The ELLIS project: Monitoring and Mitigating Environmental Health Inequalities in Belgium

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Objectives

1. **Study the extent** of socioeconomic differences in environmental burden of disease
2. **Develop a tool** to assess the impact of policy measures on the extent of and inequalities in environmental burden of disease
Environmental Health Inequalities
Environmental Health Inequalities

Environmental Health Inequalities

Health Inequalities
Data by stat. sector → Environmental burden of disease (PAF) → Inequalities in EBD
PhD 1 — Multiple deprivation and health inequalities in Belgium

[Y1] Socioeconomic deprivation
[Y2] Health outcomes
[Y3] Health inequalities
[Y4] Ecological bias

PhD 2 — Environmental inequalities and burden of disease in Belgium

[Y1] Environmental exposure
[Y2] Policy scenarios
[Y3] Comparative risk assessment
[Y4] Scenario analyses

Knowledge translation and policy transfer
Multiple deprivation and health inequalities in Belgium
<table>
<thead>
<tr>
<th>Employment</th>
<th>Income</th>
<th>Crime</th>
<th>Housing</th>
<th>Education</th>
<th>Health</th>
</tr>
</thead>
<tbody>
<tr>
<td>Working-age population who is unemployed (25-64)</td>
<td>Individuals with low income</td>
<td>Property crime</td>
<td>Proportion of dwellings with: less than 1 room per inhabitant</td>
<td>NEET indicator</td>
<td>Standardized mortality ratio</td>
</tr>
<tr>
<td>Working-age population who is classified as disabled or receiving long-term disability benefits</td>
<td>Households with net taxable income below the minimum living wage</td>
<td>Family violence</td>
<td>smaller than 35 m²</td>
<td>School leavers &lt; 18 years old</td>
<td>Standardized suicide rate</td>
</tr>
<tr>
<td></td>
<td>Proportion of individuals with increased compensation in compulsory health insurance</td>
<td>Violent crimes</td>
<td>inhabited by tenants</td>
<td>School leavers between 18-24 years of age</td>
<td>Number of ATB packs reimbursed per 1000 beneficiaries</td>
</tr>
<tr>
<td></td>
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<td>Drug-related crimes</td>
<td>without central heating</td>
<td>Working-age individuals without no or low levels of formal qualification</td>
<td>Number of antidepressants and psychotics per 1000 beneficiaries</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Fraud</td>
<td>kitchen</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Factor analysis used to generate weights to combine indicators into the domain scores for each statistical sector.

Domain scores ranked to create a domain rank. Each domain score is standardized and transformed to an exponential distribution and these values are combined using weights.

24.75%  24.75%  10.33%  14.92%  14.92%  10.33%

This creates the overall Index of Multiple Deprivation score for each statistical sector, which is ranked to create the overall Index of Multiple Deprivation rank.
Environmental inequalities and burden of disease in Belgium
• Spatial variability of environmental stressors
  • Identify co-occurrence & hotspots
  • Where are exceedances a problem?
• Environmental burden of disease
  • Disability-Adjusted Life Years
• Environmental inequalities in Belgium
  • Suite of inequality indices
2018 Annual Nitrogen Dioxide Concentrations per Statistical Sector ($\mu g/m^3$)

$$\text{PAF} = \frac{\int P(x)RR(x)dx - 1}{\int P(x)RR(x)dx}$$

Male ASMRs per 100,000 person-years
Suitable to put in interactive monitoring and simulation tool in the framework of the ELLIS project.

In cooperation with stakeholders: define scenario’s, Different methods to reach the percentages of the modal shift can be included in the model (e.g. road pricing, investment in public transport, investment in bicycle infrastructure, …)

For all the interventions, it can be assessed 1) how the environmental burden of disease can be mitigated and 2) how environmental health inequalities can be mitigated.

Mitigation Model: Generic Model - Modal Shift Scenario’s

Transport Scenarios
- Car-use +30%, public transport -20%, cycling -10%
- Car-use +20%, public transport -10%, cycling -10%
- Car-use +10%, public transport -5%, car-use -5%
- Status quo (0%)

Transport Scenarios
- Car-use -10%, public transport 0%, cycling +10%
- Car-use -10%, public transport +5%, cycling +5%
- Car-use -20%, public transport +10%, cycling +10%
- Car-use -30%, public transport +20%, cycling +10%
- Car-use -40%, public transport +30%, cycling +20%
- Car-use -50%, public transport +35%, cycling +25%
- Car-use -60%, public transport +30%, cycling +30%

Cumulative exposure
Air pollution, noise pollution, cold stress, heat stress, land cover, access to green areas, proximity to roads, ...

Confounding factors
BMI, physical activity, diabetes, ...

Traffic fatalities and injuries

Health Outcomes
- Ischemic Heart Disease, Ischemic Stroke
- Colon Cancer
- Diabetes
- …

DALYs
Next steps

• Publish Belgian Index of Multiple Deprivation
• Estimate Environmental Burden of Disease
• Estimate Environmental Health Inequalities
• Implement mitigation model
• Develop online visualisation tool
follow our progress
https://www.brain-ellis.be/blog
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