Collaborating Centre for Oxford University and CUHK
for Disaster and Medical Humanitarian Response
CCOUC 災害與人道救援研究所

Policy Implication of Health Impacts of Climate Change in Hong Kong – What's Next?

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Outline

Part 1: Climate change and Hong Kong

Part 2: Climate change and health

Part 3: Health impacts of climate change – Hong Kong

Part 4: Policy implications – What's next?

About Climate Change

What is "Climate change"?

"a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods"

Article 1, United Nations Framework Convention on Climate Change

Climate change = global warming?

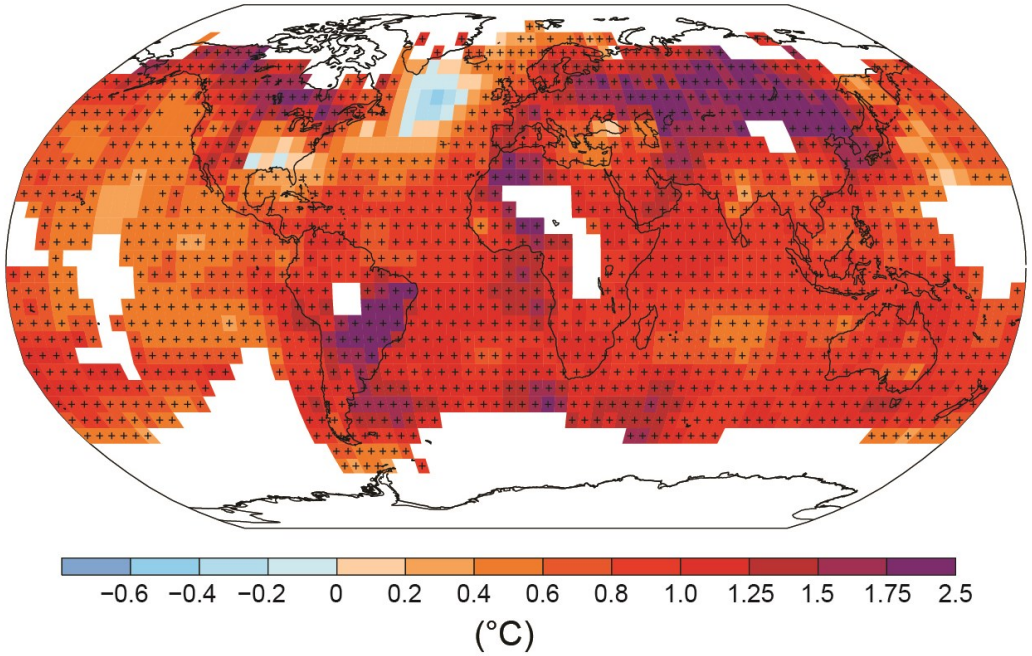
Photo credit: National Geographic

- One of the climate change phenomena
- A cause of climate change

Climate change phenomena

1. Temperature rise and Extreme temperature:

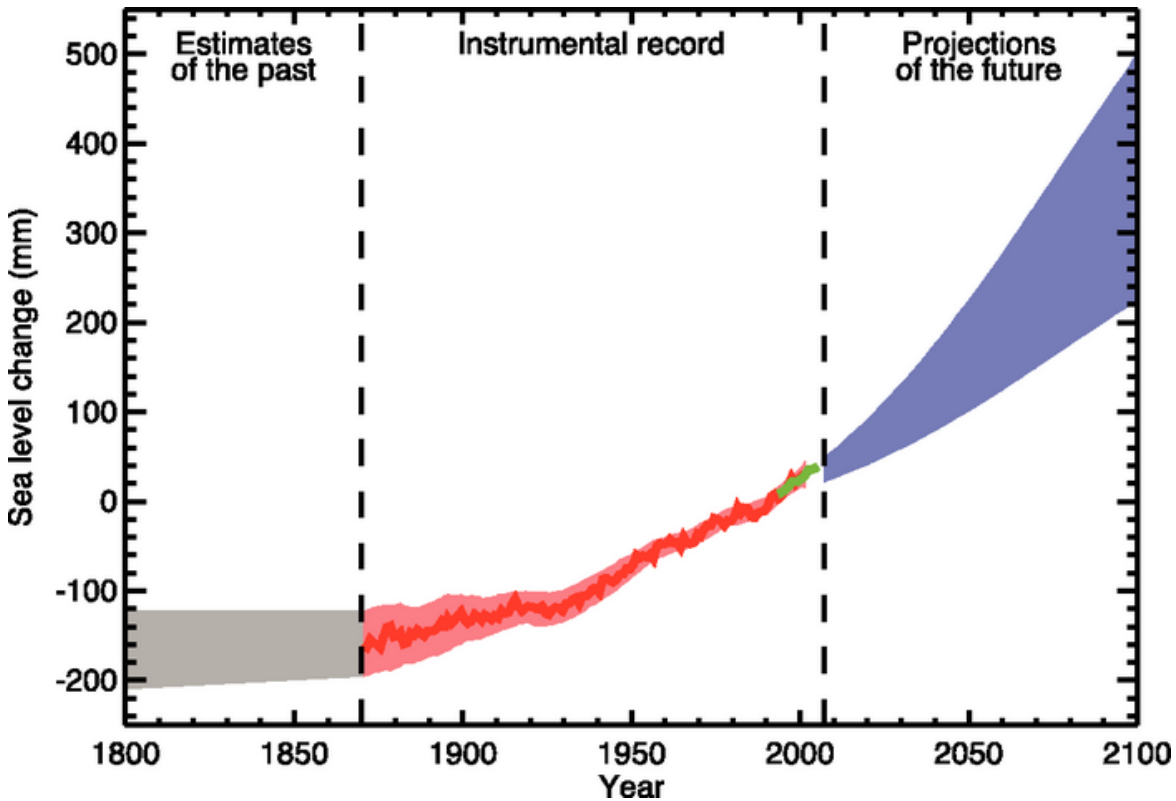
   ↑ 0.85°C in the past 100 years



Observed change in surface temperature 1901 – 2012

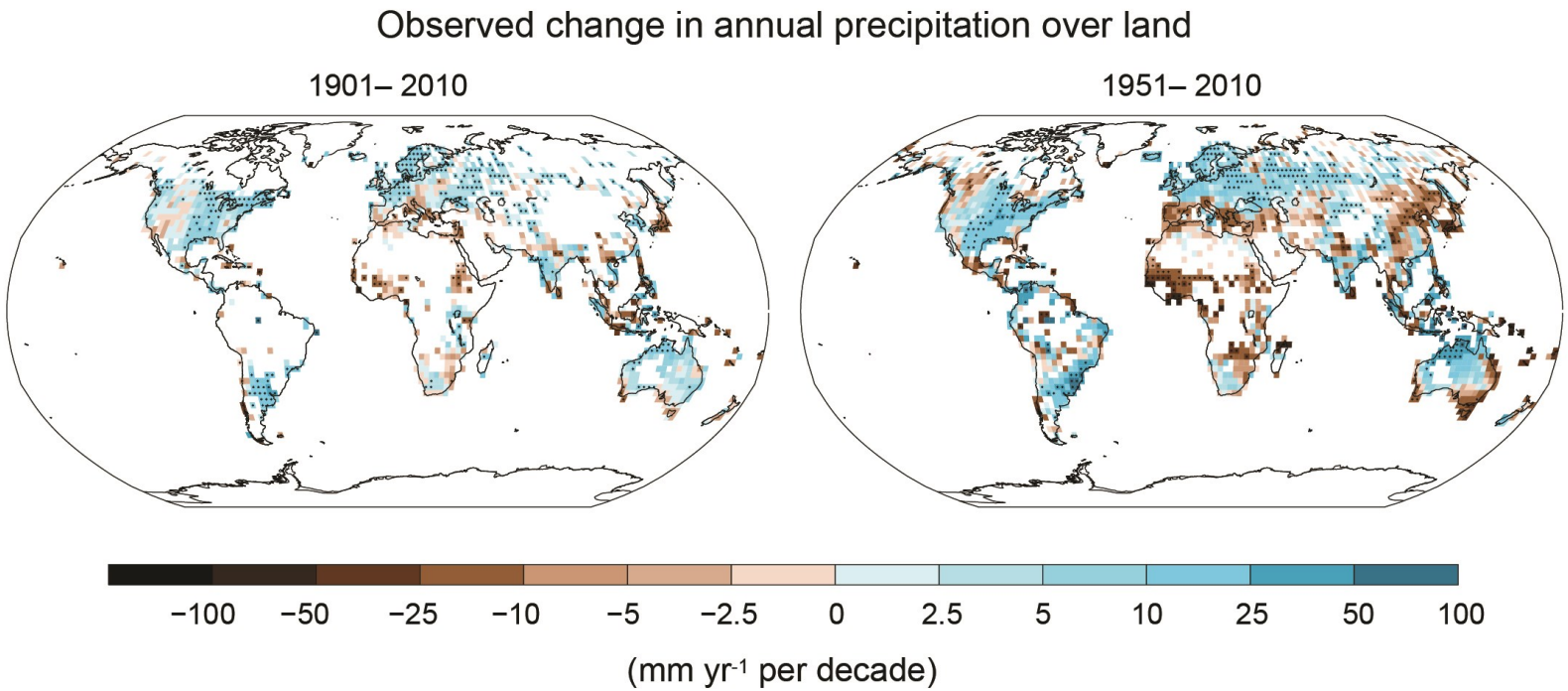
Source: IPCC, 2013

2. Sea Level Rise: 1.7 mm each year since 20th century



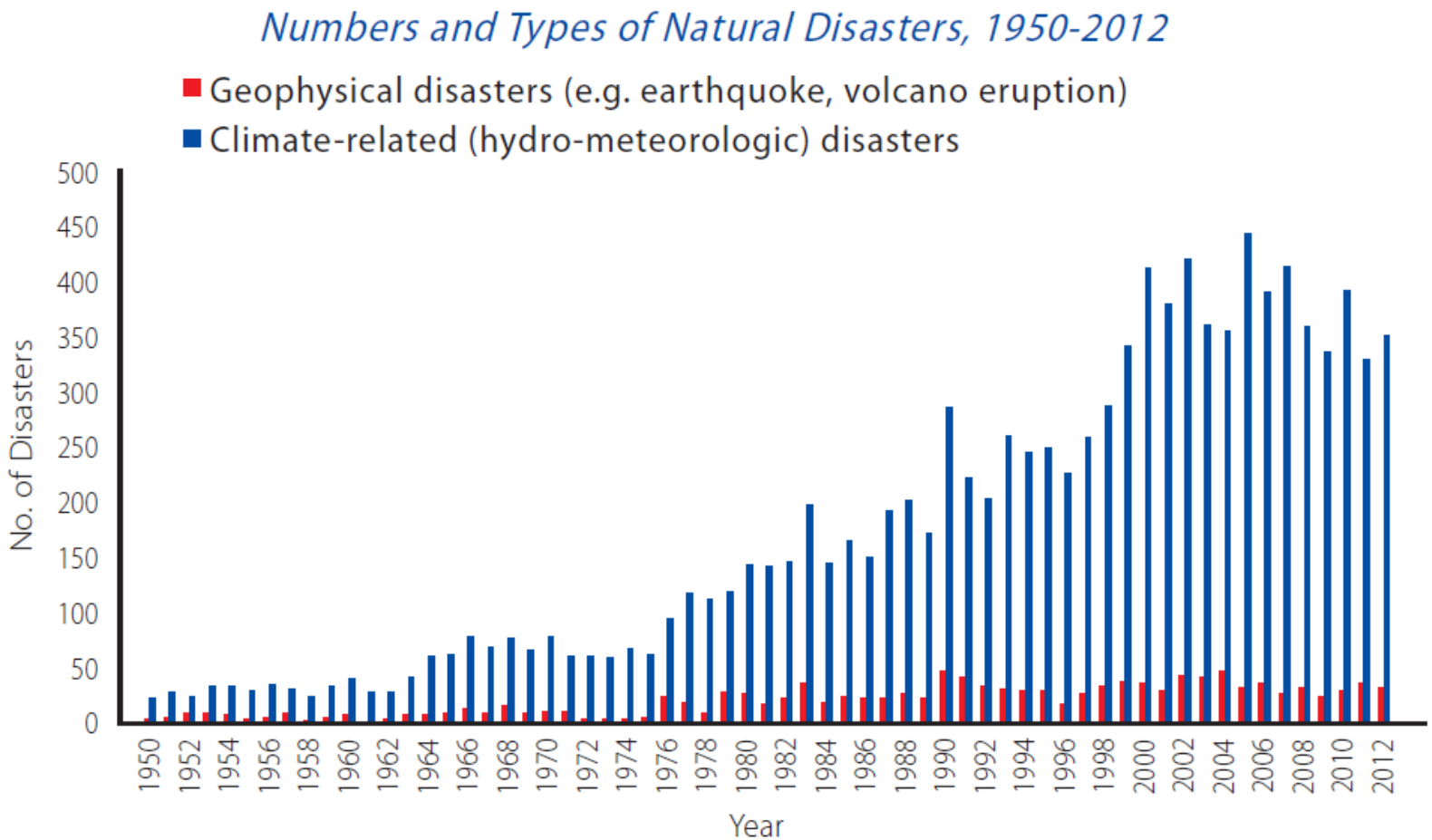
Global Mean Sea Level Rise
Source: IPCC 2007

3. Extreme Precipitation: annual average, frequency and intensity all increase



Observed change in annual precipitation over land
Source: IPCC, 2013

4. More Disasters/ Extreme Weather Events



Source: Leaning & Guha-Sapir, 2013

Climate Change Phenomena

Temperature Changes

Rainfall Changes

Sea-level Rise

More Disasters

Global Level

- United Nations Framework Convention on Climate Change (UNFCCC) (1992)
  - Kyoto Protocol (1997)
  - Paris Agreement (2015): to keep global average temperature increase well below 2 °C and to pursue efforts to limit it to 1.5 °C
- Inter-governmental Panel on Climate Change (IPCC): 5th report in 2014

Relevant to Hong Kong?

Climate change phenomena	Hong Kong
1. Temperature rise and extreme temperature	?
2. Sea level rise	?
3. Extreme precipitation	?
4. Extreme weather events	?

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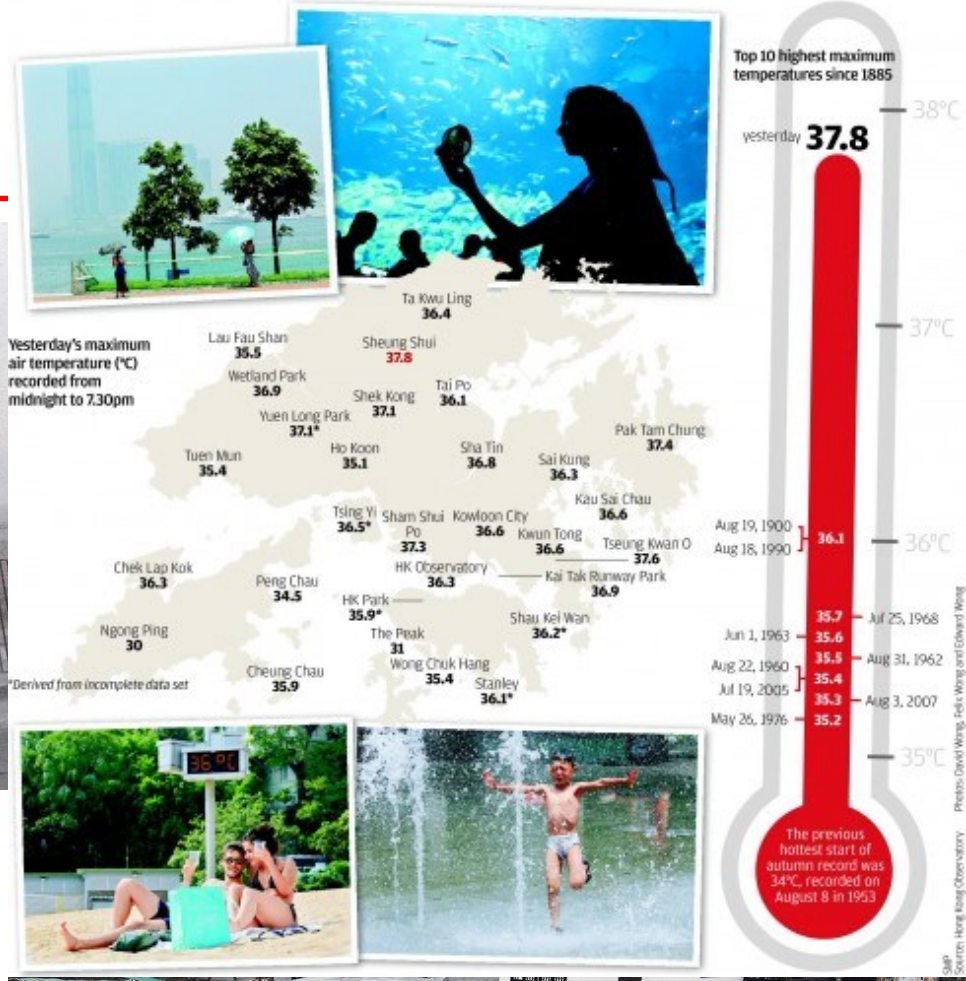


Photo credit: SCMP

Hong Kong……

- one of the world's highest average increase of urban ambient temperature during the past century
- 2015: highest annual mean temperature in Hong Kong since 1885

Ranking	Highest annual °C	Year of Record
1	24.2	2015
2	24.0	1998
3	23.9	2002
3	23.9	2017

- 2017: highest annual maximum temperature in Hong Kong since 1885 (36.6°C)

Climate change phenomena	Hong Kong in 21st century
1. Temperature rise and extreme temperature	➢ Annual mean temperature to rise by 3 to 6 °C
2. Sea level rise	➢ Annual mean sea level to rise by 0.63 to 1.07 m
3. Extreme precipitation	➢ Annual rainfall to rise by about 180 mm ➢ Extremely wet years to increase from 3 to 12
4. Extreme weather events	➢ Storm surges brought by tropical cyclones to increase

Source: Hong Kong Observatory

Climate Change and Health

Does climate change make you "sick"??

Infectious disease?

Chronic disease?

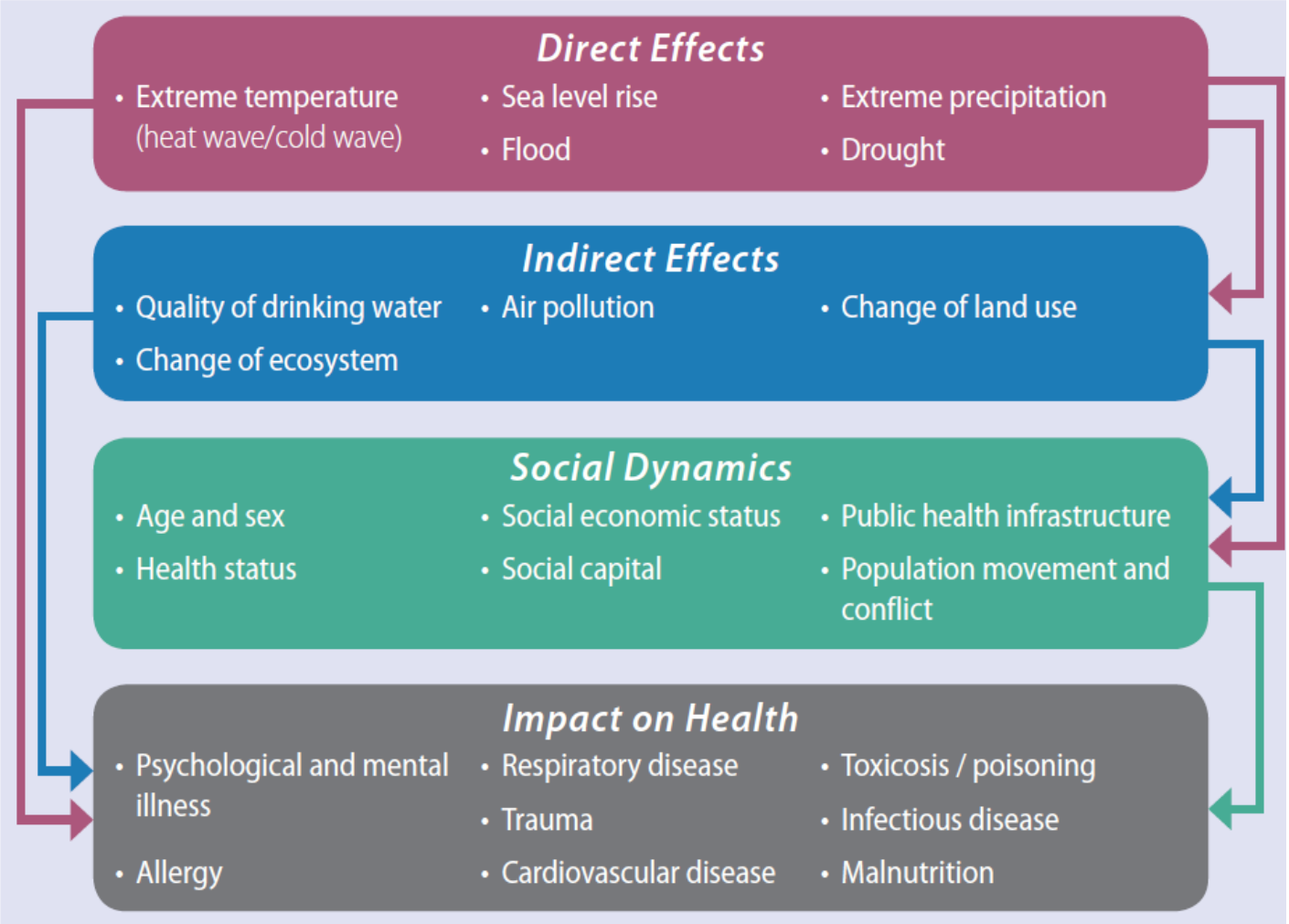
Mental health issues?

Injuries?

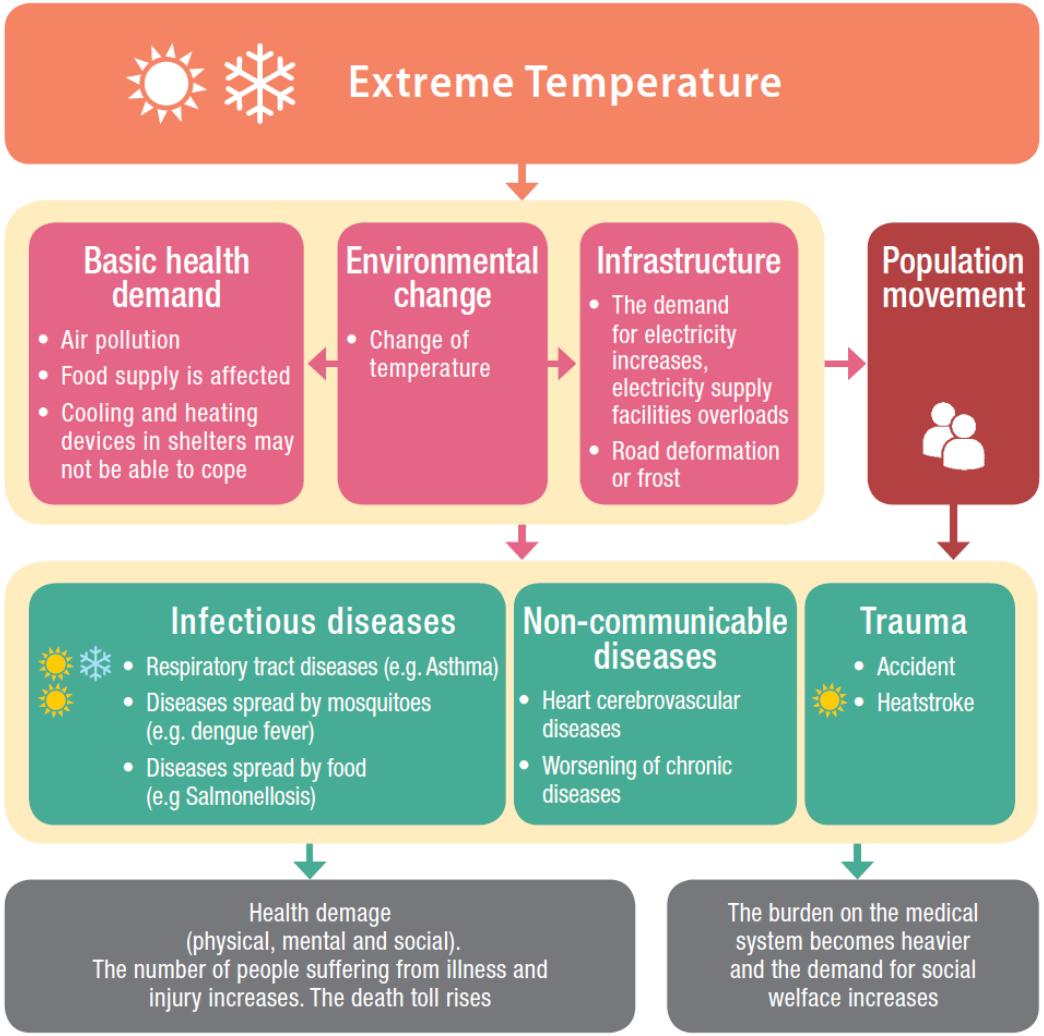
Climate Change and Health

- Climate change:
  - "the defining issue for ***health systems*** in the 21st century" (WHO)
  - "represent an acceptably high and potentially ***catastrophic risk to human health***" (Lancet Commission on Health and Climate Change)
  - "will exacerbate existing health problems …… by 2100, ***even common human activities will be compromised***, including growing of food and working outdoors (IPCC)

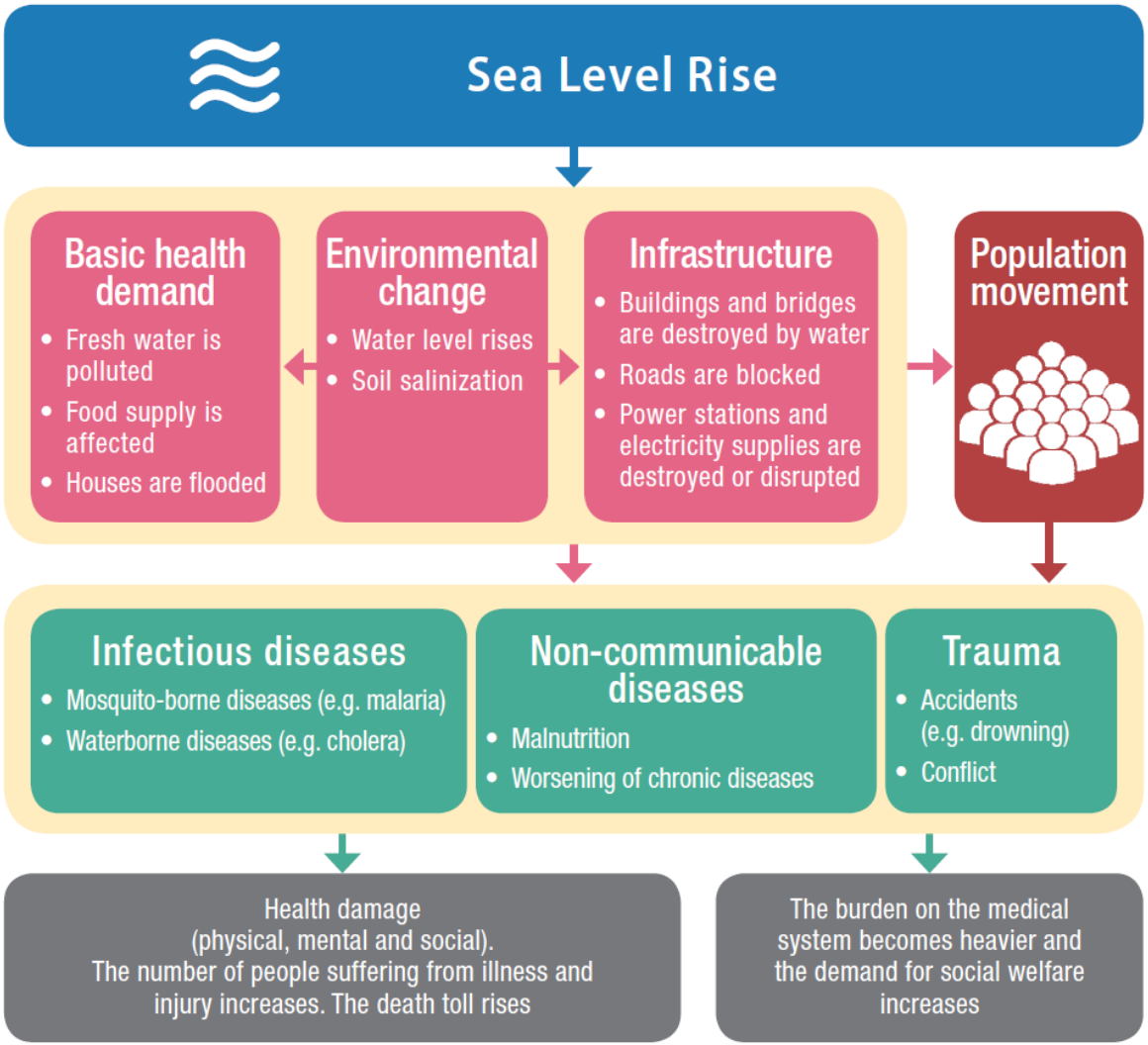
Effects of Climate Change on Health



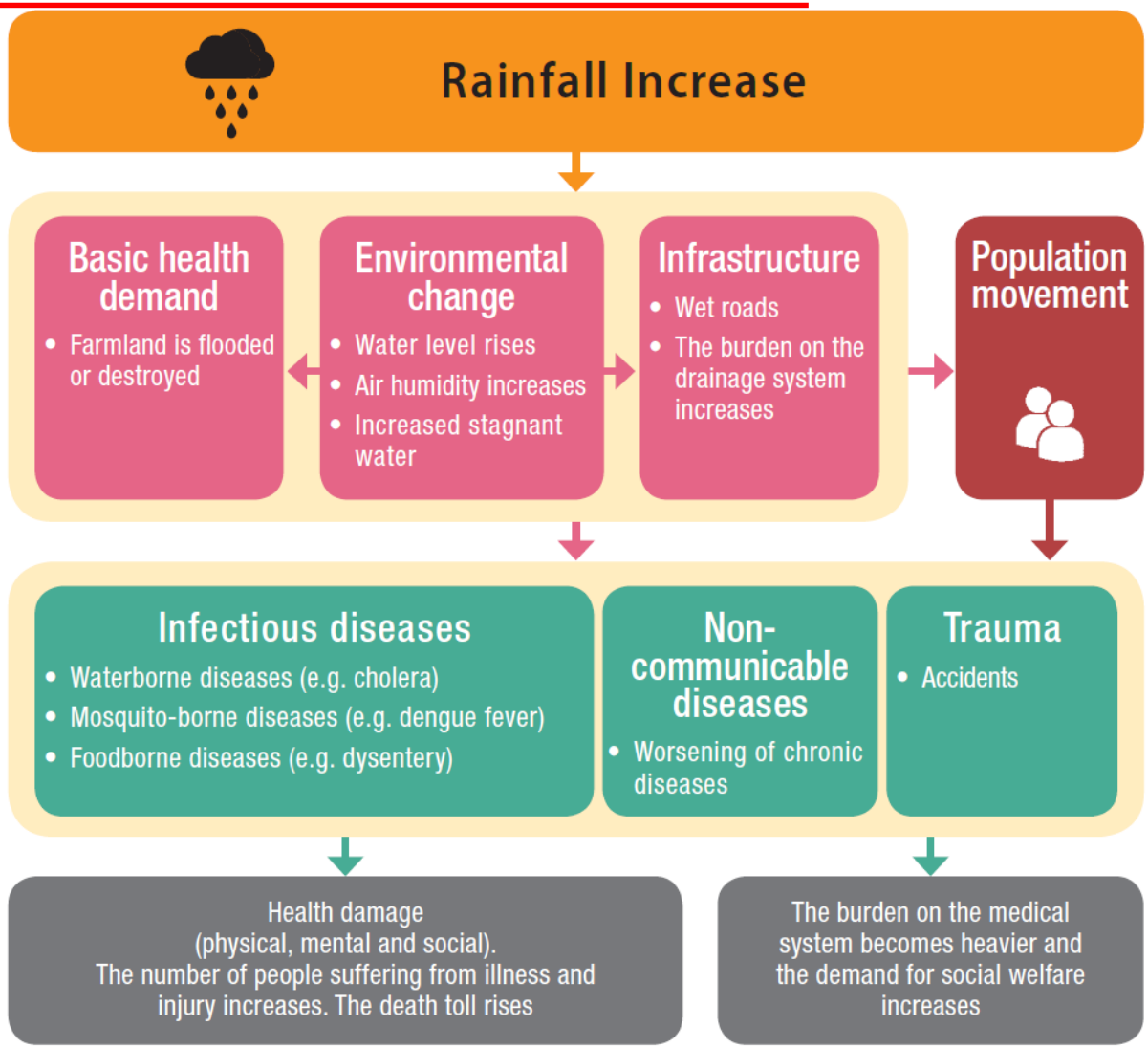
Source: Adapted from Watts et al., 2015



Source: Globalization – Climate Change and Human Health, CCOUC 2017



Source: Globalization – Climate Change and Human Health, CCOUC 2017



Source: Globalization – Climate Change and Human Health, CCOUC 2017

Flooding

Basic health demand
- Fresh water is polluted
- Food supply is affected
- Living conditions are affected

Environmental change
- The land is flooded

Infrastructure
- Water and electricity supply facilities are damaged
- Transportation and telecommunication systems malfunction

Population movement

Infectious diseases
- Waterborne diseases (e.g. cholera)
- Mosquito-borne diseases (e.g. malaria)
- Diseases spread through direct contact (e.g. skin diseases)
- Parasitic diseases (e.g. schistosomiasis)

Non-communicable diseases
- Worsening of chronic diseases

Trauma
- Accidents (e.g. drowning, food poisoning)
- Conflict

Health damage (physical, mental and social). The number of people suffering from illness and injuery increases. The death toll rises

The burden on medical system becomes heavier and the demand of social welfare increases

Source: Globalization – Climate Change and Human Health, CCOUC 2017

Climate Change and Health – Hong Kong?

Climate change phenomena	Hong Kong in 21st century	Health Impacts
1. Temperature rise and extreme temperature	➢ Annual mean temperature to rise by 3 to 6 °C	?
2. Sea level rise	➢ Annual mean sea level to rise by 0.63 to 1.07 m	?
3. Extreme precipitation	➢ Annual rainfall to rise by about 180 mm ➢ Extremely wet years to increase from 3 to 12	?
4. Extreme weather events	➢ Storm surges brought by tropical cyclones to increase	?

Climate Changes in Hong Kong in the 21st Century	Threats/ Pathways	Health Impacts
Temperatures: - **Annual mean temperature to rise by 3 to 6 °C**	• Very hot days, heat waves • Flooding • Landslides • Drain backflow • Storm surge • Cyclones • Air pollution • Altered survival patterns of vectors • More active pathogens	**(a) Temperature-related illnesses**: e.g. heat cramps, heat exhaustion, heatstroke, hyperthermia, hypothermia **(b) Non-communicable diseases**: e.g. cardiovascular disease, respiratory disease, skin cancer **(c) Communicable diseases**: e.g. vector-borne diseases (dengue fever, Japanese encephalitis, malaria), food/ water-borne diseases (cholera, Salmonella poisoning), diarrheal diseases **(d) Physical injuries**: e.g. drowning **(e) Mental health issues**: e.g. stress, anxiety, depression, post-traumatic stress disorder
Precipitation: - **Annual rainfall to rise by about 180 mm** - **Extremely wet years to increase from 3 to 12**		
Sea level: - **Annual mean sea level to rise by 0.63 to 1.07 m**		
Extreme weather events: - **Storm surges brought by tropical cyclones will increase**		

Climate Change and Health – Hong Kong?

Latest research findings ……

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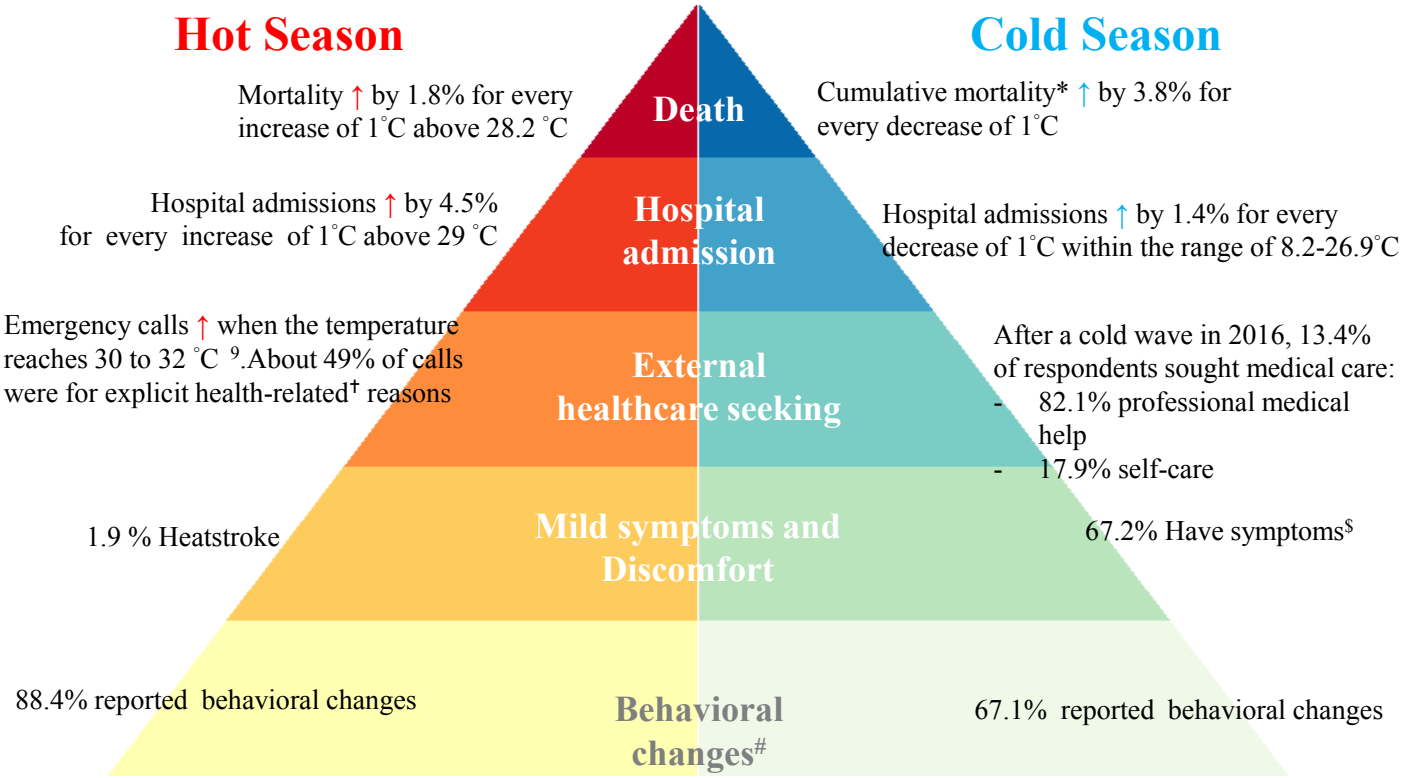
Health Impact of Extreme Temperatures



Notes: * Cumulative mortality is used because the lagged effect of coldness towards mortality is estimated to be 3 weeks. $ Symptoms include respiratory symptoms, cardiovascular symptoms and musculoskeletal pains. # Behavioral changes include amount of physical activity, appetite, frequency of social activity, mood and sleeping quality.

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Public Health

Hong Kong Study on Extreme Temperature and Mortality

Hot Weather

1 °C increase in daily mean temperature above 28.2 C° was associated with

1.8% increase in mortality

** Monthly mean temperatures from June to August in the past four years (**2014 - 2017**) are **all above 28.2 °C** **

Cold Weather

1 °C decrease in mean temperature was associated with 3.8% increase in cumulative mortality rate

(three weeks lagged effect)

Chan EY, Goggins WB, Kim JJ, Griffiths SM. A study of intracity variation of temperature-related mortality and socioeconomic status among the Chinese population in Hong Kong. Journal of Epidemiology and Community Health 2012; 66(4):322-7.
Goggins WB, Chan EY, Yang C, Chong M. Associations between mortality and meteorological and pollutant variables during the cool season in two Asian cities with sub-tropical climates: Hong Kong and Taipei. Environmental Health 2013; 12:59-60.

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Hong Kong Study on Extreme Temperature and Mortality from Heart Failure (HF)

- Between 2002 and 2011:
  - 169,879 hospital admission due to HF
  - 7,831 deaths due to HF
- Cold weather was strongly associated with increased HF admissions and mortality (based on a 11°C. day vs. a 25°C day)

  - HF admission rate is 2.63 times higher on the colder day
  - HF mortality rate is 3.13 times higher on the colder day
  - Stronger association among older age groups and for new hospitalizations

Goggins WB, Chan EY. A study of the short-term associations between hospital admissions and mortality from heart failure and meteorological variables in Hong Kong: Weather and heart failure in Hong Kong. International Journal of Cardiology 2017; 228:537-42.

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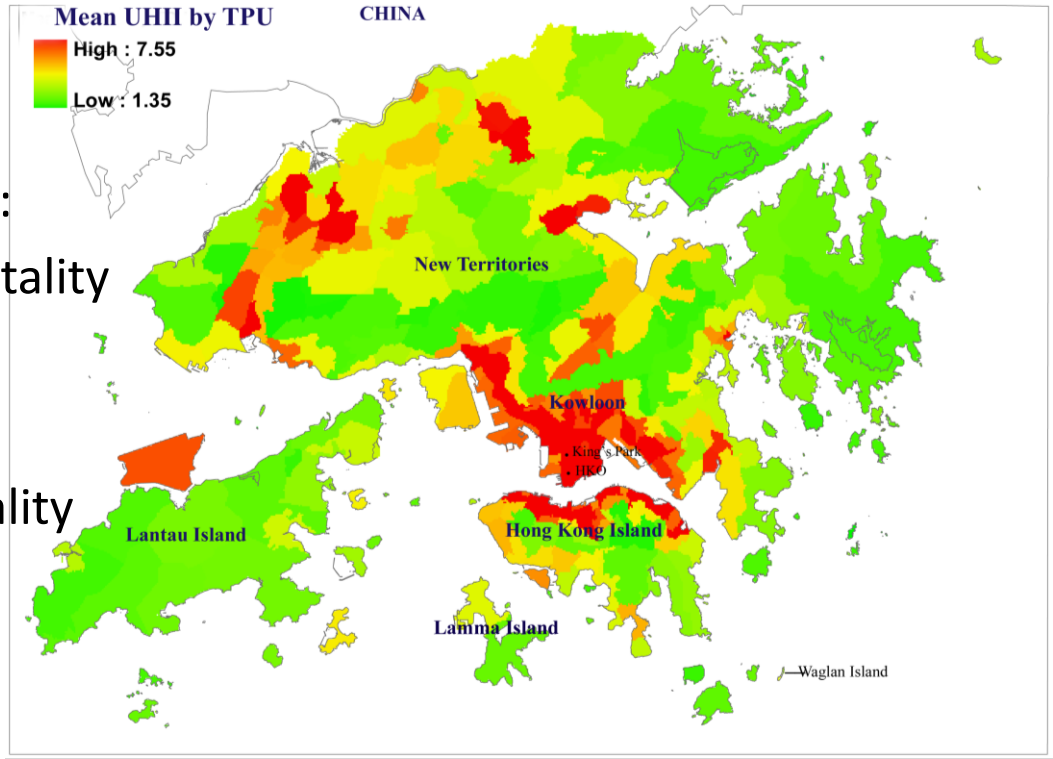
Hong Kong Study on Heat Island Effect and Mortality

When average temperature is above 29 °C for five days, 1 °C rise above 29 °C was associated with

- Areas with high urban heat island index (UHII):
  4.1% increase in natural mortality

- Areas with low UHII
  0.7% increase in natural mortality



Goggins WB, Chan EY, Ng E, Ren C, Chen L, Effect modification of the association between short-term meteorological factors and mortality by urban heat islands in Hong Kong. PLoS ONE. 2012.7(6): e38551.

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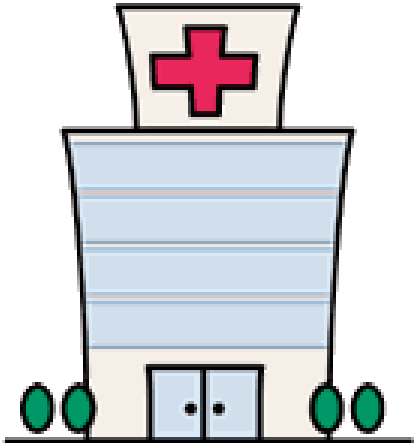
Hong Kong Study on Extreme Temperature and Hospital Admission (overall)

Hot Weather

Hospital admission rate increased by 4.5% for every increase of 1 °C above 29 °C



Cold Weather

Hospital admission rate increased by 1.4% for every decease of 1 °C within the 8.2-26.9 °C range

Chan EY, Goggins WB, Yue JS, Lee P. Hospital admissions as a function of temperature, other weather phenomena and pollution levels in an urban setting in China. Bulletin of the World Health Organization 2013; 91(8):576-84.

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Hong Kong Study on Extreme Temperature and Hospital Admission (specific disease)

	Conditions	Findings
1.	Hand, foot and mouth disease	• Temperature over 25C: rising trend • Relative humanity over 80%: significant increase
2.	Heart disease	• 1 °C drop below 24 °C: 3.7% increase AMI admission
3.	Stroke	• 1°C drop in 5-day average temperature: 2.7% increase in hemorrhagic stroke admission
4.	Injuries	• 1 °C rise above 29 °C: 1.9% increase • 1 °C drop within the range of 8.2 to 26.9°C: 2.4% increase

P Wang, WB Goggins, EY Chan, Hand, Foot and Mouth Disease in Hong Kong: a time-series analysis of its relationship with weather. PLoS One 2016; 8:11 e0161006.

Goggins WB, Chan EY, Yang CY. Weather, pollution, and acute myocardial infarction in Hong Kong and Taiwan. International Journal of Cardiology. 2013,168(1):243-9.

Goggins WB, Woo J, Ho S, Chan EY, Chau PH, Weather, season, and daily stroke admissions in Hong Kong. International Journal of Biometeorology 2012; 56(5): 865-72.

Chan EY, Goggins WB, Yue JS, Lee P. Hospital admissions as a function of temperature, other weather phenomena and pollution levels in an urban setting in China. Bulletin of the World Health Organization 2013; 91(8):576-84.

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Video

Between Extremes: Threatening Heat and Cold Health Series

Local research on health impacts of climate change is still **very limited!!!**

www.ccouc.org/video

Health impacts of climate change in Hong Kong are real!

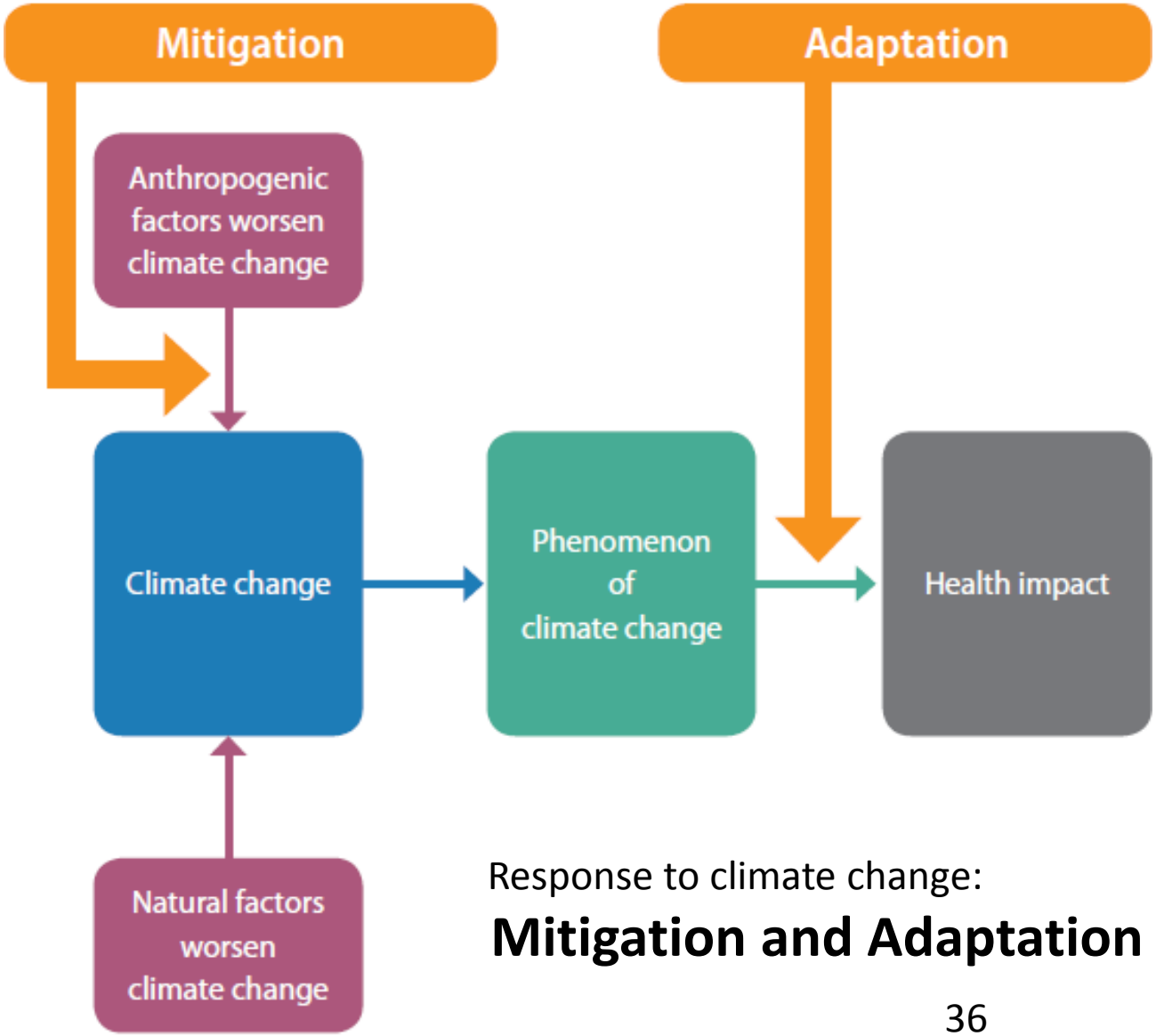
How are we managing them?

Policy implications – What's next?

- Climate change-related policies
- Existing policy in Hong Kong (?)
- Our policy call

International Climate-change "policies"

- Paris Agreement 2015 (COP 21)
- Transforming our world: the 2030 Agenda for Sustainable Development (Sustainable Development Goals)
- Sendai Framework for Disaster Risk Reduction 2015 – 2030



Response to climate change:

Mitigation and Adaptation

Mitigation Policies	Adaptation Policies
• Tax on fossil fuels/ subsidies on renewable energy	• Water resource management: desalination, rainwater storage and preservation
• Standards on carbon emission for transport	• Reduce dependence on single energy source
• Infrastructure to promote cycling and walking	• Tree planting
• Energy efficiency labelling	• **Strengthen health service and contingency planning**
• Building regulation on energy efficiency	• **Surveillance on climate-related diseases**

Adaptation and Mitigation Synergies

Adaptation Measures

- Enhance the hygienic and medical infrastructure
- Assessment of water quality and water supply
- Haze Pollution Warning, Air Quality Health Index
- Mosquitoes control measures

Integrated Measures

- Green roofs
- Save water
- Afforestation
- Strengthen public education

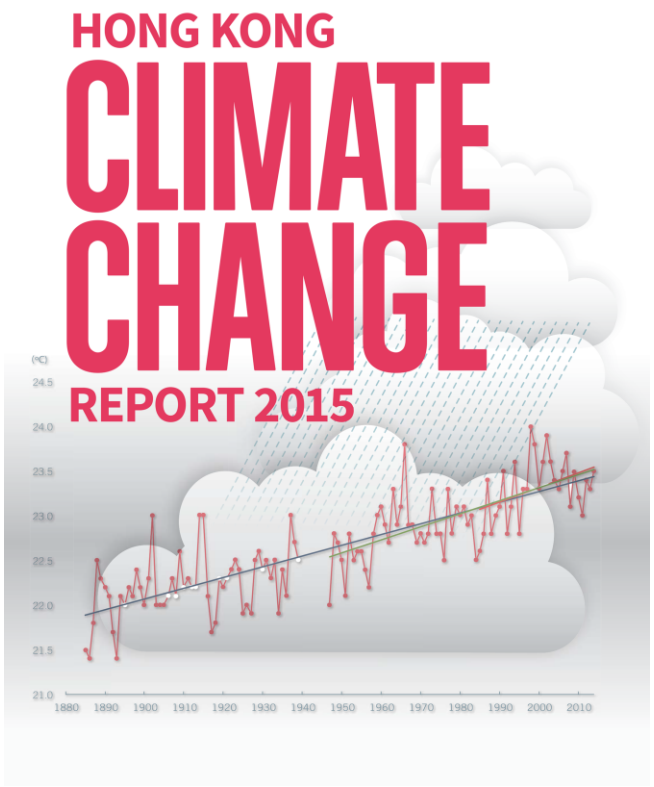
Mitigation Measures

- Renewable energy
- Energy saving vehicles
- Reduce air transportation

(Adapted from Center for Clean Air Policy, 2013)

Source: Globalization – Climate Change and Human Health, CCOUC, 2017

HKSARG Climate Change Reports



POSSIBLE MAJOR CLIMATE CHANGE IMPACTS AFFECTING HONG KONG

BIODIVERSITY	BUILT ENVIRONMENT AND PHYSICAL INFRASTRUCTURE	BUSINESS AND INDUSTRY	ENERGY SUPPLY
Greater stress to montane and freshwater ecosystems due to increase in surface temperatures and extreme weather; loss of inter-tidal habitats, such as coral reefs or mangroves due to sea-level rise; harsher growing environments; increased erosion and landscape degradation and change in species distribution and migration patterns	Damage to building foundations; damage to utilities cables, pipes and assets; increase risk of rain penetration, flooding and landslides due to heavy rain, storm surges, tree failures and extreme weather	Higher maintenance and insurance costs due to extreme weather related damage; staff training to deal with extreme weather events	Damage to power lines and other assets under extreme weather; higher energy demand due to increase in temperature and extreme weather; supply interruptions and power spikes

FINANCIAL SERVICES	FOOD RESOURCES	HUMAN HEALTH	WATER RESOURCES
Direct and indirect risk related to telecommunications and computer system failure; changes in risk profile of individual business and investment; insurance sector exposed to higher extreme weather risks	Lower availability of local/regional food output as a result of extreme weather	Aggravate chronic health condition; higher risk of thermal stress, exacerbation of asthma and heat stroke; more accidents and emergency situations; changes in transmission patterns of infectious diseases	Change in rainfall pattern and rise of demand under higher temperature may affect local water resources

Source: Hong Kong's Climate Action Plan 2030+, 2017, Environmental Bureau

Statements of SFH

"Climate and weather play a role in people's health. Climate change affects the average weather conditions that we are used to. Hotter weather could increase the number of heat-related illnesses. Changes in temperature, rainfall patterns, and the increase extreme weather events could also enhance the spread of certain diseases. We need to stay vigilant of these changes from the healthcare perspectives."

Dr WM Ko Secretary for Food and Health

Source: Hong Kong Climate Change Report, 2015, Environmental Bureau

"We have a good grasp of the climate change-related risks that could impact on the health of our people. We have a role in helping Hong Kong people to become more aware of those health risks, and for the community as a whole to prepare better."

Ko Wing-man Secretary for Food and Health

Source: Hong Kong's Climate Action Plan 2030+, 2017, Environmental Bureau

- Health impact of climate change recognized
- Role of Government (health authorities)
  - Help people **to be more aware** of the health impacts of climate change
  - Help community as a whole **to prepare better**

How to move forward?

Existing policies in Hong Kong?

- Stronger emphasis on mitigation (to meet emission target) than adaptation (changing?)
- Recognized health impact of climate change (?)
- **NO** policy targeting at health impact of climate change (some existing structures)

Our Policy Call

Priority areas

1. Recognize climate change as a public health issue

2. Recognize health co-benefits of existing climate change policies

3. Mainstream climate resilience into health system

Priority 1: Recognize climate change as a public health issue

- FHB's portfolio
- Not only under general climate change efforts
- Local research

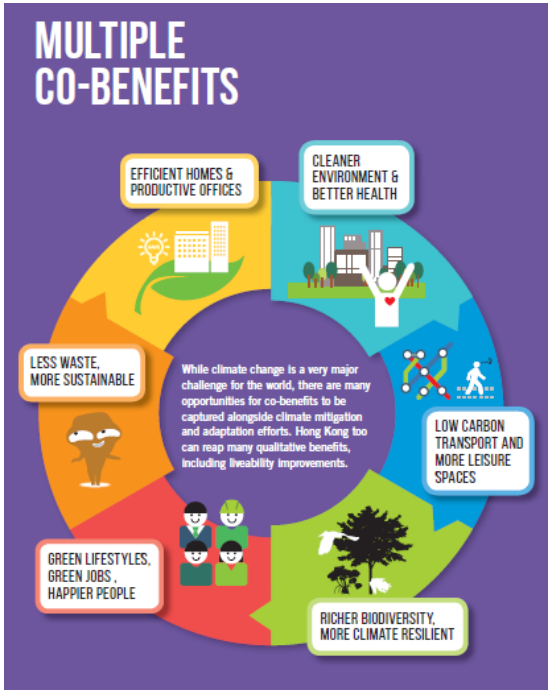
* Existing structures:
DEVB: CCWGI, Inter-departmental Task Force on Emergency Preparedness

Priority 2: Recognize health co-benefits of existing climate change policies

- "health co-benefits": health gains from policies primarily directed at mitigation of climate change

Climate change policies	Health co-benefits
Reduce fossil fuels	Improve respiratory health related to air pollution
Promote cycling and walking	Reduce obesity, diabetes, depression caused by inactive lifestyle
Increase green space	Reduce diseases related to high temperature

- No mention of co-benefits in 2015 Report; general reference in 2017 Report, including health co-benefits



- Advantages –
  - Bring up profile/ awareness of health impact of climate change
  - Stronger justifications for mitigation policies
  - Health impact assessment

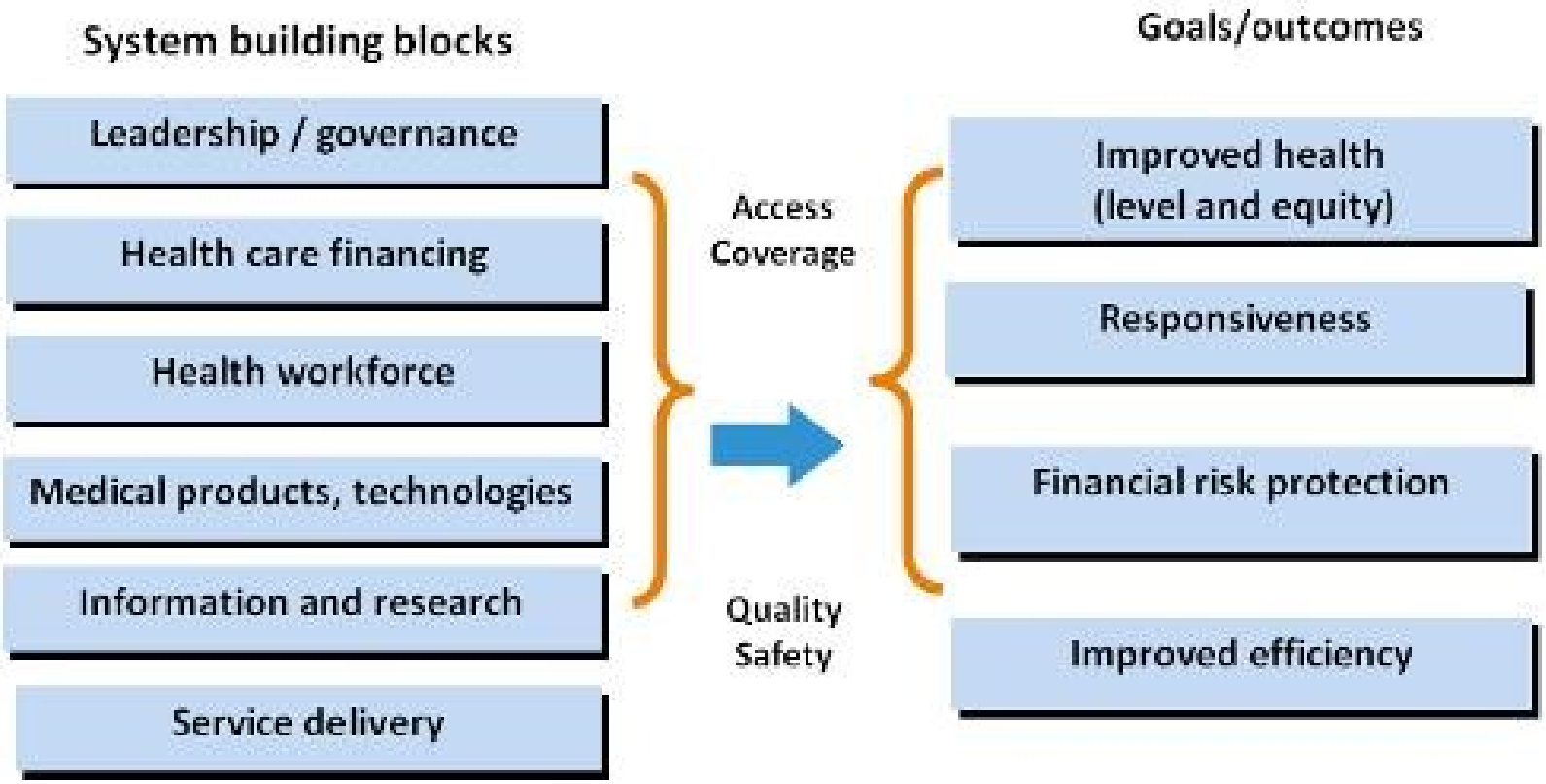
Priority 3: Mainstream climate resilience into health system

- Climate resilient health system:

"capable **to anticipate, respond to, cope with, recover from and adapt to** climate-related shocks and stress, so as to bring sustained improvement in population health, despite an unstable climate" (WHO, 2015)

- Not piecemeal changes but an **evidence-informed system transformation**

WHO's "six building blocks" of Health System



Source: WPRO, WHO

WHO's "ten components framework" on Climate-resilient Health System

Source: Operational Framework for Building Climate Resilient Health Systems, WHO, 2015

Application to HK Health System

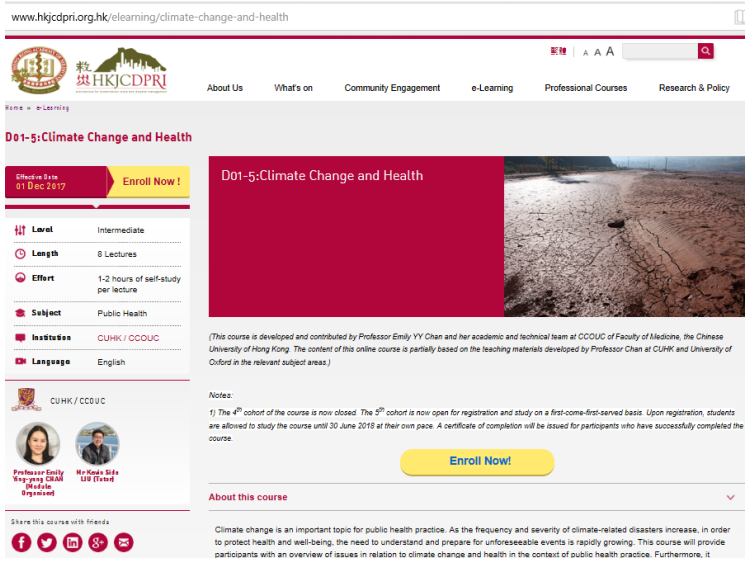
1. **Leadership and Governance:** main climate change policies should reflect climate change and health connection

- Develop government-wide strategy on climate change and health
- Climate change and health lead/ team within FHB, with specific programme and budget
- Mainstream health into climate-related policies/ health impact assessment
- Health representation in climate change processes at local and national level

* Existing structure: Steering Committee on Climate Change (CS chair)

2. **Health workforce:** empower healthcare personnel to address climate change and health links

- Training courses on climate change and health for health personnel (HKJCDPRI, CCOUC/ CUHK)

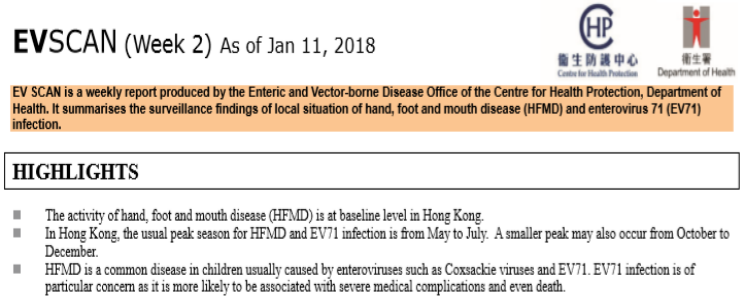


- Develop contingency plan for deployment of sufficient health personnel in case of extreme weather events (local research on mortality and hospital admission)
- Communications plans and forums

3. **Health Information Systems:** surveillance system to monitor disease risks posed by climate change

- Measure baseline rates of climate-related health conditions and identify vulnerable population (e.g. data on old people admitted for AMI during coldest months)
- Identify changing incidence and trigger early action and warning (e.g. health facilities contingency plan)
- Support multidisciplinary research on local situation and mechanism for research to inform policy

* Existing structures: CHP surveillance on flu, HFMD, EV71, etc.;
HKO very hot weather warning



EVSCAN (Week 2) As of Jan 11, 2018

衞生防護中心 Centre for Health Protection
衞生署 Department of Health

EV SCAN is a weekly report produced by the Enteric and Vector-borne Disease Office of the Centre for Health Protection, Department of Health. It summarises the surveillance findings of local situation of hand, foot and mouth disease (HFMD) and enterovirus 71 (EV71) infection.

HIGHLIGHTS

- The activity of hand, foot and mouth disease (HFMD) is at baseline level in Hong Kong.
- In Hong Kong, the usual peak season for HFMD and EV71 infection is from May to July. A smaller peak may also occur from October to December.
- HFMD is a common disease in children usually caused by enteroviruses such as Coxsackie viruses and EV71. EV71 infection is of particular concern as it is more likely to be associated with severe medical complications and even death.

4. **Essential medical products and technologies:** ensure climate sustainability of health care facilities

- Sustainability in procurement, e.g. waste management, transport
- Take into account climate risk in siting and construction of health facilities
- Use new technologies to improve performance, e.g. satellite imagery in anticipating disease pattern

5. **Service Delivery:** control programmes and emergency management of climate-sensitive diseases

- New health interventions: outreach to elderly living alone with chronic conditions, cooling centres
- Analyze impact of climate change on existing disease control programmes
  (e.g. FEHD's ovitrap index for dengue fever)
- Health sector contingency planning
- Empower community groups as
  primary actors in emergency preparedness

Photo credit: FEHD

6. **Financing:** health budget designated for climate change and health issues

- Part of central health budget
- New money item?
- Contracting out / financial incentives for NGO participation?

- **Non-health sectors**: other key determinants of health – environmental and social
  - Urban planning
  - Energy
  - Food
  - Environmental hazards

Summary

Mainstream climate resilience to health system through –

1. Leadership and governance
2. Health workforce
3. Health information systems
4. Essential medical products and technologies
5. Service delivery

✓ Components are interconnected

✓ Start with building on some existing structures

✓ Political will to recognize it as an essential public policy area

Questions and Discussion