Human Health Adaptation
to Heat wave due to Climate Change

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1. **Climate change impacts on health**

2. Adaptation plan & tools to tackle health impacts of heat wave

3. The mid- and long-term direction of adaptation plan
Potential health impacts of climate change

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

- **Most expected health impacts of climate change will become 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)
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).

1. Climate change impacts on health
## Evidences in South Korea

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

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<th>Researches in South Korea</th>
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<td><strong>Current death burden of high temperature</strong></td>
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<td><strong>Future death burden of high temperature due to climate change</strong></td>
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</table>
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)

- **Implications**
  
  - **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)
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)

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

- **Implication**
  
  - Communities with higher death burden should be given higher priorities in adaptation strategies and policies

  (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 for deaths due to climate change
  
  (source: Yang J and Ha J*, 2013, JEHS)
Outline

1. Climate change impacts on health

2. Adaptation plan & tools to tackle health impacts of heat wave

3. The mid- and long-term direction of adaptation plan
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2. Adaptation plan & tools to tackle health impacts of heat wave

National Climate Change Adaptation Plan (NCCAP)

Extreme heat response plan to prevent impacts of heat wave

<table>
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<th>NCCAP in 7 sectors</th>
<th>Health</th>
<th>Heat wave / UV rays</th>
<th>Adaptation tools</th>
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<tr>
<td>Health</td>
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<td>Extreme heat watch warning system</td>
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<tr>
<td>Disaster</td>
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<td>Heat shelter, Heat break</td>
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<td>Agriculture</td>
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<td>Health care guidelines &amp; Manuals for guide</td>
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<td>Forest</td>
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<td>Ocean/Fisheries</td>
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<td>according to Extreme heat response plan</td>
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<td>Water management</td>
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<tr>
<td>Ecosystem</td>
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</table>

Meteorological disasters
Infectious disease
Air pollution / Chemicals
Allergy
2. Adaptation plan & tools to tackle health impacts of 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)

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Definition of Heat wave

Extreme heat watch/warning system

- Operated by Korea Meteorological Administration since 2007
- Temporal resolution: daily (June 1 ~ September 30)
- Spatial resolution: lower level local government (si / gun / gu)
- Watch & Warning criteria

<table>
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<tr>
<th>Criteria</th>
<th>Description</th>
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<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 1. Breaking news in public TV

Fig 2. Frequency of heat wave in 2012
2. Adaptation plan & tools to tackle health impacts of heat wave

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

Materials to prevent health impacts of 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
2. Adaptation plan & tools to tackle health impacts of heat wave

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

Visiting health care program for the elderly
- Management by **public health center in a 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 governments

Heat-health impacts surveillance system

- Surveillance based on emergency medical treatment center (458 in 2012)
- Operating period: June 1 ~ September 30
- Reported information: the daily number of thermal patients, as well as sex, age, address, job, etc.
  (※ Thermal disease: heat stroke, heat exhaustion, heat cramps, heat edema, heat syncope)
- Reporting system: Emergency medical treatment center → Public health center → Ministry of health & welfare → Center disaster and safety countermeasures

- Information utilization
  - To analyze key features of health effects of heat
  - To promote perception of heat risk to health
  - To develop new adaptation tools

Fig. results of surveillance system in 2012 (modified in source: Ministry of Health & Welfare)
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Human Health Adaptation to Heat wave due to Climate Change

3. The mid- and long-term direction of adaptation plan

Background: Impact pathway of heat wave, Heat wave due to climate change

Impact pathway of heat wave
- Not only health, heat wave has given a variety of effects.
- But in the end, the consequences to the impact are health and welfare of human health.

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

[Fig. 1] Impact Pathway to Health and Wellbeing of Heat wave

[Fig. 2] The changes of temperature distribution in the future from climate change (source: McMichael AJ et al., 2006, Lancet)
3. The mid- and long-term direction of adaptation plan

Direction: Integrative and adjustable approach

Policy Integration
• To incorporate a range of factors at multiple scales, from physiologic susceptibility to macroeconomic factors on a preventive basis (Meijers and Stead, 2004; OECD)

Adaptive Management
• To adjust a policy through social learning on a basis of uncertainty and complexity of climate change (Hess et al., 2012)

[Fig. 1] Components of heat-related morbidity and mortality risk operative at various spatial scales (Source: Hess et al., 2012)

[Fig. 2] Adaptive Management Cycle (Source: Hess et al., 2012)
Thank you!

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