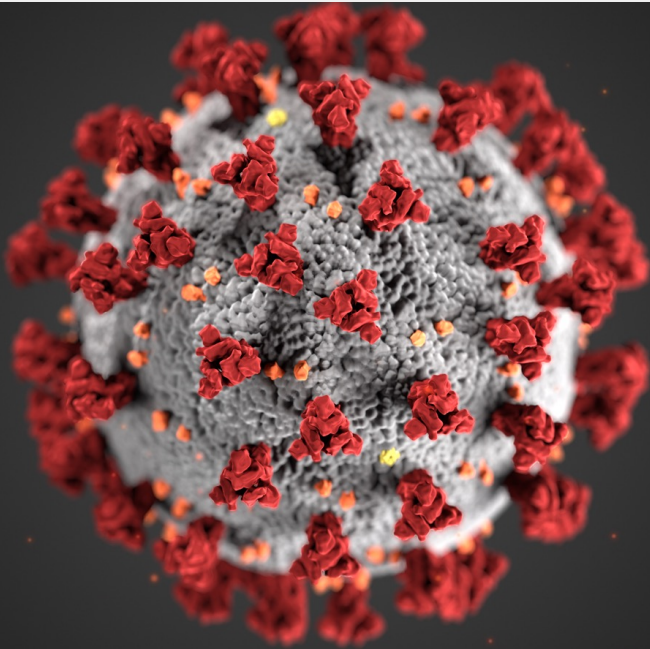


Early Warning & Forecasting of Systemic Risk



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Director of the UCL Warning Research Centre
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UCL
WARNING
RESEARCH
CENTRE



Contents

- 1) What are warnings and why do they matter?
- 2) The COVID-19 pandemic: we were warned
- 3) Forecasting and Alerting for COVID-19
- 4) Key lessons identified, learnt, and emerging
- 5) How can we do better?



Image by Kevin Frayer/Getty Images



1. WHAT ARE WARNINGS AND WHY DO THEY MATTER?



FORTUNA VS. SAPIENTIA

© WORDS & UNWORDS

Warnings ≠ Siren



What are Warning Systems?

An integrated system of hazard monitoring, forecasting and prediction, disaster risk assessment, communication and preparedness activities systems and processes that enables individuals, communities, governments, businesses and others to take timely action to reduce disaster risks in advance of hazardous events.

(UN DRR, 2017)

They bring together:

- Different experts
- Thresholds or tipping points
- Communication mediums and iconographies



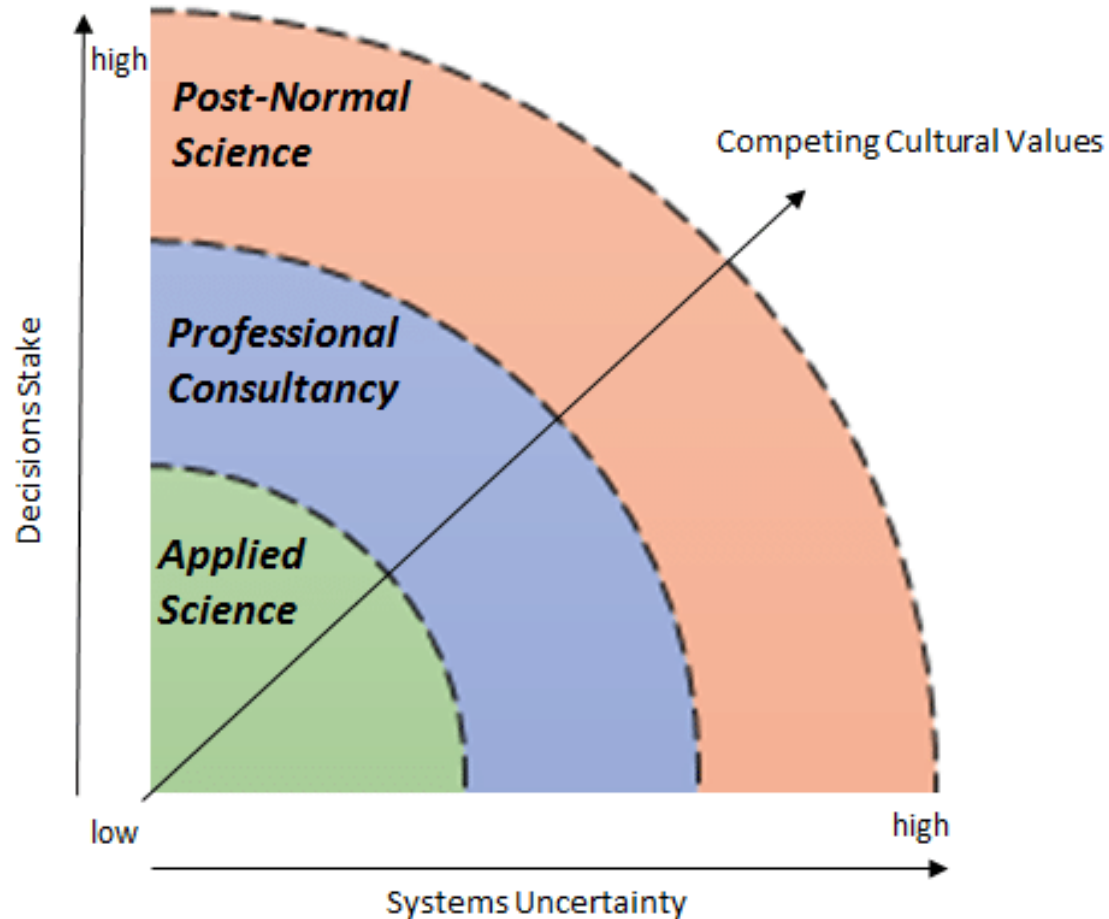
Science Is Only Part Of The Answer

Post Normal Science
(PNS)

*'Facts are uncertain,
values in dispute, stakes
high and decisions urgent'*

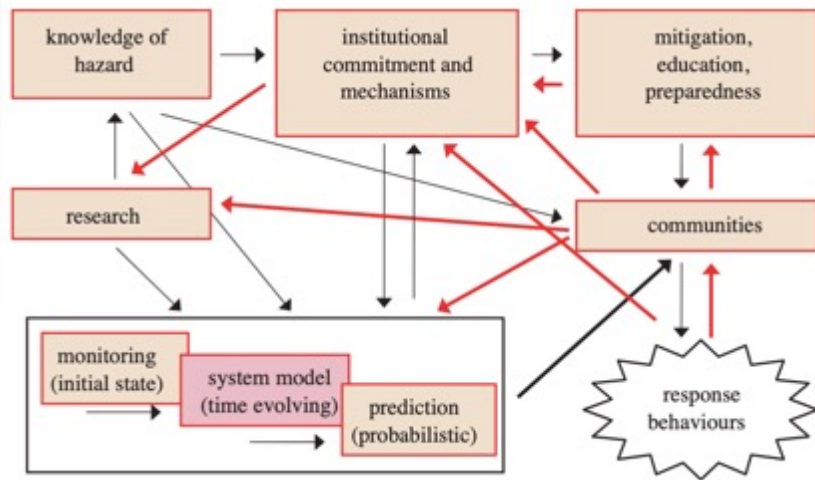
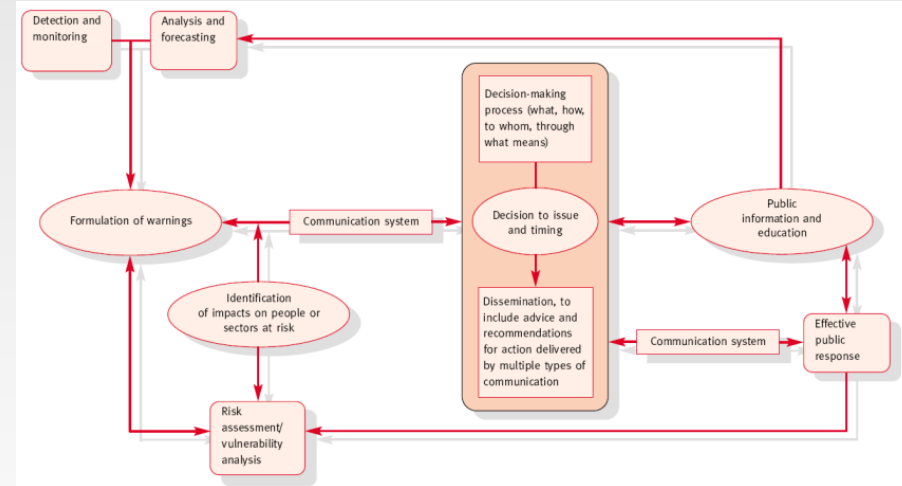
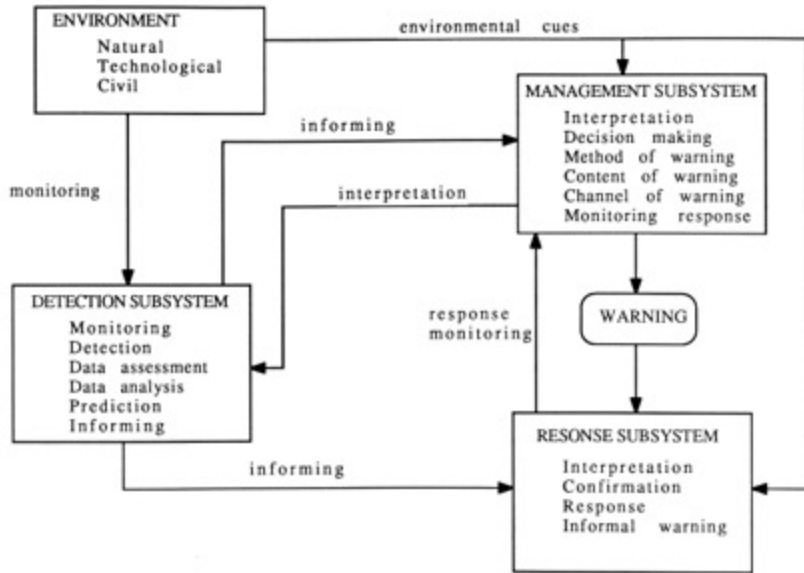
Funtowicz & Ravetz, 1993,
p.744

PNS brings together an
extended peer community
to enter into a dialogue



Adapted from: Ravetz, 2004, p.354

The Evolution of Warning Systems



Disaster risk knowledge

- Are key hazards and related threats identified?
- Are exposure, vulnerabilities, capacities and risks assessed?
- Are roles and responsibilities of stakeholders identified?
- Is risk information consolidated?

Detection, monitoring, analysis and forecasting of the hazards and possible consequences

- Are there monitoring systems in place?
- Are there forecasting and warning services in place?
- Are there institutional mechanisms in place?

Warning dissemination and communication

- Are organizational and decision-making processes in place and operational?
- Are communication systems and equipment in place and operational?
- Are impact-based early warnings communicated effectively to prompt action by target groups?

Preparedness and response capabilities

- Are disaster preparedness measures, including response plans, developed and operational?
- Are public awareness and education campaigns conducted?
- Are public awareness and response tested and evaluated?

Early Warnings for All Initiative

- Forecasts of what the weather will BE are no longer enough. Impact-based forecasts that inform the public of what the weather will DO are vital to save lives and livelihoods. Yet one in three people are still not adequately covered by EWS



António Guterres

Secretary-General of the United Nations



WORLD
METEOROLOGICAL
ORGANIZATION

“

We must boost the power of prediction for everyone and build their capacity to act. On this World Meteorological Day, let us recognize the **value of early warnings and early action** as critical tools to reduce disaster risk and support climate adaptation.

”



Workers in South Korea, which has been hit hard by COVID-19, disinfect a subway station in Seoul to slow the virus's spread. NEWSIS/ASSOCIATED PRESS

2. COVID-19 PANDEMIC: WE WERE WARNED

Warning a Global Community



An emergency hospital in Kansas during the 1918 influenza epidemic.

Credit: National Museum of Health and Medicine

“Past warnings of a pandemic were often ignored, despite mounting evidence...”.

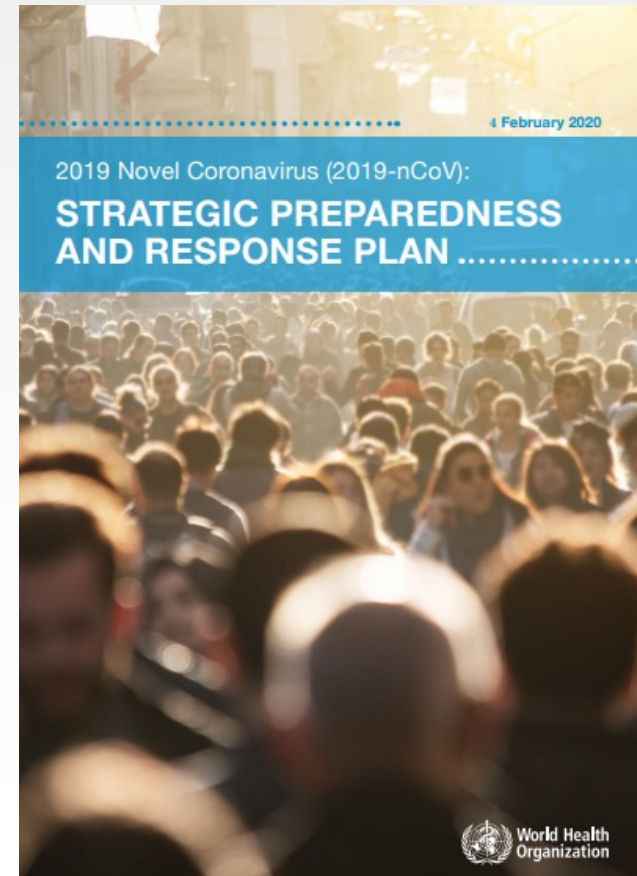
Mami Mizutori, Head of UNDRR, April 2020

Heath and Warning Policy

In 2015 the UN extended the definition of risk to include biological hazards, adopting the Sendai Framework for Disaster Risk Reduction

Yet, across recent documents 'warning' is only mentioned twice:

1. The WHO's **2019 Novel Coronavirus (2019-nCoV): Strategic Preparedness And Response Plan**
2. The Global Preparedness Monitoring Board report **A World at Risk** (2019)
3. The International Working Group on Financing Preparedness' report **From Panic and Neglect to Investing in Health Security** (2017)
4. The International Health Regulations' **The Joint External Evaluation Tool** (2016)



Global Warning Failures



TIMELINE OF WHO ALERTS ON COVID-19

Jan 10

WHO issued its first advisory on the novel coronavirus, in a bid to help national authorities (1) identify primary loopholes, (2) perform risk assessments, (3) plan for additional investigations, response, and prevention efforts

Jan 22

The members of the Emergency Committee said the event did not constitute a PHEIC (Public Health Emergency of International Concern)

Jan 30



WHO Director-General Dr Tedros Adhanom Ghebreyesus declared the 2019-nCoV outbreak a **Public Health Emergency of International Concern**

Feb 21



WHO Director-General emphasized that the window of opportunity to contain the outbreak is "narrowing" and that the international community needs to ramp up efforts and finances

Feb 28

WHO raised the risk assessment of the coronavirus from "high" to "very high" across the world

Feb 29

WHO continues to advise against the enforcement of travel or trade restrictions on countries grappling with COVID-19 outbreaks

Countries should intensify surveillance for unusual outbreaks of influenza-like illness and severe pneumonia, and monitor carefully the evolution of COVID-19 outbreaks, reinforcing epidemiological surveillance

Feb 29

WHO reminded all countries and communities that the spread of this virus can be significantly slowed or even reversed with the implementation of robust containment and control efforts

Mar 7

WHO declared COVID-19 a pandemic

Mar 11

Governments should commit to making available all necessary resources to combat COVID-19 with minimum delay, and ensure the effective and efficient functioning of supply chains of cross-border medical and essential goods

Mar 16

The Director-General warned the pandemic is accelerating



Mar 23

WHO spokesperson Margaret Harris said the US has the potential to be the next epicenter amid a rapid acceleration of cases across the nation



Mar 24

WHO Director-General called on G20 leaders to fight, unite, and ignite against COVID-19



Mar 26

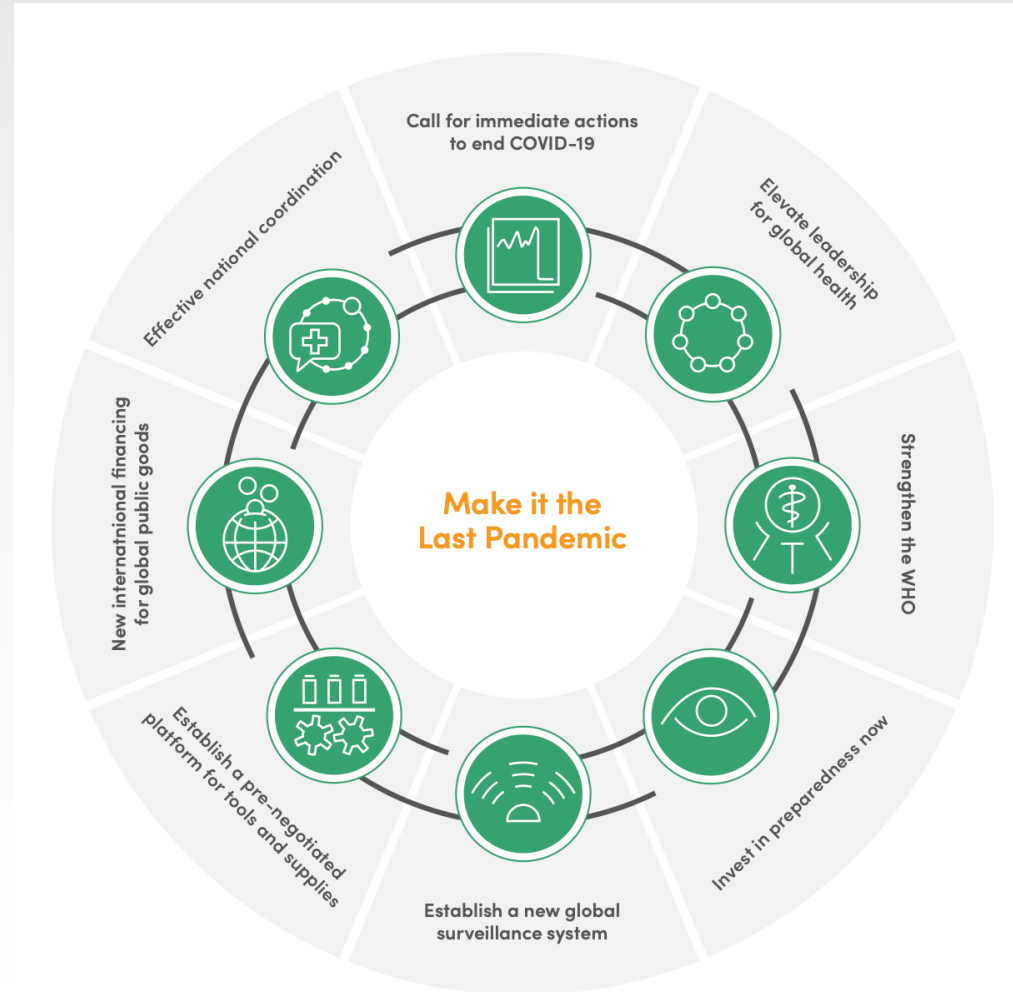
COVID-19: Not acting on the warnings

'PHEICS sound an alarm but come without operational teeth: no special pots of money are unlocked, no crack teams of epidemiologists are deployed.

Countries are not incentivised to follow health regulations nor sanctioned for breaking them.

That allowed what should have been a unified struggle against Covid to splinter into national efforts, resulting in vaccine inequality and the kind of travel bans that the regulations are supposed to deter'.

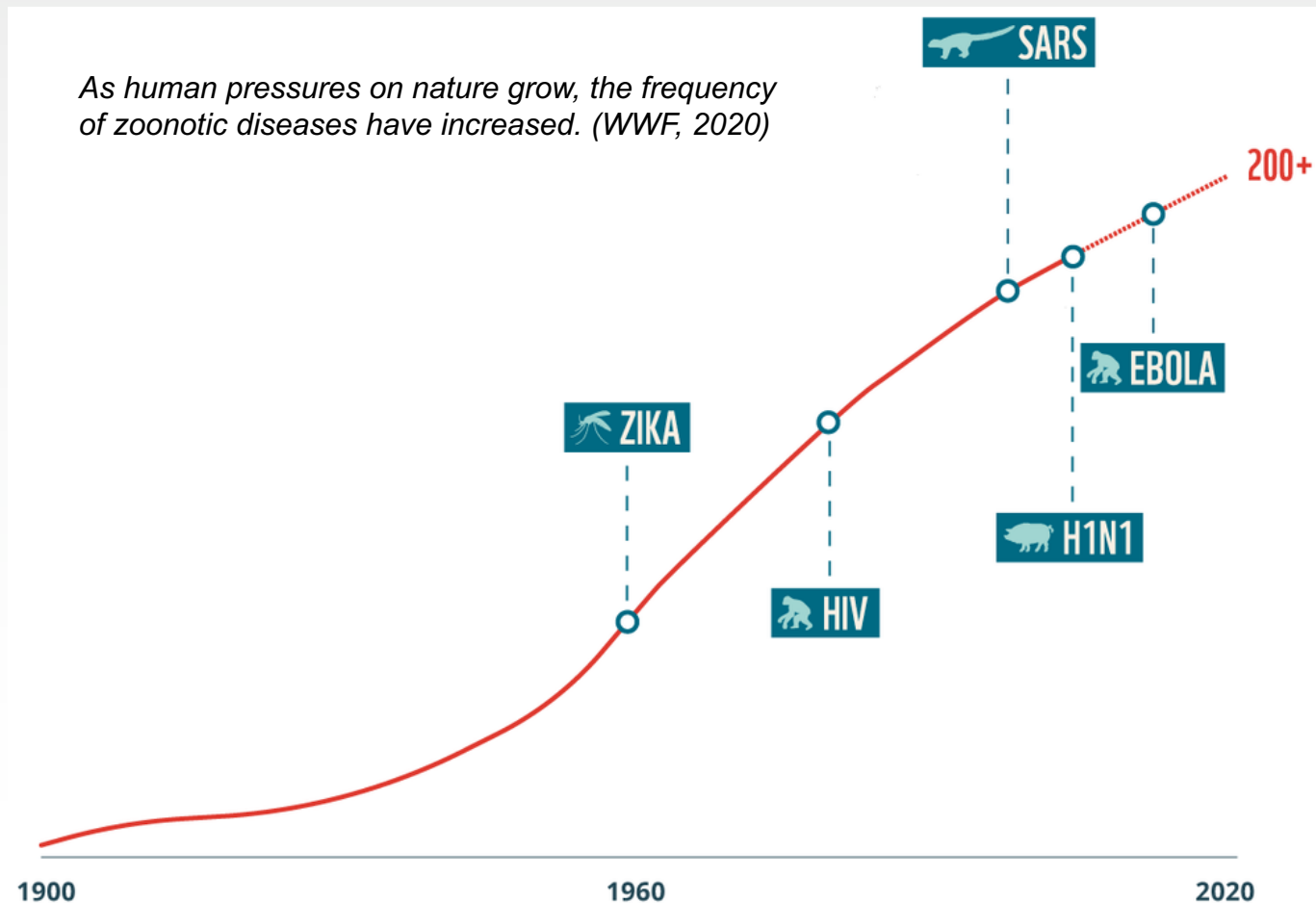
Clare Wenham, London School of Economics, 2022



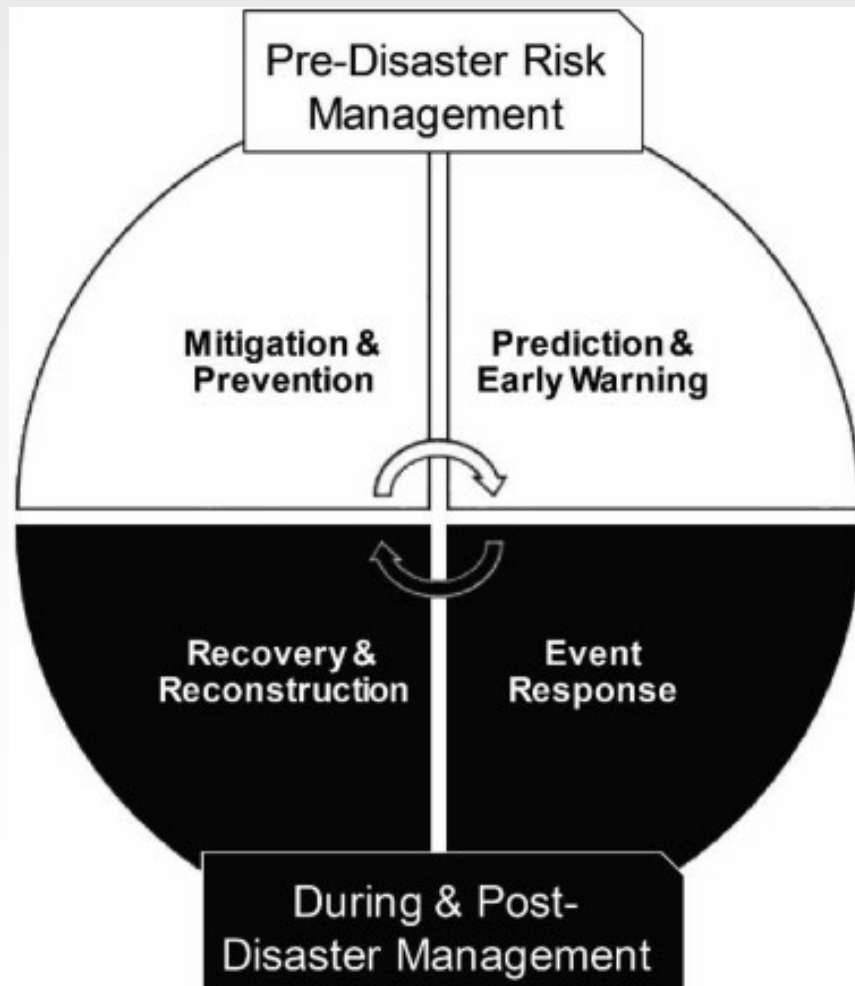
The Independent Panel for Pandemic Preparedness and Response, 2021 p.60

Warning Signs from the last 40 years

Why do we keep ignoring warnings?



Key elements in responding to health threats

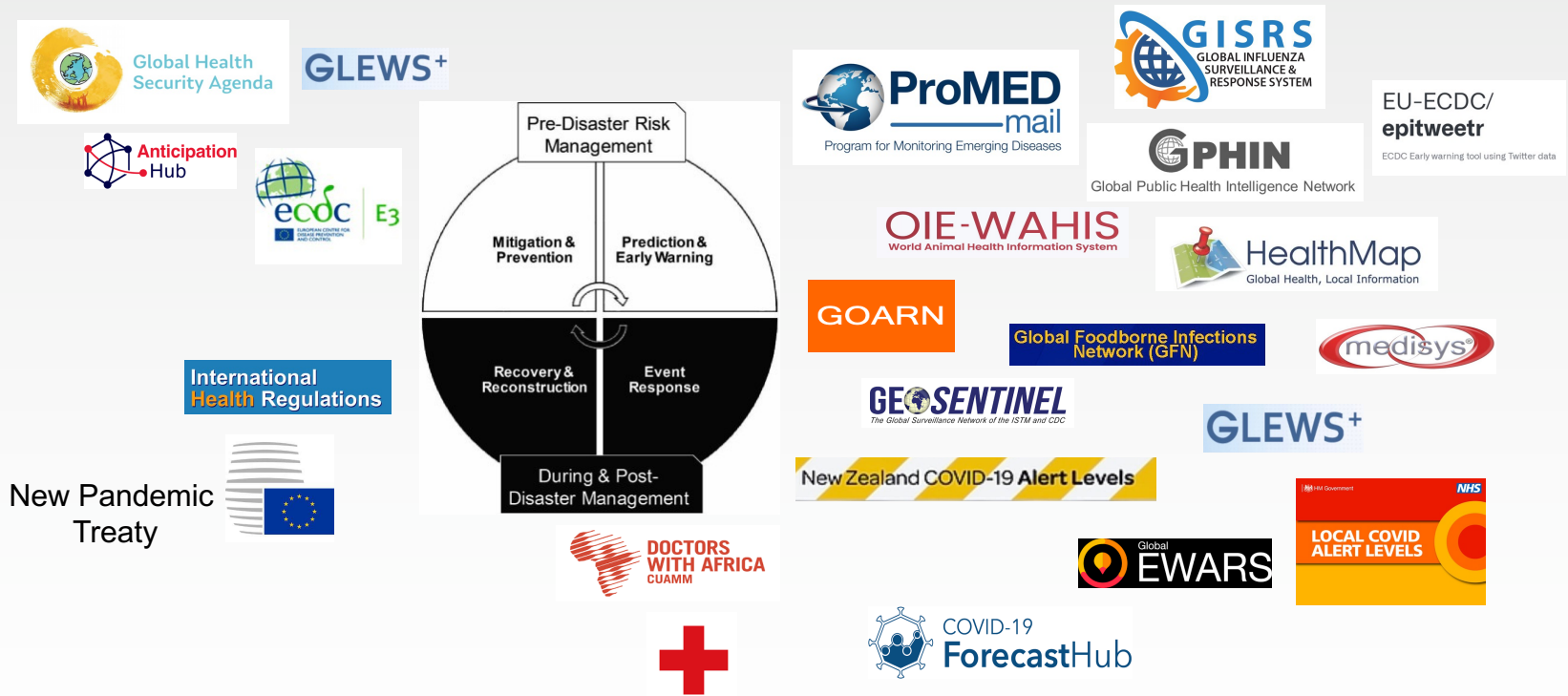


Disaster risk management cycle (Ekstrom, 2020)

- **Prevention:** tackling the factors increasing the emergence of infectious
- **Preparedness:** building a strong health care system able to cope with health emergencies
- **Prediction and early warning:** anticipating, detecting new outbreaks and communicating those risks
- **Response:** diminishing the spread of the virus (NPI, vaccine)
- **Recovery:** building back better, (creating a new pandemic treaty, adapting IHR, changes in national resilience strategies)

Different components involved in responding to infectious disease emergence

Priorities of our current warning systems



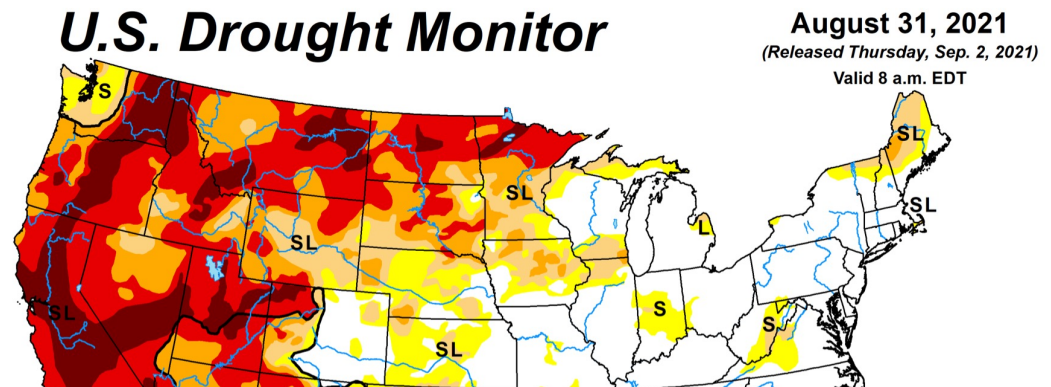
Claudia Fernandez de Cordoba Farini, 2021

- Our research and understanding of the problem is not aligned with how we are responding to it

Shifting to Anticipatory Warnings

‘There is a lack of attention towards the prevention and the pre-spillover environmental and climatic conditions that increase health risks to begin with such as deforestation, land use change, intensive livestock production, and climate change’. C. Fernandez de Cordoba Farini (2023)

- **The cost of preventing the next pandemic is about 2% of the cost we are paying for COVID-19**
 - Preventing Deforestation
 - Regulating Wildlife Trade
 - Early detection and response: Creating a driver-centric warning system
 - Creating more sustainable food systems



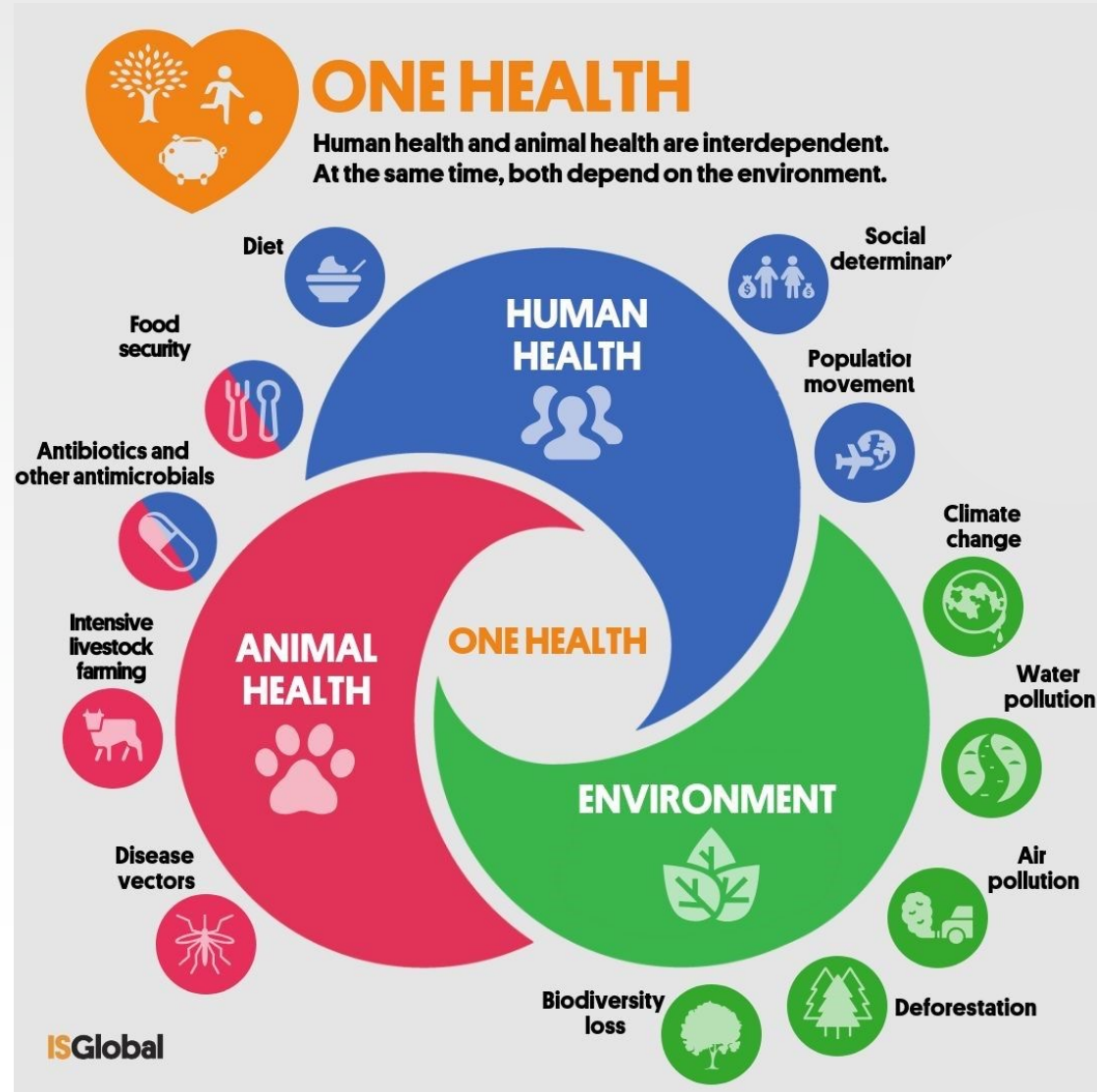
Current Interdisciplinary frameworks

- WHO's One Health agenda is defined as:

‘An approach to designing and implementing programmes [...] in which multiple sectors communicate and work together to **achieve better public health outcomes**’

(WHO, 2017).

- New Pandemic Treaty 2021- ongoing



People play golf as an ash plume rises from Kilauea volcano, Hawaii (Getty Images)



3. FORECASTING AND ALERTING FOR COVID-19

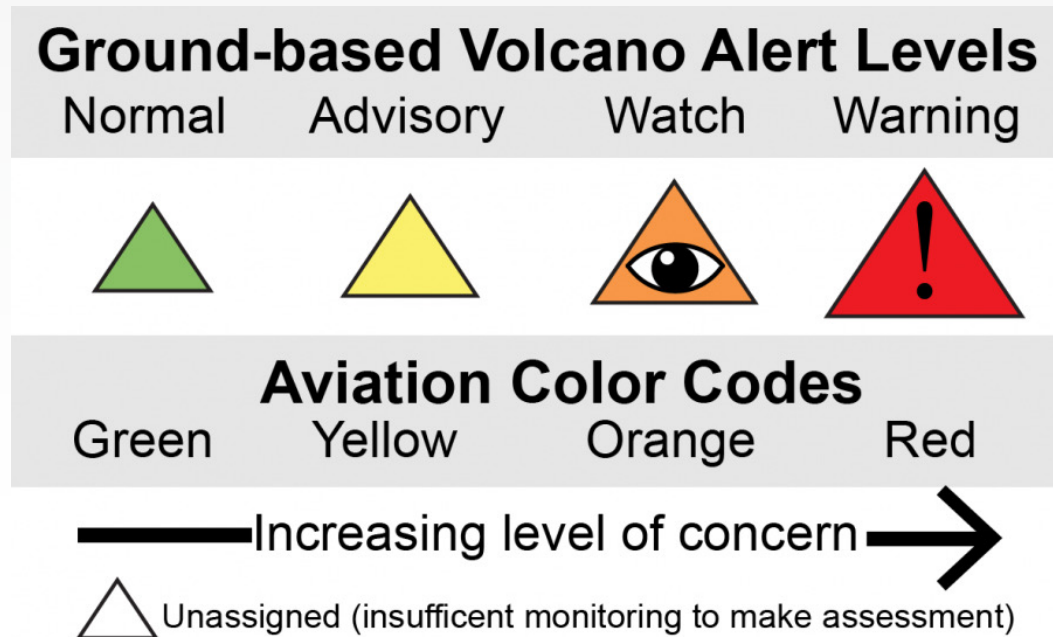
What are Alert Level Systems (ALS)?

- While ALS are commonly thought of as simple ‘triggers’, to be effective they must be embedded in an extensive system of:
 - Observation and communication that integrates different experts
 - Thresholds or tipping points
 - Communication mediums and iconographyfor the provision of **timely** warnings to public and civil authorities that can be used to gauge and coordinate response to a developing emergency.
- ALS are used globally as a shorthand system to convey concise and clear information to a wide range of stakeholders and often follow a:
 - Traffic light colour structure
 - Numerical order
 - Are standardised on national or international levels.
- ALS provide public awareness about both escalating and deescalating crises.



The Diversity of Volcano Alert Level Systems

- Volcanoes have the most diverse range of ALS of any hazard varying by:
 - **Hazard**
 - **Scale**
 - **Geography**
- One of the most frequently used ALS globally
- Frequently reviewed and improved to enhance their effectiveness



POPOCATÉPETL



Semáforo de Alerta Volcánica

NORMALIDAD

Infórmate. Conoce las rutas de evacuación, sitios de reunión y refugios temporales.



Fase 1 Volcán en calma



Fase 2 Mínimas manifestaciones



- Fumarolas y actividad sísmica esporádica.

El Popocatepetl es uno de los volcanes más estudiados y monitoreados a nivel mundial.

En un radio de menos de 100 km del cráter, habitan 25 millones de personas.

ALERTA

Permanece atento y prepárate para una posible evacuación.



Fase 1 Manifestación de actividad



- Sísmicidad volcánica local frecuente.
- Emisiones esporádicas y ligeras de ceniza.

Fase 2 Incremento de actividad



- Pluma de vapor de agua y gas.
- Ligera caída de ceniza en áreas cercanas.
- Caída de fragmentos incandescentes.
- Posibilidad de flujos piroclásticos por explosiones.
- Flujos de lodo o escombros de corto alcance.

Fase 3 Actividad intermedia a alta



- Crecimiento y destrucción de domos de lava.
- Persistencia de fumarolas, gas y caída leve de cenizas en áreas cercanas.
- Explosiones de intensidad creciente con lanzamiento de fragmentos incandescentes.
- Posibles flujos piroclásticos de mediano alcance.

ALARMA

Hay peligro. Tú y tu familia deben estar listos para la evacuación.



Fase 1 Actividad explosiva de peligro intermedio a alto








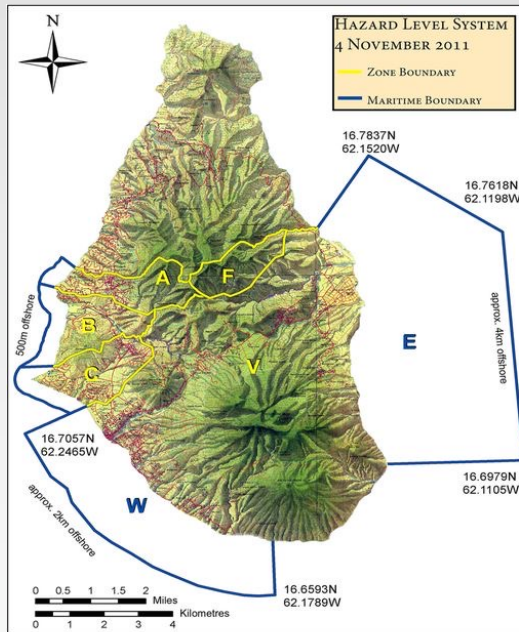
- Columna eruptiva de varios kilómetros de vapor de agua y gas.
- Lanzamiento de fragmentos incandescentes sobre las laderas del volcán.
- Caída importante de cenizas en poblaciones y ciudades lejanas.
- Flujos piroclásticos y de lodo que pueden alcanzar poblaciones cercanas.

Fase 2 Actividad explosiva de peligro alto a extremo



- Columnas eruptivas de gran alcance.
- Intensa caída de ceniza, arena y fragmentos volcánicos a distancias mayores.
- Posibles derrumbes parciales del edificio volcánico.
- Flujos piroclásticos y de escombros alcanzando poblaciones cercanas e intermedias.
- Grandes lahares de efectos devastadores.
- Daños graves al entorno y áreas señaladas en el mapa de peligros volcánicos.

Abbreviated Term	Target area	Levels & Keyword		Explanation			
				Expected volcanic activity	Action to be taken by inhabitants ¹⁾	Action to be taken by climbers ¹⁾	
Warning	Residential areas	Level 5	Evacuate		Eruption that may cause serious damage in residential areas, or imminent eruption.	Evacuate from the danger zone ²⁾ . (Target areas and evacuation measures are determined in line with current volcanic activity.)	
					Possibility or increasing possibility of eruption that may cause serious damage in residential areas.	Prepare to evacuate from alert areas ²⁾ . Let disabled persons evacuate. (Target areas and evacuation measures are determined in line with current volcanic activity.)	
Near-crater Warning	Non-residential areas near the crater	Level 3	Do not approach the volcano		Eruption or possibility of eruption that may severely affect places near residential areas (threat to life is possible in these areas).	Stand by, paying attention to changes in volcanic activity. Let disabled persons prepare to evacuate in line with current volcanic activity.	Refrain from entering the danger zone. (Target areas are determined in line with current volcanic activity.)
	Around the crater			Level 2	Do not approach the crater		Eruption or possibility of eruption that may affect areas near the crater (threat to life is possible in these areas).
Forecast	Inside the crater	Level 1	Normal				Calm: Volcanic ash emissions or other related phenomena may occur in the crater (threat to life is possible in these areas).



HAZARD LEVEL SYSTEM

Soufriere Hills Volcano, Monsterrat:
Hazard Levels and Access Restrictions

4 November 2011

ZONES	
A	South of Nantes River, including: Salem, Frith, Flemmings, parts of Olveston and Old Towne, and upper part of Happy Hill
B	Iles Bay, Belham, Waterworks, parts of Old Towne and lower part of Happy Hill
C	Cork Hill, Weekes, Fox's Bay, Richmond Hill and Delvins.
F	Corbett Springs, Locust Valley. This zone is dedicated to farming and is defined by NDPRAC.
V	St George's Hill, Soufriere Hills, South Soufriere Hills, Plymouth, Lee's, Harris, and Spanish Point

MARITIME EXCLUSION ZONES	
W	2 km offshore between Sturge Point and O'Garra's.
E	4 km offshore between Roche's Yard and Spanish Point, decreasing to 2 km offshore from Spanish Point to Pelican Ghaut.

HAZARD LEVEL ¹	1	2	3	4	5
TYPICAL ACTIVITY ²	More than one year with no measured activity.	No activity that threatens the north or west. ³ Low measured activity. ⁴	Mild activity that threatens the west. ⁵ Significant change of measured activity. ⁶ High measured activity. ⁷	Lava extrusion that threatens the north or west. Large unstable dome to the north or west.	Threat of large pyroclastic flows to the north or northwest. Threat of lateral blast or sector collapse.
ZONES	A Unrestricted B Unrestricted C Unrestricted F Unrestricted V Daytime access to some areas	Unrestricted Unrestricted Daytime access Daytime access Essential workers	Unrestricted Unrestricted Controlled access Daytime access Essential workers	Unrestricted Controlled access Controlled access Controlled access Essential workers	Controlled access Controlled access Essential workers Controlled access Essential workers
MARITIME EXCLUSION ZONES	W Unrestricted E Unrestricted	Daytime transit Essential workers	Daytime access Essential workers	Essential workers Essential workers	Essential workers Essential workers

ACCESS RESTRICTIONS	
UNRESTRICTED-	Ashfall and lahars can be significant hazards in all areas, and require appropriate cautions.
DAYTIME ACCESS-	Access is permitted from 8:00 am until 4:00 pm. Access gates will be locked at all other times.
DAYTIME ACCESS TO SOME AREAS-	Areas will be defined depending on the state and location of the volcanic activity.
DAYTIME TRANSIT-	Boats permitted to travel through the MEZ without stopping from 6:30 am to 5:30 pm.
CONTROLLED ACCESS-	No access without approval from NDPRAC. Approval considered on a case-by-case basis. Gates will be locked at all times.
ESSENTIAL WORKERS-	No access apart from MVO and associated staff. Access for essential maintenance only with approval from NDPRAC. Gates will be locked at all times.

SEVERE WEATHER
Hazard Level or access restrictions may be changed for severe weather such as unusually high rainfall, storms or hurricanes.

1	The Hazard Level System is not related to the Alert Level used prior to 1 August 2008.
2	The descriptions of types of volcanic activity are indicative only. The level will be set by the MVO based on assessment of actual activity.
3	For example, growth contained by the crater or non-growing lava dome contained by the crater.
4	Measured activity refers to all the monitoring techniques used by Montserrat Volcano Observatory (MVO) including seismic, ground deformation, gas measurements, and visual observation.
5	For instance, mild ash venting from vents located on the northern or western side of the crater with no measured activity that might be a precursor to larger activity.
6	Any change in measured activity which may be the precursor to an eruption caused by a sudden rise of magma beneath the dome. This may, or may not, be accompanied by surface activity such as explosions or dome growth.
7	A high level of measured activity which may be the precursor to an eruption caused by the steady rise of magma within the volcano. This may, or may not, be accompanied by surface activity such as explosions or dome growth.



Further information: www.mvo.ms

Mind the gap: issuing a warning

- Alerts used globally as a visual and text-based **shorthand** system to convey concise and clear information to a wide range of people
- Changing alert level is **challenging** as often scientists encounter difficulties in interpreting scientific data
- The decision to move between alert levels is based upon a **complex negotiation** of perceived political, economic, and environmental risks rather than the scientific data.
- ALS can not convey all the risks alone, **additional information** is required



COVID-19 Alert Levels Systems (ALS)

- Key national alert systems include: Singapore, Vietnam, South Korea, South Africa, and New Zealand
- Warn of the ongoing crisis rather than provide an early warning

	GREEN	YELLOW	ORANGE	RED
Nature of Disease	Disease is mild OR Disease is severe but does not spread easily from person to person (e.g. MERS, H7N9)	Disease is severe and spreads easily from person to person but is occurring outside Singapore. OR Disease is spreading in Singapore but is (a) Typically mild i.e only slightly more severe than seasonal influenza. Could be severe in vulnerable groups. (e.g. H1N1 pandemic) OR (b) being contained	Disease is severe AND spreads easily from person to person, but disease has not spread widely in Singapore and is being contained (e.g. SARS experience in Singapore)	Disease is severe AND is spreading widely
Impact on Daily Life	Minimal disruption e.g. border screening, travel advice	Minimal disruption e.g. additional measures at border and/or healthcare settings expected, higher work and school absenteeism likely	Moderate disruption e.g. quarantine, temperature screening, visitor restrictions at hospitals	Major disruption e.g. school closures, work from home orders, significant number of deaths.
Advice to Public	<ul style="list-style-type: none"> Be socially responsible: if you are sick, stay at home Maintain good personal hygiene Look out for health advisories 	<ul style="list-style-type: none"> Be socially responsible: if you are sick, stay at home Maintain good personal hygiene Look out for health advisories 	<ul style="list-style-type: none"> Be socially responsible: if you are sick, stay at home Maintain good personal hygiene Look out for health advisories Comply with control measures 	<ul style="list-style-type: none"> Be socially responsible: if you are sick, stay at home Maintain good personal hygiene Look out for health advisories Comply with control measures Practise social distancing: avoid crowded areas

UK COVID Alerts

- On May 10th 2020, the UK Prime Minister Boris Johnson introduced the national COVID Alert Levels
- Due to non-standard, changing information that has been haphazardly presented, the UK government introduced an entirely new local COVID-19 alert level system based on three tiers on 14th October 2020



The national alert system. UK government. Contains public sector information licensed under the Open Government Licence v3.0.

COVID Alert Levels

Level	Description	Action
5	As level 4 and there is a material risk of healthcare services being overwhelmed	Social distancing measures increase from today's level
4	A COVID-19 epidemic is in general circulation; transmission is high or rising exponentially	Current social distancing measures and restrictions
3	A COVID-19 epidemic is in general circulation	Gradual relaxing of restrictions and social distancing measures
2	COVID-19 is present in the UK, but the number of cases and transmission is low	No or minimal social distancing measures; enhanced testing, tracing, monitoring and screening
1	COVID-19 is not known to be present in the UK	Routine international monitoring

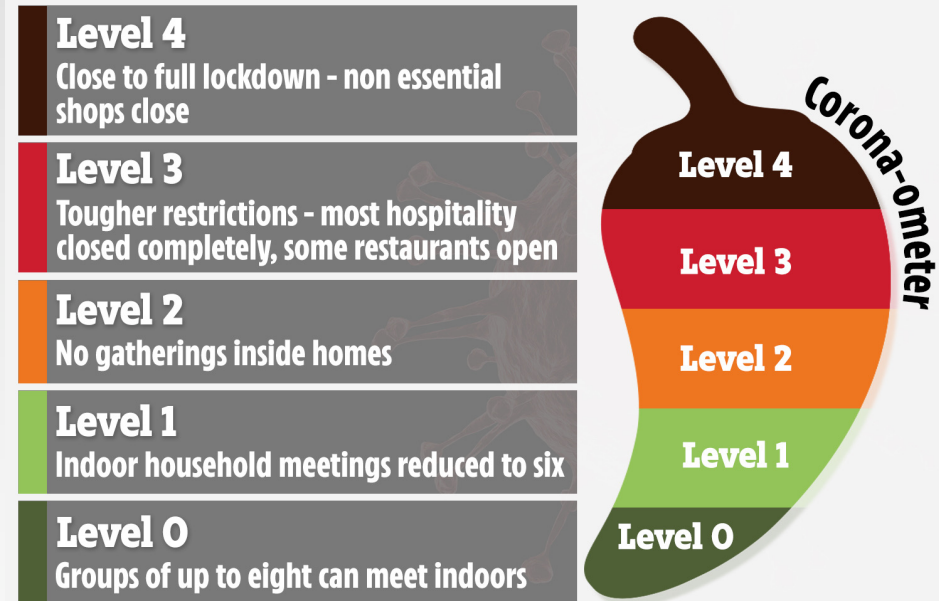
STAY ALERT ▶ CONTROL THE VIRUS ▶ SAVE LIVES

Pros and Cons of Standardising Warnings

Issues	Local (Non-Standardised)	National (Standardised system)
Users' needs	Provides flexibility to local community but global users may be confused	Limits flexibility possible, but provides consistency and clarity to all
Communication Methods	Local interpretation likely to be more effective	Common terminology and understanding, but must be known
Decision Making	Gear decision on local needs, circumstances and knowledge	Descriptions provide guidelines / criteria, but implications may vary
Management	Local stakeholders develop close relationships	Streamlines communication within government agencies reducing confusion

Key challenges

- No **standardisation** across the UK 4 nations
- Lack of **expertise** from emergency management or civil protection experts
- Lack of **transparency** and clarity over the rules, which have changed between the two ALS introduced
- Significant failures in **preparedness** including testing facilities and providing key workers with personal protective equipment



Coronavirus alert levels in UK

Stage of outbreak		Downing St party level
Risk of healthcare services being overwhelmed	5	Full on rave. Everyone off their tits. Jacob crying in corner asking for nanny
Transmission is high or rising exponentially	4	Boris topless, asking Thatcher's portrait if she comes here often
Virus is in general circulation	3	Booze, snogging, Gove in charge of refreshments
Number of cases and transmission is low	2	Tinsel, party hats, PM hosting pub quiz
Covid-19 no longer present in UK	1	Small gathering with wine and cheese



Changing Systems – confused?

	2020	2021
Jan	Normal	LOCKDOWN
Feb	Normal	LOCKDOWN
Mar	→ LOCKDOWN	→ Step 1
Apr	LOCKDOWN	→ Step 2
May	LOCKDOWN	→ Step 3
Jun	STAY ALERT	Step 3
Jul	EAT OUT	→ 'Normal'
Aug	EAT OUT	'Normal'
Sep	RULE OF 6	'Normal'
Oct	TIERS	'Normal'
Nov	'LOCKDOWN'	'Normal'
Dec	TIERS	PLAN B

Wednesday,
December 22,
2021

[https://diamond
geezer.blogspot
.com](https://diamondgeezer.blogspot.com) -

New Zealand COVID-19 Alert Levels

A recent global survey of the public relations industry put New Zealand's prime minister Jacinda Ardern at the top of the list for COVID-19 response:

“The early setting out of the four alert levels, linked to the progress of the virus and the restrictions that each level would entail, set expectations at the beginning and have given people a framework for thinking about how their futures might look and feel. Very few countries have done that, which is one of the reasons why other governments have found it so much harder to manage expectations and get and maintain compliance to restrictions”



Photograph: Hagen
Hopkins / Getty
Images

New Zealand COVID-19 Alert Levels Summary

- The Alert Levels are determined by the Government and specify the public health and social measures to be taken in the fight against COVID-19. Further guidance is available on the [Covid19.govt.nz](https://www.covid19.govt.nz) website.
- The measures may be updated based on new scientific knowledge about COVID-19, information about the effectiveness of control measures in New Zealand and overseas, or the application of Alert Levels at different times (e.g. the application may be different depending on if New Zealand is moving down or up Alert Levels).

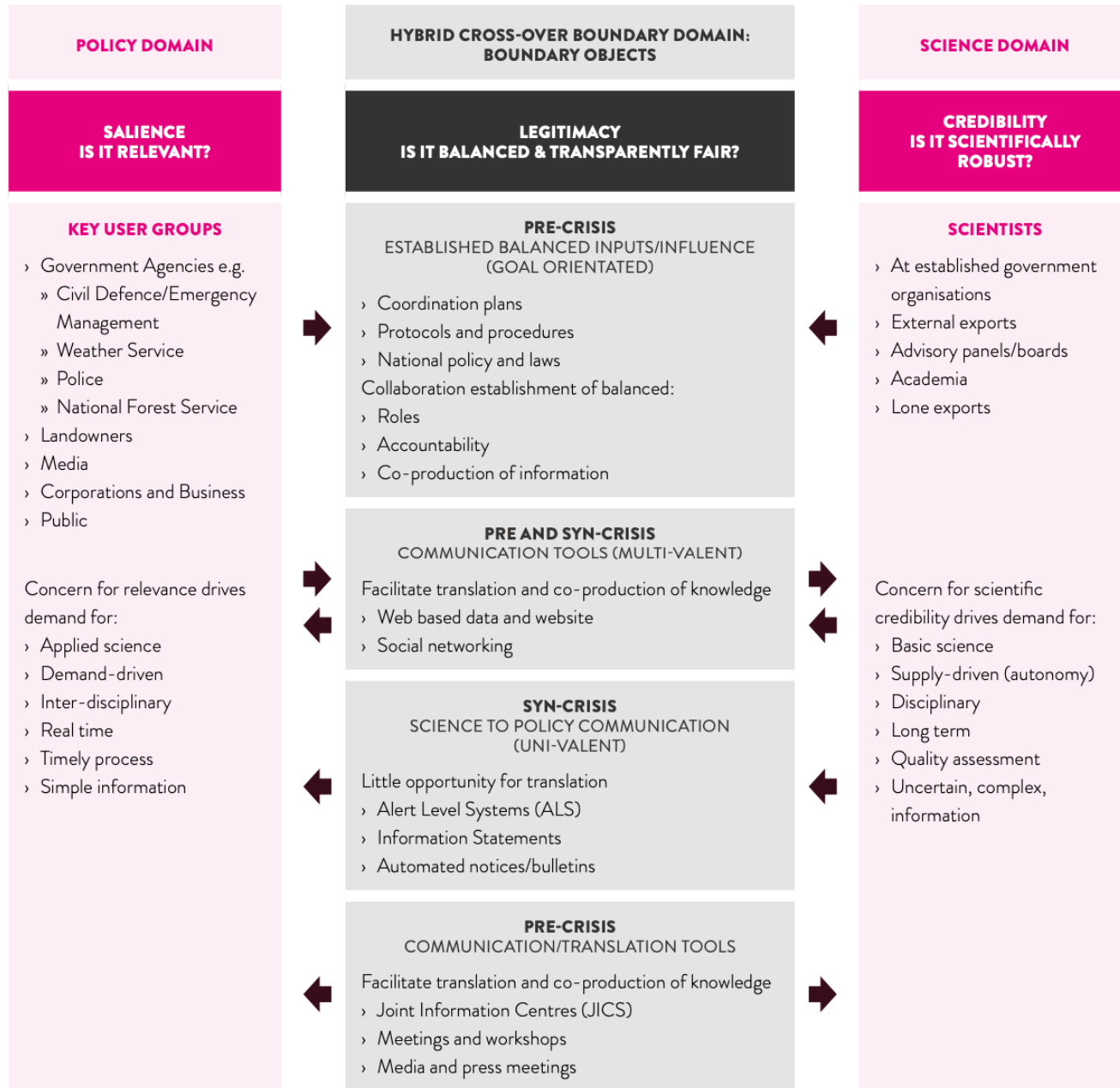
- Different parts of the country may be at different Alert Levels. We can move up and down Alert Levels.
- Services including supermarkets, health services, emergency services, utilities and goods transport will continue to operate at any level. Employers in those sectors must continue to meet health and safety obligations.
- Restrictions are cumulative (e.g. at Alert Level 4, all restrictions from Alert Levels 1, 2 and 3 apply).

Updated 14 December 2020

ELIMINATION STRATEGY – New Zealand is working together to eliminate COVID-19

Alert Level	Risk Assessment	Range of Measures (can be applied locally or nationally)
Level 4 – Lockdown Likely the disease is not contained	<ul style="list-style-type: none"> Sustained and intensive community transmission is occurring. Widespread outbreaks. 	<ul style="list-style-type: none"> People instructed to stay at home in their bubble other than for essential personal movement. Safe recreational activity is allowed in local area. Travel is severely limited. All gatherings cancelled and all public venues closed. Businesses closed except for essential services (e.g. supermarkets, pharmacies, clinics, petrol stations) and lifeline utilities. Educational facilities closed. Rationing of supplies and requisitioning of facilities possible. Reprioritisation of healthcare services.
Level 3 – Restrict High risk the disease is not contained	<ul style="list-style-type: none"> Multiple cases of community transmission occurring. Multiple active clusters in multiple regions. 	<ul style="list-style-type: none"> People instructed to stay home in their bubble other than for essential personal movement – including to go to work, school if they have to, or for local recreation. Physical distancing of two metres outside home, or one metre in controlled environments like schools and workplaces. People must stay within their immediate household bubble, but can expand this to reconnect with close family / whānau, or bring in caregivers, or support isolated people. This extended bubble should remain exclusive. Schools (years 1 to 10) and Early Childhood Education centres can safely open, but will have limited capacity. Children should learn at home if possible. People must work from home unless that is not possible. Businesses cannot offer services that involve close personal contact, unless it is a supermarket, primary produce retailer, pharmacy, petrol station or hardware store providing goods to trade customers, or it is an emergency or critical situation. Other businesses can open premises, but cannot physically interact with customers. Low risk local recreation activities are allowed. Public venues are closed (e.g. libraries, museums, cinemas, food courts, gyms, pools, playgrounds, markets). Gatherings of up to 10 people are allowed but only for wedding services, funerals and tangihanga. Physical distancing and public health measures must be maintained. Healthcare services use virtual, non-contact consultations where possible. Inter-regional travel is highly limited (e.g. for critical workers, with limited exemptions for others). People at high risk of severe illness (older people and those with existing medical conditions) are encouraged to stay at home where possible, and take additional precautions when leaving home. They may choose to work.
Level 2 – Reduce The disease is contained, but the risk of community transmission remains	<ul style="list-style-type: none"> Limited community transmission could be occurring. Active clusters in more than one region. 	<ul style="list-style-type: none"> People can reconnect with friends and family, and socialise in groups of up to 100, go shopping, or travel domestically, if following public health guidance. Keep physical distancing of two metres from people you don't know when out in public or in retail stores. Keep one metre physical distancing in controlled environments like workplaces, where practicable. No more than 100 people at gatherings, including weddings, birthdays and funerals and tangihanga. Businesses can open to the public if following public health guidance including physical distancing and record keeping. Alternative ways of working encouraged where possible. Hospitality businesses must keep groups of customers separated, seated, and served by a single person. Maximum of 100 people at a time. Sport and recreation activities are allowed, subject to conditions on gatherings, record keeping, and – where practical – physical distancing. Public venues such as museums, libraries and pools can open if they comply with public health measures and ensure 1 metre physical distancing and record keeping. Event facilities, including cinemas, stadiums, concert venues and casinos can have more than 100 people at a time, provided that there are no more than 100 in a defined space, and the groups do not mix. Health and disability care services operate as normally as possible. It is safe to send your children to schools, early learning services and tertiary education. There will be appropriate measures in place. People at higher-risk of severe illness from COVID-19 (e.g. those with underlying medical conditions, especially if not well-controlled, and seniors) are encouraged to take additional precautions when leaving home. They may work, if they agree with their employer that they can do so safely. Face coverings required on public transport and aircraft (but not inter-island ferries) – school buses and children under 12 are exempt along with passengers in taxis or ride share services and people with disabilities or mental health conditions.
Level 1 – Prepare The disease is contained in New Zealand	<ul style="list-style-type: none"> COVID-19 is uncontrolled overseas. Sporadic imported cases. Isolated local transmission could be occurring in New Zealand. 	<ul style="list-style-type: none"> Border entry measures to minimise risk of importing COVID-19 cases. Intensive testing for COVID-19. Rapid contact tracing of any positive case. Self-isolation and quarantine required. Schools and workplaces open, and must operate safely. No restrictions on personal movement but people are encouraged to maintain a record of where they have been. No restrictions on gatherings but organisers encouraged to maintain records to enable contact tracing. Stay home if you're sick, report flu-like symptoms. Wash and dry hands, cough into elbow, don't touch your face. No restrictions on domestic transport – avoid public transport or travel if sick. No restrictions on workplaces or services but they are encouraged to maintain records to enable contact tracing. QR codes issued by the NZ Government must be displayed in workplaces and on public transport to enable use of the NZ COVID Tracer App for contact tracing.

Multi-Way Dialogue



Taken from Fearnley and Kelman, 2021 p.23

Figure 2: Mapping credibility, relevance and the generation of legitimacy to translate, communicate and mediate crisis information (adapted from Fearnley and Beaven, 2018, p. 11).



4. KEY LESSON IDENTIFIED, LEARNT, AND EMERGING

COVID-19 Lessons learnt



There is a need to:

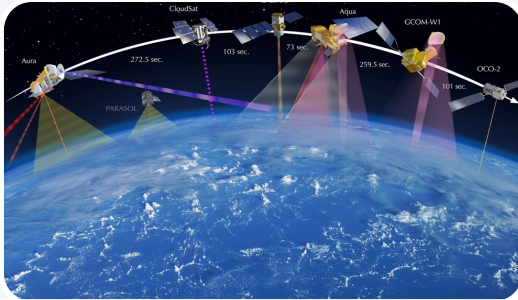
1. Make sure action is taken over warnings by investing in **Disaster Risk Reduction and Preparedness**
2. Adapt a **range of tools of communication** to integrate **credibility, relevance and legitimacy** as part of the science / policy interface to aid decision making processes
3. Work with **multi-stakeholders** in the decision-making process to issue warnings as they work across hazard and risk, often with great uncertainties
4. Consider the **design of standardised systems** at different scales to make sure they are locally relevant

But also:

- Understand that warnings are part of a broader **mitigation system**

Warning Types and Tools

Warning can be divided into classes relative to the timing, hazard events that they mitigate, of the actions that they prescribe



PERMANENT

Automated warning systems: without human input / trigger automated responses

Common Alerting Protocol (CAP)

Earth Observation Systems



ANTICIPATORY

Community-based warning systems (CBEWS)

Multi-hazard early warning systems (MHEWS)

Traditional warning systems



RESPONSIVE

Sirens / Alerts

Community-based warning systems

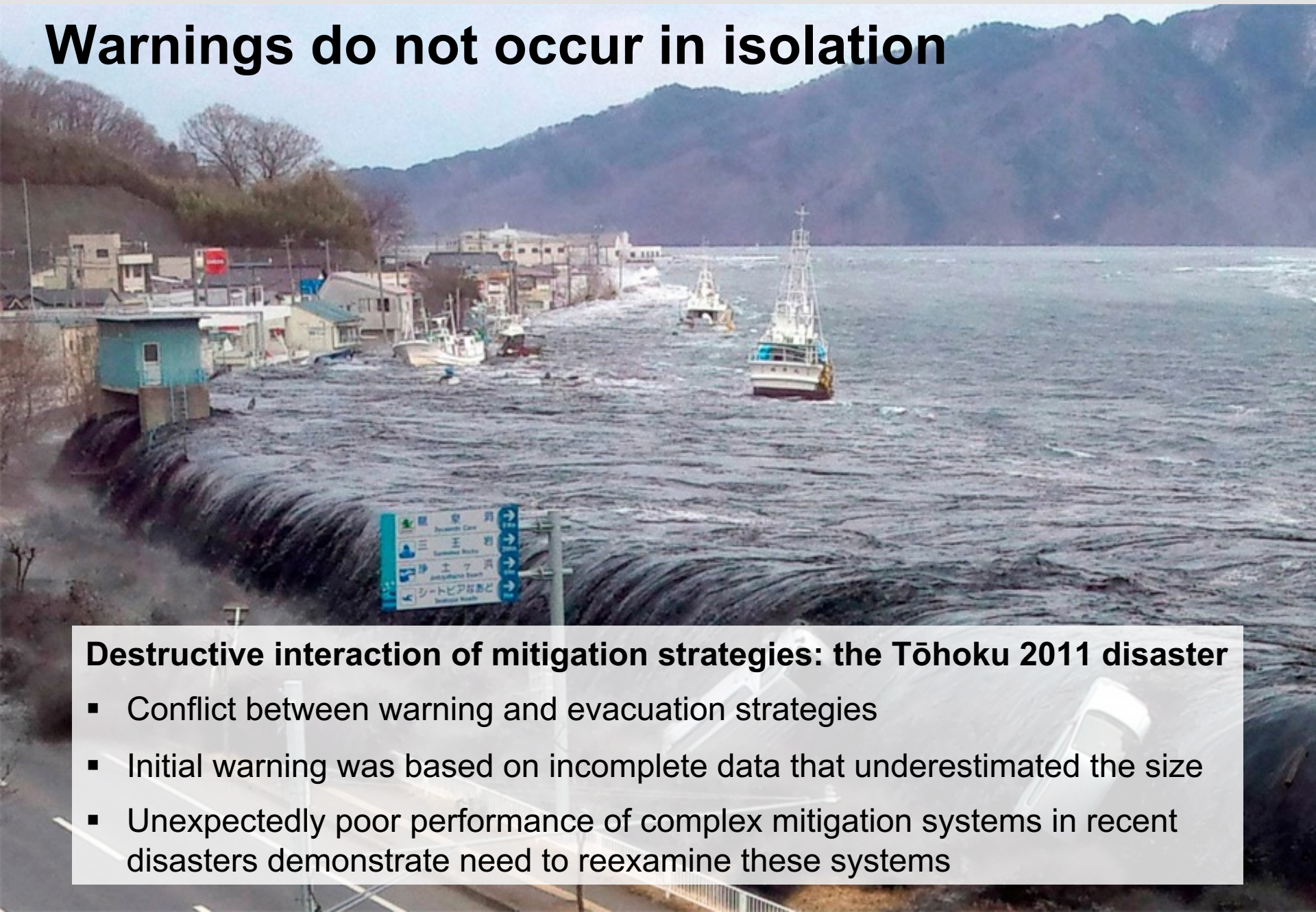
Multi-hazard early warning systems

Traditional warning systems

INTEGRATED WARNING SYSTEMS

Bring together data, analysis, warnings, and response in one system e.g. the Global Information and Early Warning System on Food and Agriculture (GIEWS).

Warnings do not occur in isolation



Destructive interaction of mitigation strategies: the Tōhoku 2011 disaster

- Conflict between warning and evacuation strategies
- Initial warning was based on incomplete data that underestimated the size
- Unexpectedly poor performance of complex mitigation systems in recent disasters demonstrate need to reexamine these systems

Safe houses that failed

- Minami Sanriyuku Miyagi three story disaster prevention building designed to announce warnings.
- Was over topped by the tsunami
- Only 10 of the 39 roof evacuees survived

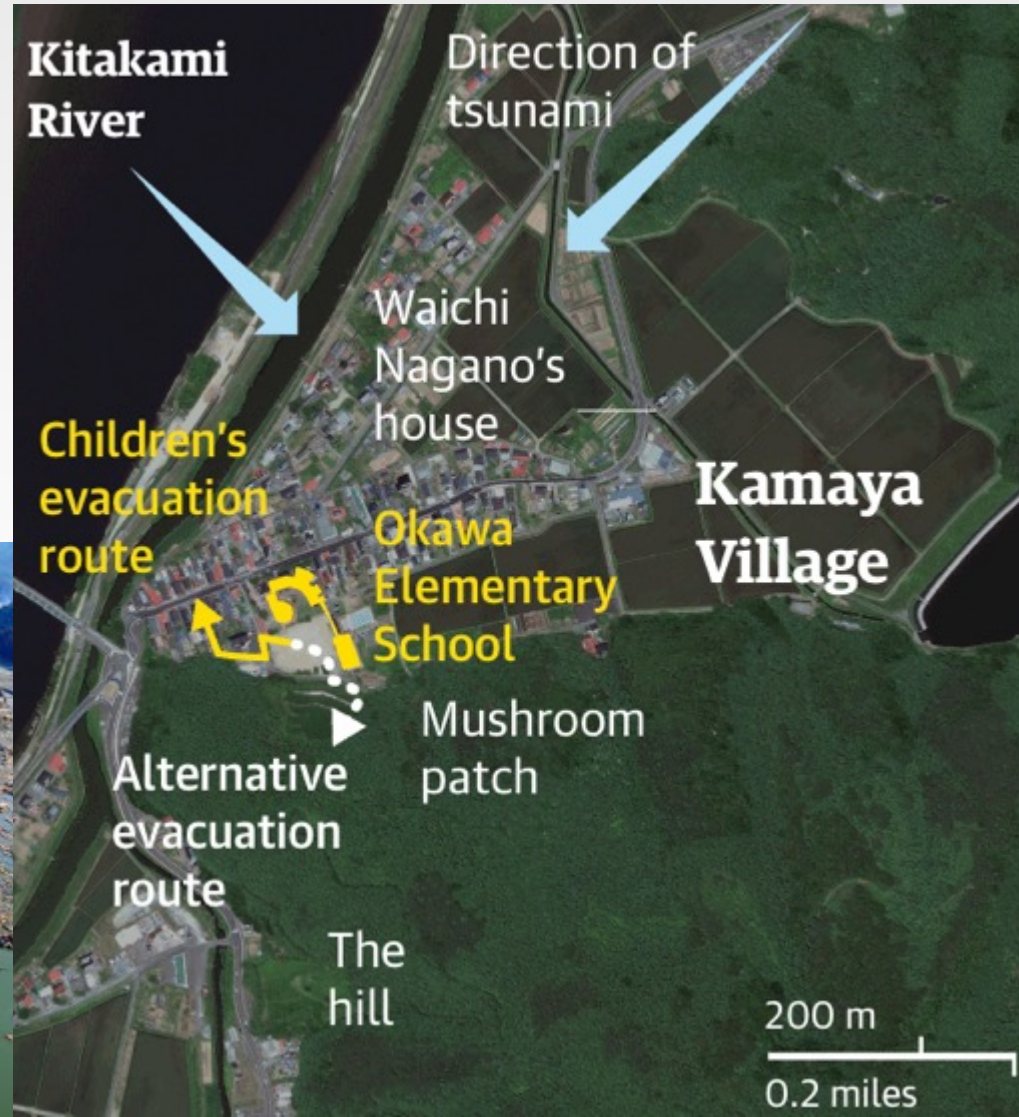


Photo by: Mark R. Pierepiekarz

Okawa Elementary School: conflict in decision making

- 75 children and 10 teachers died on the school grounds.
- Of the 34 children who survived: 26 children were picked up by their parents
- 8 children survived under the care and supervision of teachers

Photograph: The Asahi Shimbun/Getty Images



Multiple Warning Strategies

All warnings (not just EWS) at different stages of hazards, threats, and crises, need to be considered holistically, along with their interactions

Multiple warnings and mitigation strategies are:

- developed and applied together

OR more commonly

- added in a progressive sequence reflecting technological and socio-economic developments rather than any systematic overall plan
- May result in a mix of strategies *that may interact in unexpected ways*

“Brittle” mitigation = a strategy that works up to a limit of hazard intensity, then fails



Photo: REMOGRAPHY

Managing Multiple Hazards and Threats, and Cascading Complex Situations



Flood warning

Areas affected: River Severn at Severn Ham, Tewkesbury

ACTIVE Started at: 17:39 GMT on Mon 28 February

Flooding is expected - immediate action required

ipcc

INTERGOVERNMENTAL PANEL ON climate change

Climate Change 2022 Impacts, Adaptation and Vulnerability

Summary for Policymakers



Toyota to shut down Japanese plants after supplier hit by cyber attack

Move comes as governments step up warnings of hacking following Russia's invasion of Ukraine



A Toyota factory in Japan. Japanese officials fear the country's leading companies are now targets for reprisals after the government backed tougher sanctions against Russia © Yoshikazu Tsuno/Gamma-Rapho/Getty



WGII

Working Group II contribution to the
Sixth Assessment Report of the
Intergovernmental Panel on Climate Change





 NATIONAL
GEOGRAPHIC

Photograph by Gunjan Sinha, My Shot

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5. HOW CAN WE DO BETTER?

Knowledge about
PROBABILITIES

Knowledge about
OUTCOMES

NOT problematic ←

→ Problematic

NOT problematic

■ **RISK**

- Familiar systems
- Controlled conditions
- Engineering failure
- Known epidemics
- Transport safety
- Flood (under normal conditions)

■ **UNCERTAINTY**

- Complex, nonlinear, open systems
- Human element in causal models
- Specific effects beyond boundaries
- Flood under climate change
- Unassessed carcinogens
- New variant human pathogens

■ **AMBIGUITY**

- Contested framings, questions, assumptions, methods
- Comparing incommensurables: apples and oranges
- Disagreements between specialists, disciplines
- Issues of behaviour, trust and compliance
- Interest, language, meaning
- Matters of ethics and equity

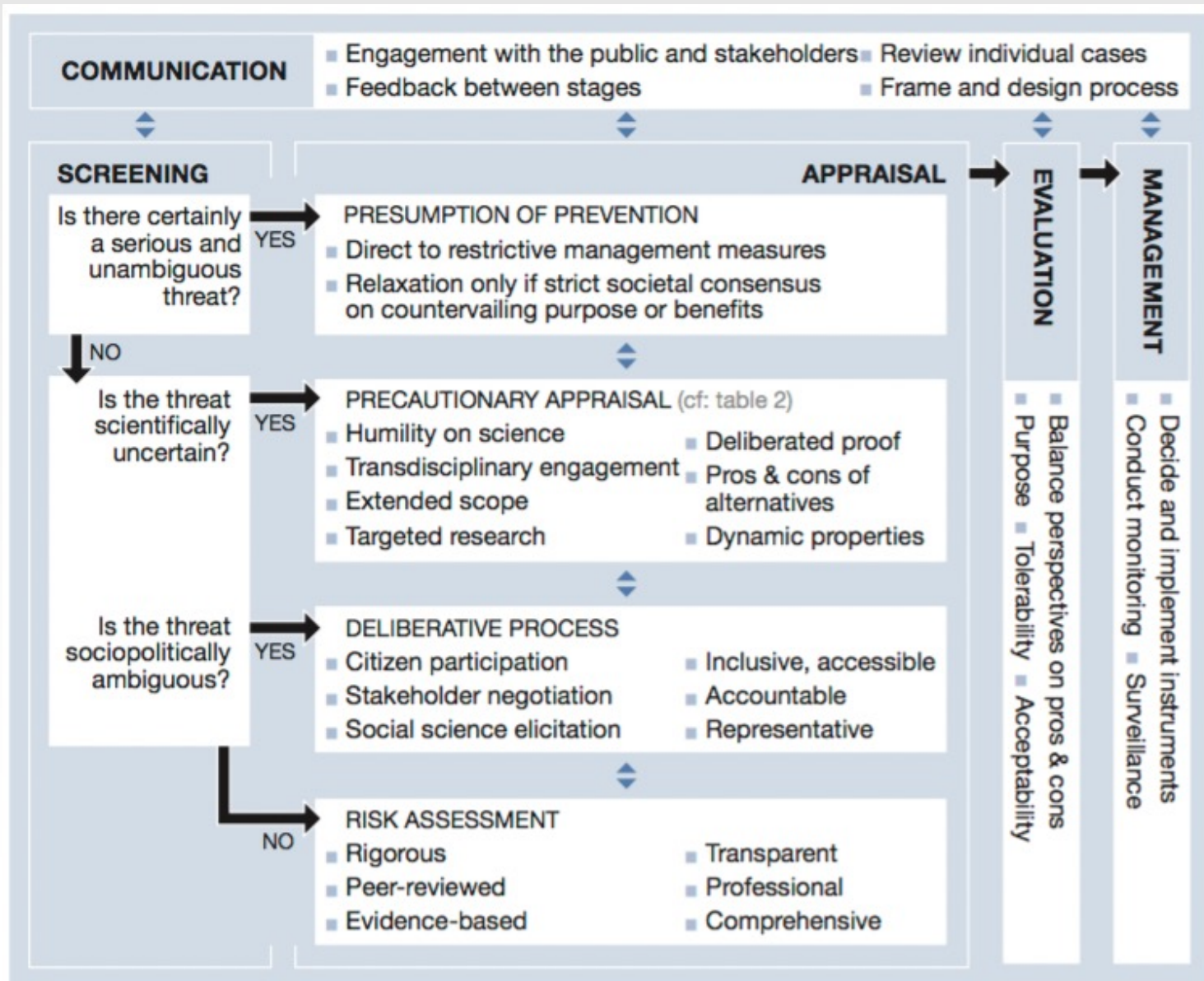
■ **IGNORANCE**

- Unanticipated effects
- Unexpected conditions
- Gaps, surprises, unknowns
- Novel agents like TSEs
- Novel mechanisms such as endocrine disruption

Problematic



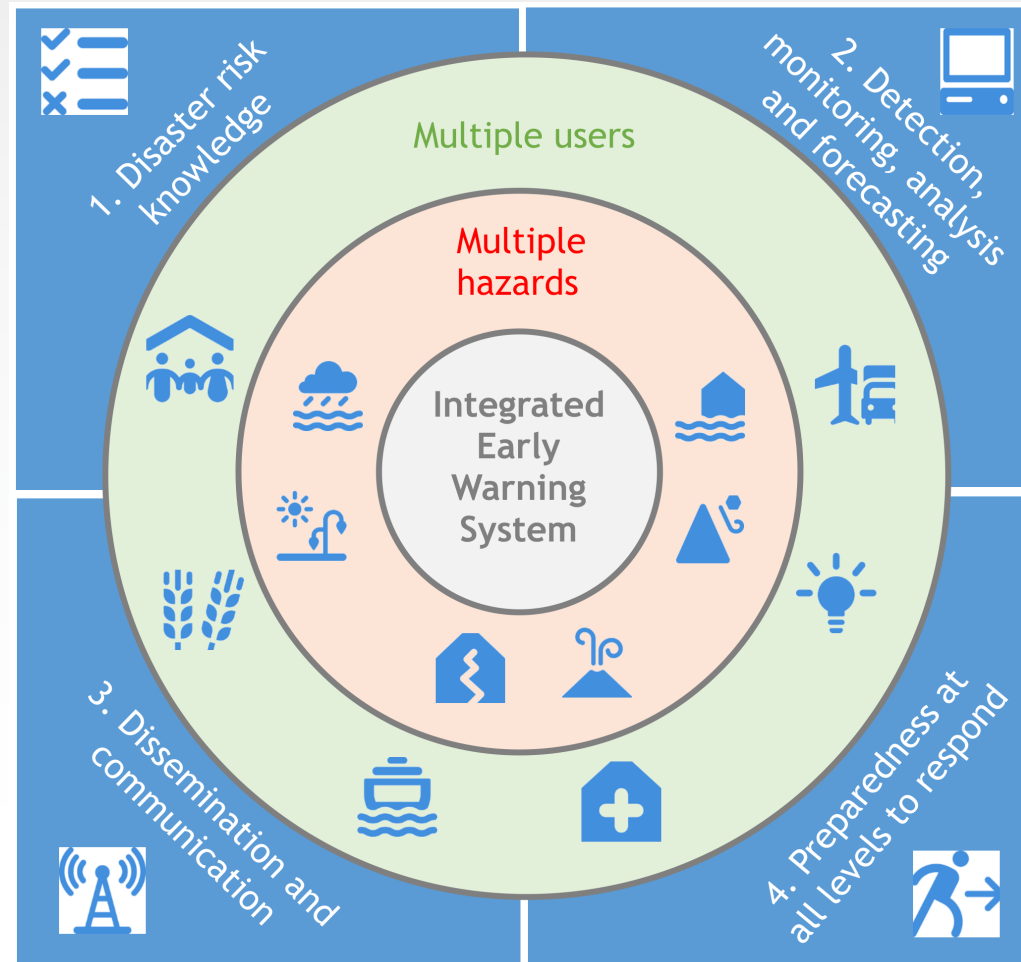
Moving beyond risk assessments



1. Develop effective warnings that consider multiple-hazards, cascading events, and integration across stakeholders

Integration needs to consider all hazards and threats:

- Natural Hazards
- Human-Made Hazards and Threats
 - Accidental
 - Intentional
- Multiple Hazard Events
- Cascading Hazards
- Emerging Risks
 - New Technologies
 - Climate change



How to Integrate Successfully



Figure 3: Diagram of warning systems with factors to improve the linking of subsystems as defined by the UNDRR (Garcia and Fearnley, 2012, p133).

2. Working Across Silos

Create & support mechanisms to overcome silos and territorialism

Instead encourage idea and action exchange for building trust and connections that support action when a major situation arises.

This can be accomplished via:

1. Develop a warning expert committee / initiative
2. Develop training and exercise programmes for warnings
3. Integrate successful public engagement lessons
4. Design warnings to be flexible and facilitate multi-directional feedback and communication
5. Evaluate scales of standardisation, and decision-making processes



Recommendations for MHEWS

Expand the warning agenda:

- Cut across the wide range of vulnerabilities and contexts, hazards / threats globally **to examine and share knowledge** of warning designs, practices, and lessons identified
- Develop warnings that address the **realities** of vulnerabilities, hazards / threats, and anticipatory actions that range from local to international scale
- Develop **simple systems** to manage complexity. Too many differing systems can result in confusion resulting in a loss of trust or credibility
- Build **inclusive** warnings



*Taken from Compendium of multi-hazard
early warning cooperation
(ESCAPRIMESUNDRR, WMO, 2023, p.9)*

3. Warnings are a Social Process

- Policy Engagement
- Community Engagement
- Integrating Education Exchange



The First Mile is essential to effective action:

‘The key is that the people who need EWS information can assist in providing that information and they should be involved as the first, not last, step of setting up and operationalising an EWS’.

(Kelman and Glantz, 2014 pp.105-106)

‘Warnings are part of a social process means that it should be ongoing, engrained in the day-to-day and decade-to-decade functioning of society - even while recognising that this ideal is rarely met in practice’

(Kelman and Glantz, 2014, p.100)

Effective EWS Policy

Recommendations for effective decision-making within EWS (Sarevitz et al., 2000):

- 1) Prediction is insufficient for effective decision-making
- 2) Develop effective communication strategies
- 3) Establish proper priorities
- 4) Establish and strengthen legal frameworks
- 5) Clarify responsibilities



Designing Inclusive, Accessible Early Warning Systems: Good Practices and Entry Points

Conclusions: Principles for Systemic Risk Warnings



WARNING

Failure to observe the following warnings could create a risk of death or serious injury.

1. Warnings are long-term social processes
2. Warnings must use multiple channels / modes and be clear, transparent, and credible
3. Warnings must be relevant to everyone, covering a range of timeframes and spatial coverage
4. Warnings need to connect all governance levels, including local, national and international
5. Warnings require integration across different vulnerabilities to respond to multiple hazards, sequences, and cascade events

(Fearnley and Kelman, 2021 pp.14-15)