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

2021 APRU Multi-Hazards Webinar Series: Health, Climate Change and Innovation in Disaster Risk Reduction:

Latest Frontier and application of Health-EDRM for Multihazard Context: The case of COVID-19

12th October 2021

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- Academic partner of:

- **Integrated Research on Disaster Risk International Centre of Excellence (IRDR ICoE)**
  - One of the ICoEs since Nov 2016
  - Focuses on Health and DRR

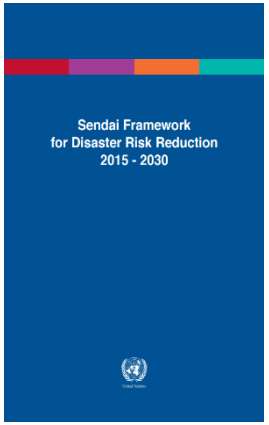
Health and DRR: WHO Health-EDRM Framework

- The ***Health-EDRM Framework*** *(WHO 2019)* provides a common language and a comprehensive approach for all actors in health and other sectors, to reduce health risks and consequences of emergencies and disasters

- ***Top-down*** government efforts in infection control and management, ***Bottom-up*** resilience efforts at the individual and household level have crucial roles of health-EDRM for biological hazards

- Health-centred
  - putting people's health at the centre of emergency and disaster risk management
  - emphasizes the centrality of prevention, preparedness and readiness, together with the more traditional focuses of response and recovery

- Comprehensive and interdisciplinary approach
  - originates from the current fragmented approaches to different types of hazards and gaps in coordination across the entire health system
  - emphasizes assessing, communicating and reducing risks across the whole risk reduction continuum



World Health Organization

IRDR ICoE
Integrated Research on Disaster Risk
International Centre of Excellence

Health-EDRM: Health-Emergency and Disaster Risk Management

- Health Emergency Disaster Risk Management (Health-EDRM) is the latest World Health Organization paradigm that includes DRR at intra-, inter- and multi-disciplinary levels. Scientific advancement under Health-EDRM is necessary for health and non-health actors in DRR education and research(WHO 2019).
- Relevant Interventions can be divided by **when** they should be implemented:

PRIMARY:	to prevent health risk before the disaster	**EXAMPLE:** childhood vaccination programmes, and early warning systems: Impact driven Warning
SECONDARY:	to prevent health risks after the disaster	**EXAMPLE:** emergency vaccination campaigns, knowing how to prepare ORS
TERTIARY:	to reduce the impact after disaster	**EXAMPLE:** using ORS, provide first aid (physical and psychological), and healthcare staff specifically trained for disaster-related injury/disease outbreak

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Thematic Research Network for Health Emergency and Disaster Risk Management (H-EDRM)

World Health Organization

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www.ijdrs.com
www.springer.com/13753

SHORT ARTICLE

Health Emergency and Disaster Risk Management (Health-EDRM): Developing the Research Field within the Sendai Framework Paradigm

Sharon Tsoon Ting Lo[1] · Emily Ying Yang Chan[1,2,3] · Gloria Kwong Wai Chan[1] · Virginia Murray[4,5,6] · Jonathan Abrahams[7] · Ali Ardalan[8] · Ryoma Kayano[9] · Johnny Chung Wai Yau[10]

Published online: 9 May 2017

Abstract The intersection of health and disaster risk reduction (DRR) has emerged in recent years as a field of critical inquiry. Health is recognized as an outcome and a goal of DRR, and the integration of both fields is essential to ensure the implementation of the Sendai Framework for Disaster Risk Reduction 2015–2030. Health Emergency and Disaster Risk Management (Health-EDRM) has emerged as an umbrella field that encompasses emergency and disaster medicine, DRR, humanitarian response, community health resilience, and health systems resilience. In September 2016, an international group of experts met in Hong Kong to assess the current status and potential of strategic research agenda, absence of consensus regarding terminology, and limited coordination between stakeholders. The Sendai Framework provides a useful paradigm within which to shape the research field's strategic development. The WHO Thematic Platform for Health-EDRM Research Group was established to coordinate activities, promote information-sharing, develop partnerships, and provide technical advice to strengthen the Health-EDRM research field. This group will promote the generation of robust and scientific health research to support the meaningful implementation of the Sendai Framework.

Health EDRM: the systematic analysis and management of **health risks** surrounding emergencies and disasters by **reducing the hazards** and **vulnerability** along with extending preparedness, response, and recovery measures.

IRDR ICoE Integrated Research on Disaster Risk International Centre of Excellence
University of Oxford
Nuffield Department of Medicine
CU Medicine
Public Health

What are the health research needs for the Sendai Framework (2017)

What are the health research needs for the Sendai Framework?

There is an important opportunity to build coherence across different policy areas with the 2015–16 adoption of four landmark UN agreements—the Sendai Framework for Disaster Risk Reduction 2015–2030,[1] the 2030 Sustainable Development Goals (SDGs), the Paris Agreement, and the New Urban Agenda (Habitat III). Ensuring that health is at the heart of the Sendai Framework is crucial. The 2030 targets of the Sendai Framework call for substantial global reductions in disaster-related mortality, number of affected people, direct economic loss, and damage to critical infrastructure (panel). The framework identifies strategies that might alleviate the impact of disasters, including reduction and management of hazard, exposure, and vulnerability and capacity building for prevention, preparedness, response, and recovery.[2] Health resilience is also promoted throughout the Sendai Framework.[3,4]

Since 2007, global platforms for disaster risk reduction have provided a biennial forum for strategic advice, coordination, partnership development, and review of progress in the implementation of international instruments on disaster risk reduction. On May 24–26, 2017, the Global Platform in Cancun, Mexico, highlighted measures needed to ensure implementation of the Sendai Framework and presented the proposed indicator framework to monitor the seven Sendai targets, such as the building of resilience of infrastructure and housing.[5] Although discussion at the Global Platform recognised and health systems resilience. Health-EDRM promotes the intersection of health and disaster risk reduction and supports the implementation of the health aspects of the Sendai Framework.[8]

If the Sendai Framework objectives are to be fulfilled, research gaps must be addressed. There are general uncertainties about the agreed tracking and monitoring of health indicators for disaster risk reduction.[9] The absence of an agreed all-hazard and disasters classification is an issue for health data collection. Working epidemiological definitions are required, given concerns about how thresholds relating to temporality (slow-onset/protracted events), attribution (direct *vs* indirect causes of morbidity and mortality), and baseline data should be accounted for.[9] Furthermore, global data collection systems, such as the International Health Regulations and the *Lancet* Countdown, could have a role in facilitating the identification, prevention, preparation, response, and recovery from emergency threats and risks. Indicator reporting guidelines require consultation with a diverse range of stakeholders to ensure adequate implementation and integration with national data collection systems.

Disasters affect people's wellbeing and human development with both short-term and long-term effects, such as loss of life, injury and illness, and disability. There is insufficient research on the long-term health effects of disasters on mental health, social health, and wellbeing.[10] More research is needed about disaster

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For the **Sendai Framework** http://www.unisdr.org/we/coordinate/sendai-framework

For the **SDGs** see http://www.undp.org/content/undp/en/home/sustainable-development-goals.html

For the **Paris Agreement** see http://unfccc.int/paris_agreement/items/9485.php

For the **New Urban Agenda** see http://habitat3.org/

- **Build coherence across different global polices**
  - Sendai Framework
  - Sustainable Development Goals (SDGs)
  - Paris Agreement
  - New Urban Agenda (Habitat III)
- **Sendai Framework**
  - Alleviate impact of disasters across all disaster phases
  - Account for exposure, vulnerability, capacity building

Multidisciplinary gap

Chan EYY et al (2019). What are the Health research needs for Sendai Framework? Lancet 2017

H-EDRM Research Gap in Sendai Priority

	Research Gaps	Example
1	What might be acceptable agreed all-hazard and disasters classification?	Delphi method study to develop working epidemiological definitions of thresholds relating to temporality (slow-onset/protracted events), attribution (direct *vs* indirect causes of morbidity and mortality), baseline data and Indicator reporting guidelines.
2	How to provide an updated picture of patterns and trends in health risks associated with disasters and emergencies?	How to use Big/Data, Global data collection systems, (eg the International Health Regulations and the *Lancet* Countdown) to facilitate the identification, prevention, preparation, response, and recovery from emergency threats and risks?
3	How to profile health risk for subgroups with vulnerabilities— eg, very old people, people with disabilities, patients with chronic conditions? — because these groups have specific health needs that are not always recognized in national local policies, plans, and practices.	Health Vulnerability Index Development
4	What might be effective ways to support preparedness, response and rehabilitation in Health?	Community intervention trials should be implemented to assess the best strategies to build bottom up capacity at all level (individual, household, and community-based disaster risk literacy)
5	How to engage in health risk communication for warning and health protection efforts and health decision making?	Stakeholders interviews, Community RCT of technology applications of disaster health risk message

Chan EYY and Murray V. What are the health research needs for the Sendai Framework? Lancet June 19, 2017 http://dx.doi.org/10.1016/ S0140-6736(17)31670-7

WHO Classification of hazards

GENERIC GROUPS[1]	1. NATURAL						2. HUMAN-INDUCED[2,3]		3. ENVIRONMENTAL
GROUPS	1.2 HYDRO-METEOROLOGICAL						2.1 TECHNOLOGICAL	2.2 SOCIETAL	3.1 ENVIRONMENTAL DEGRADATION[17]
SUBGROUPS	1.1 GEOPHYSICAL[4]	1.2.1 HYDROLOGICAL[4]	1.2.2 METEOROLOGICAL[4]	1.2.3 CLIMATOLOGICAL[4]	1.3 BIOLOGICAL[5]	1.4 EXTRATERRESTRIAL[4]			
MAIN TYPES -SUBTYPES [SUB-SUBTYPES]	Earthquake: - *ground-shaking* Tsunami Mass movement (geophysical trigger): - *landslide* - *rock fall* - *subsidence* Liquefaction Volcanic activity: - *ash fall* - *lahar* - *pyroclastic flow* - *lava flow*	Flood: - *riverine flood* - *flash flood* - *coastal flood* - *ice jam flood* Mass movement (hydro-meteorological trigger): - *landslide* - *avalanche (snow)* - *mudflow* - *debris flow* Wave action: - *rogue wave* - *seiche*	Storm: - *extratropical storm* - *tropical cyclone* [cyclonic wind, cyclonic rain, cyclone (storm) surge] - *convective storm* [tornado, wind, rain, winter storm, blizzard, derecho, lightning, thunderstorm, hail, sand/dust storm] Extreme temperature: - *heatwave* - *coldwave* - *severe winter condition* [e.g. snow/ice, frost/ freeze, dzud][6] Fog	Drought Wild fire: - *land fire [e.g. brush, bush, pasture]* - *forest fire* Glacial lake outburst (flood)	Airborne diseases Waterborne diseases Vector-borne diseases Foodborne outbreaks[7] Insect infestation:[4] - *grasshopper* - *locust* Animal diseases Plant diseases Aeroallergens Antimicrobial resistant microorganisms Animal-human contact - *venomous animals* [snakes, spiders]	Impact: - *airburst* - *meteorite* Space weather: - *energetic particles* - *geomagnetic storms* - *shockwave*	Industrial hazards:[8] - *chemical spill* - *gas leak* - *radiation* [radiological, nuclear] Structural collapse: - *building collapse*[8,9] - *dam/bridge failures* Occupational hazards - *mining* Transportation:[8,11] - *air, road, rail, water, space* Explosions Fire[8] Air pollution:[9] - *haze*[10] Infrastructure disruption: - *power outage*[11] - *water supply* - *solid waste, waste water* - *telecommunication* Cybersecurity Hazardous materials in air, soil, water:[12,13] - *biological, chemical, radiological* Food contamination[7]	Acts of violence Armed conflicts:[14] - *international* - *non-international* Civil unrest Stampede Terrorism: - *chemical, biological, radiological, nuclear, and explosives*[15,16] Financial crises: - *hyper-inflation* - *currency crisis*	Erosion Deforestation Salinization Sea level rise Desertification Wetland loss/ degradation Glacier retreat/ melting Sand encroachment

Source: https://www.who.int/hac/techguidance/preparedness/health-emergency-and-disaster-risk-management-framework-eng.pdf?ua=1

Case of DRR: Climate change and Health

Subtropical context

	Research Gaps	Example
1	What might be acceptable agreed all-hazard and disasters classification?	Delphi method study to develop working epidemiological definitions of thresholds relating to temporality (slow-onset/protracted events), attribution (direct *vs* indirect causes of morbidity and mortality), baseline data and Indicator reporting guidelines.
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Hong Kong
Beijing
Hong Kong
Population:
7,300,000
GDP per capita:
US$ 42,290
Climate:
Sub-tropical (Hot summer and mild winter)

Hong Kong SAR

- Hong Kong is a highly urbanized and densely populated city with a complex spatial distribution of population
  - an estimated population about 7.47 million (17% in Hong Kong Island, 31% in Kowloon, and 52% in New Territories)
  - Hong Kong also has one of the highest income inequalities in the world

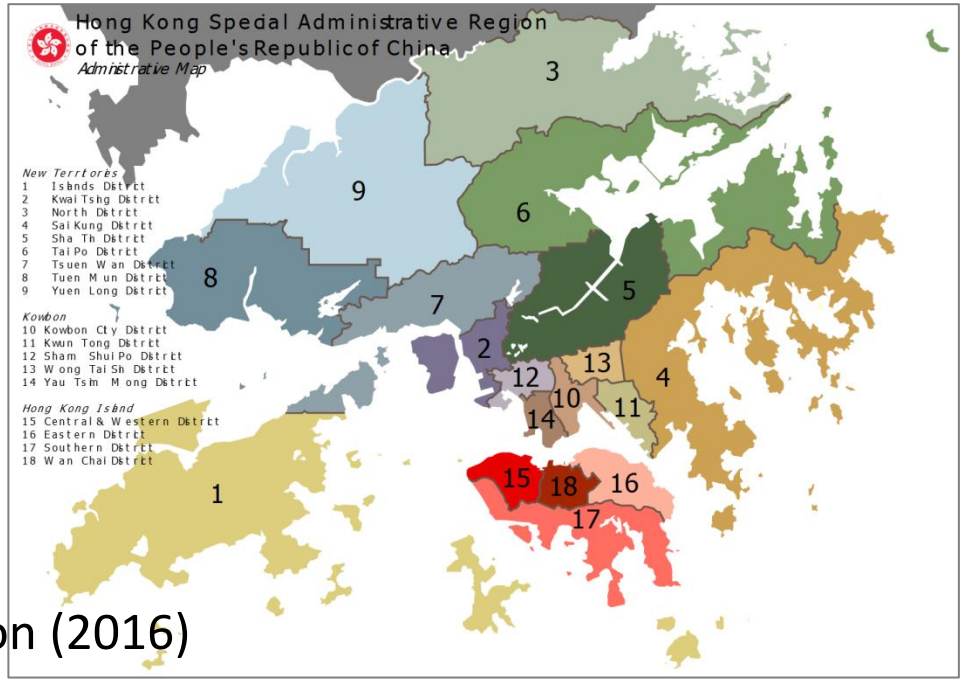
- Hong Kong's climate is subtropical with cold winters and wet, hot summers, and a pronounced urban heat island effect
  - annual temperature is 23.5℃
  - annual rainfall is 2,431.2 mm

Hong Kong's Climate and Geography (1)

- **South-eastern tip of China**
- **Three main territories**

  Hong Kong Island,
  Kowloon Peninsula, and
  New Territories (includes outlying islands)

- **Total area:** 1,106.34 km^2
- **Total population:** approx. 7.34 million (2016)
  - Population density: 6,780 people per square kilometre
  - Dense urban development resulted in significant long-term decrease in local wind speed in the past few decades



Map of Hong Kong and 18 Districts / CC BY 3.0

https://www.gov.hk/en/about/abouthk/facts.htm
http://www.hko.gov.hk/cis/climahk_e.htm

Climate change in Hong Kong

Increased 1.5 to 3°C **Extreme temperature days (above 33°C or below 12°C) will increase**	**Number of very wet years: increased 4 times** **Extreme Rainfall: 180 mm**	**Sea level Rise: 30mm per decades** **3.53M for Typhoon Hagupit; 3.96M For Typhoon Wanda (1962)** **4 .05 M (1937)**	**More Extreme events:** **Typhoon Hagupit (2008)** **16 major urban floods with island population evacuated, 58 injury** **400 flights cancelled** **4500 Trees collapsed, Rotated 2 Boeing planes**

Summary: Metereological Impact

Hong Kong Subtropical Climate (Hottest time: May – Sept)

- Vertical-based City
- Intra-city variation effect (Heat Island Effect)
- Seasonal Variation in mortality*

Impact of Climate change on Temperature

- Reduce wind speed
- Losing night time cooling
- 2-3 degree increase than current scenario (WBGT)

Health Impact?

*Winter is known to accumulate more mortality

WHAT IS THE CURRENT KNOWLEDGE AND SCIENTIFIC FINDINGS IN TEMPERATURE AND HEALTH?

Research frontiers of global Health-EDRM: Multidisciplinary Sector

Urgent multi-disciplinary support in health systems and sectoral improvements in 6 areas are identified. Namely,

1. Infrastructural support for health system resilience;
2. Data management to support medical research health decision making;
3. Residual risk management;
4. Risk communication;
5. Digital literacy;
6. Knowledge product marketing.

International Journal of *Environmental Research and Public Health*

MDPI

Commentary

Reflection of Challenges and Opportunities within the COVID-19 Pandemic to Include Biological Hazards into DRR Planning

Emily Ying Yang Chan [1,2,3,4,5,*], Caroline Dubois [3,4], Ada Ho Yin Fong [4], Rajib Shaw [6,7], Ranit Chatterjee [7,8], Ambika Dabral [7], Antonia Loyzaga [9], Yong-kyun Kim [10], Kevin Kei Ching Hung [1,3,5] and Chi Shing Wong [1,3]

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Citation: Chan, E.Y.Y.; Dubois, C.; Fong, A.H.Y.; Shaw, R.; Chatterjee, R.; Dabral, A.; Loyzaga, A.; Kim, Y.-k.; Hung, K.K.C.; Wong, C.S. Reflection of Challenges and Opportunities within the COVID-19 Pandemic to Include Biological Hazards into DRR Planning. *Int. J. Environ. Res. Public Health* **2021**, *18*, 1614. https://doi.org/10.3390/ijerph18041614

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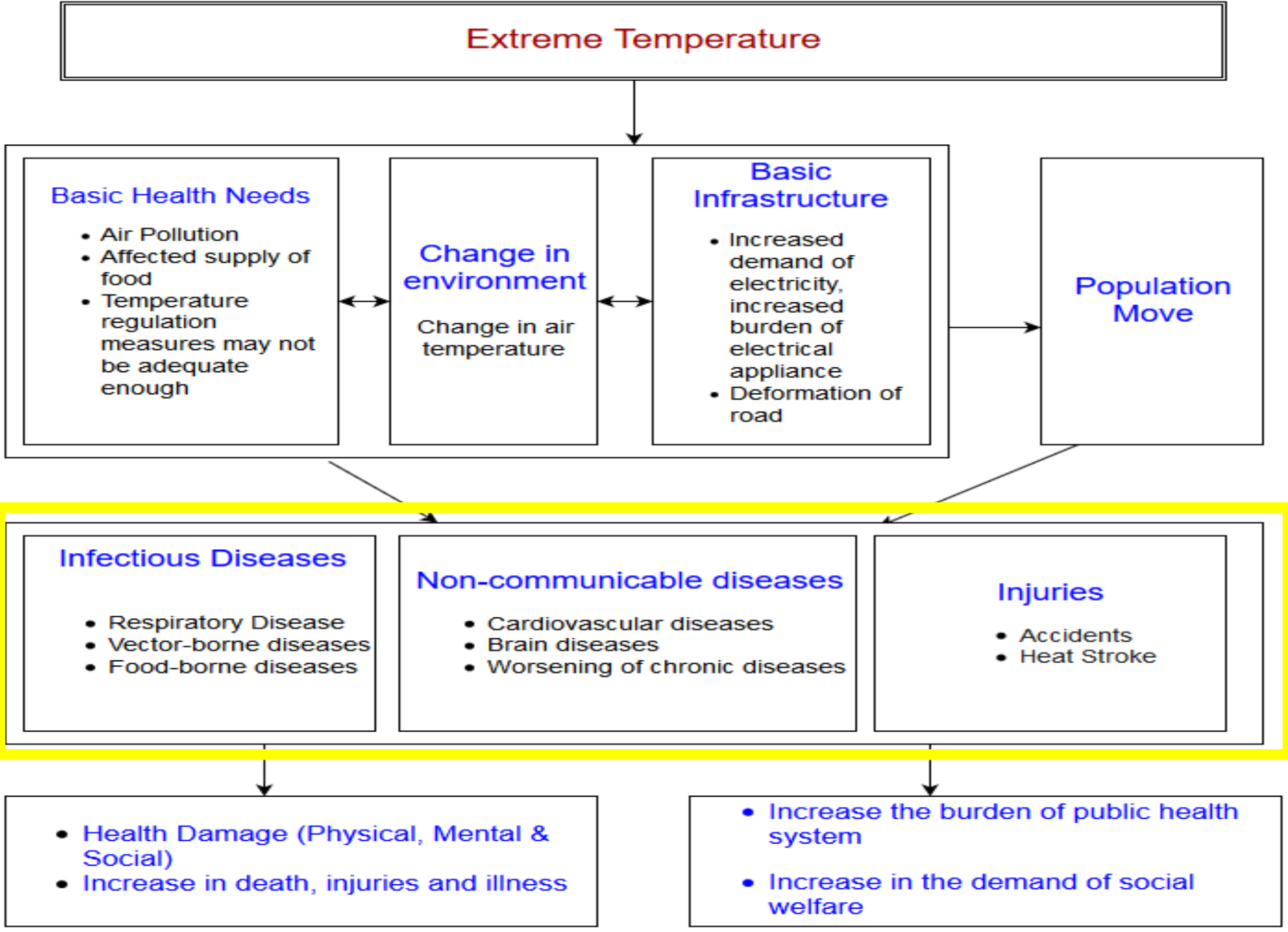
Abstract: COVID-19 has reinforced the need to revisit the integration of health within disaster risk reduction (DRR) strategies for biological hazards in a system-wide approach. In November 2020, DRR experts attended the Asia-Pacific Partnership for Disaster Risk Reduction (APP-DRR) Forum to share progress and learnings in the areas of health system resilience, data management, residual risk management, risk communication, digital literacy, and knowledge product marketing. Advancements for health in DRR included the importance of multi-sectoral, multi-hazard action plans; adaptation to technological advancements in data collection, dissemination and protection; promoting the health and wellbeing of essential and nonprofessional workers; and improving inclusivity in digital literacy. COVID-19 has affected progress towards the Sustainable Development Goals (SDG) and created a unique opportunity within DRR to re-evaluate the adequacy of response mechanisms against concurrent, cascading or interacting risks of future biological hazards. Health emergency disaster risk management (Health-EDRM) is a new World Health Organization paradigm that includes DRR at intra-, inter- and multidisciplinary levels. Scientific advancement under Health-EDRM is necessary for health and non-health actors in DRR education and research. Continuous education on the multifaceted risk governance is a key to building awareness, capacity and accelerating towards achieving the international DRR and the SDG targets.

Keywords: health-EDRM; disaster risk reduction; biological hazards; Sendai Framework; COVID-19, pandemic

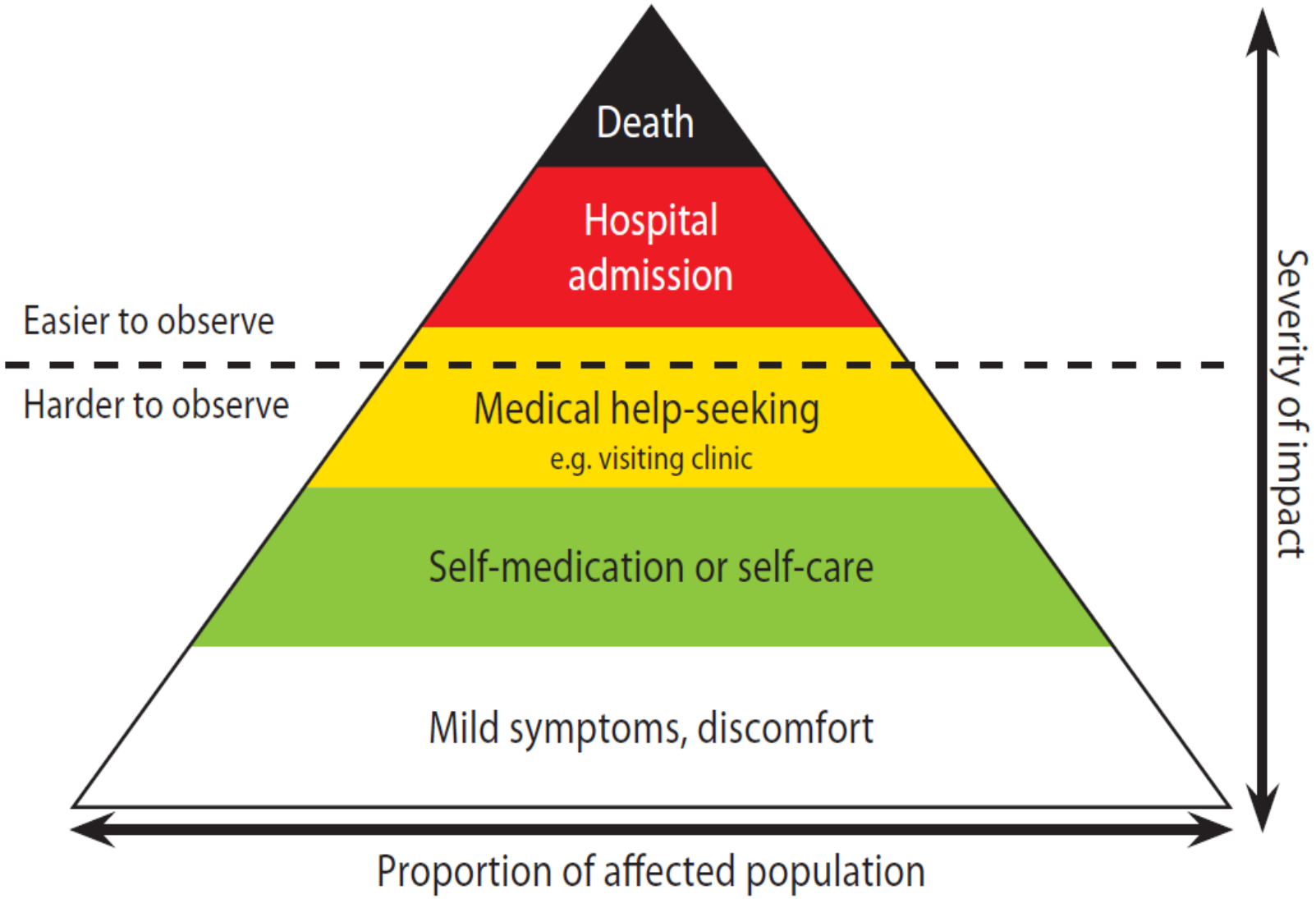
1. Introduction

The intersection between health, resilience capacity building and disaster risk reduction (DRR) planning and strategies has emerged as an interdisciplinary field of great importance for the protection of human health and wellbeing [1] since the publication of

Chan, E.Y.Y.; Dubois, C.; Fong, A.H.Y.; Shaw, R.; Chatterjee, R.; Dabral, A.; Loyzaga, A.; Kim, Y.-k.; Hung, K.K.C.; Wong, C.S. Reflection of Challenges and Opportunities within the COVID-19 Pandemic to Include Biological Hazards into DRR Planning. *Int. J. Environ. Res. Public Health* **2021**, *18*, 1614. https://doi.org/10.3390/ijerph18041614


Extreme Temperature
Basic Health Needs
Air Pollution
Affected supply of food
Temperature regulation measures may not be adequate enough
Change in environment
Change in air temperature
Basic Infrastructure
Increased demand of electricity, increased burden of electrical appliance
Deformation of road
Population Move
Infectious Diseases
Respiratory Disease
Vector-borne diseases
Food-borne diseases
Non-communicable diseases
Cardiovascular diseases
Brain diseases
Worsening of chronic diseases
Injuries
Accidents
Heat Stroke
Health Damage (Physical, Mental & Social)
Increase in death, injuries and illness
Increase the burden of public health system
Increase in the demand of social welfare

Health Impact Pyramid



Modeling Methods and DATA

Outcome Dimensions	Outcome Indicators	Sources	Coverage
Mortality	Causes of Death (By age, gender, district, socio-economic status)	Hong Kong Census and Statistic. Government of HKSAR, PRC China	99%
Morbidity	Daily Hospital Admissions; ICD 9 & ICD 10.	Hong Kong Hospital Authority. Government of HKSAR, PRC China.	83%
Practices: Health Seeking behavior	Hotline calls, Reasons for calls, outcomes of calls	PE Link(HK Government Subsidized NGOs target vulnerable population)	75%
Practices: Self-reported self help	Self-reported activities. Semi-structured	Randomized, Population based, computerized telephone survey	96%
Practices: Behavior changes			
Perception: Attitude			
Knowledge			

Time-series temperature-health studies

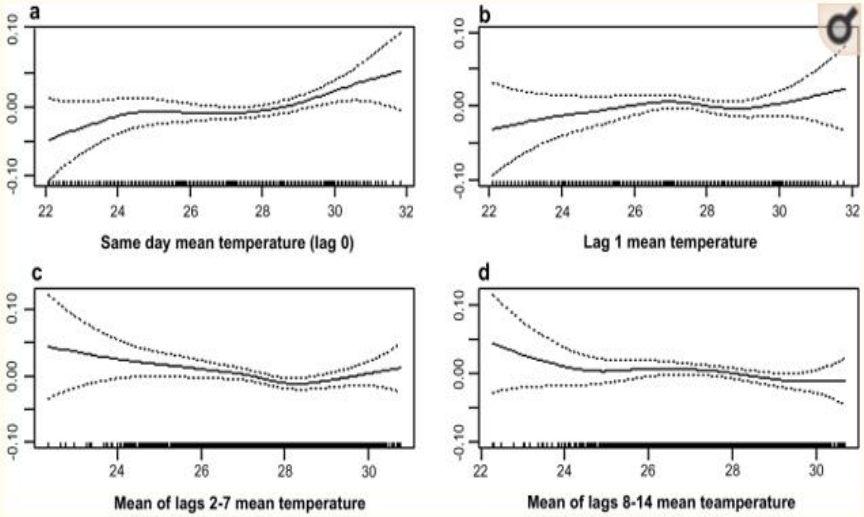
1) Basic Model: Generalized Additive Model

E [daily record of admissions/ deaths] = mean temperature + mean RH + mean wind speed* + total solar radiation* + mean level air-pollutants* + long term trend + seasonal trend + holiday effect + day-of-week + same day rainfall

2) Stratified analysis with: Season, Gender, Age, Disease subtypes (ICD 9 and ICD 10),

*Variables were included when substantial associations were observed.

Overall Mortality and Hot temperature Relationship



Open in a separate window

Figure 1

Adjusted smoothed relationships between various lags of mean temperature and the centred log of mortality, all with 4 df and adjusted for seasonality, pollutants, day of week, holidays, influenza rates and the other lagged temperature variables.

An average 1°C increase in daily mean temperature above 28.2°C was associated with an estimated 1.8% increase in mortality.

Women, men less than 75 years old, people living in low socioeconomic districts, those with unknown residence and married people were more vulnerable.

Non-cancer-related causes such as cardiovascular and respiratory infection-related deaths were more sensitive to high temperature effects.

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. *J Epidemiol Community Health*. 2010;66(4):322-7.

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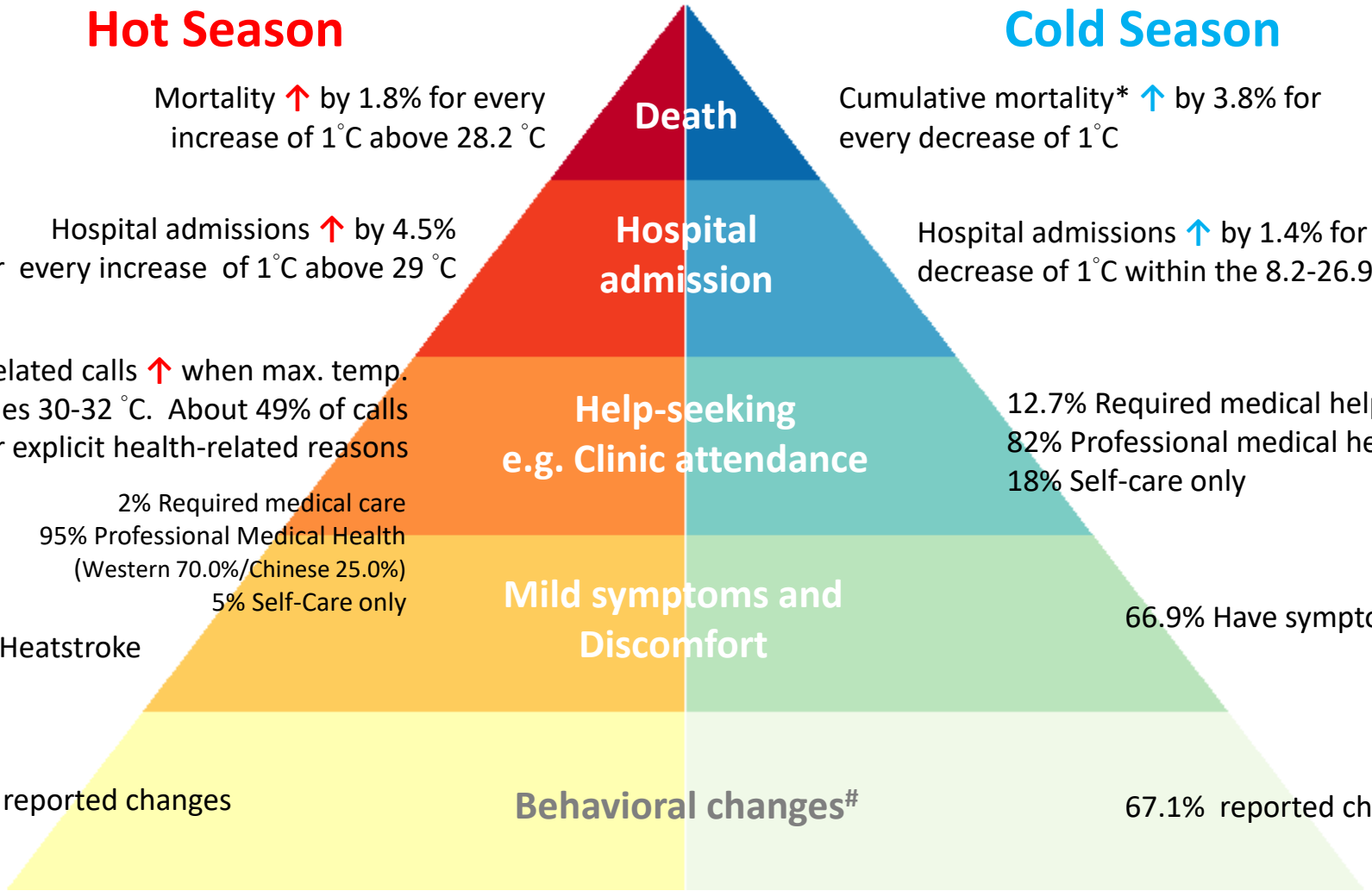
Temperature Health Impact in Hong Kong

Hot Season

Cold Season



Mortality ↑ by 1.8% for every increase of 1°C above 28.2 °C

Cumulative mortality* ↑ by 3.8% for every decrease of 1°C

Hospital admissions ↑ by 4.5% for every increase of 1°C above 29 °C

Hospital admissions ↑ by 1.4% for every decrease of 1°C within the 8.2-26.9°C range

Health-related calls ↑ when max. temp. reaches 30-32 °C. About 49% of calls were for explicit health-related reasons

12.7% Required medical help
82% Professional medical help
18% Self-care only

2% Required medical care
95% Professional Medical Health
(Western 70.0%/Chinese 25.0%)
5% Self-Care only

1.9 % Heatstroke

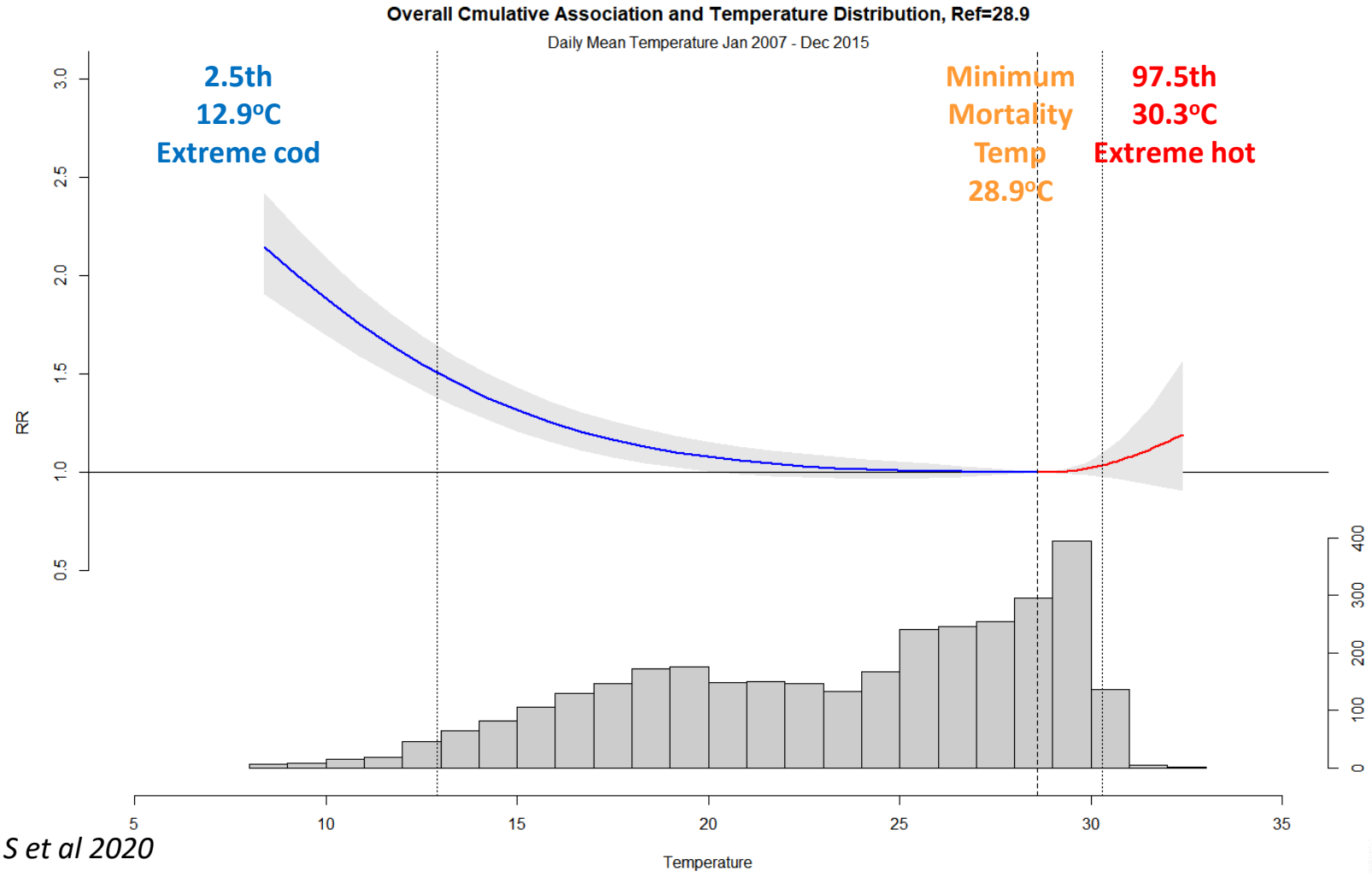
66.9% Have symptoms

88.4% reported changes

67.1% reported changes

* Cumulative mortality is used because the lagged effect of coldness towards mortality is estimated to be 3 weeks. # Behavioral changes include *amount of physical activity*, *appetite*, *frequency of social activity*, *mood* and *sleeping quality*

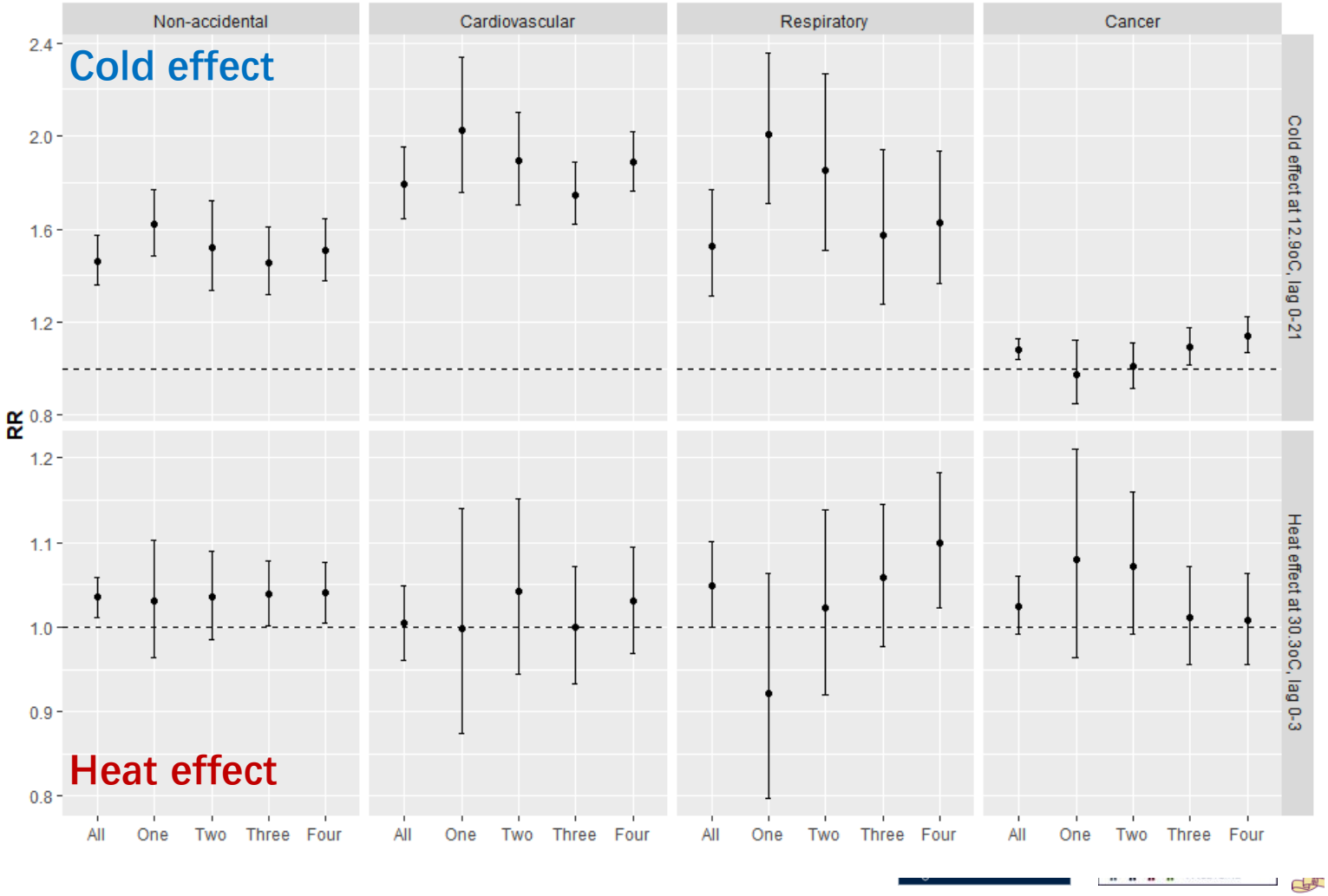
Low temperature pose much stronger overall effect on mortality than high temperature in Hong Kong, a subtropical city



Liu S et al 2020

Temperature effect on different cause of death by SES groups

The **cold** (12.9°C, 2.5th at lag 0-21) and **heat** effect (30.3°C, 97.5th at lag 0-3) compared to 27°C by **cause of death** and SES groups (where **One = the highest SES**, **Four =lowest SES**)



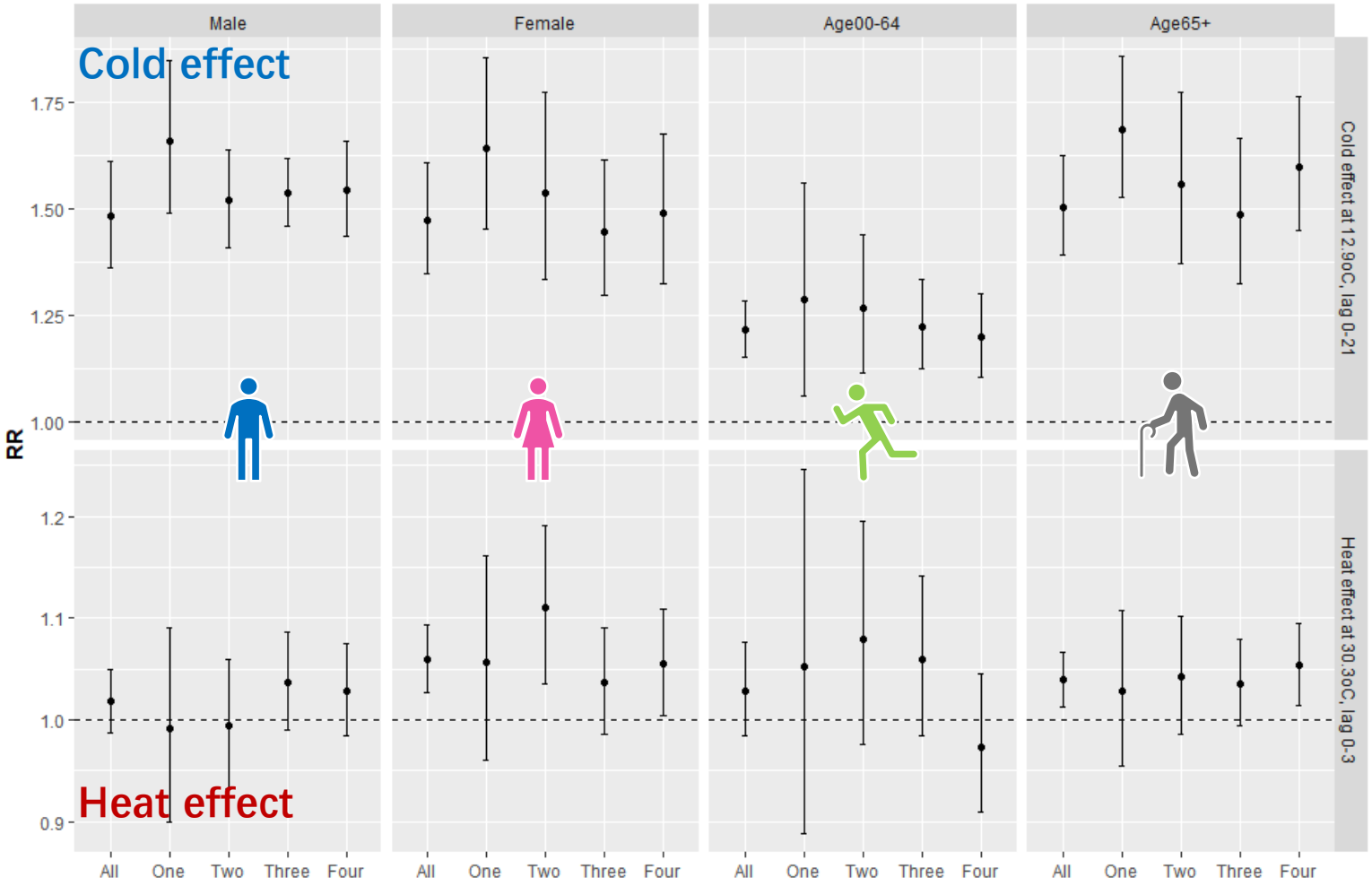
Key Findings

- **Cold effect** was significantly associated with higher mortality risk across all SES groups, despite the inter group difference was not clear.
- **Heat effect** was only significant among lower SES groups.

Liu S et al 2020

Temperature effect on different gender and age by SES groups

The **cold** (12.9°C, 2.5th at lag 0-21) and **heat** effect (30.3°C, 97.5th at lag 0-3) compared to 27°C by **cause of death** and SES groups (where **One = the highest SES**, **Four =lowest SES**)

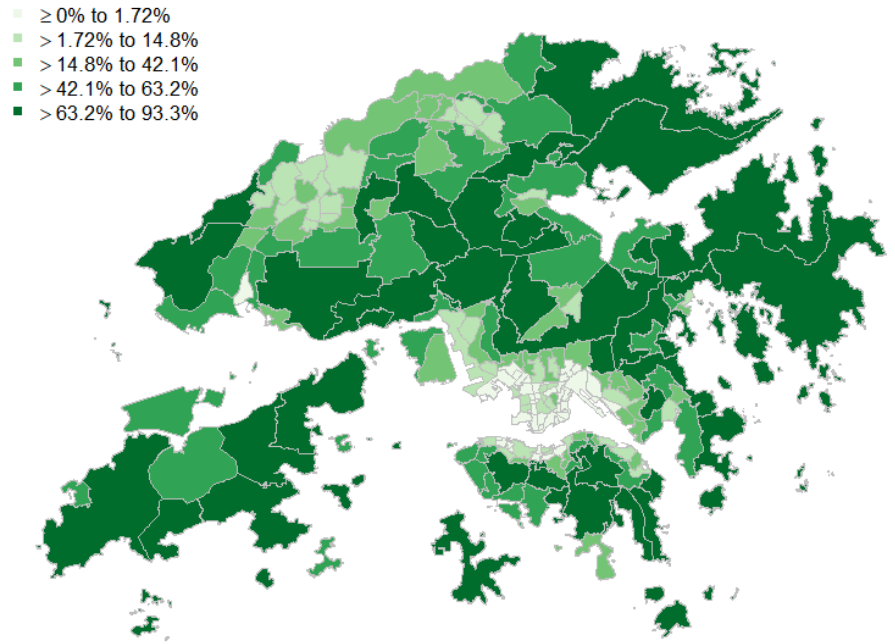


Key Findings

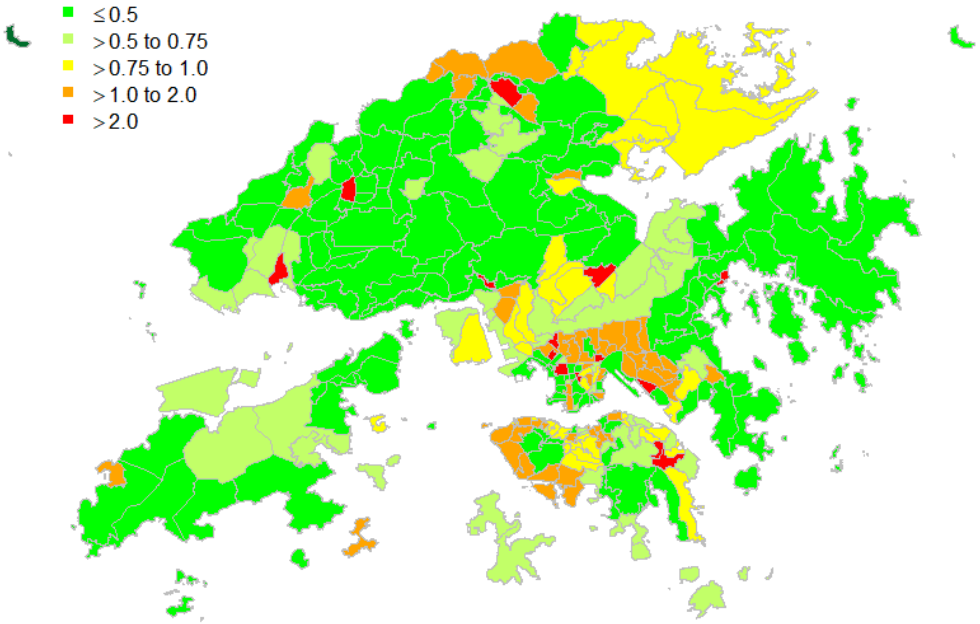
- **No clear gender difference** for **cold effect**, but **female** may be more sensitive to hot temperature.
- Higher **cold effect** was observed in highest SES group
- Older age was associated with higher mortality risk for both high and low temperature.

Liu S et al 2020

Green space density



Relative risk for non-accidental mortality



An increase of 10% in green space density for a TPU was associated with a decrease of 4.8% of non-accidental mortality

Huang Z et al 2021

Climate change in Hong Kong

Increased 1.5 to 3°C **Extreme temperature days (above 33°C or below 12°C) will increase**	**Number of very wet years: increased 4 times** **Extreme Rainfall: 180 mm**	**Sea level Rise: 30mm per decades** **3.53M for Typhoon Hagupit;** **3.96M For Typhoon Wanda (1962)** **4 .05 M (1937)**	**More Extreme events:** **Typhoon Hagupit (2008)** **16 major urban floods with island population evacuated, 58 injury** **400 flights cancelled** **4500 Trees collapsed, Rotated 2 Boeing planes**

IRDR 2021 Conference: Health

Health in DRR included:

- The importance of multi-sectoral, multi-hazard action plans;
- Re-Conceptualization of Human Health security and Health-EDRM for compound, complex, cascading, concurrent and protracted crisis
- Adaptation to technological advancements in data collection, dissemination and protection
- The improving inclusivity in digital literacy.

[On 19th April 2021]

Case of DRR: COVID-19

Subtropical context

WHO Classification of hazards

GENERIC GROUPS[1]	1. NATURAL						2. HUMAN-INDUCED[2,3]		3. ENVIRONMENTAL
GROUPS	1.2 HYDRO-METEOROLOGICAL						2.1 TECHNOLOGICAL	2.2 SOCIETAL	3.1 ENVIRONMENTAL DEGRADATION[17]
SUBGROUPS	1.1 GEOPHYSICAL[4]	1.2.1 HYDROLOGICAL[4]	1.2.2 MTEOROLOGICAL[4]	1.2.3 CLIMATOLOGICAL[4]	1.3 BIOLOGICAL[5]	1.4 EXTRATERRESTRIAL[4]			
MAIN TYPES -SUBTYPES [SUB-SUBTYPES]	Earthquake: - *ground-shaking* Tsunami Mass movement (geophysical trigger): - *landslide* - *rock fall* - *subsidence* Liquefaction Volcanic activity: - *ash fall* - *lahar* - *pyroclastic flow* - *lava flow*	Flood: - *riverine flood* - *flash flood* - *coastal flood* - *ice jam flood* Mass movement (hydro-meteorological trigger): - *landslide* - *avalanche (snow)* - *mudflow* - *debris flow* Wave action: - *rogue wave* - *seiche*	Storm: - *extratropical storm* - *tropical cyclone* [cyclonic wind, cyclonic rain, cyclone (storm) surge] - *convective storm* [tornado, wind, rain, winter storm, blizzard, derecho, lightning, thunderstorm, hail, sand/dust storm] Extreme temperature: - *heatwave* - *coldwave* - *severe winter condition* [e.g. snow/ice, frost/ freeze, dzud][6] Fog	Drought Wild fire: - *land fire [e.g. brush, bush, pasture]* - *forest fire* Glacial lake outburst (flood)	Airborne diseases Waterborne diseases Vector-borne diseases Foodborne outbreaks[7] Insect infestation:[4] - *grasshopper* - *locust* Animal diseases Plant diseases Aeroallergens Antimicrobial resistant micro-organisms Animal-human contact - *venomous animals* [snakes, spiders]	Impact: - *airburst* - *meteorite* Space weather: - *energetic particles* - *geomagnetic storms* - *shockwave*	Industrial hazards:[8] - *chemical spill* - *gas leak* - *radiation* [radiological, nuclear] Structural collapse: - *building collapse*[8,9] - *dam/bridge failures* Occupational hazards - *mining* Transportation:[8,11] - *air, road, rail, water, space* Explosions Fire[8] Air pollution:[9] - *haze*[10] Infrastructure disruption: - *power outage*[11] - *water supply* - *solid waste, waste water* - *telecommunication* Cybersecurity Hazardous materials in air, soil, water:[12,13] - *biological, chemical, radiological* Food contamination[7]	Acts of violence Armed conflicts:[14] - *international* - *non-international* Civil unrest Stampede Terrorism: - *chemical, biological, radiological, nuclear, and explosives*[15,16] Financial crises: - *hyper-inflation* - *currency crisis*	Erosion Deforestation Salinization Sea level rise Desertification Wetland loss/ degradation Glacier retreat/ melting Sand encroachment

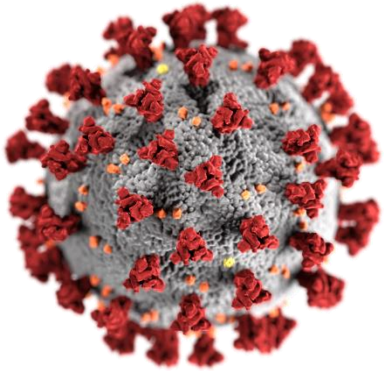
Source: https://www.who.int/hac/techguidance/preparedness/health-emergency-and-disaster-risk-management-framework-eng.pdf?ua=1

COVID-19 Pandemic as a Biological Hazard

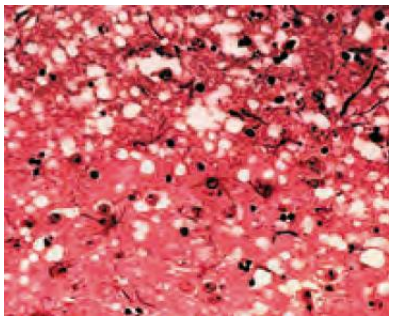
- Hazard is "a process, phenomenon or human activity that may cause loss of life, injury or other health impacts, property damage, social and economic disruption or environmental degradation."

- Biological hazards are those "of organic origin or conveyed by biological vectors, including pathogenic microorganisms, toxins and bioactive substances"

Salmonella bacteria



COVID-19



Mad Cow Disease

Parasite

About COVID-19 Pandemic

- The SARS-CoV2, also known as COVID-19, belongs to the ***coronavirus family***, which is the same family as ***SARS*** and ***MERS*** viruses.

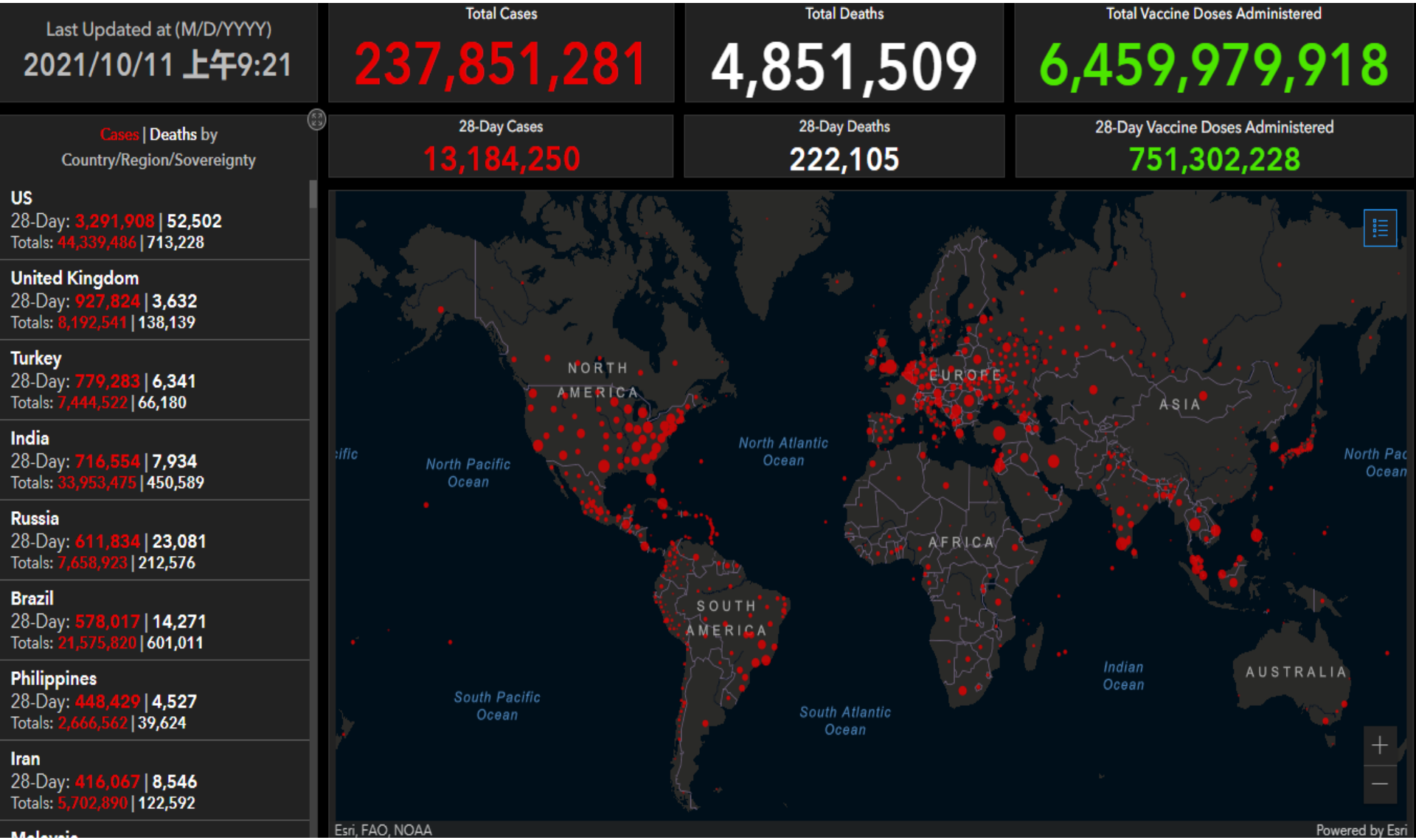
- The COVID-19 pandemic was considered a ***Public Health Emergency of International Concern (PHEIC)*** by the WHO on 30 Jan 2020.

- COVID-19 is a serious public health emergency threat:
    - Several 1.9 million deaths reported and affected 88million in global (Jan 2021).
    - Health Threats to overwhelm the national healthcare systems globally.

- COVID-19 has reinforced the need to revisit the integration of health within disaster risk reduction (DRR) strategies for biological hazards in a systems-wide approach.

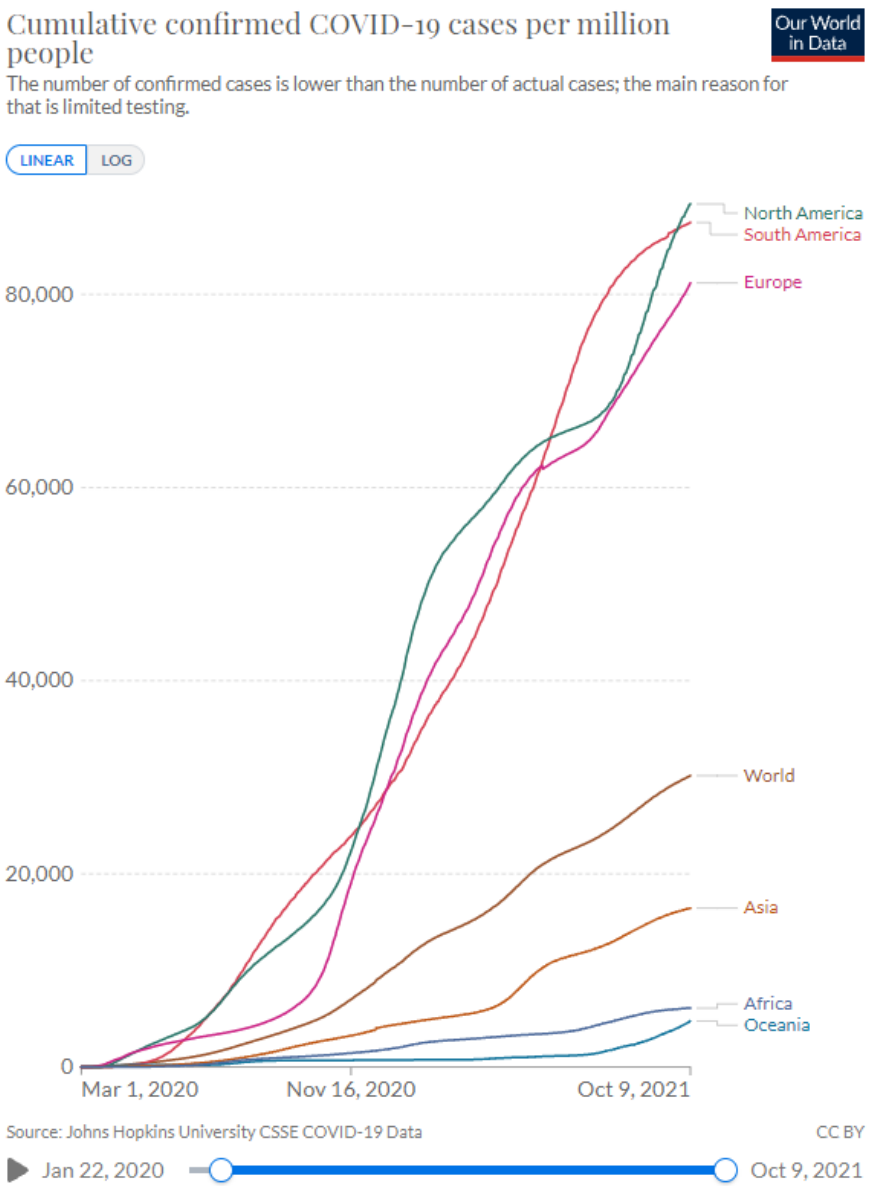
Source: https://www.who.int/docs/default-source/coronaviruse/situation-reports/20201005-weekly-epi-update-8.pdf

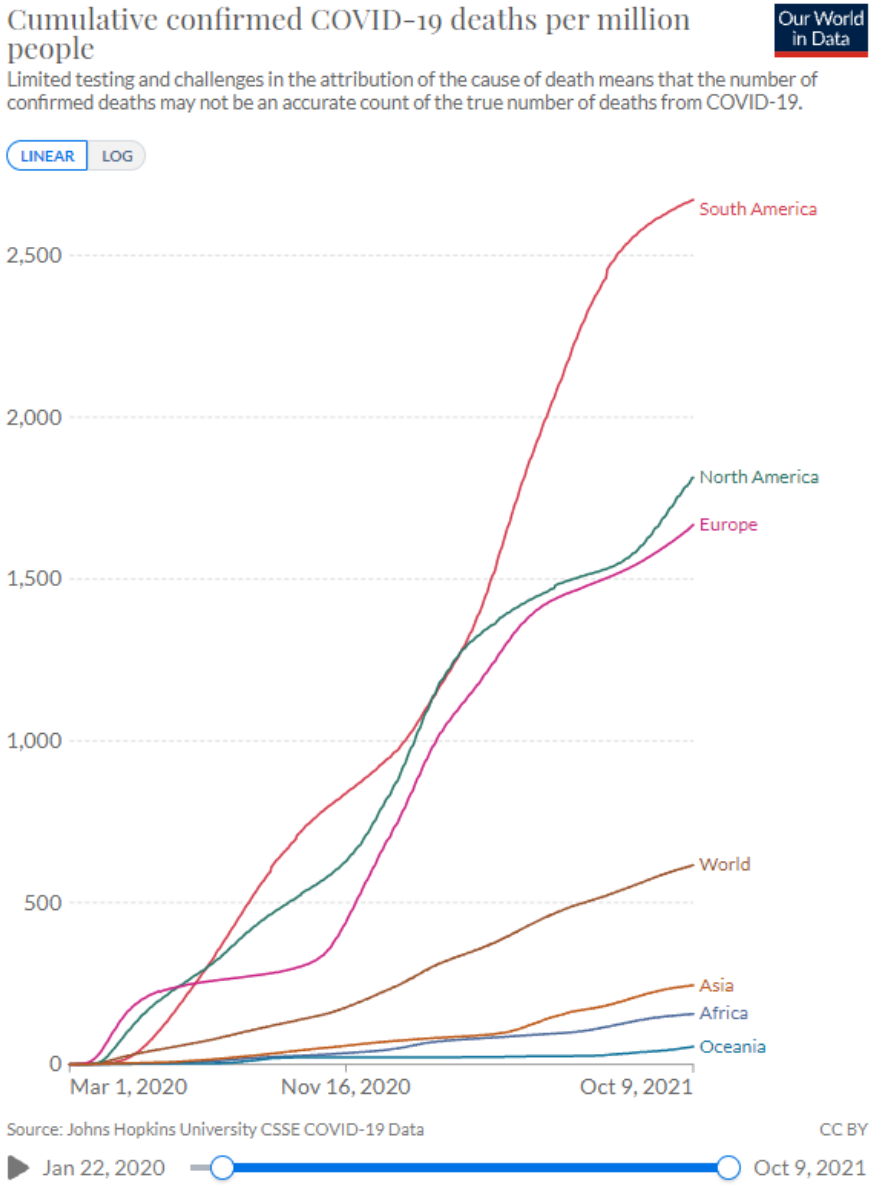
COVID-19 situation (11th October 2021)



Source: https://coronavirus.jhu.edu/map.html

Cumulative cases and deaths by continent (as of 9 October 2021)





Protracted biological hazard: Case of COVID-19 Pandemic

- Disaster risk management planning and response strategies have yet to better reflect the non-linear transition of biological hazards
  - the community must enter a response phase before the previous recovery phase is completed
  - Health systems will also be required to plan and implement strategies to support, strengthen and restore local capacities during protracted crises

- There remains a huge gap in the resilience and preparedness strategy, planning and building about a protracted biological hazard

Panel: **Ways to advance bottom-up citizen engagement in health disaster and emergency management programmes, policies, and research**

Risk communication

- Identify ways to build trust, awareness, and knowledge before, during, and after responses, and address underlying drivers of fear, anxiety, and stigma.[10]
- Recognise that resource and information channels vary with demographics, acceptability, and access, and tailor communication to participant groups.[12]

Research participation

- Identify systematic ways to rapidly involve communities in participation, notably clinical research for vaccines and therapeutics.[10,12]
- Develop protocols for rapid research ethics review to allow impactful and timely community involvement.[8,12]

Research design

- Identify approaches to encourage participation with urbanised, isolated, and mobile populations equitably.[8,12]
- Capture disaggregated data to understand the complexity of community diversity, particularly in relation to marginalised, vulnerable, and underserved groups.[10,12]
- Develop protocols for appropriate research design and outcome evaluation to maximise impact and relevance.[10]

Knowledge sharing

- Identify relevant channels for dissemination of research learnings into the source community to better understand and scale up effective and empowering innovation among citizens and vulnerable groups.[8,12]
- Build mechanisms for multidisciplinary partnerships to analyse and share data related to community preparedness, response, and evaluations.[8,12]

Bottom Up citizen engagement in Health-EDRM since COVID 19

(Lancet/2021)

Comment

Bottom-up citizen engagement for health emergency and disaster risk management: directions since COVID-19

https://www.thelancet.com/journals/lancet/article/PIIS0140-6736(21)01233-2/fulltext

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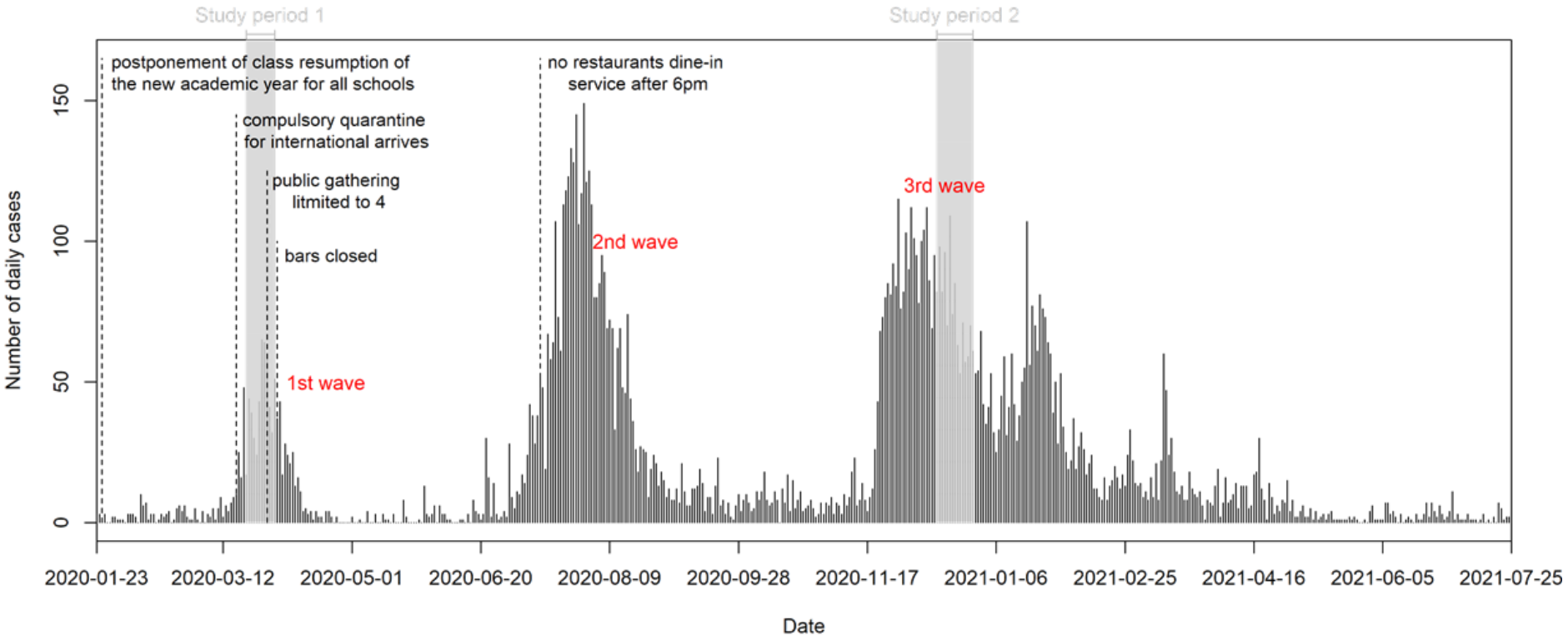
	Research Gaps	Example
1	What might be acceptable agreed all-hazard and disasters classification?	Delphi method study to develop working epidemiological definitions of thresholds relating to temporality (slow-onset/protracted events), attribution (direct *vs* indirect causes of morbidity and mortality), baseline data and Indicator reporting guidelines.
2	How to provide an updated picture of patterns and trends in health risks associated with disasters and emergencies?	How to use Big/Data, Global data collection systems, (eg the International Health Regulations and the *Lancet* Countdown) to facilitate the identification, prevention, preparation, response, and recovery from emergency threats and risks?
3	How to profile health risk for subgroups with vulnerabilities— eg, very old people, people with disabilities, patients with chronic conditions? — because these groups have specific health needs that are not always recognized in national local policies, plans, and practices.	Health Vulnerability Index Development
4	What might be effective ways to support preparedness, response and rehabilitation in Health?	Community intervention trials should be implemented to assess the best strategies to build bottom up capacity at all level (individual, household, and community-based disaster risk literacy)
5	How to engage in health risk communication for warning and health protection efforts and health decision making?	Stakeholders interviews, Community RCT of technology applications of disaster health risk message

Chan EYY and Murray V. What are the health research needs for the Sendai Framework? Lancet June 19, 2017 http://dx.doi.org/10.1016/ S0140-6736(17)31670-7

Hong Kong COVID-19 pandemic waves (2020-2021) with daily caseloads, government pandemic responses and timing of the serial cross-sectional studies



Sociodemographic comparison

	First Wave sample (n=765) March 2020	Third Wave sample (n=651) December 2020	2016 Hong Kong census
Gender			
Male	46.5% (356)	48.4% (315)	45.1%
Female	53.5% (409)	51.6% (336)	54.9%
Age			
18-24	9.3% (71)	6.9% (45)	9.5%[c]
25-44	32.4% (248)	26.3% (171)	35.3%
45-64	39.6% (303)	41.8% (272)	36.8%
65 or older	18.7% (143)	25.0% (163)	18.4%
Residential district			
Hong Kong Island	19.2% (147)	17.5% (114)	17.2%
Kowloon	30.2% (213)	29.8% (194)	30.6%
New Territory	50.6% (387)	52.6% (342)	52.2%
Education			
Primary level or below	8% (61)	12.8% (83)	25.7%
Secondary	43.3% (330)	43.7% (283)	43.7%
Tertiary level	48.7% (371)	43.5% (282)	30.6%
Household Income			
<2000 - 7999	9.3% (66)	13.7% (86)	15.1%
8000-19999	14.1% (101)	16.2% (102)	25.9%
20000 - 39999	26.6% (191)	27.3% (172)	27.8%
40000 or more	50.2% (360)	42.8% (269)	31.2%
Employment status			
White collar worker	44.6% (341)	42.2% (275)	26.5%
Blue collar worker	16.7% (128)	14.3% (93)	24.7%
Housewife	12.2% (93)	12.9% (84)	7.4%
Fulltime student	6.1% (47)	3.5% (23)	15.0%
Unemployed/Retired	19.0% (145)	26.7% (174)	26.4%

Preventive behaviors against COVID-19 *

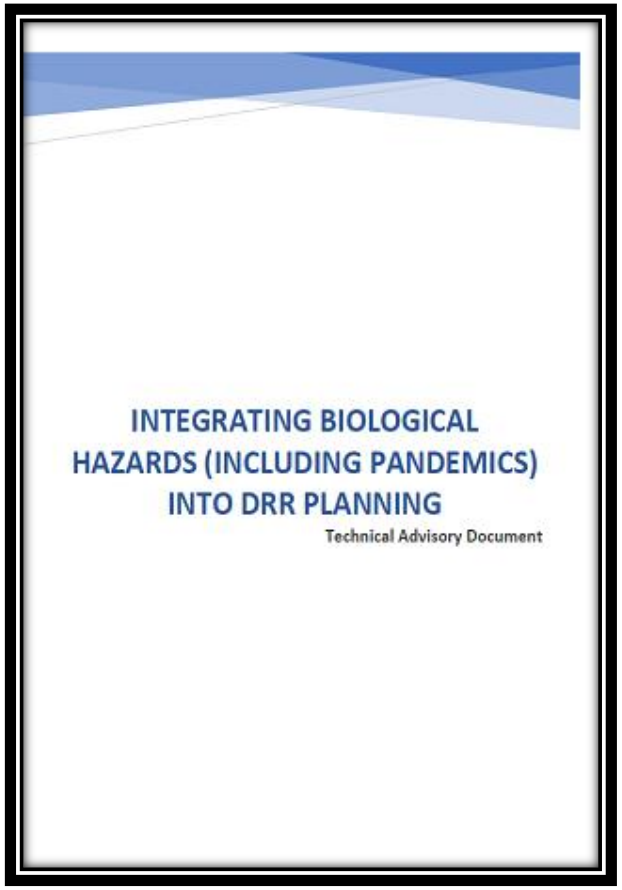
	1st wave (n=765) % (n)	3rd wave (n=651) % (n)	% Change	p-value[a]
Hygiene practices				
Wearing face mask outside the home	97.4% (745)	100.0% (651)	+2.6%	<0.001
Washing hands with soap	92.3% (706)	90.0% (586)	-2.3%	0.158
Use of serving utensils	74.2% (568)	69.4% (452)	-4.8%	0.051
Bring own utensils when dining out	7.9% (52)	5.3%(31)	-2.6%	0.086
Social distancing practices				
Avoidance of international travel to high-risk regions	85.8% (656)	76.6% (498)	-9.1%	<0.001
Avoidance of social gatherings	80.5% (616)	72.0% (469)	-8.5%	<0.001
Avoidance of public places and public transport	53.3% (408)	26.0% (169)	-27.5%	<0.001
Avoidance of dine-in services at restaurants by using takeout/home delivery services	34.4% (262)	44.8% (290)	+10.4%	<0.001

[a] Two-proportions z-test with continuity correction were used to test the difference between the two waves of studies

*% of respondents who stated that they "Always" or "Usually" engaged in the behaviors.

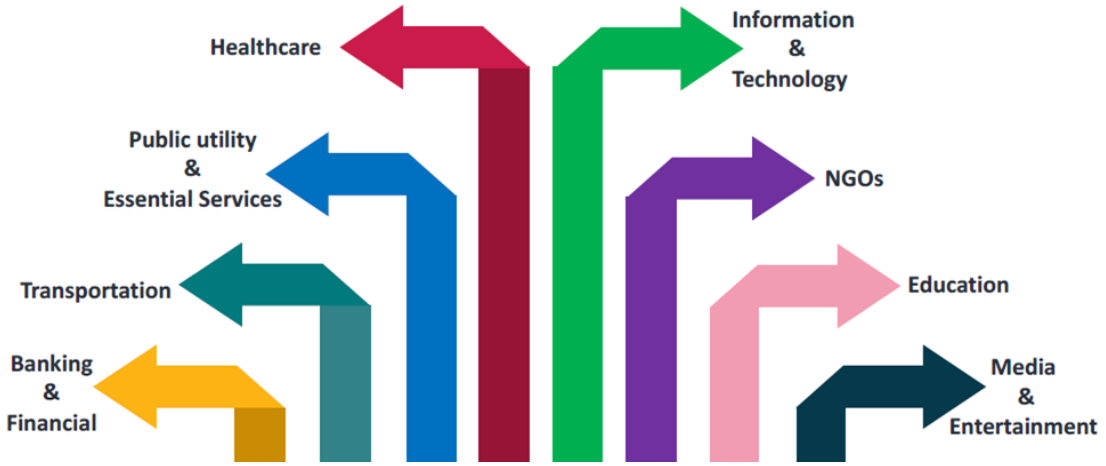
Shaw R, Chatterjee R and Dabral A (2020) Integrating Biological Hazards (including pandemic)s into DRR Planning.

http://www.ccouc.ox.ac.uk/technical-advisory-document-integrating-biological-hazards-including-pandemics-into-drr-planning



Sectors that help in mitigation

- The role of the **healthcare** sector is paramount in mitigating a health emergency
  - It provides early warning, and share critical information. During a health emergency, the sector supports containment efforts by carrying out testing, diagnosis and treatment
- The **Information and Telecommunication** sector underpins many sectors and can support the different aspects of the response to biological hazards
  - including medical services, information sharing, data collection, early warning, and risk communication. It also powers remote learning modalities, tele-medicine, tele-working and e-commerce



Chan EYY, COVID19, DRR and S&T Agenda e-Asia Pacific Science and Technology Conference for Disaster Risk Reduction, 15th October 2020

Risk Assessment Of Biological Hazards
Four key components of risk – hazards, exposure, vulnerability and coping capacity

Conclusion: Health

- COVID-19 pandemic presents an opportunity for multidisciplinary research and action engagement in DRR.
- Health-EDRM, as a platform of DRR and Health will provide a foundation for research and policy development.
- Update global lecture and webinar series which emphasizes on the multidisciplinary nature and capacity of Health-EDRM contribution to health and DRR. www.ccouc.org

Thank You

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Informal home care providers: the forgotten health-care workers during the COVID-19 pandemic

Published Online June 1, 2020 https://doi.org/10.1016/S0140-6736(20)31254-X

The COVID-19 pandemic has placed pressure on many national health-care systems worldwide. Due to the rapid surge in caseloads and resource constraints in health systems, in many high-income settings, the focus has been on disease screening, with those who have severe disease prioritised for hospitalisation. But the COVID-19 pandemic has also led to an unprecedented reliance on home care as one pillar of the health-care system to support people with confirmed or suspected COVID-19. Meanwhile, informal home care provision and challenges faced by care providers, excluding those who are formal and paid, in the home context have largely been overlooked. In such population-wide public health emergencies, home care can be the only care option for people in low-income and resource-constrained settings who do not have access to health-care facilities due to such factors as distance, lack of transport, financial issues, or cultural–linguistic barriers.[1] Of course, people in need of home care are not limited to those with COVID-19. A large proportion of home care recipients include patients with chronic diseases, mental disorders, or disabilities who require essential life-sustaining care, health maintenance support, and supplementary care during this pandemic. Moreover, home care recipients can include healthy but dependent individuals such as infants, young school-aged children, or older people.[1]

In public health emergencies, informal home care providers are a crucial human resource that improves the community's health-care capacity, especially in regions with an ageing population and areas with suboptimal health-care systems.[2,3] Yet our knowledge of the characteristics of these informal home care providers and the challenges they are facing during the COVID-19 pandemic is limited. The physical, mental, and social wellbeing of home care providers has been largely overlooked in the research literature. Policy planners who advocate for home care often make the assumptions that home care providers possess an appropriate level of health literacy, disease knowledge, psychological readiness, and medical care abilities. Another common assumption is that care recipients live in housing with adequate space where there are facilities for isolated care with ready access to home care materials. However, evidence gaps have shown there is a need for research with appropriate study outcomes to facilitate home care for people who

The case of informal case providers

[Informal home care providers: the forgotten health-care workers during the COVID-19 pandemic (thelancet.com)]

Published Online June 1, 2020
https://doi.org/10.1016/ S0140-6736(20)31254-X

Knowledge into Action:
COVID 19, DRR and Health-EDRM

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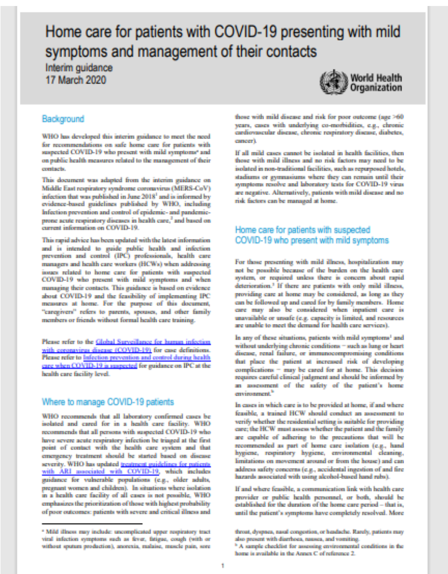
The Case of "Home Care"



March 17 2020 Version

August 12 2020 Version

WHO Home care for patients with suspected or confirmed COVID-19 and management of their contacts

https://www.who.int/publications/i/item/home-care-for-patients-with-suspected-novel-coronavirus-(ncov)-infection-presenting-with-mild-symptoms-and-management-of-contacts

Health-EDRM and Research ethics (2019)

Health-emergency disaster risk management and research ethics

Health-emergency disaster risk management (health-EDRM) aims to reduce the health risks and vulnerability associated with emergencies and disasters,[1-3] such as natural disasters, infectious disease epidemics, complex emergencies, technology failure, or global population movement. Medical care and health responses in emergency contexts often rely on best-fit interventions rather than best practices to protect communities in suboptimally functioning systems and complex contexts.[4,5] Unlike health emergency actions that are focused on the response, the health-EDRM approach emphasises emergency preparedness and disaster risk reduction and can take account of the limitations of the response-focused research landscape.[4,6] A greater emphasis on prevention can provide opportunities for research infrastructure building in normal times to support any emergency-related research attempts.

John Moore/Staff/Getty Images

The ecology of the global emergency research system involves a range of stakeholders including, but not limited to, families, caregivers, local governments or authorities, funders, research institutions, journals and publishers, and users of the relevant research results. Although research stakeholders have a responsibility to protect the interests of communities involved in research, achieving this is rarely straightforward in emergencies. Research can be simultaneously subject to different, sometimes competing, requirements and expectations. Issues such as decision making about research participation, determination of duties and roles at the research interface, treatment and public health, management of expectations on the front line, and participant protection from stigmatisation, discrimination, and exclusion are questions hotly debated in the bioethics community.[5,7]

Chan EYY et al (2019). Health EDRM and research ethics. Lancet 2019

Infrastructure and platform

- Emphasis on prevention can provide for research infrastructure in normal times to support any emergency-related research attempts

Evidence based science

- Medical care and health response in emergency contexts often rely on best-fit interventions rather than best practices

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Disaster Risk Reduction and Climate Change Adaptation: Understanding Framework Roadblocks

Bapon Fakhruddin, PhD

Technical Director- DRR and Climate Resilience

Chair- CODATA TG FAIR Data for DRR

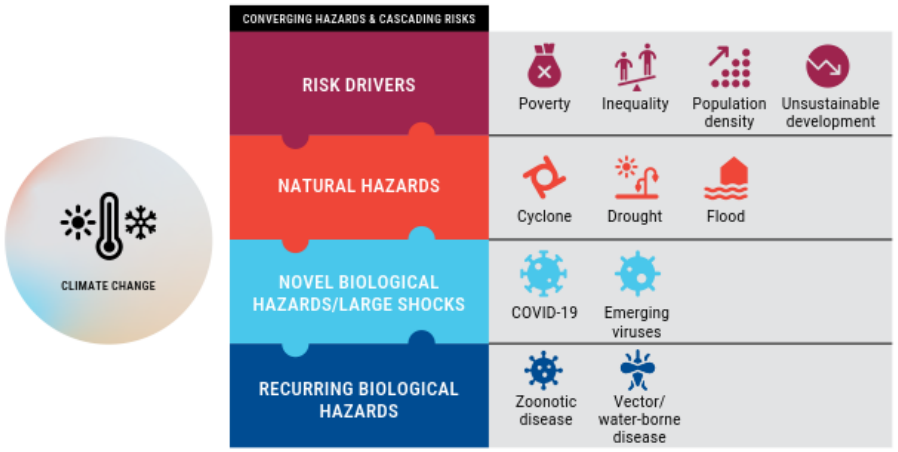
Tonkin+Taylor

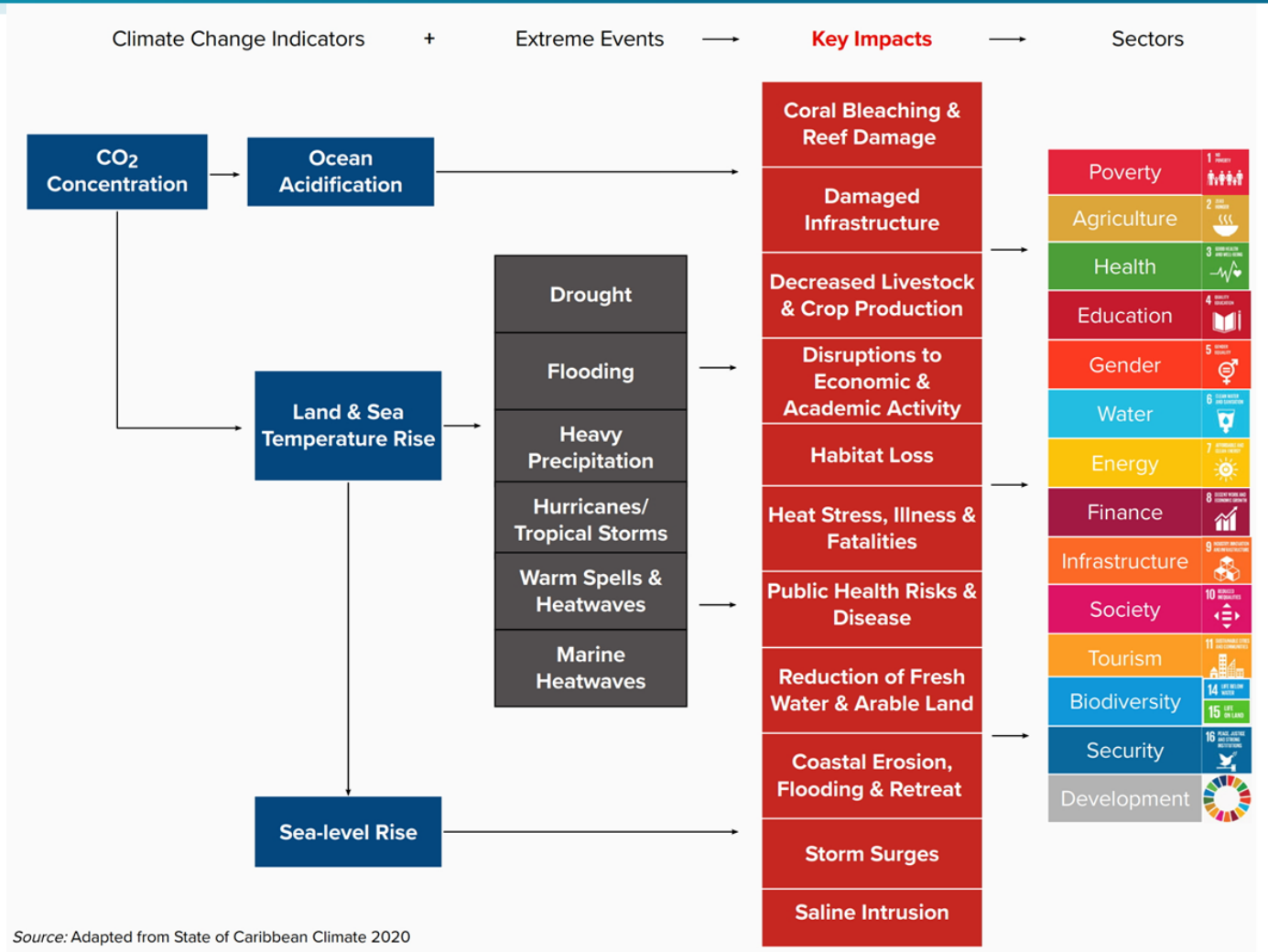
Tonkin + Taylor Group Pacific Island Capability Summary

	Environmental Impact Assessment	Geotechnical Investigations	Foundations	Slope Stability	Coastal Process Studies and Engineering	Roading & Infrastructure	Resort Developments	Airport Projects	Port Projects	Solid Waste Projects	Hydro Power Projects	Quarry and Material Studies	Water Supply Projects	Survey Services (incl. Bathymetric)*	Construction Management	DRR & Climate Resilience
Fiji	●	●	●	●	●	●	●	●	●	●	●	●	●		●	●
Samoa	●	●	●	●	●	●	●	●	●		●	●	●		●	●
American Samoa		●	●	●	●	●		●	●		●	●	●		●	●
Solomon Islands	●	●	●	●		●	●	●	●		●	●				●
Vanuatu		●	●	●	●		●		●		●		●			●
Cook Islands	●	●	●	●	●	●	●	●	●			●	●		●	●
Papua New Guinea	●					●										●
Tuvalu		●	●		●				●	●						●
Nauru		●	●						●							●
Kiribati	●	●	●						●				●	●	●	●
Palau		●							●			●		●		●
Pitcairn		●	●	●		●			●			●			●	
Tahiti							●									
Kosrae	●	●							●			●		●		
Chuuk (FSM)	●								●					●		
Marshall Islands	●									●			●			●
Tonga		●	●													●
New Caledonia		●	●				●		●						●	
Hawaii		●	●													

* Associated specialist sub-consultant

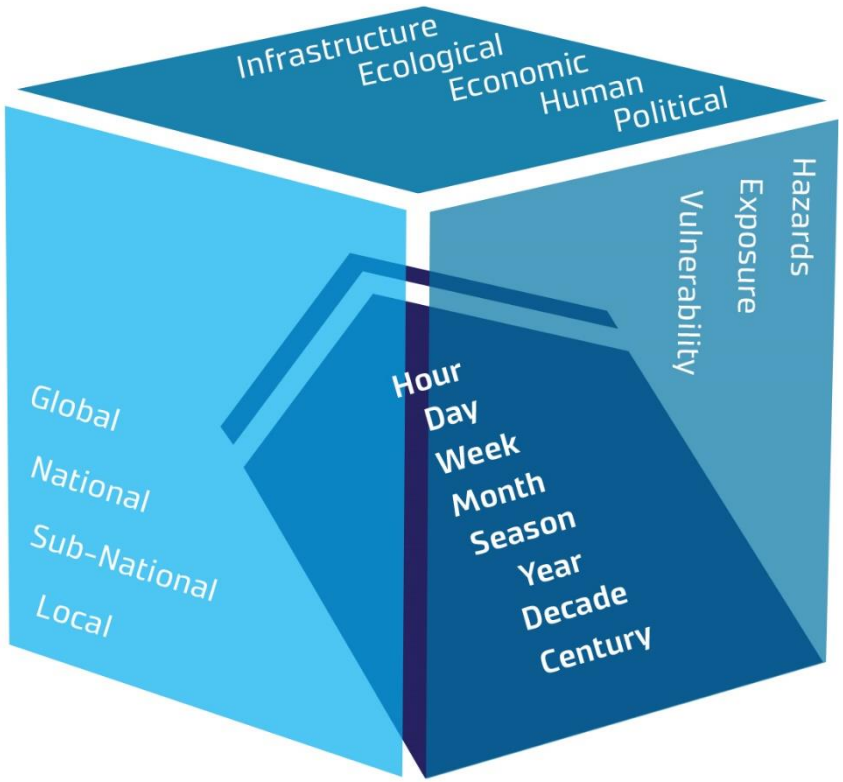
Historical + projected impacts of climate change

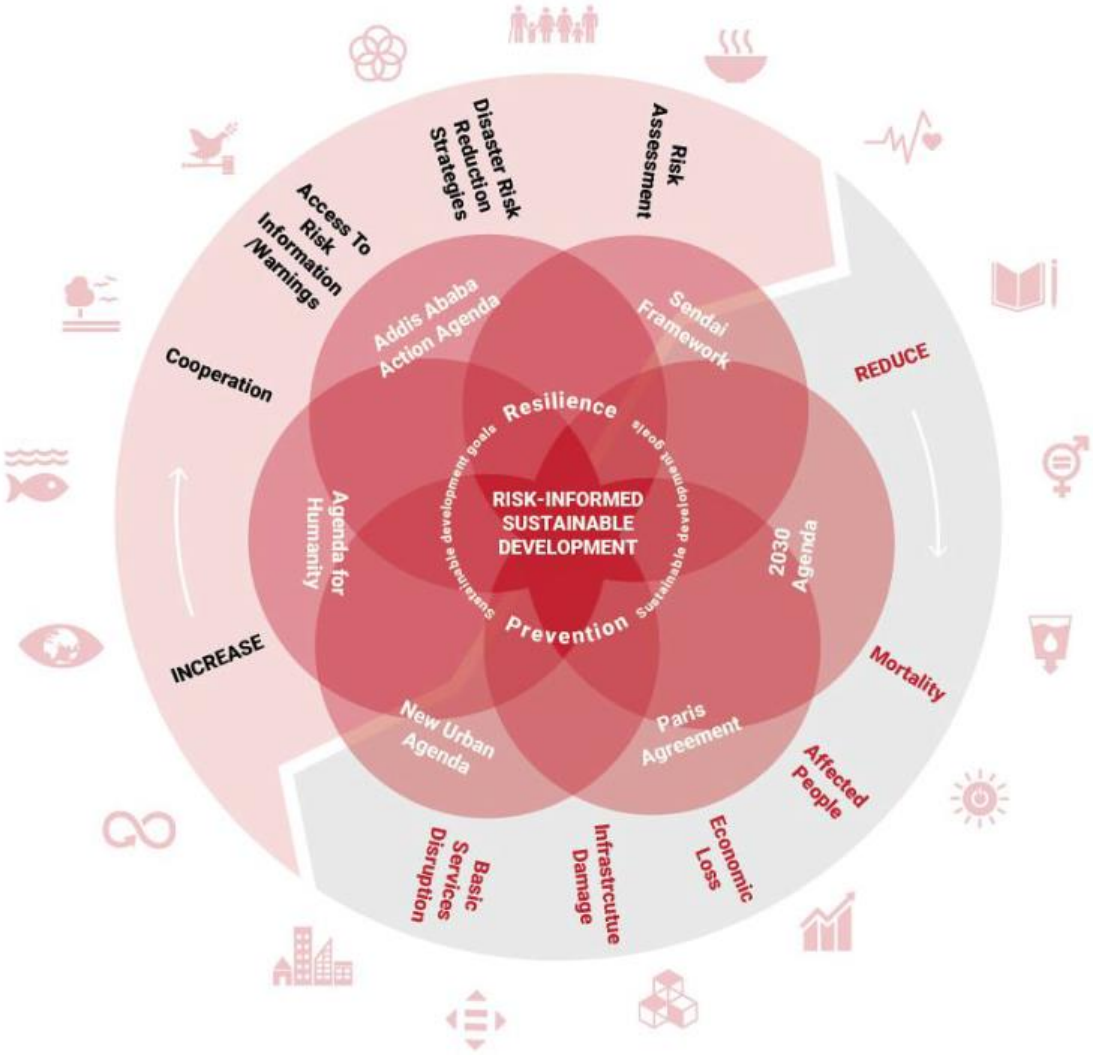




Source: Adapted from State of Caribbean Climate 2020

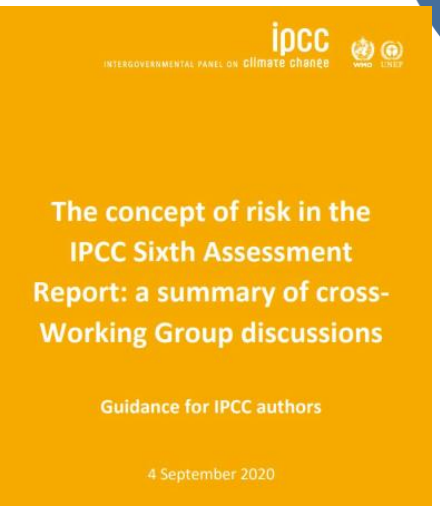
FAIR DRR Data and International Policy Agreements – Coherence from Global Framework

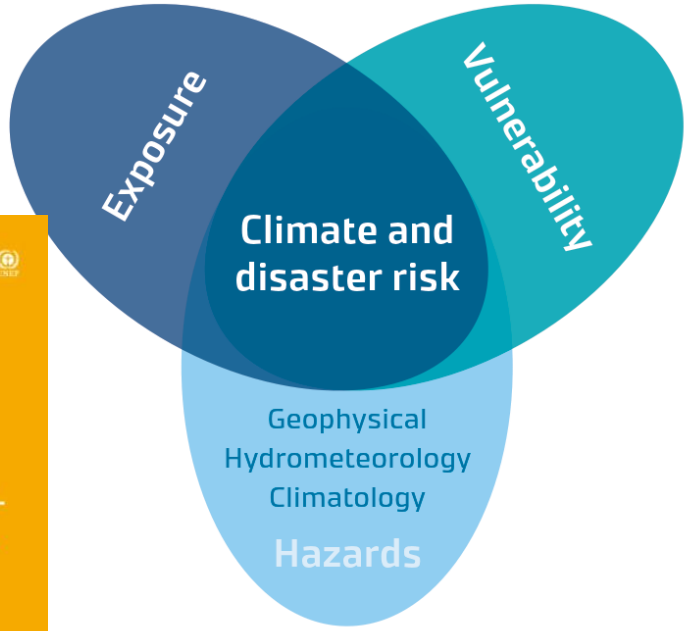




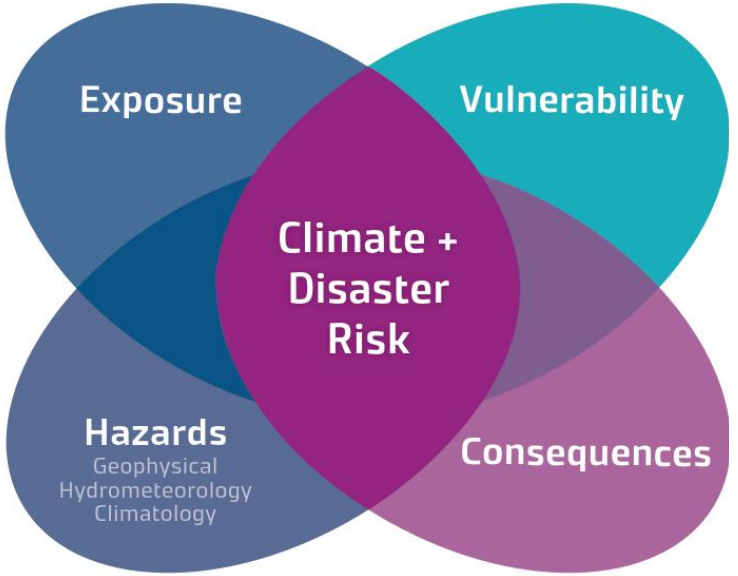
IPCC Risk Framework

The potential for adverse consequences for human or ecological systems, recognising the diversity of values and objectives associated with such systems.





SREX, 2012



Fakhruddin et al., 2019

Simpson et al., 2021

What COVID-19 teach us about preparing climate risk

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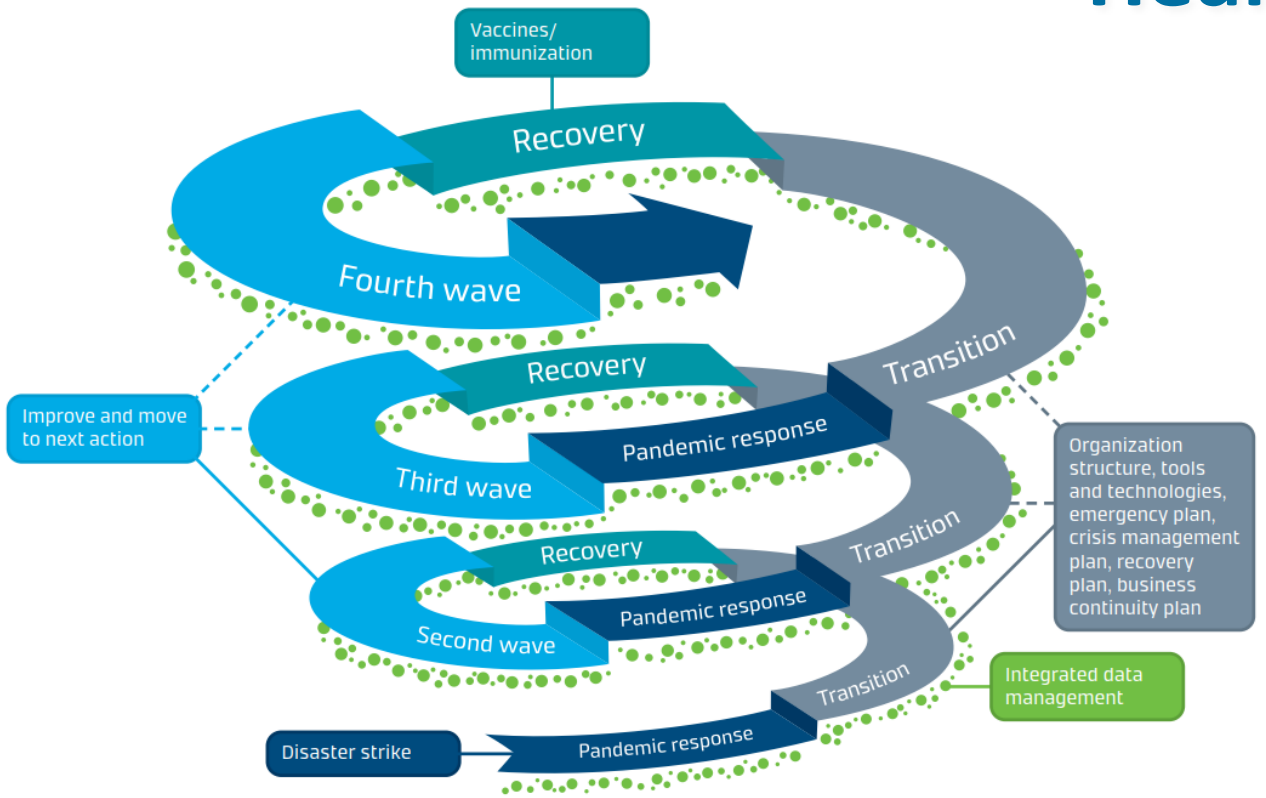
A systemic integration of Climate + Health Data for Risk Assessment

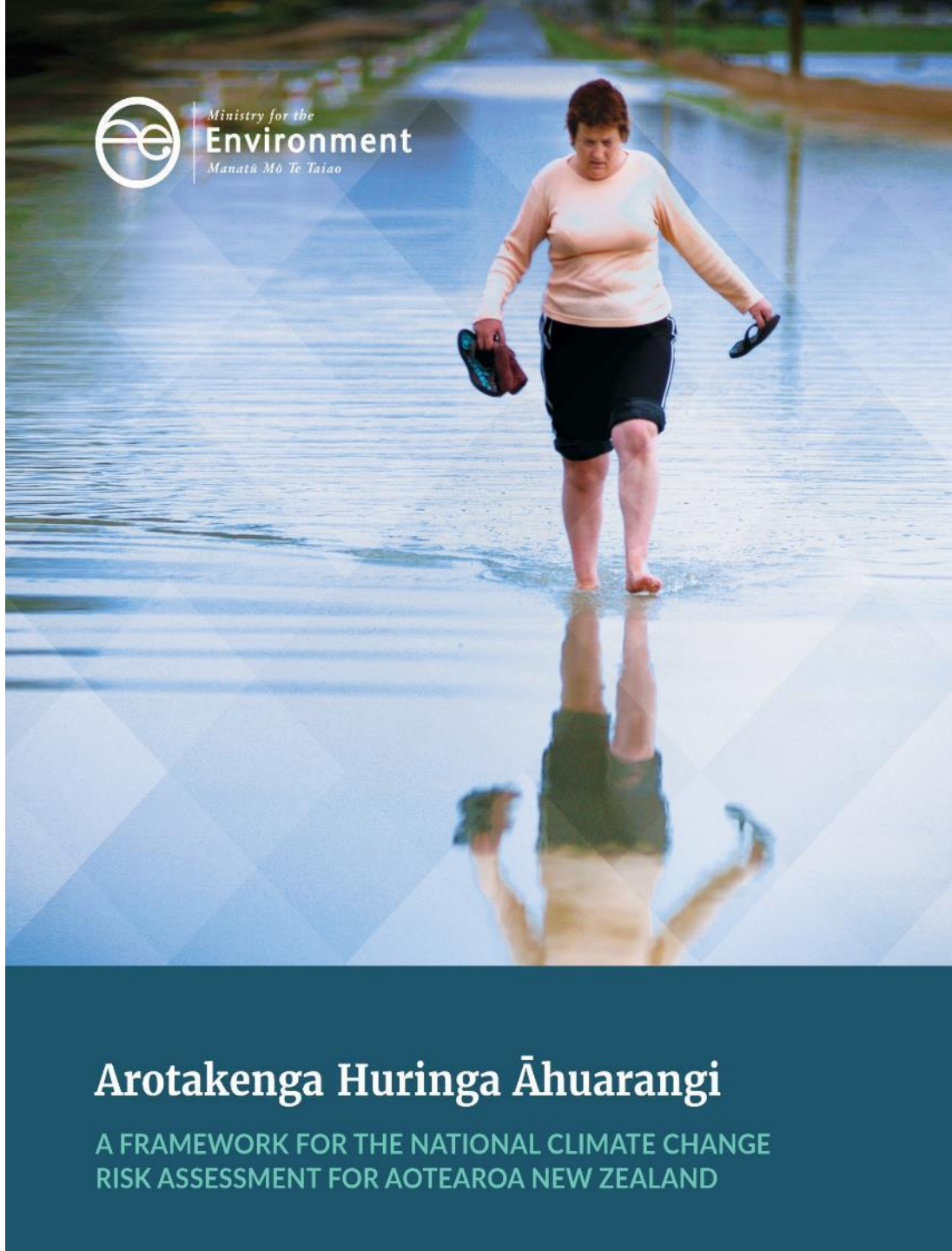


- Contextualising observed and anticipated climate
- Assessment of climate-related risks
- Modelling climate impacts on different socio-economic activities
- Enhancing predictions at different times and spatial scales
- To effectively utilise climate information in epidemic early warning
- Seasonal forecasts of temperature and rainfall – occurrence of malaria outbreak
- Real-time data (temperature and rainfall) – initiate tailormade interventions and assists in early disease outbreak detection

Fakhruddin et al., 2020

National Climate Risk Framework

- Range of expertise in climate change and risk assessments, vulnerability assessments, and risk in the context of Te Ao Māori
- The initial step was to create a risk assessment framework, which enable comparisons of a broad range of additional risks arising from climate change
- Weave in te ao Māori perspectives and values
- A national overview of how various hazards and threats may be influence by climate change
- Risk framework leads to risk assessment and national adaptation option

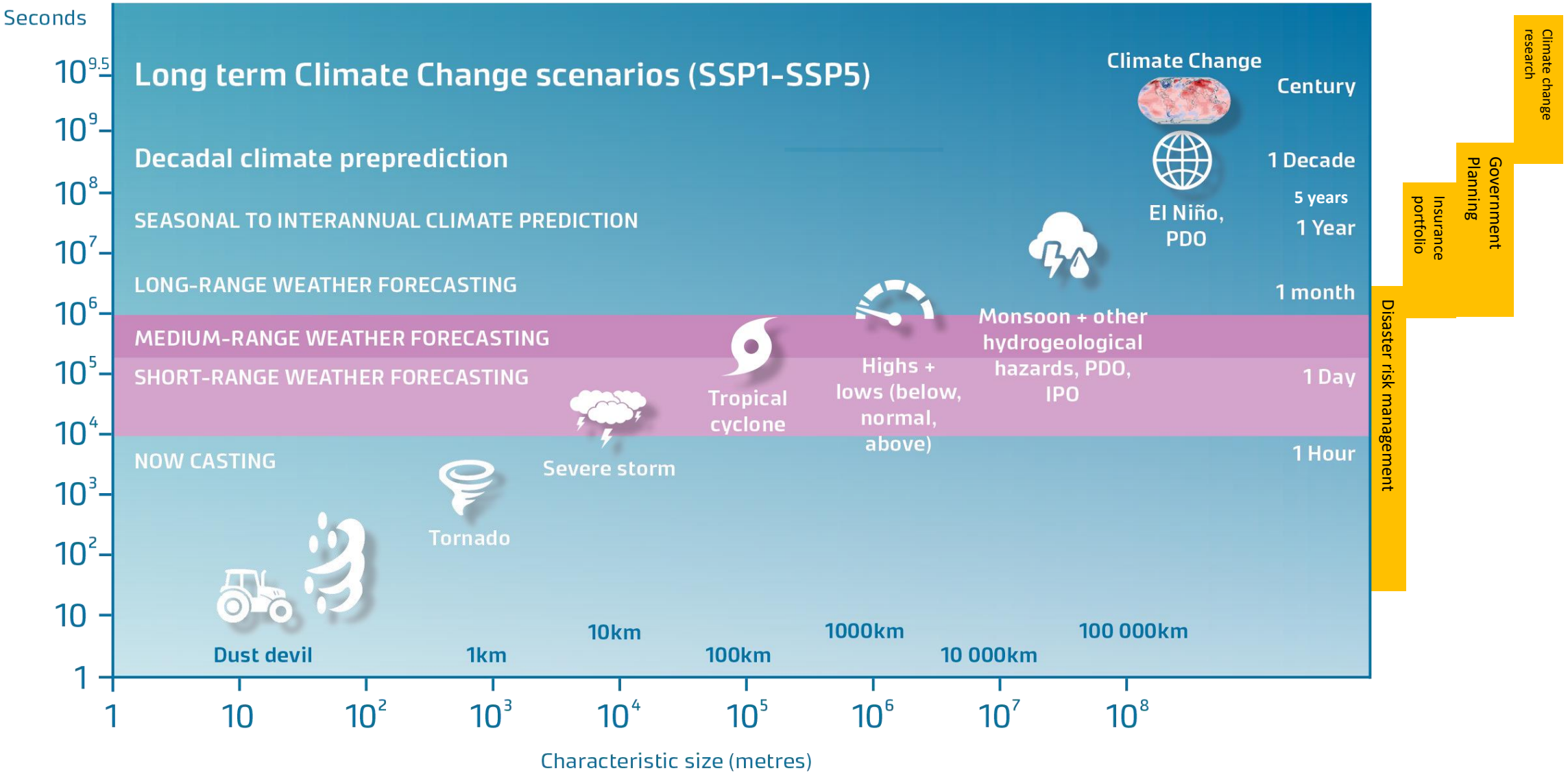


NCCRA – an overview

- New Zealand's first National Climate Change Risk Assessment
- Provides picture of how New Zealand may be affected by climate change-related hazards
- Enables Government to prioritise actions

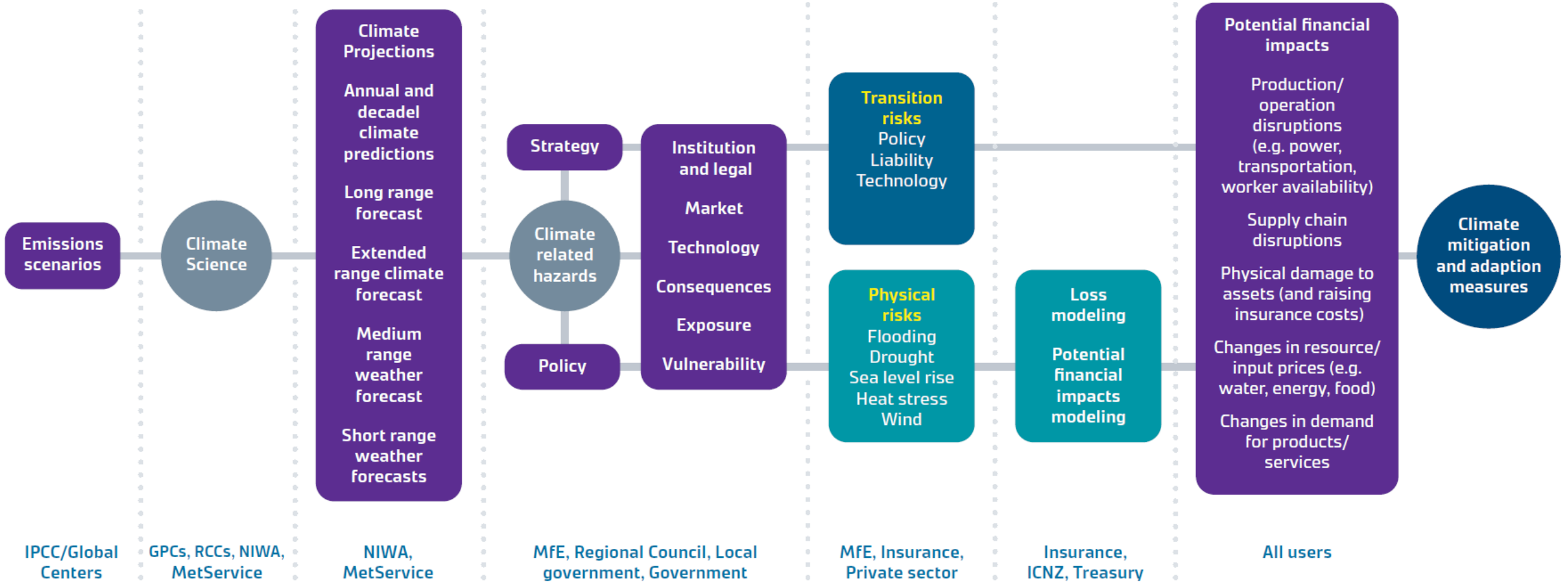
Climate Change Gaps: Seamless integration

Tonkin+Taylor



Climate science + risk evaluation for a foreseeable future

Tonkin+Taylor



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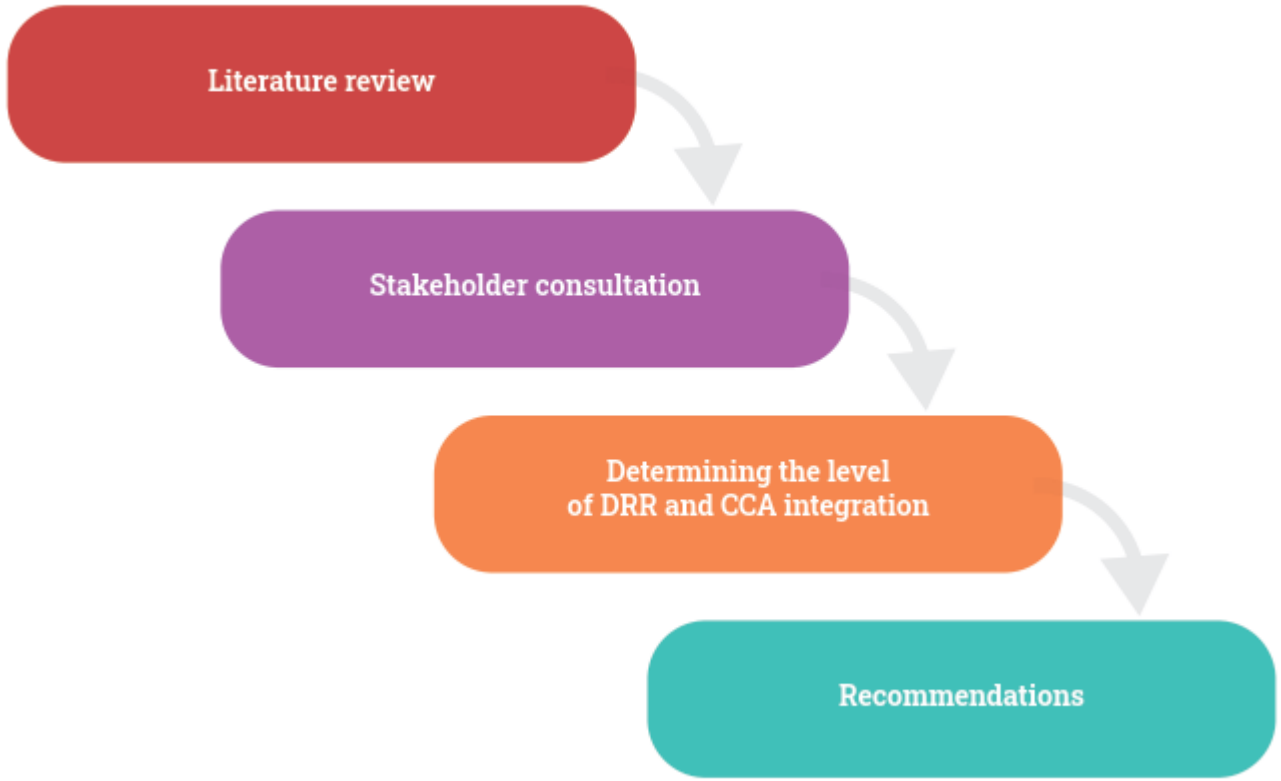
Analysis of DRR inclusion in National Climate Change Commitments

NAPs/ NDCs and contributing documents were reviewed to better understand how disaster risk management is approached in climate change documents, and if systemic risk issues, where impacts cascade across sectors, are considered.

Methodology

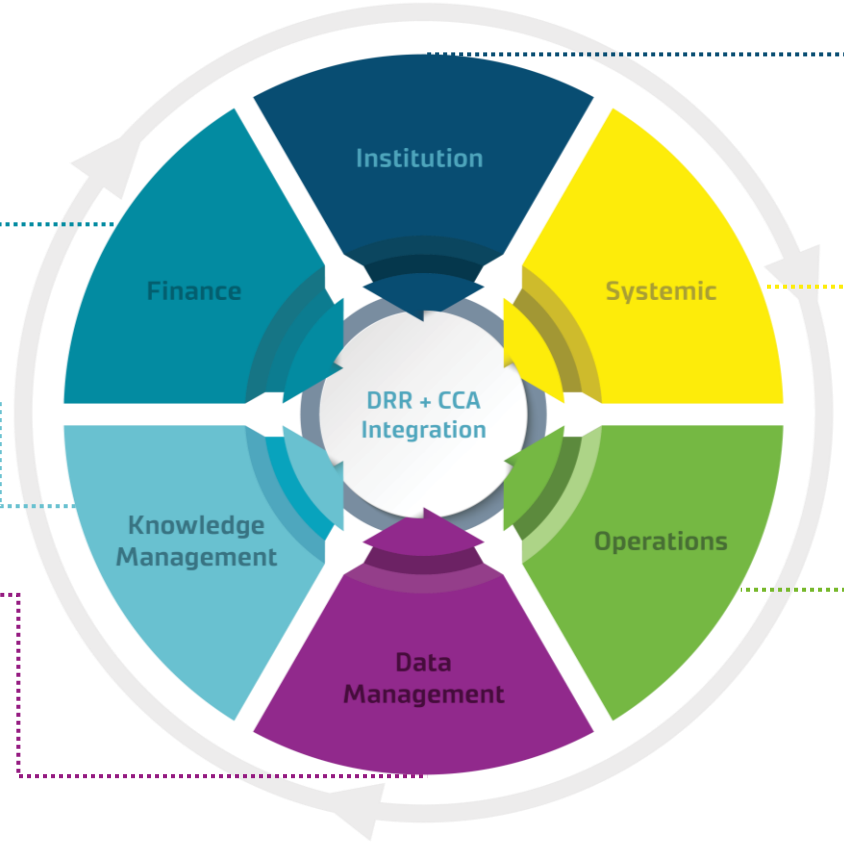
Geographic region, NAPs/NDCs, Population, Fatalities, World Risk Index, Development categories and income level.



- Benin
- Ethiopia
- Fiji
- Guyana
- Kiribati
- Malawi
- Sudan
- Sri Lanka
- St. Vincent and the Grenadines
- Uganda

Integrated Framework

1. **Finance:** Assesses whether actions and plans are costed, and if funding is available for implementing DRR and CCA actions
2. **Knowledge management:** Explores the processes for CCA and DRR knowledge management and dissemination, with a focus on stakeholders including the community
3. **Data management:** Analyses data collection methods for formulating CCA documents and identifies and examines the agencies that collect and monitor climate- and disaster-related data



4. **Institution**: Examines the roles and responsibilities of relevant institutions and analyses how DRR and CCA measures are integrated
5. **Systemic/policy:** Explores how DRR measures are integrated into CCA policies and whether planning is undertaken in a coherent and cross-sectoral manner
6. **Operations:** Investigates the measures, actions, and activities for implementing DRR and CCA practices, and examines the efficacy of Monitoring and Evaluation (M&E) mechanisms

Integration is defined as the approach and processes and actions within a country to integrate the implementation of Paris Agreement and Sendai Framework for Disaster Risk Reduction to increase efficiency, effectiveness, and the achievement of both common goals (e.g., resilience).

Findings- Red (weak), Orange (Average), Green (Strong)

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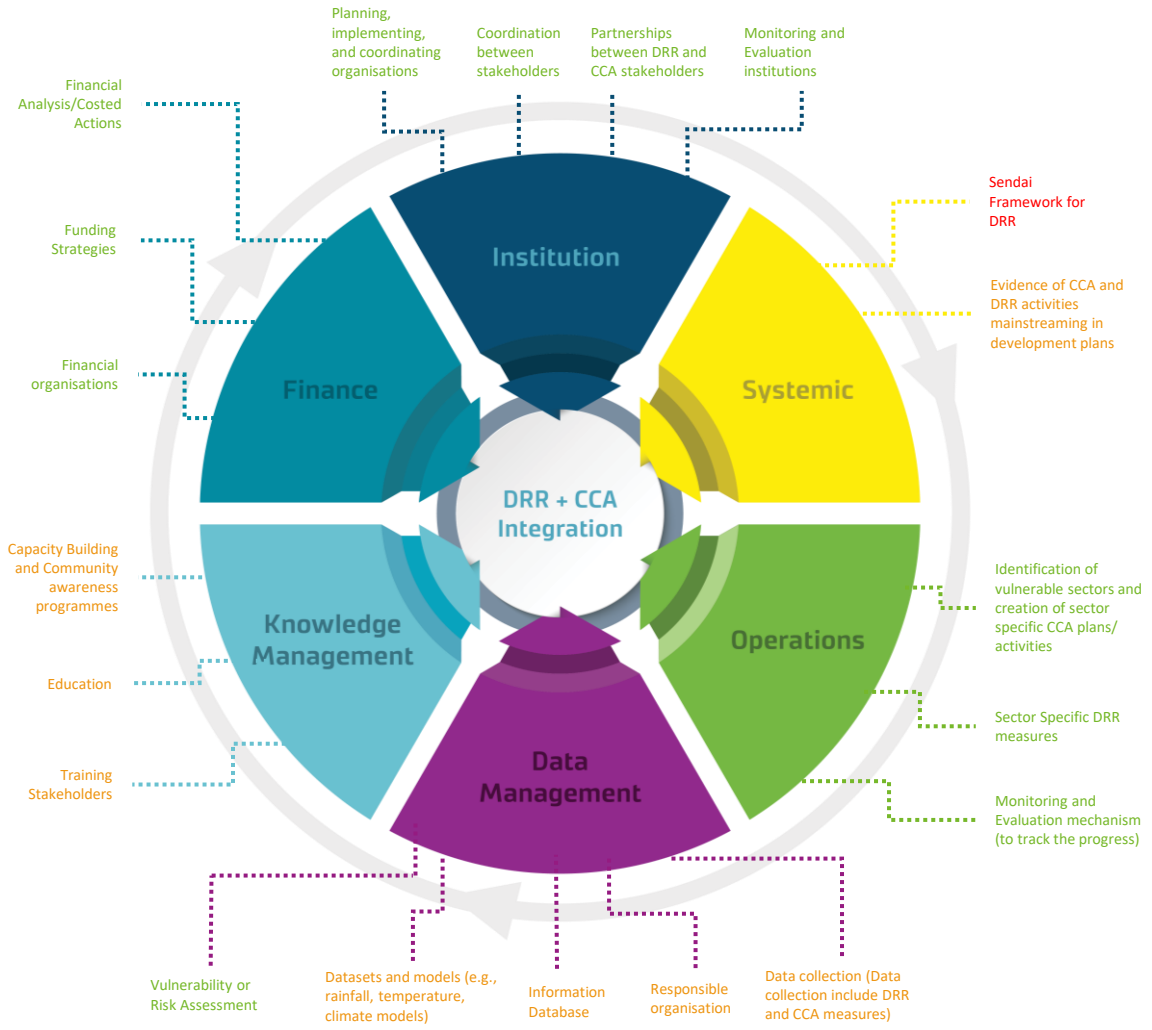
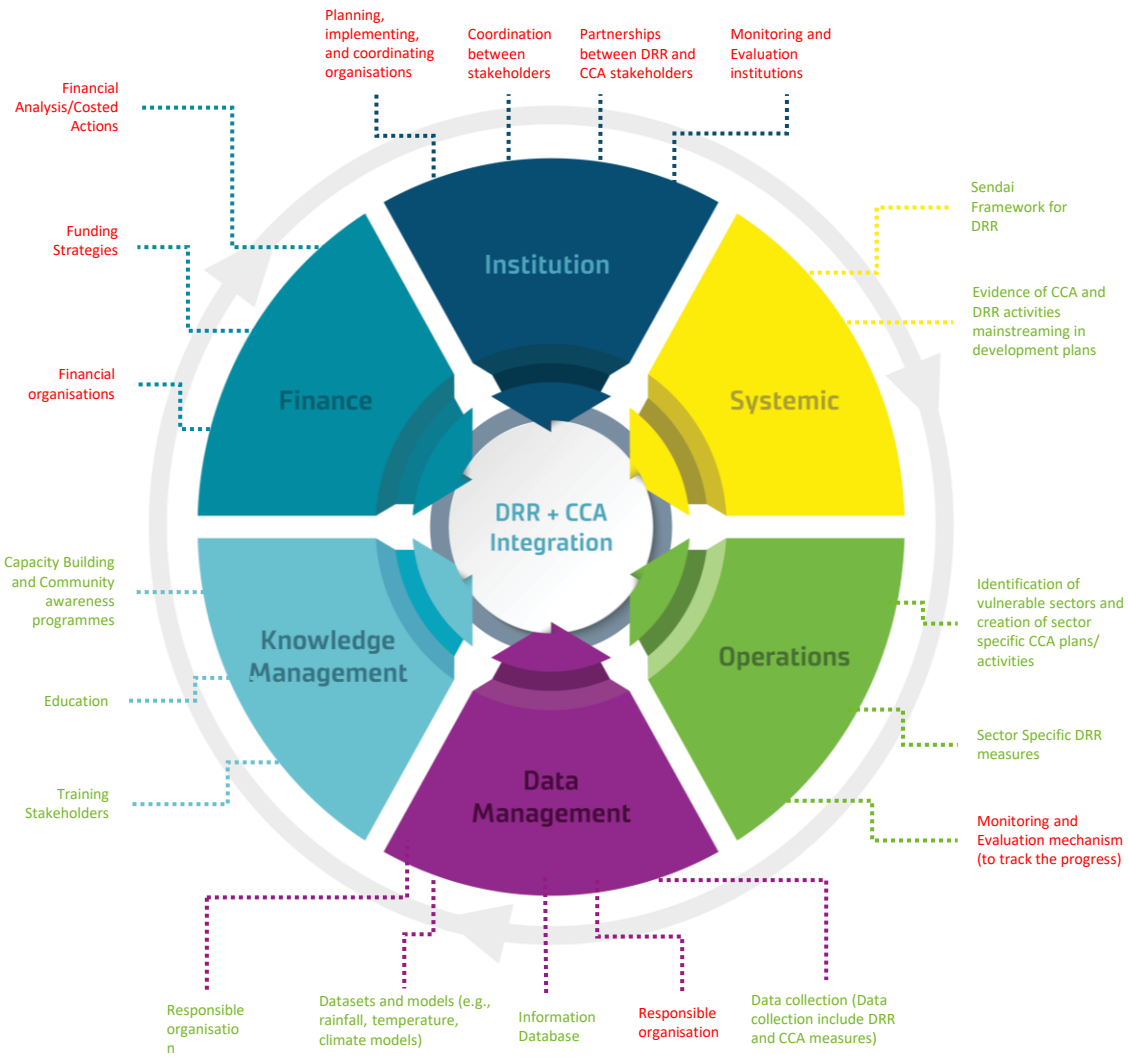
Sri Lanka



Fiji



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Recommendations for Countries

- Clear roles and responsibilities of the institutions responsible for implementing the CCA and DRR measures
- NAP and NDC has different goals but could be informed, guided, and streamlined with each other; NDC could be used as an instrument or framework for the NAP
- Proper climate risk assessment to understand NAP
- Investments in awareness raising and capacity building programmes and infrastructure to store and collect available (current and future) climate information, data and risk assessment

Engagement for Capacity Building + Awareness

News

UNDP Insurance and Risk Finance Facility

UNDP launches new Insurance and Risk Finance Facility

The United Nations Development Programme (UNDP) has launched the Insurance and Risk Finance Facility (IRFF), a new initiative that aims to build financial resilience and bridge a $1.4 trillion global health, mortality, and disaster protection gap, with support from the insurance-linked securities (ILS) market expected in future.

NASA Test Satellite Provides Insight into Hurricane Ida

In 2022, NASA will launch a constellation of six small satellites (smallsats) to improve our understanding of tropical cyclones and support NASA's TROPICS mission. But before then, NASA launched the TROPICS pathfinder, a test satellite that aids the TROPICS mission by enabling full testing of the technology, communication systems, data processing, and data flow to application users in advance of the constellation's launch next year.

https://codata.org/events/webinars/

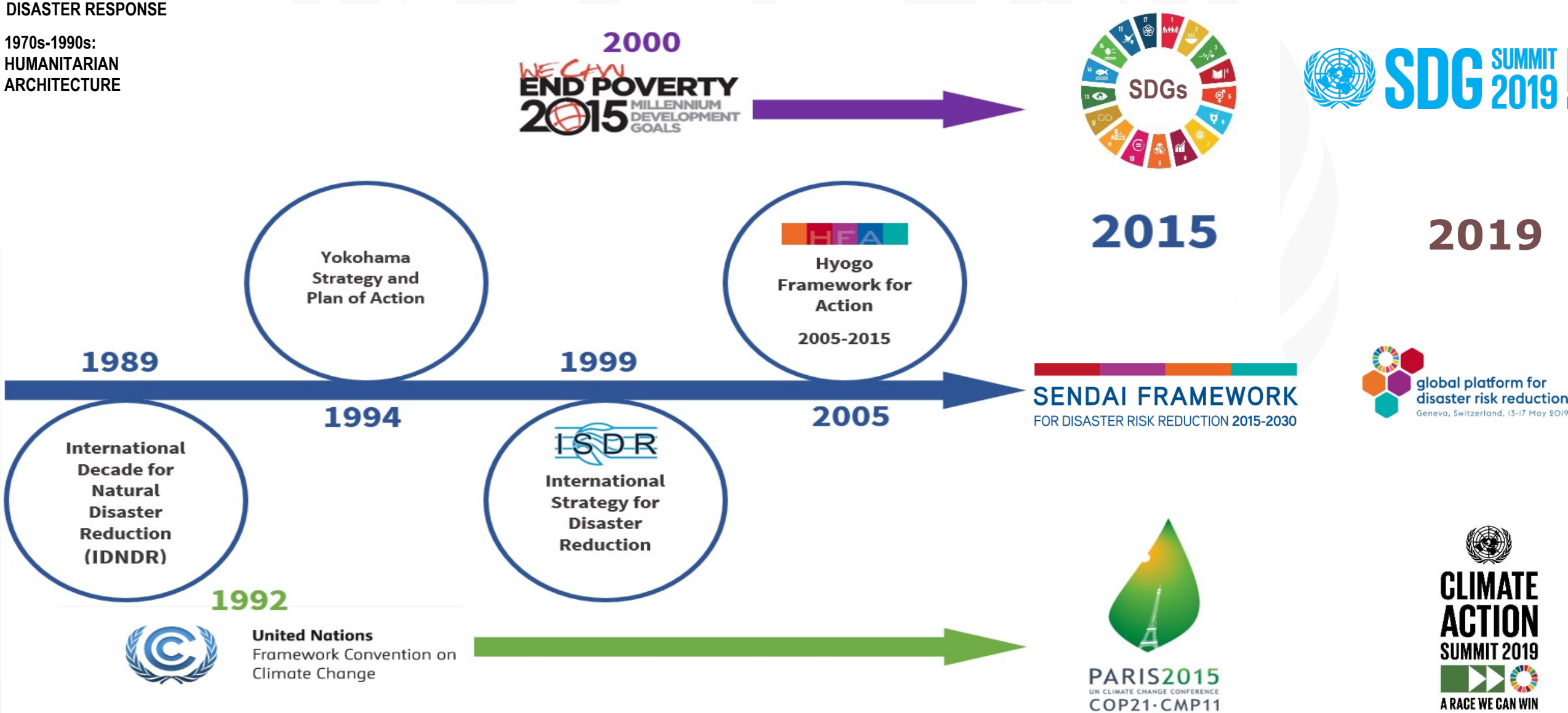
www.tonkintaylor.co.nz/what-we-do/events-and-webinars/

Resiliency in the 2030 Global Development Agenda

Sanny R. Jegillos
Team Leader and Senior Advisor
Disaster Risk Reduction and Recovery
Asia Pacific Region
UNDP Bangkok Regional Hub

2021

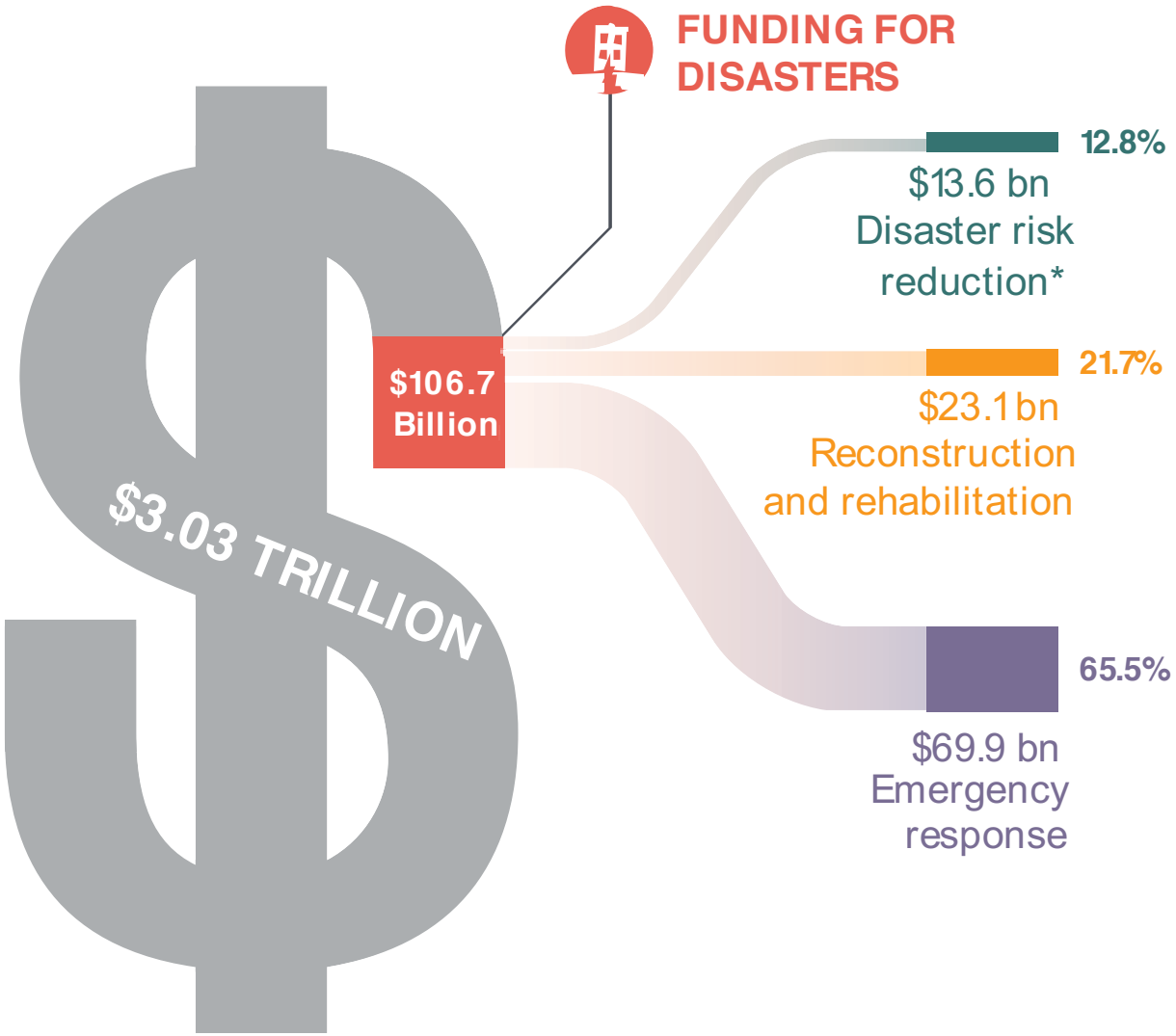
DRR: 30 years of Disaster Risk Reduction



INTERNATIONAL FINANCING FOR DRR (UNDP-ODI Study) 2005-2014

Volume

- Aid $3 trillion, to disasters $106 Bn, to DRR 13 Bn. **40¢ in every $100** spent on international aid
- 12 out of 23 low-income countries received **$160 response for every $1 DRR**



Domestic Financing (UNDP-ADB multi country study) 2017

Risk Informed PIP

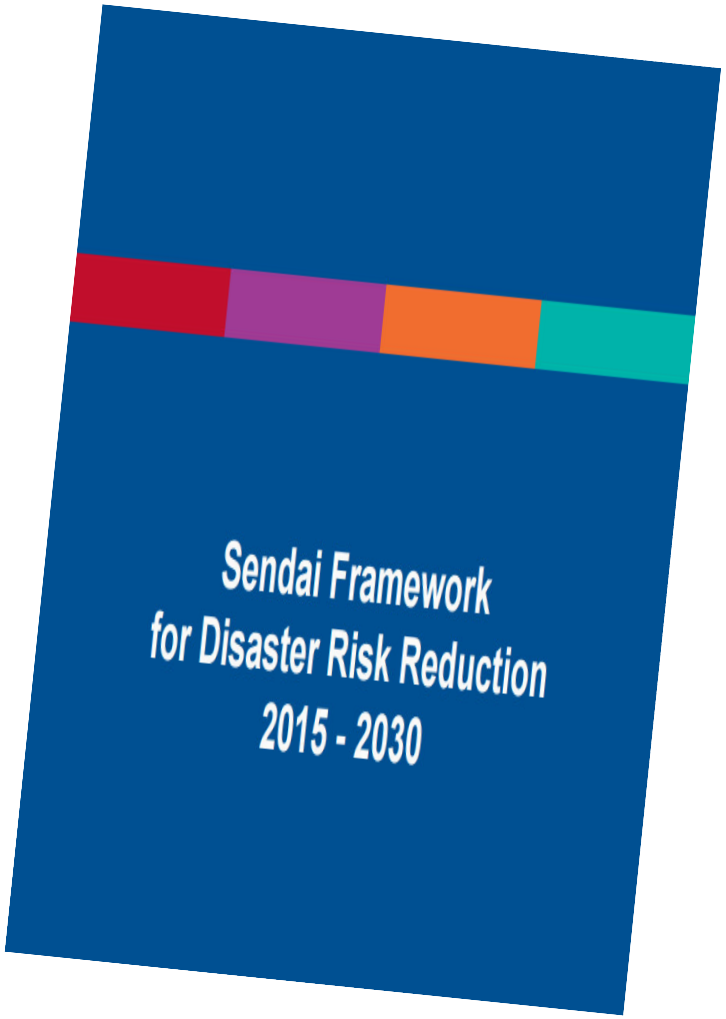
- Investments to strengthen disaster resilience remain low
- Weaknesses in collection and analysis of hazard, climate and disaster impact data, particularly sector-specific damages and losses. Disaster risk information rarely used to inform development planning
- Unless scale of economic losses are made visible and fiscal impact understood - increased public **investments** in risk informed development would be **difficult to justify**

2030 Global Development Agenda

Resilience to disasters common theme of all frameworks

✓ **Expected Goal**

The substantial reduction of disaster risk and losses in lives, livelihoods and health and in the economic, physical, social, cultural and environmental assets of persons, businesses, communities and countries



✓**Seven global targets**

✓**Four Priorities of Action**

Setting 7 Global Targets for 2030

3 INCREASES:

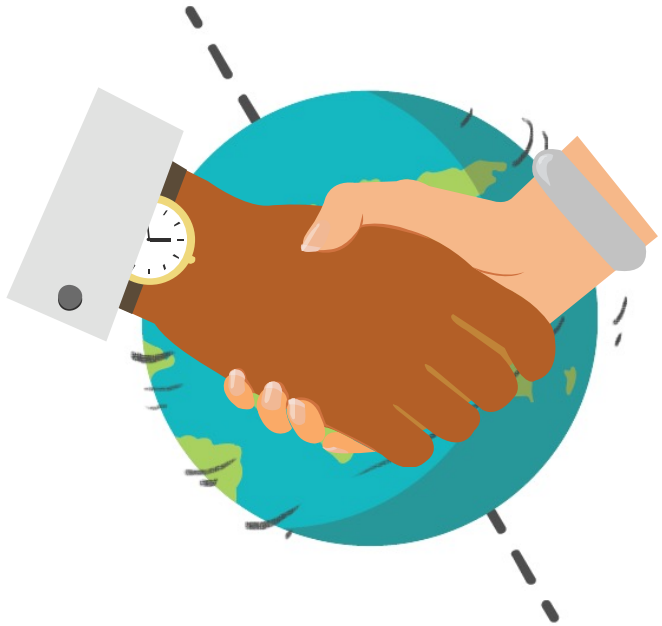
- # of countries with **national & local DRR strategy**
- International **cooperation** to developing countries
- Availability and access to multi-hazard early warning systems & **disaster risk information** and assessments

4 REDUCTIONS:

- Mortality
- Affected people
- Economic loss
- Damage to critical infrastructure and disruption to basic services

4 Priorities for Action

What is different: New Context and Challenges



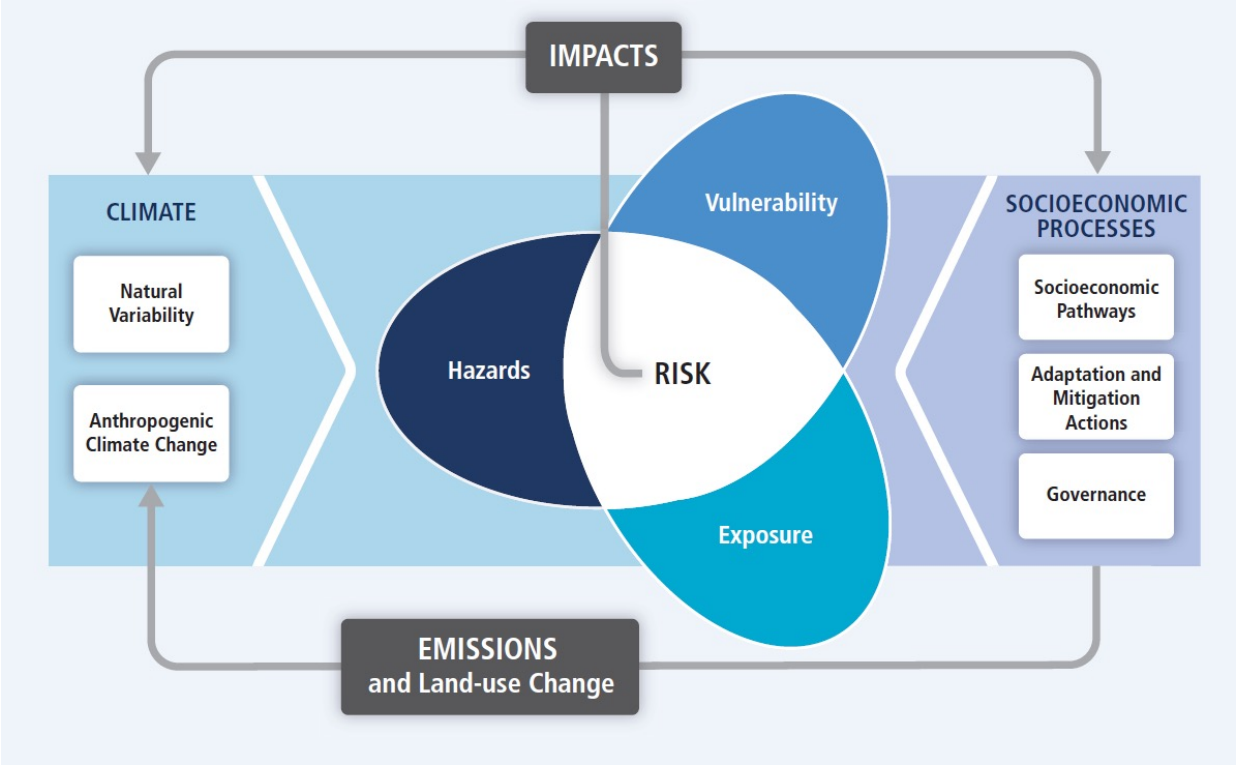
1. **Complexities of building resilience**
2. **Ensuring that development is sustainable**
3. **No one is left behind**

Volatility, Uncertainty, Complexity, Ambiguity

IPCC Risk Framework

The IPCC AR5 definition of Risk is:

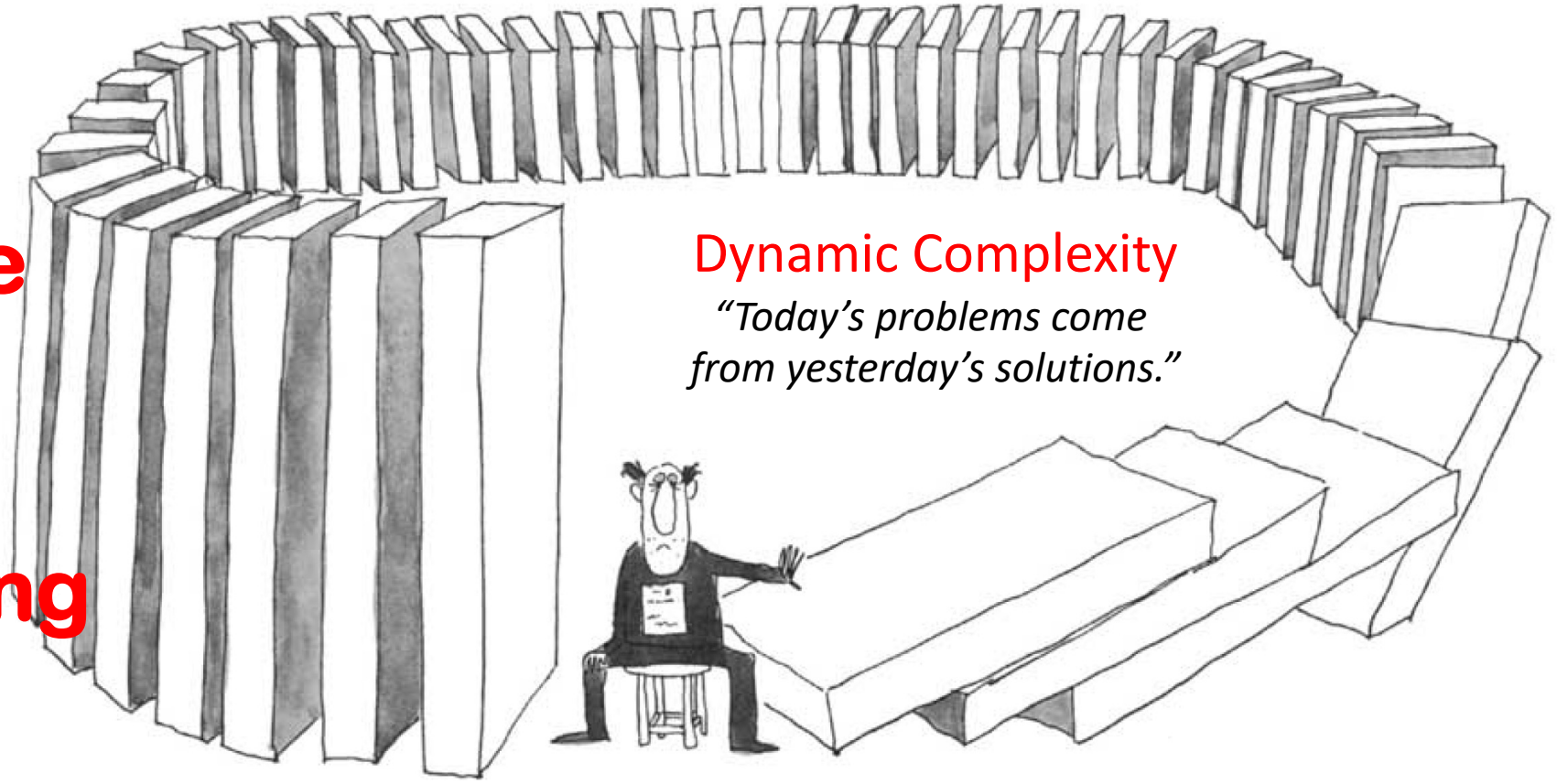
- *The probability of occurrence of hazardous events or trends multiplied by the impacts if these events or trends occur*



ARE WE REALLY GOING TO ACHIEVE
OUR DEVELOPMENT GOALS WITH THE SAME STRATEGIES?

Understand the Risk Nexus

Systems thinking to deal with complexity



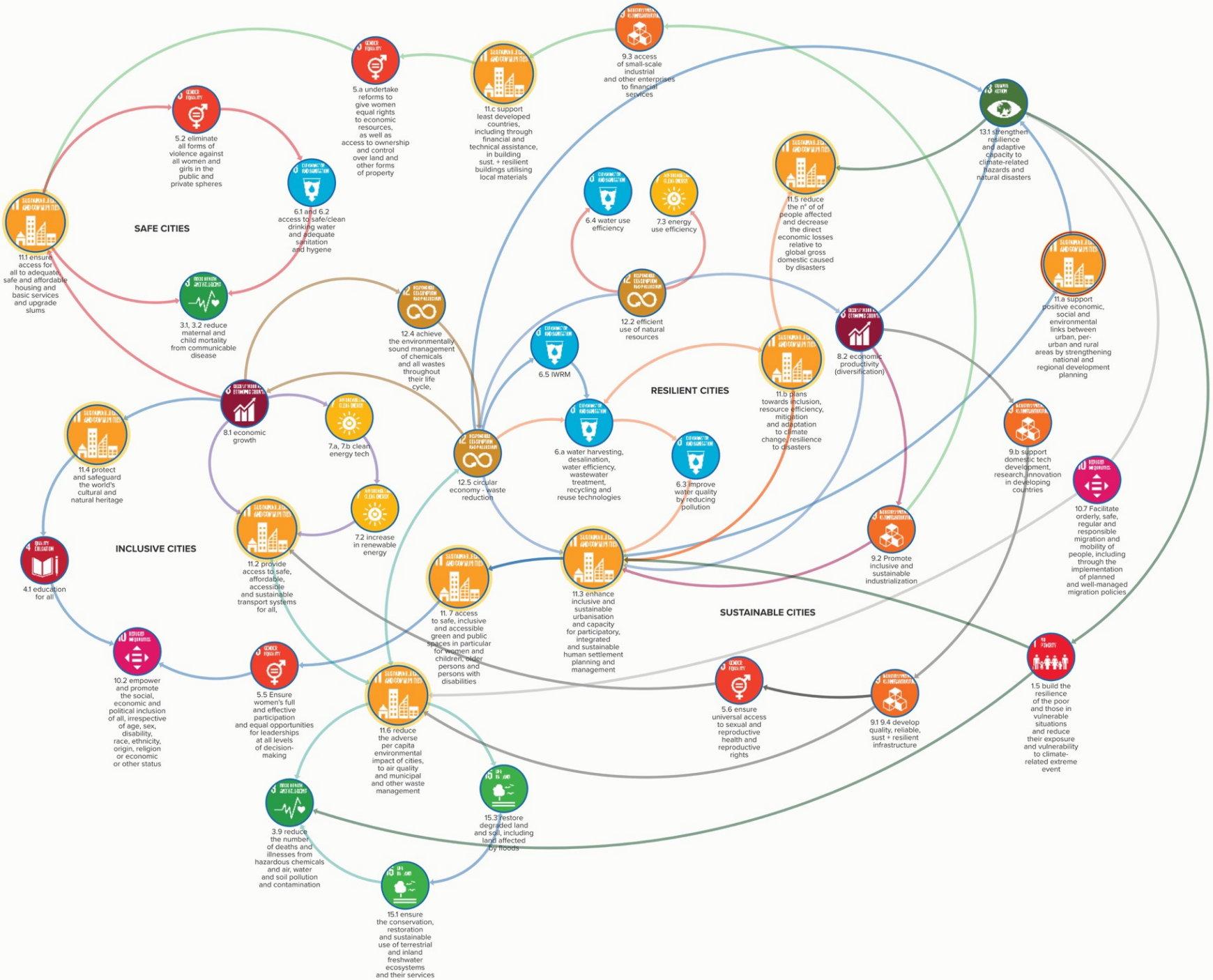
What is different: How should we address these challenges?

1. **Humanitarian and Development Nexus**
2. **The Risk Nexus**
   - Risk and Climate
   - Risk and Poverty
   - Risk and Inequality

SYSTEMS THINKING: Invest on resiliency, sustainability, inclusiveness

The achievement of SDGs **3**, **4**, **6**, **7**, **8**, **9**, **11**, **13**, **14** and **15**, is heavily dependent on increased capital **investment in infrastructure**. However, in low income countries, AAL represents 30% of capital investments.

11 SUSTAINABLE CITIES AND COMMUNITIES



Legend

- - - - - Opposite

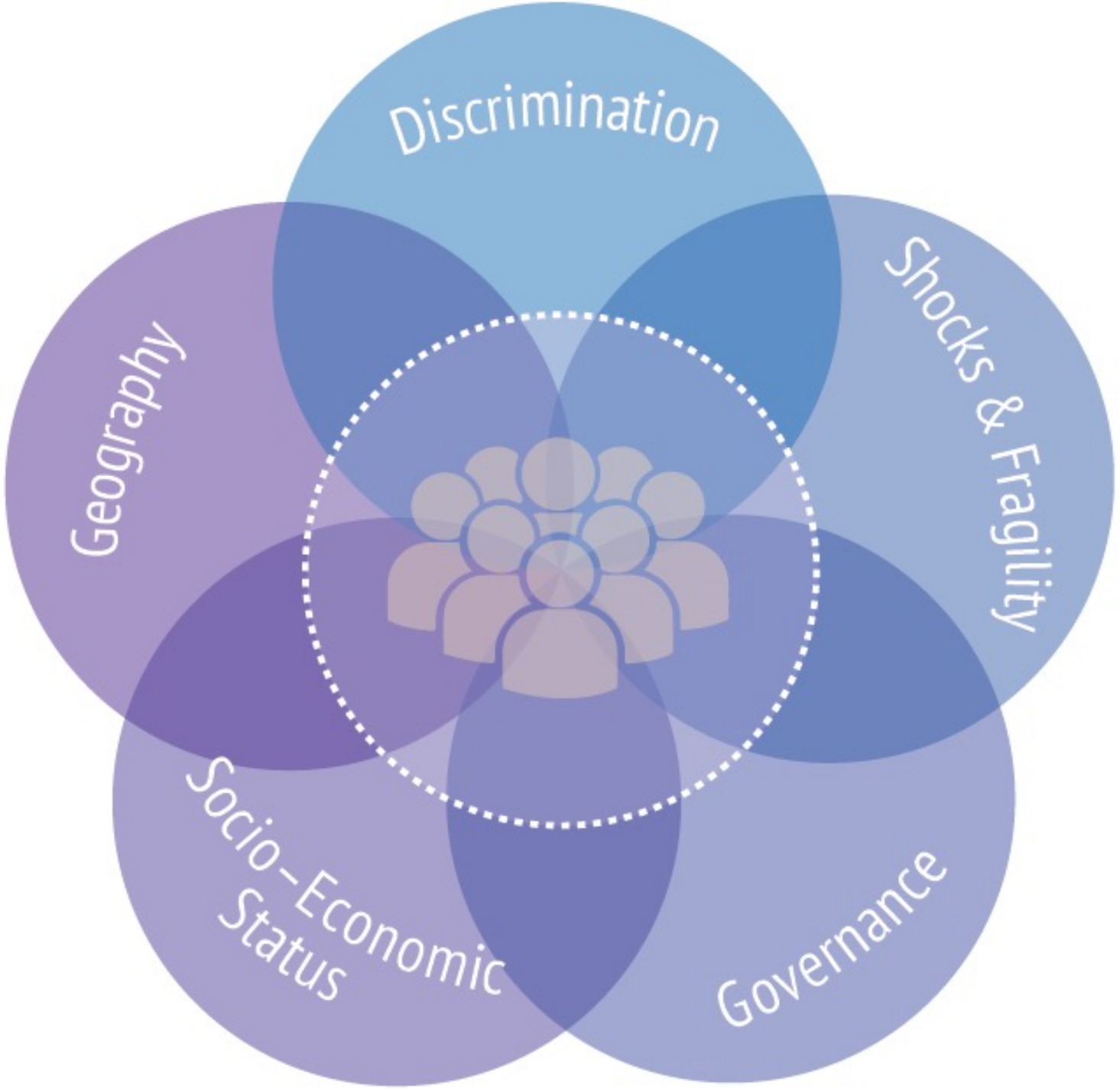
SYSTEMS THINKING: Invest on Resiliency, Sustainability and Inclusiveness

The achievement of SDGs **1**, **2**, **3**, **4**, **5**, and **10** depends on increasing **social expenditure. However in low income countries, the AAL is 20% of social expenditure**

Resiliency for those who are left behind and furthest behind

- People at the intersection of these factors face reinforcing and compounding disadvantage and deprivation, making them likely among the furthest behind.

THE WORLD IS UNEQUAL.



DISASTER RISK REDUCTION/ RESILIENCE

How to reduce risk and prevent risk accumulation?

1. **DRR investments**
   1. **Stand alone**
   2. **Mainstream**

2. **Non DRR activities that affect vulnerability, hazard probability**

Challenge:

Developing a complete balance sheet of

DRR expenditures; And

Expenditures that create risk

DRR

Setting 7 Global Targets for 2030

3 INCREASES:

- # of countries with **national & local DRR strategy**
- International **cooperation** to developing countries
- Availability and access to multi-hazard early warning systems & **disaster risk information** and assessments

4 REDUCTIONS:

- Mortality
- Affected people
- Economic loss
- Damage to critical infrastructure and disruption to basic services

Thank you!

SANNY RAMOS JEGILLOS

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International Day for Disaster Risk Reduction
2021