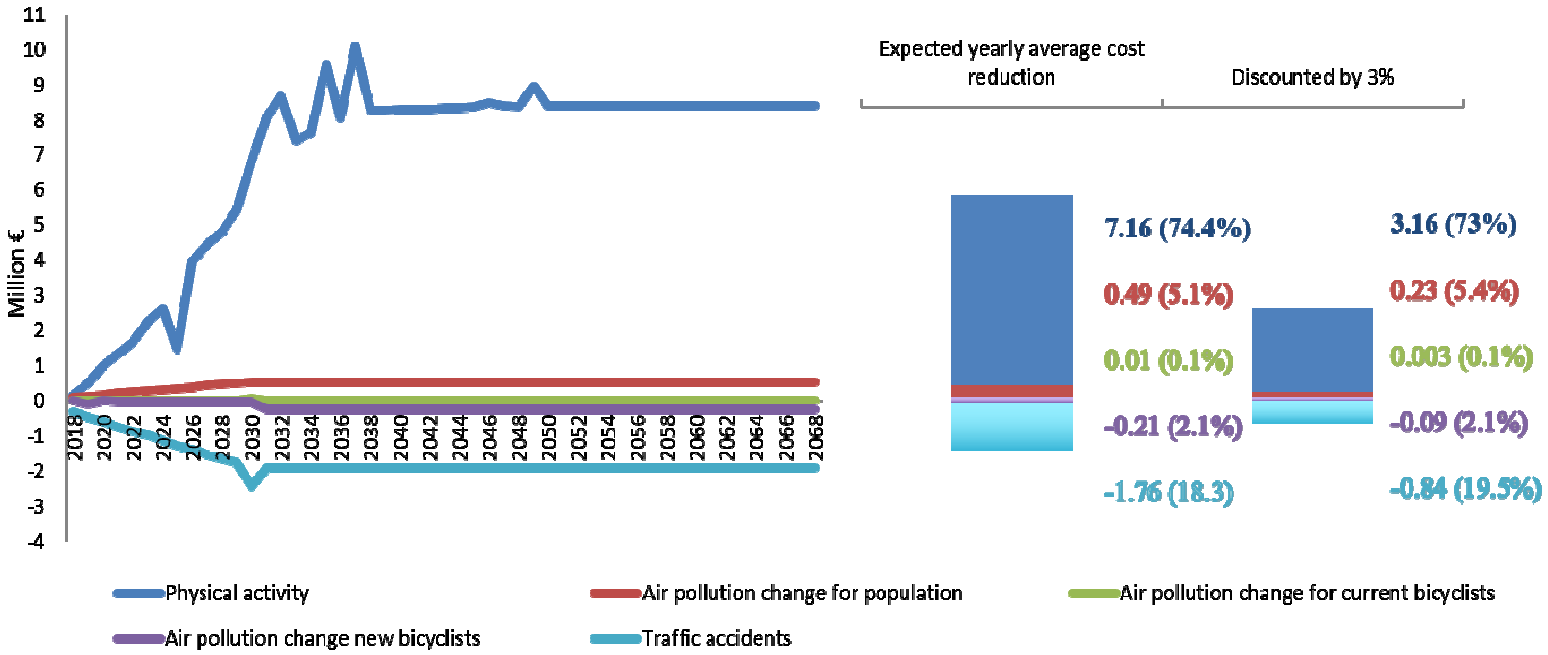
DISEASE COSTS AND NUMBER OF CASES AVERTED

Disease	Number of cases averted	Life-time costs €/2017	Reference
Diabetes type II	48.6	83 155	Zhou et al. (2013)
Stroke	10.6	74 125	Ghatnekar et al.(2014)
Dementia	0.7	13 765	Yang et al.(2012)
Myocardial infarction	18.2	147 262	Walker et al.(2016)
Heart failure	7.3	113 975	Dunlay et al.(2011)
Breast cancer	3.8	21 177*	Yabroff et al.(2008)
Colon cancer	3.4	42 446*	Yabroff et al. (2008)
Lung cancer	0.78	43 211*	Yabroff el al. (2008)
Asthma	0.16	49 528**	Jabob et al. (2016)

CALCULATING EXPECTED YEARLY HEALTH IMPACTS DURING THE PERIOD OF INVESTMENT

Year	Investment million€	Number of bicyclists	Physical activity	Traffic accidents	Air pollution exposure among new bicyclists	Air pollution exposure among the current bicyclists	Air pollution exposure within the population
2018	32	18773	140126	-323608	-7393	1002	90102
2019	15	8874	487031	- 476584	-10888	1476	132695
2020	12	7024	1008959	-597677	-13654	1851	166411
2021	15	9037	1340658	-753458	-17213	2334	209785
2022	13	7530	1658014	-883275	-20178	2736	245930
2023	10	6024	2258377	-987128	-22551	3058	274846
2024	15	9037	2623113	-1142909	-26110	3541	318220
2025	13	7530	3364367	-1272726	-29075	3943	354365
2026	10	6024	3962670	-1376850	-31448	4265	383281
2027	15	9037	4433356	-1532360	-35007	4748	426655
2028	13	7530	4822841	-1662177	-37973	5150	462800
2029	10	6024	5412764	-1766031	-40345	5472	491716
2030	15	9037	5993742	-2441079	-43904	5884	535090
….	185	111487					
2068			29 5521888	-42 117 426	- 4 479 947	11 628 310	158 618

ESTIMATED AVERTED HEALTH CARE COSTS



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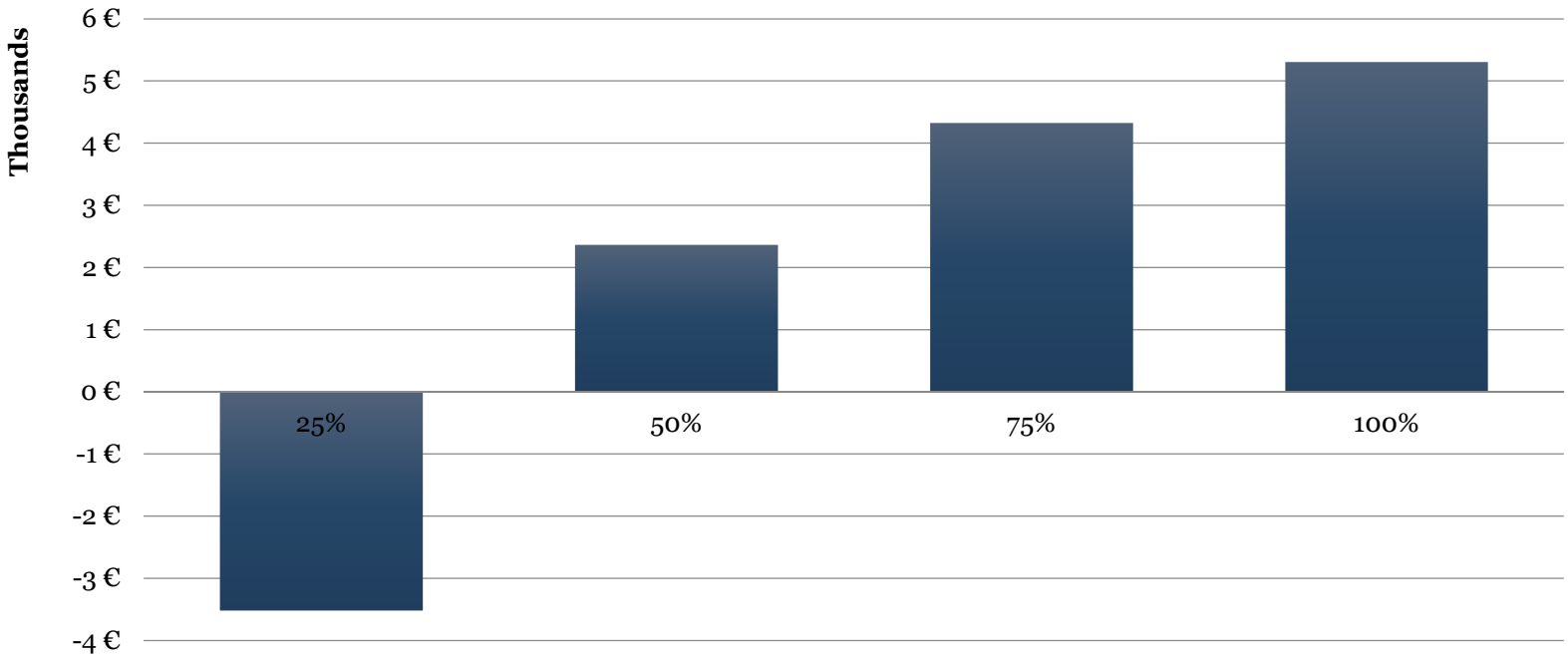
ESTIMATED ECONOMIC BENEFITS

- Cost-effectivness ratio of averted health care cost per DALY:
    - A surplus of **5309€/DALY** per averted
- Adding also mortality outcomes using VSL a **1 to 11€** cost-benefit ratio was obtained.
- 3.5 % of Stockholm County's health care budget (2017) could be reallocated to opportunity costs

SENSITIVITY ANALYSIS

FIGURE 1. CER CHANGE WHEN MODIFYING THE NUMBER OF BICYCLISTS



LIMITATIONS

- Cost estimates based on cost-of-illness studies from the literature.
- Health care perspective – underestimating the potential economic gains.

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