Does social expenditure mitigate the effect of environmental shocks on health?

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• Extreme high/low temperatures are known to have adverse effects on health, especially among the young and elderly.
  • Temperatures are growing and this may lead to higher extreme temperatures.
  • These issues are emphasized by population aging.
• Policy makers should address services that allow to offset the effect of extreme temperatures.
  • Social care services may allow to reduce hospitalizations if they foster the utilization of home and nursing home care services by the elderly.
Temperatures and health:

- Extreme temperatures increase mortality and hospital admission rates (Deschênes and Moretti, 2009, Karlsson and Ziebarth, 2018).
  - Cardiovascular and respiratory systems more stressed (Basu and Samet, 2002).
  - Elderly more exposed because of less responsive body thermo-regulation (Kenney and Hodgson, 1987).
- Long-run exposure to extreme temperatures makes population more resilient against weather thanks to offsetting behavior and reduces mortality rates (Barreca et al., 2016).
  - However, outdoor workers still exposed to heat-related diseases (Dillender, 2017).

Social expenditure and health:
What we do

- We analyze the effect of temperatures on emergency hospitalization rates for cardiovascular and respiratory diseases among the elderly in Italy.
  - We use both temperature levels and deviations from municipality mean temperatures to account for local resilience.
- We investigate the role of municipal public social expenditure in mitigating the effect of extreme temperatures.
Institutional setting

**Hospital care:**

- The Italian NHS provides universal coverage for health care services funded by revenues from taxation (mainly VAT).
- Emergencies are treated in emergency wards, freely accessible.
  - Call center for emergencies that do not allow the sick person to reach the hospital.

**Social expenditure:**

- Mainly performed by municipal governments, but with regional guidelines.
- Funds services for families, the disabled and the elderly.
  - The elderly consume 25% of resources on average.
  - The main services for the elderly are home and nursing home care, and proximity services.
Data

**Hospital admissions:**

- Monthly hospital discharge data for cardiovascular and respiratory diseases of elderly people aggregated by municipality for the period Jan 2001 - Dec 2015 provided by the Italian Ministry of Health.

**Temperature data:**

- Global Summary Of the Day (GSOD) data by weather station (at least one per province) provided by NOAA.

**Other data:**

- Municipal government social expenditure (Ministry of the Interior)
- Demographic municipality characteristics (ISTAT)
- Personal income (Ministry of Economics and Finance)
Table 1: Emergency hospital admission rates by disease

<table>
<thead>
<tr>
<th>Disease</th>
<th>Obs</th>
<th>Mean</th>
<th>SD</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cardiovascular</td>
<td>1308024</td>
<td>43.638</td>
<td>21.763</td>
<td>0</td>
<td>2000</td>
</tr>
<tr>
<td>Respiratory</td>
<td>1308024</td>
<td>17.293</td>
<td>12.860</td>
<td>0</td>
<td>1250</td>
</tr>
</tbody>
</table>

Notes - Monthly emergency hospital admission rates per 10,000 elderly for the period Jan 2001 - Dec 2015. Statistics weighted by elderly population.
Temperature measures

Average daily temperature in a municipality:

\[ T_{id} = \frac{\sum_k w_{ik} T_{kd}}{\sum_k w_{ik}} \]  

(1)

with \( i \) denoting the municipality, \( d \) the day and \( k \) the weather station, and \( w_{ik} = 1/distance_{ik} \). Considered weather stations are those within 30 km from a municipality’s centroid.

Monthly temperature measures in a municipality:

Share of days in a month:

- within 10°F bins.
- within 0.4 std. dev. bins from municipal average temperature.
- within 0.2 std. dev. bins from municipal seasonal average temperature (robustness check).
  - positive dev. in Summer and negative dev. in Winter.
Model specification:

\[ \ln H_{ipmy} = \sum_j \beta_j T_{jimy} + x'_{imy} \gamma + \alpha_i + \theta_{my} + \rho_{pm} + \delta_p t_{pmy} + \varepsilon_{imy} \]  

(2)

with \( \ln H_{ipmy} \) being the log emergency hospital admission rate per 10,000 elderly for cardiovascular or respiratory diseases in municipality \( i \) in province \( p \) in month \( m \) and year \( y \).

\( T_{jimy} \) = share of days with temperature falling in bin \( j \).

\( x'_{imy} \) = average monthly precipitation, personal income.

Regressions weighted by elderly population.

Robust standard errors clustered by province → accounts for spatial correlation in temperatures.
Results

Seasonal

Elective

Cardiovascular - Levels

Respiratory - Levels

Cardiovascular - Deviations

Respiratory - Deviations

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Mitigating effect of social expenditure (1)

- We classify municipalities based on quintiles of per capita social expenditure lagged by 1 year.

- Classification by region and by year.
  - by region mitigates the effect of regional heterogeneity in regulation and spending levels.
  - by year allows to generate time-variant classes.

- We estimate Eq. 2 within each group of municipalities to assess the effect of social expenditure.
  - Together with the lagged social expenditure, this mitigates endogeneity of social expenditure due to reverse causality.
Regression results of log hospital admission rates by social expenditure quintiles
Conclusions

• Extremely hot and cold temperatures increase emergency hospital admissions for cardiovascular and respiratory diseases among the elderly.

• Public social expenditure does not appear to have a relevant role in mitigating this effect. Possible reasons:
  • The services provided are not effective in preventing temperature-related diseases.
  • Measurement error: we cannot precisely measure social expenditure for elderly services.

• Considering the aging trend, policymakers should identify measures that allow to reduce temperature-related diseases among the elderly:
  • promote heating/air-conditioning systems
  • informative campaigns to foster individual offsetting behavior
Thanks for the attention!

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Appendix
Yearly cycles in hospital admission rates

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Average hospital admission rates by municipality

Cardiovascular

Respiratory

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Seasonal temperature deviations

Cardiovascular - Seasonal deviations

Respiratory - Seasonal deviations

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Elective hospital admissions

Cardiovascular - Deviations

Respiratory - Deviations

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References


