Influence of changes in socioeconomic and climatic conditions on future heat-related health impacts in Europe

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Scenarios and risk framework

### Socioeconomic scenarios – European SSPs

<table>
<thead>
<tr>
<th>Climate scenarios – RCPs</th>
<th>Eu-SSP1</th>
<th>Eu-SSP3</th>
<th>Eu-SSP4</th>
<th>Eu-SSP5</th>
</tr>
</thead>
<tbody>
<tr>
<td>RCP2.6</td>
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<tr>
<td>RCP4.5</td>
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<tr>
<td>RCP8.5</td>
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</tbody>
</table>

### Climate scenarios
- RCP2.6
- RCP4.5
- RCP8.5

### Socioeconomic scenarios
- Income
- Education
- Ageing
- Urbanization
- Social isolation
- Overweight

### Health-related health risk

- Heat wave days

- Population
Spatial and temporal scales

- Time-horizon of 2050
- 25 European countries
- Spatial resolution of 0.1°
Projections of heat hazard

Basis of every climate impacts study.

Rather “easy” task thanks to widely-available climate projections from the EURO-CORDEX experiment.
Projections of vulnerability and exposure

Where to get the data from?

SSPs mostly quantified at national-scale only, and for a few socioeconomic variables

→ Requires innovative modelling and downscaling approaches

- Population and GDP: Downscaling of national-level projections with regionalization scenarios
- Urbanization: regional urban growth model based on assumptions of age groups-specific residential preferences
- Ageing and education: downscaling of national-level projections based on benchmark of current statistics
- Overweight and social isolation: semi-quantitative approach with correlation analyses and experts’ elicitation + fuzzy set theory
Spatially-explicit projections of vulnerability
Future heat-related health risk under SSP*RCP combinations (risk scenarios)
Density of people at very high risk

People at very high risk only

[Map showing density across different scenarios and regions]
Contribution of climate change vs socioeconomic change

Based on baseline conditions (year 2010)

Climate effect ➔ assume baseline socioeconomic conditions

Population effect ➔ assume baseline climatic conditions
Closer look at influence of changes in vulnerability

Key findings:

Influence of changes in vulnerability outweighs changes in exposure

Benefits of shifting towards lower social vulnerability (SSP1) are comparable to strong mitigation options (shift from higher to lower RCP)

Benefits of mitigation strategies can be annihilated by certain types of socioeconomic development pathways (e.g. SSP4)
Conclusions and future work

Integration of future socioeconomic conditions in climate impact research is crucial, and should not be constrained to changes in population exposure only, but should also integrate changes in vulnerability

→ Easier said than done!

Ongoing study: Projections of heat stress risk in 180 large African cities under different combinations of SSPs and RCPs, until 2100

Innovative modelling approaches to produce projections of vulnerability drivers under different socioeconomic scenarios are needed – particularly in data-poor environment – to enable a wider use of vulnerability scenarios and to better understand the role that socioeconomic development plays in shaping future climate risks
Thanks!

Questions?


G Rohat, J Flacke, H Dao, M van Maarseveen (Under Review) Co-use of existing scenario sets to extend and quantify the Shared Socioeconomic Pathways, *Climatic Change*.


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Supplementary slides


G Rohat, J Flacke, H Dao, M van Maarseveen (Under Review) Co-use of existing scenario sets to extend and quantify the Shared Socioeconomic Pathways, *Climatic Change*.


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Experts’ elicitation – online questionnaire

420 experts in living arrangements (29 “usable” answers)
Fuzzy set theory

Overweight prevalence (%)

Min
Max
Median

High increase [+ +]

High decrease [- -]

Center of gravity

(63.3%)

(45.1%)
## Computation of adjustment factors

→ Use center of gravity and current statistics

<table>
<thead>
<tr>
<th>Variable</th>
<th>Area</th>
<th>Trend</th>
<th>Center of gravity</th>
<th>Adjustment factor (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overweight prevalence</td>
<td>Europe</td>
<td>Large increase</td>
<td>63.3</td>
<td>+19.5</td>
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<tr>
<td></td>
<td></td>
<td>Increase</td>
<td>55.8</td>
<td>+0.1</td>
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<tr>
<td></td>
<td></td>
<td>Decrease</td>
<td>51.3</td>
<td>-14.1</td>
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<tr>
<td></td>
<td></td>
<td>Large decrease</td>
<td>45</td>
<td>-27.6</td>
</tr>
<tr>
<td>Proportion of elderly living alone</td>
<td>Northern Europe</td>
<td>Increase</td>
<td>46.6</td>
<td>+16.7</td>
</tr>
<tr>
<td></td>
<td>Central/Western Europe</td>
<td>Decrease</td>
<td>33.6</td>
<td>-15.8</td>
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<tr>
<td></td>
<td></td>
<td>Large increase</td>
<td>42.7</td>
<td>+29.3</td>
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<td></td>
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<td>Increase</td>
<td>39.5</td>
<td>+19.7</td>
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<tr>
<td></td>
<td></td>
<td>Decrease</td>
<td>30.8</td>
<td>-6.5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Large decrease</td>
<td>26.7</td>
<td>-19.2</td>
</tr>
<tr>
<td></td>
<td>Southern Europe</td>
<td>Large increase</td>
<td>34.5</td>
<td>+38.0</td>
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<tr>
<td></td>
<td></td>
<td>Increase</td>
<td>29.3</td>
<td>+17.3</td>
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<tr>
<td></td>
<td></td>
<td>Decrease</td>
<td>23.7</td>
<td>-5.3</td>
</tr>
</tbody>
</table>
Future heat-related health risk