Human Health Adaptation from Heat wave in South Korea

Mar 19, 2013

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Outline

1. Climate change impacts on health

2. Health adaptation strategy & tools for heat wave
1. Climate Change Impacts on Health

Potential health impacts from climate change

- Climate change is the biggest global health threat of the 21st century
  (source: The UCL-Lancet commission, 2009)

- Most expected health impacts from climate change will be adverse
  - Mainly, changes in frequency or severity of familiar health risks

(Source: Based on Patz et al, 2000, EHP; IPCC, 2007; Haines et al, 2004, JAMA)
1. Climate Change Impacts on Health

Why is heat wave a public health threat?

More intense and frequent hot weather events are expected as a consequence of predicted climate change (source: IPCC, 2007)

Fig. 1. The changes of temperature distribution in the future from climate change (source: McMichael AJ et al., 2006, Lancet)

Fig. 2. Schematic representation of how high temperature from climate change would affect annual total of temperature-related deaths (source: McMichael AJ et al., 2006, Lancet)

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## 1. Climate Change Impacts on Health

### Evidences in South Korea

#### Health impacts from high temperature due to climate change

| The current associations between high temperature and deaths | Jongsik Ha, Ho Kim. Changes in the association between summer temperature and mortality in Seoul, South Korea. International Journal Biometeorol. 2012 DOI:10.1007/s00484-012-0580-4  
1. Climate Change Impacts on Health

Evidences in South Korea

The current associations between high temperature and deaths

• The goal: The examination of the current associations between daily temperature and daily deaths in South Korea

• Main results

Fig. Temperature-mortality risk functions in South Korea
(source: Kim et al., 2006, STOTEN)

- High temperature is an important predictor of deaths in summer (Kim et al., 2006, STOTEN)

- High temperature has an effect on mortality, not advancing the date of adverse events by a few days (Ha J et al., 2011, STOTEN)

- Health effects of high temperature is higher in low mortality of previous winter than in high mortality of previous winter (Ha J et al., 2011, EHP)

- Health effects of high temperature is decreasing in Seoul, particularly during late summer (Ha J et al., 2012, IJB)
1. Climate Change Impacts on Health

Evidences in South Korea

Current death burden of high temperature

- **The goal**: The estimation of the current death burden of high temperature, considering current climate, population, and incidence

- **Main results**

  Table. Yearly death burden of high temperature in Seoul and Daegu
  (source: Ha J, 2012, JEHS)

<table>
<thead>
<tr>
<th>City</th>
<th>Definition of study period</th>
<th>Yearly attributable death on deaths</th>
<th>Yearly attributable burden of high temperature on deaths</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Population</td>
<td>Attributable death counts (95% CI)</td>
</tr>
<tr>
<td>Seoul</td>
<td>1996-2010</td>
<td>10,066,343</td>
<td>60 (39 - 82)</td>
</tr>
<tr>
<td></td>
<td>1996-2000</td>
<td>10,095,278</td>
<td>85 (48 - 121)</td>
</tr>
<tr>
<td></td>
<td>2001-2005</td>
<td>10,041,178</td>
<td>72 (35 - 129)</td>
</tr>
<tr>
<td></td>
<td>2006-2010</td>
<td>10,062,574</td>
<td>77 (41 - 64)</td>
</tr>
<tr>
<td>Daegu</td>
<td>1996-2010</td>
<td>2,503,126</td>
<td>28 (16 - 40)</td>
</tr>
<tr>
<td></td>
<td>1996-2000</td>
<td>2,505,501</td>
<td>18 (-3 - 38)</td>
</tr>
<tr>
<td></td>
<td>2001-2005</td>
<td>2,526,268</td>
<td>42 (20 - 62)</td>
</tr>
<tr>
<td></td>
<td>2006-2010</td>
<td>2,477,809</td>
<td>17 (-7 - 39)</td>
</tr>
</tbody>
</table>

※ definitions of threshold: 80th percentile of daily mean temperature in summers of study period

- **Implication**

  - Adaptation strategies and policies should be a priority in communities, where death burden is high
  (source: Ha J, 2012, JEHS)
1. Climate Change Impacts on Health

Evidences in South Korea

Future death burden of high temperature due to climate change

- The goal: The prediction of the future death burden of high temperature from climate change, considering future climate, population, incidence, and adaptation

- Main results

  Fig. Yearly death burden of high temperature in Seoul, based on the relationship in 1996-2010 (source: Yang J and Ha J*, 2013, JEHS)

- Implication

  - In the future, high temperature would be a risk factor on deaths due to climate change

    (source: Yang J and Ha J*, 2013, JEHS)
Outline

1. Climate change impacts on health
2. Health adaptation strategy & tools for heat wave
2. Health adaptation strategy & tools for heat wave

National Climate Change Adaptation Strategies (NCCAS)

Extreme heat response plan to prevent impacts from heat wave

Adaptation strategy structure

NCCAS in 7 sectors

- Health
- Disaster
- Agriculture
- Forest
- Ocean/Fisheries
- Water management
- Ecosystem

Heat wave / UV rays

- Meteorological disasters
- Infectious disease
- Air pollution / Chemicals
- Allergy

Adaptation tools

- Extreme heat watch warning system
- Heat shelter, Heat break
- Health care guidelines & Manuals for guide
- Heat health impacts surveillance system

according to
Extreme heat response plan

Human Health Adaptation from Heat wave in South Korea
2. Health adaptation strategy & tools for heat wave

Extreme heat response plan when heat wave hits

Organization chart of Extreme heat response plan

Control Agency
(Center disaster and safety countermeasures headquarters)

Overall Situation Task
(National Emergency Management Agency, Local government)
- Heat wave situation control
- Inspection of plan
- Networking for plan

Health Management Task
(Ministry of Health & Welfare, local government)
- Visiting health care program
- Health care guideline
- Heat health impacts surveillance system

Infrastructure Management Task
(Ministry of Agriculture and Forestry, Ministry of National Defense, Ministry of Education, Science and Technology, Ministry of Knowledge Economy)

...
2. Health adaptation strategy & tools for heat wave

Definition of Heat wave

Extreme heat watch/warning system
- Operation by Korea Meteorological Administration from 2007
- Temporal resolution: daily (June 1 ~ September 30)
- Spatial resolution: lower level local government (si / gun / gu)
- Watch & Warning criteria

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Watch</td>
<td>In case of being expected to hold out 2 days in ≥33°C of daily max temperature from June to September</td>
</tr>
<tr>
<td>Warning</td>
<td>In case of being expected to hold out 2 days in ≥35°C of daily max temperature from June to September</td>
</tr>
</tbody>
</table>

- Main actions
  - Breaking news on public TV
  - Notification to the related agency

Fig. Breaking news in public TV
Fig. Frequency of heat wave in 2012
2. Health adaptation strategy & tools for heat wave

Main adaptation tools of Ministry of Health & Welfare and Local government

Materials to prevent health impacts from heat wave

Health care guidelines for general population

Health care guidelines for the elderly

Manuals for guide on how to deal with heat waves

For elderly nursing homes

For child care teacher

For heat wave guide

Human Health Adaptation from Heat wave in South Korea
Main adaptation tools of Ministry of Health & Welfare and Local government

Visiting health care program for the elderly
- Management by public health center in lower level local government (si/gun/gu)
  (※Visiting health care worker, elderly helper)
- Operating period: when heat wave hits in June 1 ~ September 30
- Visiting health subjects (154,000 people in 2012)
  · Single elderly, disabled
- Main actions
  · Calling to subjects
  · A personal visit for health care
  · Network of emergency contacts
    (recipient–elderly helper–recipient relative)

Fig. visiting health care for the elderly
Main adaptation tools of Ministry of Health & Welfare and Local government

Heat health impacts surveillance system
- Surveillance based on emergency medical treatment center (458 in 2012)
- Operating period: June 1 ~ September 30
- Reported information: daily thermal patient counts with sex, age, address, job etc
  (※ Thermal disease: heat stroke, heat exhaustion, heat cramps, heat edema, heat syncope)
- Report system: Emergency medical treatment center → Public health center → Ministry of health & welfare → Center disaster and safety countermeasures headquarters

- Information utilization
  - Characteristics analysis of heat health impacts
  - Attention inspiration of heat health impacts
  - Development of new adaptation tools

Fig. results of surveillance system in 2012
(modified in source: Ministry of Health & welfare)
Future direction or next researches

Policy related researches to protect human health from climate change (source: WHO, 2009)

<table>
<thead>
<tr>
<th>Past</th>
<th>Present</th>
<th>Future</th>
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<tbody>
<tr>
<td><strong>Empirical data-based studies</strong></td>
<td><strong>Scenario-based health risk projections</strong></td>
<td>Climate change mitigation</td>
</tr>
<tr>
<td>1. Determine the baseline climate-health relations</td>
<td>4. Prediction of future risks (modeling)</td>
<td>Adaptation strategies</td>
</tr>
<tr>
<td>2. Detect any emerging impacts</td>
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<tr>
<td>3. Estimate current climate change related burden</td>
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<tr>
<td>5. Assess adaptive strategies</td>
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<td>6. Assess health impacts of mitigation</td>
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Researches for more specific policies
- Identification of vulnerable population (e.g. vulnerability in geographical level)
- Detection of emerging health impact (e.g. mental health from heat wave)

Researches for improvement of policies
- Identification of the most effective adaptive strategies (e.g. cost-effectiveness analysis)
Thank you!

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