



PHASE

Public health Adaptation Strategies to extreme weather events

SCIENTIFIC SUMMARY for Public Health on Floods

What is known on the health effects of floods:

Floods are the most common natural hazard in the European Region. In recent years member states have experienced some of the largest events in their history. The effects of flooding on health are extensive and significant, ranging from mortality and injuries resulting from trauma to infectious diseases and mental health impacts. While some of these outcomes are relatively easy to track, quantification of the human impact of floods in Europe remains challenging.

The health effects of flooding can be divided into those associated with the immediate event and those arising afterwards. Immediate, direct effects are caused by the floodwater and the debris within it, but a flood continues to have health effects during the clean-up process and subsequently, which may persist for months or years. The longer-term, indirect health effects include those due to damage to infrastructure, food and water supplies, displacement and disruption to people's lives and wellbeing.

Type of effect	Health effect
Direct: effects on people exposed to flood-water	Drowning and injuries from walking or driving through floodwater, contact with debris in floodwater, falling into hidden manholes, injuries from submerged objects, injuries while trying to move possessions during floods.
	Building collapse and damage (injuries)
	Electrocution
	Diarrhoeal, vector- and rodent-borne diseases
	Respiratory, skin and eye infections
	Chemical contamination, particularly carbon monoxide poisoning from generators used for pumping and dehumidifying
	Water shortages and contamination due to loss of water treatment works and sewage treatment plants
	Stress, short- and longer-term mental health issues, including the impacts of displacement
Indirect: effects of flood-water on other health determinants	Loss of access to and failure to obtain continuing health care
	Damage to health care infrastructure, and loss of access to essential care
	Damage to or destruction of property, including hospitals and other vital community facilities
	Damage to water and sanitation infrastructure
	Damage to crops, disruption of food supplies
Disruption of livelihoods and income	

	Population displacement
	Mental health problems due to length of flood recovery and fear of recurrence; indirect effects of stress in dealing with insurance claims and refurbishing properties

Subgroups of the population most at risk

All populations affected by a flood are at direct or indirect risk of health impacts before, during and after the event. However, certain groups are at higher risk than others for morbidity and mortality associated with flooding, and known factors and determinants increase the risk. The health impacts and groups most vulnerable may depend on the particular context of the flood and responses to it. The table below lists factors that can serve to increase the vulnerability of certain population groups. These factors have been identified through a review of the literature relevant to the European region, the WP2 stakeholder analysis and the work undertaken in WP8.

Vulnerable group	Factors associated with vulnerability (adapted from WHO, 2013 and Lowe <i>et. al</i> , 2013)
Children	May become separated from their parents or caregivers
	May witness the death of a close family member
	May not have adequate cognitive or motor skills to move from danger or seek help if faced with a stressful event
	May be unable to vocalize their symptoms
	Greater risk for anxiety reactions
Elderly people	May have reduced mobility, impaired balance or reduced strength
	May have decreased physical strength and weakened physiological responses due to health conditions such as hypertension, heart disease, cancer, stroke or dementia
	May have a decreased immune response
	May be more susceptible to temperature extremes
	May have sensory impairment
	May have delayed verbal and physical responses
	May have reduced ability to retain information, understand what is happening and follow rescue instructions; may become disoriented or confused in unfamiliar surroundings
May lose hearing aids, eyeglasses or dentures, which may impede recovery	
People with chronic illnesses	Likely to rely on medications; if these are unavailable, may suffer adverse health consequences (e.g. diabetes, asthma and epilepsy)
People with physical impairments	May rely on mobility aids, such as wheelchairs, walking canes and walkers, loss of which during a flood may result in a loss of independence
	May be unable to move, and emergency personnel may not have the required skills to move them
People with sensory impairment	May be unable to communicate aurally or visually by modes of communication commonly used in emergency responses
People with cognitive impairment	May believe that authority figures are trying to harm them
	May not have the same perception of risk as people without impairments
	May be unable to express their symptoms when receiving triage health care
Gender	Health impacts may differ by gender and timing of exposure (before, during, after). For example, males aged 10-29 may be at greater risk of mortality during a flood.
Pregnant women	May be reluctant to accept treatment because of possible adverse health effects on their fetus
	May have a poorer immune response than non-pregnant women
Tourists	May be unable to speak the language, perhaps resulting in difficulty in obtaining help or understanding instructions
	May be unfamiliar with the local resources that can be relied on in emergency situations

Homeless	May have a substantial rate of mental illness, which can be exacerbated by the acute stress of flooding
	May have difficulty in reading or interpreting written instructions
	May be at disproportionately greater risk of being disabled or persistently ill
People with cultural and language vulnerability	May be unable to speak the language, perhaps resulting in difficulty in understanding instructions
	May be unable to express their needs to health care providers, resulting in incorrect treatment or diagnosis
	May be assumed to be uncooperative if they are unable to read written instructions
	May lose vital components of messages
	May lack trust in authority figures or members of the medical community
	May express differences in gender roles or gender-appropriate behaviour
	May have different beliefs regarding health and treatment of illness
Housing	People living in rented accommodation
	People living in high-risk built environments
	People living in vulnerable housing (caravan, bungalow, basement flat)
Insurance	People with no insurance
	People experiencing problems with insurance
Other	Risk behavior / risk taking (for example, driving through floodwater)
	Socio-economic status and educational achievement
	Perception of flood risk
	Prolonged recovery
	Reliance on regular home care
	Reliance on regular care at health facility
	People who may be socially isolated

What the PHASE project has contributed

The successful completion of WP5 has significantly aided the development of the evidence base on the health impacts of flooding. The survey results of 27 member states has also enabled the development of a pan-European perspective. This added value to the project has helped ensure the outputs of WP5 are transferrable to other PHASE partners and member states.

The framework of tools presented in WP5 includes the development of contemporary surveillance indicators to monitor and assess the impact of flooding on health, and a health register protocol to improve preparedness and response to flooding. Furthermore, the creation and evaluation of public health guidance (before and after the winter 2013/14 flooding in England), has enabled the effectiveness of this intervention to be explored.

The three years of the PHASE programme has provided good learning at the EU level and demonstrated the impact of a common approach that utilises literature and science to inform policy. Furthermore, the use of case studies has raised awareness of different approaches and methodologies that can be applied to other hazards. The continued development of the evidence base using professionals' good practice and research evaluation is essential.

The partnerships with national and international agencies created through PHASE will assist future research strategies. Post PHASE, ways should continue to be found to

involve all partners to provide a multi-disciplinary approach across science, practice and policy to bring together specialities and increase resilience to floods.

Implications for Public health (key public health messages for your EWE)

Key public health messages for floods include:

- the effects of flooding on health are extensive and significant and occur before, during and after a flood episode
- while some health outcomes are relatively easy to track, quantifying the human impact of floods in Europe remains challenging
- flooding is frequently associated with acute and long-term impacts on mental health and wellbeing
- adequate planning and a multi-agency approach is required to effectively minimise the health effects from floods
- the consistency of public health messaging across agencies is imperative and pre-agreed statements should be created before a flood event
- in light of climate change, heavy precipitation is likely to become more frequent throughout Europe and rises in sea-level and storm surges may cause coastal flooding

Preparedness and response tools necessary to define a Prevention Plan

Public Health messaging

As part of the PHASE development of preparedness and response tools, Public Health England (PHE) and the Environment Agency (EA) jointly produced a public flooding advice leaflet in December 2013. This followed a consultation exercise conducted in March and April 2013 with both members of the public and front-line responders. This feedback informed the development of the published PHE/EA [leaflet](#).

The new leaflet was intended as a single, evidence-based resource designed to be easy to read, temporally arranged, and able to be widely distributed. During the flooding of winter 2013/14, the new leaflet was published online, promoted via social media and press releases and printed and distributed by frontline responders to members of the public. Some Local Authorities also used the text from the PHE/EA leaflet within their own locally tailored materials.

The post-flood evaluation has determined the extent to which the new PHE/EA leaflet was considered useful as part of the flooding response and in the recovery phase. This learning experience will inform future versions of the published leaflet and contribute to other future communication strategies.

Health & social care infrastructure

The flooding of health infrastructure can result in the loss of facilities, loss of operational capacity and subsequent interruption of business, introducing difficulty in providing routine medical and nursing care for patients with chronic diseases (eg diabetes) or those with complex healthcare needs.

Effective protection of health and social care assets from flooding should include both physical protection of the site itself and its operational remit to help ensure services are maintained. Moreover, the resilience of supporting infrastructure should also be considered to ensure a whole-site approach to contingency planning.

The [Strategic Health Asset Planning and Evaluation](#) (SHAPE) tool is a web-enabled application which informs and supports the strategic planning of services and physical assets across the whole health system. The inclusion of EA flood risk data into SHAPE coupled with pre-existing health infrastructural data and population vulnerability indices, provides an opportunity for further research, identification of flood risk exposure and an integrated approach to emergency preparedness.

Measuring health impacts of floods

Measuring the health effects of a flood has two purposes:

- to provide information on the affected population's health during ("real-time"), and in the aftermath of, a flood in order to deliver clinical, public health and societal interventions to improve health and wellbeing
- to provide epidemiological evidence of the health effects of flooding to inform research, future planning, prevention and management strategies.

A suite of indicators that could be used in England has been proposed by reviewing the literature and the routine data sources available. Given the heterogeneity of floods and surveillance systems available, it may be more useful for each country to monitor the impact using indicators relevant to them, and share this intelligence across Europe to constantly improve the evidence and work towards a standardised system. The PHASE collaboration has provided the opportunity to do this now, and in the future.

Indicator data represent a rapid, objective and cheap way to show if any health impact is occurring. However, to get a full picture of the acute and chronic health effects of a flood, from the immediate response to completion of recovery, an in-depth longitudinal study developed from health register could be useful. As part of the PHASE project, a protocol for establishing a health register after a flood has also been produced, which public health professionals could use to explore this further.

References and hyperlinks to published results:

1. Milestone 1: Literature review of health impact of flooding and overview the existing tools for flood response and health resilience

1.1 Literature review

a) [Floods in the WHO European Region: Health effects and their prevention](#)

b) [Examining the relationship between infectious diseases and flooding in Europe. A systematic literature review and summary of possible public health interventions](#)

c) [Power Outages, Extreme Events and Health: a Systematic Review of the Literature from 2011-2012](#)

1.2 [Using routine health data for surveillance of the health effects of floods](#)

1.3 [Protocol for establishing a health register after a flood](#)

1.4 [Using the SHAPE tool to increase climate change resilience within health and social care](#)

1.5 Study on effectiveness of PHE flood guidance

a) [Findings of a study of the usefulness of HPA/PHE Flood Factsheets](#)

b) [Evaluation of joint PHE/EA flooding leaflet following winter 2013/14 floods](#)

1.6 Development of new public health flood guidance

a) [Flooding: Advice for the Public](#) Leaflet

2. Milestone 2: Guidance and evaluation of the health risks and benefits of flood minimisation and resilience structures

2.1 Effective flood resilience in health providers: Flooding at a major NHS Blood and Transplant facility

a) [Submitted article](#)

b) [Poster presentation](#)

2.2 [Community resilience in response to flooding - Case studies from three flood-affected areas](#)

2.3 [Impact of wetland management and flooding on mosquitoes – a UK and European perspective](#)

2.4 [Carbon Monoxide Poisoning and Flooding: Changes in Risk Before, During and After Flooding Require Appropriate Public Health Interventions](#)

2.5 [Improving the response to flooding: Changes implemented in Gloucestershire since summer 2007 floods](#)

3. Milestone 3: Topical workshop in the UK with stakeholders from the project partners where possible and hold workshop

3.1 [European flood workshop report](#)