

Flooding: managing health risks in the WHO European Region

Dr Vladimir Kendrovski

WHO European Centre for Environment and Health

Bonn, Germany

kendrovskiv@who.int



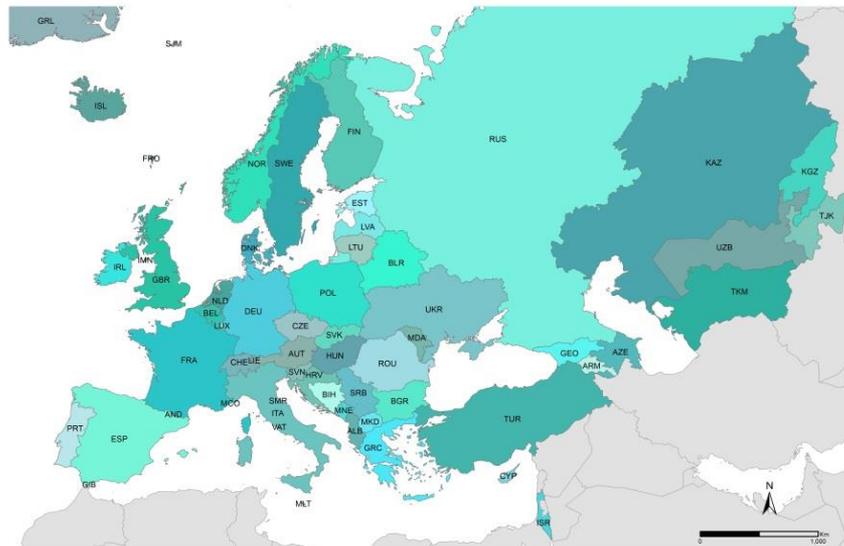
Who is WHO?

Who is WHO?

- Since 7 April 1948
- 7000 people working in 150 country offices
- 6 regional offices and headquarter in Geneva

Main areas of work:

- Health systems
- Promoting health through the life-course
- Noncommunicable diseases
- Communicable diseases
- Preparedness, surveillance and response.



The boundaries and names shown and the designations used on this map do not imply the expression of any opinion whatsoever on the part of the World Health Organization concerning the legal status of any country, territory, city or area or its authorities, or concerning the delimitation of its frontiers or boundaries. Dotted and dashed lines on maps represent approximate border lines for which there may not yet be full agreement.

Data source and map production:
Steve Huf
© WHO Regional Office for Europe 2015. All rights reserved.

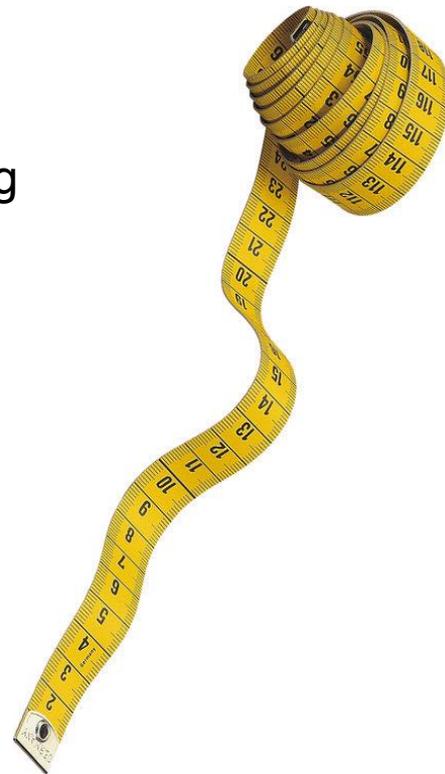


"Health is a state of complete physical, mental and social well-being
and not merely the absence of disease or infirmity."

WHO Constitution

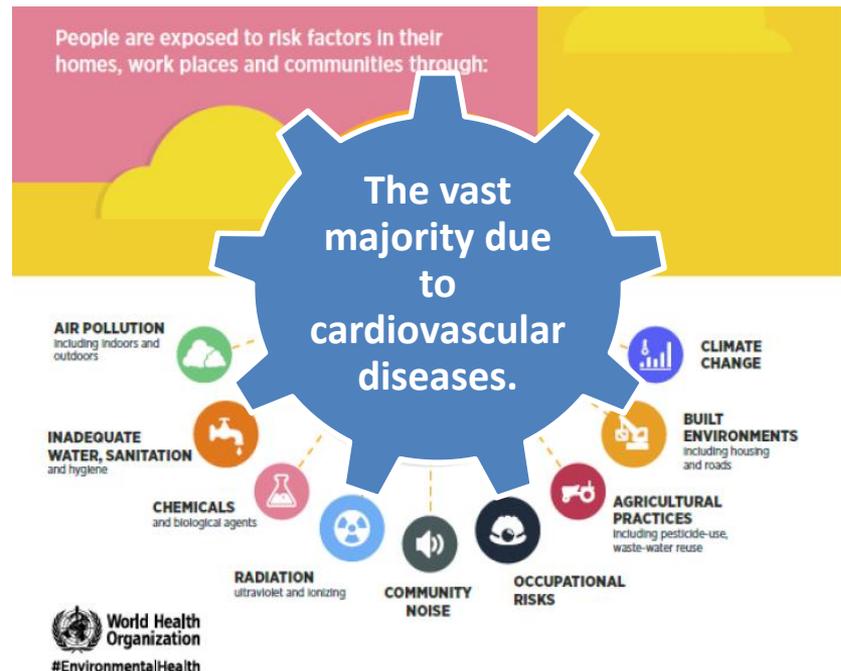
WHO's key functions

1. providing **leadership** on matters critical to health and engaging in partnerships where joint action is needed;
2. shaping the **research agenda** and stimulating the generation, translation and dissemination of valuable knowledge;
3. setting **norms and standards** and promoting and monitoring their implementation;
4. articulating ethical and evidence-based **policy options**;
5. providing technical support, **catalysing change**, and building sustainable institutional capacity; and
6. **monitoring** the health situation and assessing health trends.

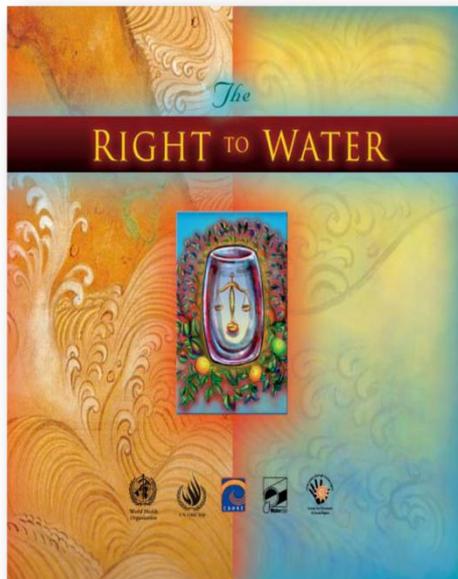


Multiple diseases can be prevented through a healthy environment

1.4 million deaths occur annually in the WHO European Region from environmental determinants.



No water, no health, no growth



- “Sustainable” & “safe” water and sanitation services are cornerstones for creating healthy & resilient communities
- Water and sanitation are the greatest “medical milestone” since the 1840s
- Water & sanitation management is a core responsibility of city municipalities, regions and countries.



The unfinished business in the European Region

- 62 million people lack access to:
 - Piped water at home
 - Adequate sanitation
- Major inequalities exist:
 - Wealthy vs. poor
 - Minorities vs. general pop
 - Home vs. schools
- Outbreaks happen

In the WHO European Region diarrhoeal diseases cause an estimated **14 deaths per day** due to inadequate

WaSH WATER SANITATION HYGIENE

Diarrhoeal diseases can be prevented through:

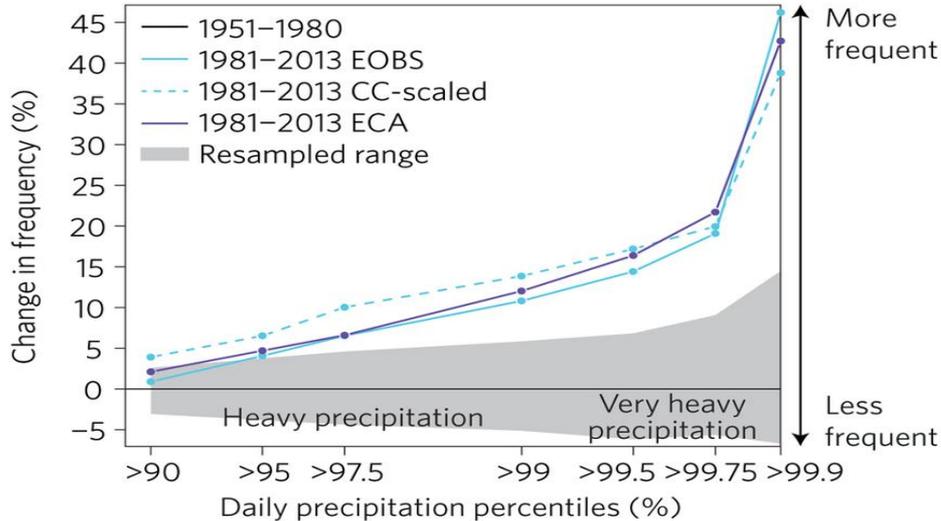
- safely managed drinking-water
- adequate sanitation and safely managed wastewater disposal
- good handwashing practices.

<http://www.euro.who.int/en/health-topics/environment-and-health/water-and-sanitation>
04/2016

World Health Organization
REGIONAL OFFICE FOR Europe

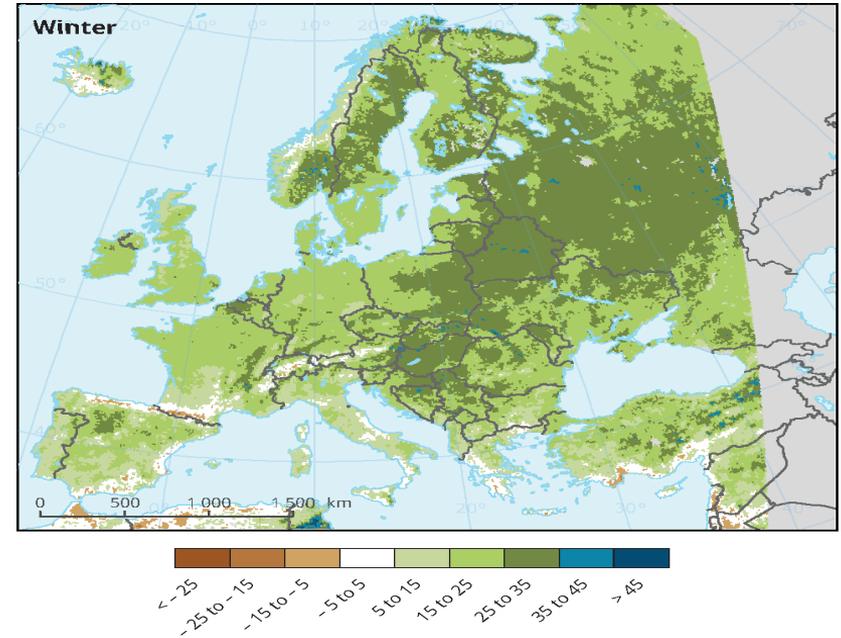
Heavy precipitation events are getting stronger

Heavy daily precipitation (1951–2013)



Source: Fischer & Knutti (2016)

Heavy daily precipitation (projected change for 2080s, RCP 8.5)

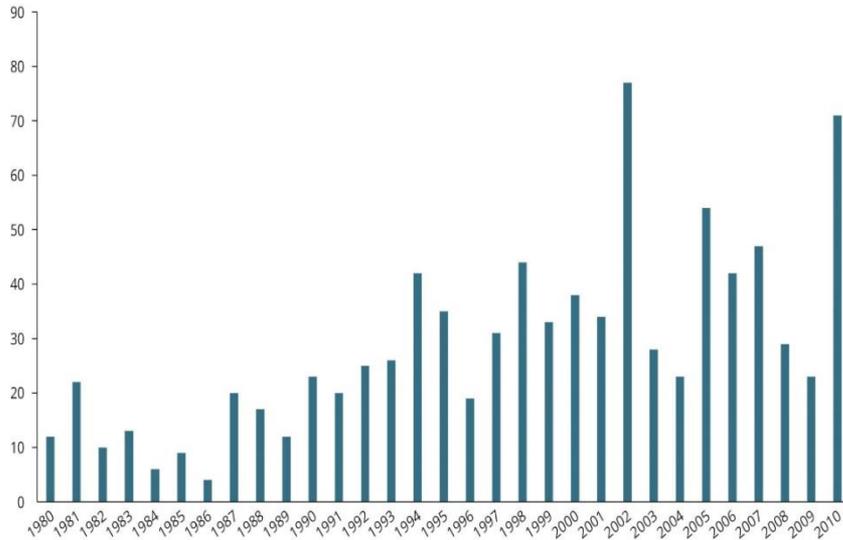


Source: EURO-CORDEX
(Jacob et al., 2014)

Increasing floods are threatening human lives

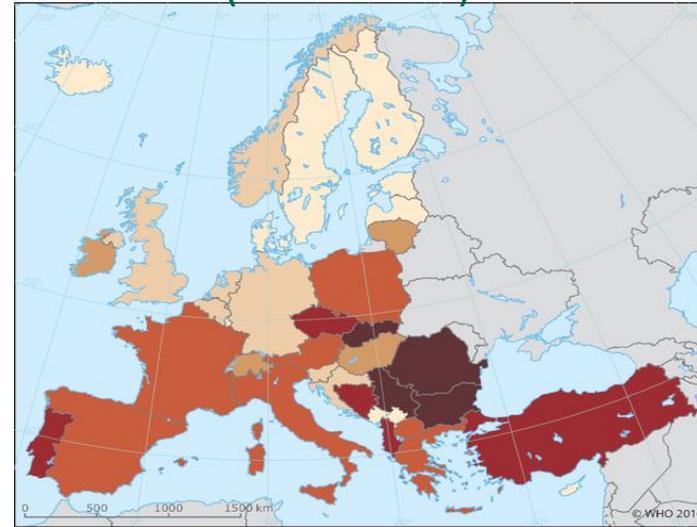
'Very severe' inland floods in Europe (1980–2010)

Number of flood phenomena in severity class 'very high'



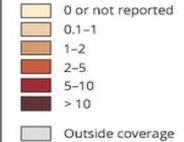
Source: EEA (2016), ETC/ICM (2015)

Deaths from flooding (1991–2015)



Deaths per million inhabitants related to flooding in Europe for the period 1991–2015

Rate per 1 000 000 inhabitant



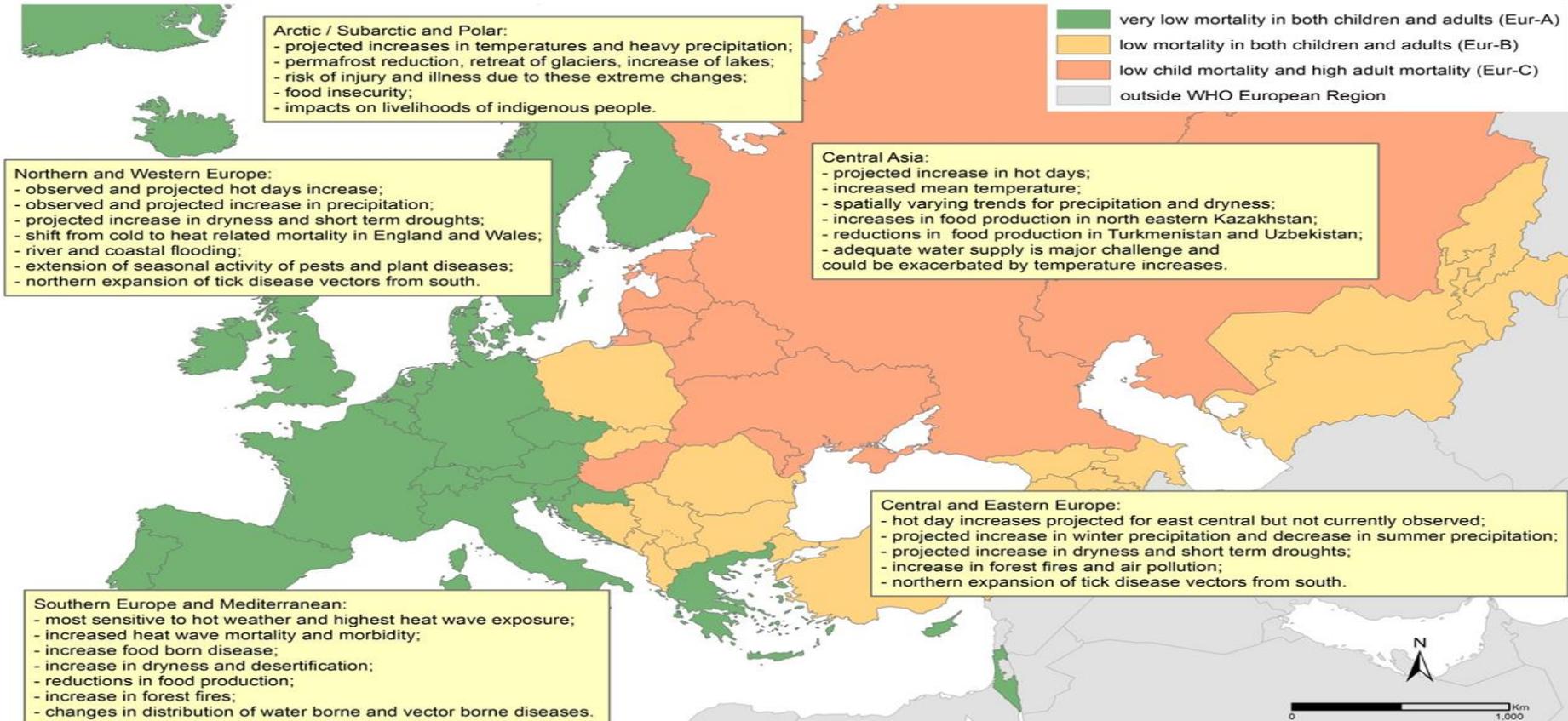
The designations employed and the presentation of this material do not imply the expression of any opinion whatsoever on the part of the Secretariat of the World Health Organization concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers and boundaries. Dotted and dashed lines on maps represent approximate borders for which there may not be full agreement.

Source: WHO (2016), EMDAT (2016)

In nutshell:

- Flooding has substantial health and social impacts
- Health system infrastructure (e.g. hospitals) is vulnerable to flooding. Disruption of services, including health services, safe water, sanitation and transportation ways, play a major role in vulnerability
- Wide range of vulnerable groups, may vary according to stage of flood
- Quantification of costs and benefits of hazards and our responses to them is key, for now and in future
- Not easy – development of methods needed to overcome challenges
- Need to think beyond flood events to health impacts of flood risk management

High level of diversity



The boundaries and names shown and the designations used on this map do not imply the expression of any opinion whatsoever on the part of the World Health Organization concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. Dotted and dashed lines on maps represent approximate border lines for which there may not yet be full agreement.

Data Source and map production:
Compiled based on EEA and IPCC reports and the WHO mortality strata
Tanja Wolf, Climate change, green health services and sustainable development (CGS),
World Health Organization
© WHO Regional Office for Europe 2015. All rights reserved

Sustainable water management at stake

Draught events

Water stress

High usage patterns

Torrential rains

Flooding events

TRANSITION

Regional wastewater reuse

Efficient water use & systems

**Alternative sources
(desalination)**

Climate resilient water & sanitation services & infrastructures

Cities in EU most affected by extreme weather due to climate change

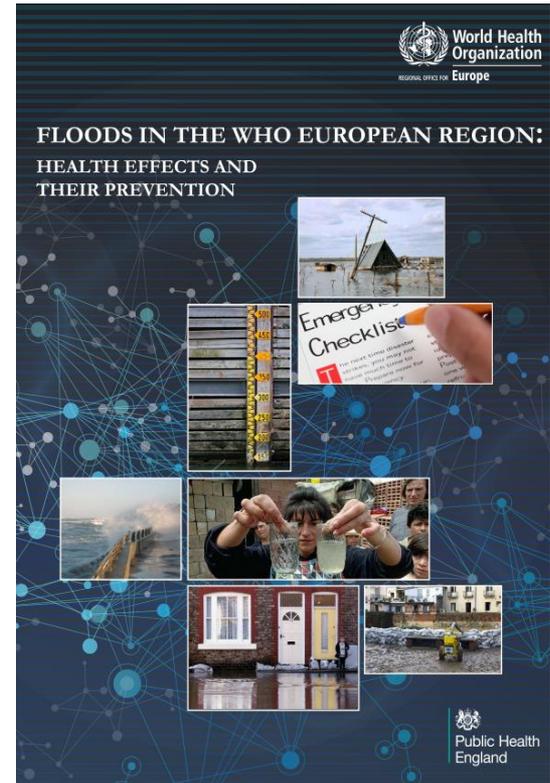
- a worsening of heatwaves for all 571 cities
- increasing drought conditions, particularly in southern Europe
- **an increase in river flooding, especially in north-western European cities**
- for the worst projections, increases in all hazards for most European cities

Flooding	Heatwaves	Drought
Dublin	Athens	Athens
Helsinki	Nicosia	Lisbon
Riga	Prague	Madrid
Vilnius	Rome	Nicosia
Zagreb	Sofia	Sofia
	Stockholm	Valletta
	Valletta	
	Vienna	

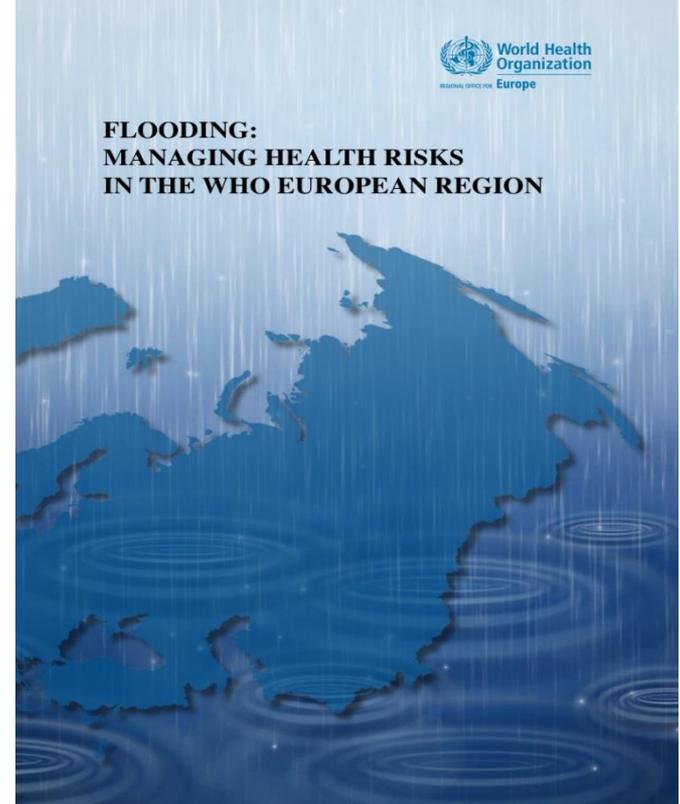
Source: Guerreiro S. et al, 2018

A survey conducted by WHO and Public Health England, highlighted the gaps in the prevention of health effects of floods and the availability of flood health response strategies or action plans, in a coordinated and systematic fashion.

- Health service operational analysis is seldom integrated into multisectoral and multihazard risk assessments.
- Advance planning seldom includes provision of sufficient quality and quantities of water and food, sanitation and hygiene
- Health benefits or risks associated with long-term structural and non-structural measures are seldom considered.
- Flood warning is often not timely enough to allow health systems to take proper
- Legal environments in many Member States do not allow for timely supply of aid, especially medications and consumables.



- This document is intended to assist health authorities in preparing for, and responding to, flood events, with the aim to reduce flood–health effects.
- A series of information sheets of an operational nature accompany this document.



<http://www.euro.who.int/en/health-topics/environment-and-health/Climate-change/publications/2017/flooding-managing-health-risks-in-the-who-european-region-2017>

Developing a flood–health emergency risk management plan

The process for developing a flood–health emergency risk management plan includes:

- conducting a vulnerability and capacity assessment
- developing tasks and actions for priority areas in flood prevention and preparedness
- developing tasks and actions for priority areas in flood response
- developing tasks and actions for priority areas in flood recovery
- monitoring and evaluation.

- Towards “Flood health emergency risk management plan”

ITS ULTIMATE AIM WOULD BE TO REDUCE FLOOD HEALTH EFFECTS.

- Flood health emergency risk management plans will allow communities, health systems and services to plan in advance for flood events to occur.
- They ensure coordination within the health community and across the communities far in advance, have resources and services available in a flood event, ensure recovery and covering the health systems/sector role in floods.
- The elements of this are derived from the health system building blocks, emergency management principles, and core capacities of the IHR.

DEVELOPING A FLOOD HEALTH EMERGENCY RISK MANAGEMENT PLAN

- The process for developing a flood health emergency risk management plan includes:
 1. Conducting a vulnerability and capacity assessment
 2. Developing tasks and actions for priorities in flood prevention and preparedness
 3. Developing tasks and actions for priorities in flood response
 4. Developing tasks and actions for priorities in flood recovery
 5. Monitoring and Evaluation

Information sheets on preparedness and response for flood events

- 1. Health effects of floods.....
- 2. Vulnerable populations and factors that increase vulnerability.....
- 3. Structural and non-structural measures
- 4. Structural measures for health services
- 5. Flood early warning system
- 6. Flood risk assessment checklist.....
- 7. Preparedness for risk communication
- 8. Hospital preparedness planning
- 9. Contingency plans for health facilities.....
- 10. Planning for emergency shelters
- 11. Chemical hazard management during and after flood events.....
- 12. Disease surveillance during and after flood events
- 13. Vaccination during flood events
- 14. How to deal with dead human bodies
- 15. How to deal with dead animals
- 16. Venomous snake bites
- 17. Food safety during or after flood events.....
- 18. Outbreak surveillance
- 19. Vector-borne diseases during or after flood events
- 20. Rodent-borne diseases.....
- 21. Prevention of West Nile virus outbreaks
- 22. Mental health and floods
- 23. Injuries and floods
- 24. Water and hygiene in health care facilities during and after flood events.....
- 25. Sanitation and hygiene in health care facilities during and after flood events ..
- 26. Generic post-flood recovery
- 27. Mould clean-up and removal after flooding

During and after a flood event:

6. Flood risk assessment checklist

5. Flood early warning system

Early warning systems are designed to make a prediction of flooding risk based on monitoring rainfall, river levels, sea and tidal conditions (Environment Agency 2009). Flood warning systems are often integrated within the weather forecasting system of a country or region, because their data are required for accurate predictions.

Meteorological forecasts of heavy precipitation and flood events are the basis for flood-health action plans. Considered alongside expected impacts on the population and on infrastructure and services, they trigger the various alert levels of a response plan and the respective measures. Flood warnings are important to allow people and institutions to prepare themselves or their properties for floods and make evacuation plans where necessary.

Table 1 illustrates an example from the United Kingdom.

Table 1. Example of flood warning codes issued by the United Kingdom Environment Agency

Warning symbol	Warning code	What it means	When it is used	What to do
	Flood alert	Flooding is possible. Be prepared.	Two hours to two days in advance of flooding	Be prepared to act on your flood plan. Prepare a flood kit of essential items. Monitor local water levels and the flood forecast on our website.
	Flood warning	Flooding is expected. Immediate action is required.	30 min to 1 day in advance of flooding	Move family, pets and valuables to a safe place. Turn off gas, electricity and water supplies if safe to do so. Put flood protection equipment in place.
	Severe flood warning	Severe flooding is expected. Danger to life.	When flooding poses a significant threat to life	Stay in a safe place with a means of escape. Be ready should you need to evacuate from your home. Cooperate with the emergency services. Call 999 if you are in immediate danger.
	Warnings no longer in force	No further flooding is currently expected in your area	When river or sea conditions begin to return to normal	Be careful. Flood water may still be around for several days. If you have been flooded, ring your insurance company as soon as possible.

Source: Environment Agency, 2012.

magnitude of health consequences and likelihood of the worst case scenario?); geographical and temporal (e.g. where is it likely to occur?);

to hazards of floods among individuals, populations and supply and sanitation services).

g. who would be most affected and how?);

se and economic value of different areas or industrial distribution of the population, including vulnerable groups and mechanisms and emergency and rescue operations

al information (e.g. food, medicine and social care wellings as well as infrastructure (e.g. hospital and social

ctors

tion sector's capacities in terms of: vulnerability to flooding; agency response procedures/protocols to secure sufficient drinking-water and/or safe disposal of wastewater under conditions; and protocols with local health offices to ensure timely advice

ices

and expected outcomes. flooding, including: onal or community vulnerability; rminants in relation to flooding such as socioeconomic ur. s available in health and other sectors.

affected population; ges to those needs; f adverse effects; m further health effects by implement piate and well defined; he effectiveness of emergency health pl to improve contingency planning. comes to consider when assessing flood

outcomes to consider when assessing

	The burden
g. injuries, rmia on myocardial n or stroke	– direct mortality from drowning); indirect r causes in the region r for approximately 0
linked to poor water sanitation and food e.g. cholera, borne disease (e.g. rosis) borne disease associated with wding	– local and regional d determine the exact r surveillance. WHO g that measles and acu diseases are monitor ed, and nutritional AIDS, sexually trans (STIs), sexual and neonatal tetanus, inf mortality should be r flooding (WHO, 201 Public Health Engal for Disease Control r recommend monitor or unusual illnesses r area (PHE, 2014; CI
g. electrocution, road traffic injuries, or strains, lacerations, ng from use of ors, exposure to ds, animal bites or	

18. Outbreak surveillance

Ideally, emergency outbreak surveillance should prio diseases or syndromes (see Table 3), ranked by:

- epidemic potential;
- ability to cause severe morbidity or death;
- international surveillance requirements (Internat health emergency of international concern);
- availability of prevention and control measures;
- availability of reliable and meaningful case defini where appropriate.

The WHO publication *Outbreak surveillance and respo* provides detailed advice and recommendations.

Table 3. Infectious diseases that may be encountered European Region

Diseases linked to poor water, sanitation and food safety	Diseases associated with overcrowding	Vector borne diseases
Diarrhoeal diseases*	Diarrhoeal diseases*	Dengu Chiku
Acute respiratory infections	Acute respiratory Pneumonia	Malar infections
	Influenza	West N
Hepatitis A	Hepatitis A	Tahya
Hepatitis E	Hepatitis E	
	Meningitis	Other borne
	Tuberculosis	
	Measles	
	Diphtheria	
	Pertussis	
	Scabies and head lice	

* Diarrhoeal diseases, potentially sensitive to flooding include: enteritis, cholera, *Escherichia coli* enteritis, paratyphoid, salmonellosis; (ii) viral diseases – rotavirus, norovirus; and (iii) *Parascariosis* (hookworm), ascariasis (roundworm), bal diphylobothriasis, giardiasis, strongyloidiasis, trichuriasis (wh

24. Water and hygiene in health care facilities during and after flood events

Needs assessment

- Consult with local authorities on whether tap water is safe to use. Agree procedures to receive warnings and access emergency water supply if tap water becomes unfit for human consumption.
- With help from the relevant authority, establish mechanisms to monitor water quality at the health care facility.
- Where tap water is unsafe, assess needs using the following recommended minimum quantities of water per person in each setting type:
 - outpatients: 5 litres/consultation
 - inpatients: 40–60 litres/patient/day
 - operating theatre or maternity unit: 100 litres/intervention
 - VHF isolation centre 300–400 litres/patient/day.

Emergency water supply

- Consult with local authorities to organize emergency water supply and technical options for sources, treatment, disinfection, storage and distribution of water. Emergency water supplies can consist of packaged water, tanker water, direct use of alternative water sources or on-site production of drinking-water.
- If circumstances allow, separate emergency water supplies are encouraged for health-care facilities and the general public.
- Prevent unauthorized people from accessing emergency water supply and storage system.

Water storage

During an emergency, health care facilities may experience intermittent supply of water, thereby creating the need for water storage. There may also be a need to store water after emergency treatment. In such situations:

- containers for transportation and storage of drinking-water should be cleaned and, preferably, disinfected before use;
- water should be stored safely in covered containers in order to prevent (re-) contamination or present a breeding place for insects.

Water quality

During an emergency, water quality may be compromised and emergency treatment may not achieve the usual quality levels. In such situations, microbial drinking-water quality is the first concern.

Water of insufficient or uncertain microbial quality must be boiled if it is intended for drinking, food preparation, brushing teeth or cleaning wounds. Water can be made safe by bringing it to a rolling boil (for example, in an electric kettle or pot on a cooker).

Geographic based Risk Assessments

- WHO e-atlas for disaster risk for the European Region
- WebGIS Risk Assessment System (WGRAS)



Legend

Flood hazard (index)

(World Health Organization, 2016)



International boundaries

(United Nations, 2016)

Disclaimer

The boundaries and names shown and the designations used on this map do not imply the expression of any opinion whatsoever on the part of the World Health Organization concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. Dotted lines on maps represent approximate border lines for which there may not yet be full agreement. All reasonable precautions have been taken by WHO to produce this map. However, this map is being distributed without warranty of any kind, either express or implied regarding its content. The responsibility for its interpretation and use lies with the user. In no event shall the World Health Organization be liable for damages arising from its use. © WHO 2016. All rights reserved.



World Health Organization
Europe

[Introduction](#) | [Methodology](#) | [View atlas by](#)



The WHO e-atlas of disaster risk
for the European Region
Volume 1: Exposure to natural hazards
Version 2.0

[Home](#) | [Overview](#) | [Publications and reports](#) | [Publications](#) | [Links](#) | [Data](#) | [Associated health](#) | [Photos](#) | [Contact us](#) | [Copyright](#)

© World Health Organization 2016. All rights reserved.

REGIONAL OFFICE for Europe



Organisation
mondiale de la Santé

BUREAU RÉGIONAL DE L'Europe



Weltgesundheitsorganisation

REGIONALBÜRO FÜR Europa



Всемирная организация
здравоохранения

Европейское региональное бюро

WebGIS Risk Assessment System

- New tool for the visualization of hazards, vulnerabilities and capacities
- Developed by the WHO Regional Office for Europe in close collaboration with the Lund University GIS Center
- Piloted in Armenia and Tajikistan in 2015
- Roll out to Georgia, Kirgizstan and Ukraine in 2016 and '17

World Conference adopts new international framework for disaster risk reduction after marathon negotiations



18 March 2015, SENDAI – Representatives from **187 UN member States** today adopted the first major agreement of the Post-2015 development agenda, a far reaching new framework for disaster risk reduction with **seven targets** and **four priorities for action**.

International Health Regulations (2005)

Geneva

INTERNATIONAL HEALTH

REGULATIONS

(2005)

SECOND EDITION



World Health
Organization

Protocol on Water and Health: a regional instrument for local action



Multilateral agreement linking sustainable water management & protection of health

Legally-binding requirement for time-bound national and local target setting

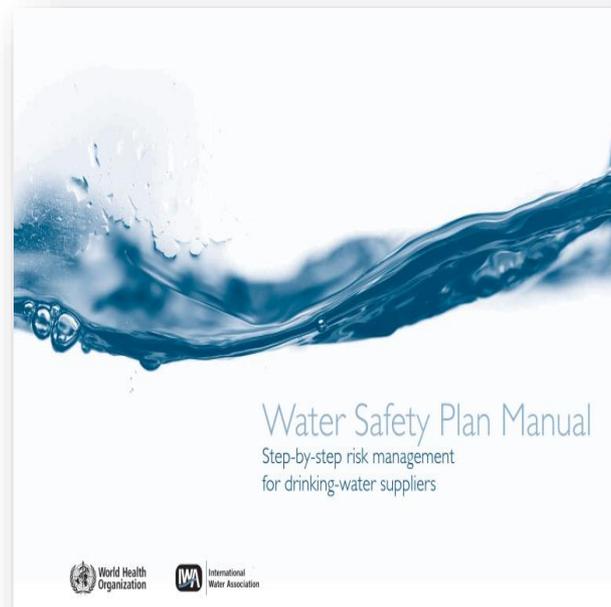
Platform for cooperation between water, health, environment & other sectors;
Regional hub for mutual support and capacity building

WSP: Safely managed water services

Multiple barriers to prevent hazards
contaminating water supply



Multiple barriers to prevent exposure to
faecal waste along the sanitation chain



6th Ministerial Conference

Ostrava, June 2017



Ministerial
Declaration

Compendium of
possible actions

Institutional
arrangements

Develop **national portfolios of action** on EH by the end of 2018

EHP as means to implement relevant **goals and targets of the 2030 Agenda**

Advance **existing commitments**

Allocate **necessary means**

Ostrava public health priorities

- Improve indoor and outdoor air quality
- Ensure access to safe drinking-water, sanitation and hygiene
- Minimize adverse effects of chemicals
- Strengthen adaptation to and mitigation of climate change
- Prevent/eliminate adverse effects of waste mgmt. & contaminated sites
- Support cities and regions to become healthier
- Build the environmental sustainability of health systems

HEALTH IN THE SDG ERA



World Health Organization

www.who.int/sdgs

SUSTAINABLE DEVELOPMENT GOALS