ASSESSING THE HEALTH BENEFITS OF URBAN REGENERATION: A CASE OF TALLINN CITY CENTRE

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DETERMINANTS OF HEALTH AND WELL-BEING

The determinants of health and well-being in our cities

Barton & Grant, 2006
HOW URBAN ENVIRONMENT IMPACTS OUR HEALTH

Müller et al., 2017

Health conditions associated with air pollution, noise, temperature
and a lack of physical activity, natural spaces

Head
- stroke
- cerebrovascular diseases
- mental health
- neurodegenerative diseases
- autism, child behaviour problems
- cognitive impairment

Heart
- myocardial infarction
- arrhythmia
- cardiovascular diseases

Arteries
- hypertension

General
- sleep disturbance and annoyance
- labour and traffic incidents with injury
- obesity
- diabetes
- thrombosis
- systemic inflammation
- increase in mortality

Respiratory tract
- lung cancer
- asthma
- respiratory diseases

Breast
- breast cancer

Reproductive system and fetus
- low birth weight
- preterm birth
- lower sperm quality

Digestive system
- colon cancer
NOT ONLY BAD THINGS – URBAN ADVANTAGES

• Best possible medical care
• Better sanitary services
• Active social life
• Better access to public services
• Better strategic planning
The process of improving derelict or dilapidated districts of a city, typically through redevelopment
HERALD SQUARE, NEW YORK
LONDON, UK
NOT ALWAYS SUCCESSFUL – KANGBASHI, CHINA
TALLINN „NEW MAIN STREET“ IN 2020

Paaver et al., 2016
AIMS

• Assess the health benefits through:
  o Improved air quality
  o Reduced noise levels
  o Enlarged active commuting
ALTERNATIVES

• **V0** – o-alternative, where traffic management as today (2+2 lanes for cars/buses and in the middle 1+1 lanes for trams)

• **V1** – Main alternative, where 1+1 lanes for cars and public transport counts as today with separate 1+1 lanes

• **V2** – Additional alternative, where main street closed for car traffic (only public transportation)

• **V3** – Future car technology alternative (2030)

• **V4** – Future car technology and buildings alternative (2030)

• **V5** – Future cars/buildings/residents alternative (2030)
HEALTH IMPACT ASSESSMENT CONCEPT

Health impact assessment

Exposure + Baseline mortality & morbidity + Exposure/response function = Number of attributable (premature) cases

Epidemiological study

Mortality & morbidity difference + Exposure difference = Exposure/response function

Observed level: annual mean

Reference level

Scenarios

Attributable cases

E-R function
METHODS – HIA CALCULATIONS

• Health risks were calculated based on HIA principles using equations and AirQ+ and software and HEAT-tool (*health economic assessment tools*)

• For air pollution exposures the micro-environmental exposure concept was applied (Kornartit et al., 2010)

• For air pollution and non-external mortality the following E-R coefficients were used:
  o 5.5% per 10 μgm⁻³ increase of NOₓ (WHO, 2013)
  o 1.68% per 10 μgm⁻³ increase of coarse (non-exhaust) PM₁₀ (Meister *et al.*, 2012)

• For noise and non-external mortality the following E-R coefficient was used:
  o 4.0% increase in areas with noise levels 60 dB compared to areas 55 dB (Halonen *et al.*, 2015)

• For active commuting and mortality the following E-R coefficient was used:
  o 10-16% decrease in mortality cycling 11.25 MET-hours per week or walking 11.25 MET-hours per week
AIR POLLUTION MODELLING ($\text{NO}_2^*$)

Current situation

Difference between current situation and main-alternative

*annual average concentration ($\mu$g/m$^3$)
TRAFFIC MODELLING
NOISE MODELLING*

Current situation

Main alternative

*Day-time noise, 7.00-23.00 (dB)
RESIDENTS AND DAILY POPULATION*

*Based on 2011 population count data
PEDESTRIANS AND PEOPLE IN PUBLIC TRANSPORTATION*

*Time in public transport based on Rannala, 2016, number of passengers based on Transport Board data
## Premature Deaths Annually (95% CI)

<table>
<thead>
<tr>
<th></th>
<th>NO$_2$ Exposure</th>
<th>PM$_{2.5-10}$ Exposure</th>
<th>Noise Exposure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Residents</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>V0 – o-alternative</td>
<td>9.48 (5.56–13.26)</td>
<td>1.19 (0.14–2.15)</td>
<td>1.94 (0.24–3.16)</td>
</tr>
<tr>
<td>V1 – Main alternative</td>
<td>9.28 (5.43–12.98)</td>
<td>1.15 (0.14–2.07)</td>
<td>1.86 (0.23–3.02)</td>
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<tr>
<td>Daily population</td>
<td></td>
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<tr>
<td>V0 – o-alternative</td>
<td>14.02 (8.21–19.62)</td>
<td>1.66 (0.20–3.00)</td>
<td>2.21 (0.28–3.60)</td>
</tr>
<tr>
<td>V1 – Main alternative</td>
<td>13.59 (7.95–19.00)</td>
<td>1.59 (0.19–2.87)</td>
<td>2.09 (0.26–3.40)</td>
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<tr>
<td>Pedestrians</td>
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<tr>
<td>V0 – o-alternative</td>
<td>0.64 (0.37–0.90)</td>
<td>0.21 (0.04–0.38)</td>
<td>0.39 (0.05–0.64)</td>
</tr>
<tr>
<td>V1 – Main alternative</td>
<td>0.53 (0.31–0.74)</td>
<td>0.17 (0.03–0.31)</td>
<td>0.34 (0.04–0.55)</td>
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<tr>
<td>People in public transportation</td>
<td></td>
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<tr>
<td>V0 – o-alternative</td>
<td>0.09 (0.05–0.13)</td>
<td>0.03 (0.01–0.05)</td>
<td>0.01 (&lt;0.00–0.02)</td>
</tr>
<tr>
<td>V1 – Main alternative</td>
<td>0.07 (0.04–0.11)</td>
<td>0.02 (0.01–0.04)</td>
<td>0.01 (&lt;0.00–0.02)</td>
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</tbody>
</table>
## DECREASE OF PREMATURE DEATHS ANNUALLY (95% CI)

<table>
<thead>
<tr>
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<th>Decrease of premature deaths compared to inactivity</th>
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<tbody>
<tr>
<td><strong>Pedestrians</strong></td>
<td></td>
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<tr>
<td>0-alternative</td>
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<tr>
<td>6000 pedestrians, each active 15 minutes daily</td>
<td>2.97</td>
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<tr>
<td><strong>Increase number of pedestrians by 50%</strong></td>
<td></td>
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<tr>
<td>9000 pedestrians, each active 15 minutes daily</td>
<td>4.47</td>
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<tr>
<td><strong>Increase walking time by 33%</strong>, 6000 pedestrians, each active 20 minutes daily</td>
<td>3.96</td>
</tr>
<tr>
<td><strong>Cyclists</strong></td>
<td></td>
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<tr>
<td>0-alternative</td>
<td></td>
</tr>
<tr>
<td>There were 4 cyclists on Google Street View. At spring/summer this would mean 100 cyclists daily</td>
<td>0.02</td>
</tr>
<tr>
<td><strong>5%-alternative</strong></td>
<td></td>
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<tr>
<td>Increase bikers to 5% of commuters (900 cyclists), each active 15 minutes at spring/summer seasons</td>
<td>0.22</td>
</tr>
<tr>
<td><strong>10%-alternative</strong></td>
<td></td>
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<tr>
<td>Increase bikers to 10% of commuters (1800 cyclists), each active 15 minutes at spring/summer seasons</td>
<td>0.44</td>
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CONCLUSIONS

• Tallinn New Main Street will decrease air pollution and noise
  o Even air pollution and noise will increase in areas bordering Main Street the total effects is positive

• Currently air pollution and noise is inducing in Main Street area up to 30.0 (95% CI 15.0–43.7) premature deaths annually
  o Realization of main-alternative would decrease the number of premature deaths by 1.1 cases, most of which is due to the decrease in the traffic exhaust exposure

• Currently every day 6,000 people are crossing the street in Tallinn Main Street areas
  o If those people would be one third more physically active or the number of pedestrians would increase by one third, one more premature death could
THANK YOU!