



Flooding and Health Research Workshop:

Research and data priorities

Public Health England, Wellington House, London, 4 July 2013.

Introduction and background

A workshop to discuss research gaps on flooding and health was convened by LWEC and hosted by Public Health England (PHE) to discuss priority research projects and funding options (Appendices A and B).

LWEC is a partnership of 22 public sector organisations that fund, carry out and use environmental research and observations. They include the UK research councils, government departments with environmental responsibilities, devolved administrations and government agencies. The private sector is represented by a Business Advisory Board. LWEC aims to ensure that decision makers in government, business and society have the knowledge, foresight and tools to mitigate, adapt to and benefit from environmental change. LWEC has a role in coordinating research on environmental issues that cannot be addressed by a single funding agency. The health and wellbeing impacts of flooding are a problem that requires interdisciplinary and multidisciplinary research.

FCERMS – LWEC “Flooding and Coastal Erosion Research Management Strategy”

The FCERMS is the first time a national research strategy has been developed to address an environmental issue. The scoping and prioritisation exercise involved the following LWEC partners: EA, SEPA, Met Office, Flood Forecasting Centre, DEFRA, Dept of Agriculture and Rural Development, EPSRC, ESRC, NERC, and devolved administration (Scottish Government, Welsh Government).

An extensive GAP analysis was undertaken on flooding research and identified several key issues for health and wellbeing where robust research is lacking (Moores and Rees, 2011) (Table 1).

Table 1. Health- and Wellbeing-related Research Topics Identified in the FCERMS [Moores and Rees 2011]

UR13: Valuing what we are considering defending: Quantifying the total value of communities, human health, economy, environment and cultural heritage [for cost-benefit analysis]
UR15: Economics of the health effects of flooding. Quantifying the health costs to society of flooding. Research should not only consider direct impacts, for instance those associated with the increased burden on the National Health Service (NHS) and associated medical services, but also secondary effects, such as the reduced earning capacity of affected individuals and communities.
MC13: Understanding the health effects of flooding: An improved understanding of the health effects of flooding on individuals and communities is important. Research on psychological and mental health impacts - which can be long-lasting, health effects associated with the inundation of properties by contaminated floodwaters, the long term consequences of living within damp buildings and the consequences of evacuation, are priorities.
MC14: Inequalities and social justice: The correlation between socially deprived areas and those susceptible to flooding has been well demonstrated. Climate change and societal pressures are likely to accentuate this pattern; floods and interventions will commonly exacerbate social injustice. As risk increases in the future, research to deliver fairness and social equality in relation to flooding needs to be prioritised. How does insurance provision impact upon different social sectors and the ability of individuals to recover from events?

Other initiatives has also identified a range of health research needs, including the HPA/PHE assessment “The Health Effects of Climate Change in the UK” (Stanke et al. 2012) and the World Health Organization European Regional Office which has published a joint report with PHE (Menne and Murray, 2013). A full list of health and flood research needs is presented in Appendix C.

Scope and purpose

- To review and prioritise current research questions on flooding and health
- Identify and prioritise the evidence needs for decision-makers and practitioners
- Identify data needs
- Identify current funding streams that could meet evidence needs, or the need for commission-led funding.

Key points of discussion

Big questions: prioritising the research needs

A main question needs to be articulated in order to prioritise the issue of concern to potential funders, and to gain support for a large programme that engages multiple funders. Important questions include:

- What is the magnitude of the health impacts of flood events?
- Who is most vulnerable to health impacts of flood events?
- What is the impact of repeated flood events?
- How are flood impacts modified by social inequality?
- What interventions are required to help people cope with a flood event and reduce the burden of ill-health?

Systematic literature reviews on health effects of flooding (Ahern et al, 2005; Menne and Murray, 2013; Alderman et al. 2012) confirmed that lack of high quality peer reviewed papers on the quantification of the health outcomes of flooding in the UK, and that significant gaps in knowledge still exist, especially surrounding mental health outcomes, and the longer term (>6 months) impacts on health. The majority of published epidemiological research on flooding relates to Hurricane impacts in the US and such studies are unlikely to be directly relevant to the UK context. Some research has been undertaken in Europe but there is a lack of rigorous epidemiological studies (Menne and Murray, 2013).

The lack of evidence regarding the magnitude of mental health problems is of particular concern, given the high priority of these effects within the National Adaptation Programme (NAP) (DEFRA 2013), and the increased policy focus on mental health in general (Department of Health, 2009).

The evidence base of public health interventions for flooding is even less apparent: no intervention studies specific to flooding and public health were found in two recent comprehensive reviews (Menne and Murray, 2013; Bouzid et al. 2013).

In order to influence policy and decision making, greater confidence in the evidence is required. Improved health impact assessment would be likely to affect policy on:

- Flood prevention practice –based on cost-benefit analysis or multi-criteria decision analysis.
- Public health practice.
- Emergency planning.

Research is needed because of the unknown magnitude of the problem:

- Although direct (recorded as drowned in flood waters) deaths are few, the Bennet study estimated a 50% increase in mortality in 12 months after a flood in Bristol (Bennet 1970).

This finding has not been replicated. If true, this would imply approximately 150 additional deaths in 2012 due to flooding (with large confidence intervals).

- DEFRA/EA acknowledges that flood events can involve risk of death, but for planning purposes generally works on the basis that these are correlated with aspects such as depth, velocity and damage to infrastructure.
- High prevalence (and high costs) of mental health outcomes mean that even relatively small relative risks could entail significant burdens on the population and the health and social care systems.

Research is also needed because flood events are going to increase in the UK.

- Flood risk unlikely to decline dramatically in next few years.
- Risk of 2007 event happening again is 1 in 14 per year.
- 1 in 6 houses are reported to be at risk of flooding [NAP 2013]

Research strategies

The group agreed that an inter-disciplinary approach is necessary that will draw upon both qualitative and quantitative methods. The analyses should consider the breadth of health impacts (mortality and range of morbidity outcomes) and not focus solely upon a single outcome.

The follow components were agreed should be include in future research programme on flooding and health:

- Long term follow up. Given evidence from Oxon study that psychosocial effects persisted 3 years after flooding (Tapsell and Tunstall, 2008)
 - In view of the above, the window of opportunity is closing given that it is now 5 years since 2007 floods.
- Retrospective studies (or prospective) studies with adequate data on pre-flood exposures and health status to reduce information bias.
 - Development of “life cycle analysis” methods.
 - Studies with control populations who have not been flooded
- Look at impacts in a range of populations: including those that are frequently flooded and those never previously flooded and not identified as at risk. Health effects may be worse in the latter.
- Exposure assessment. Improved methods to identify flooded individuals or flooded postcodes, including method to use satellite or aerial photography data.
- Better exploitation of routine health data sources
 - Primary care data from the recently expanded the Clinical Practice Research Datalink (CPRD).
 - Hospital episode statistics (HES).
- Be prepared to initiate research as soon as flood occurs.
 - For example, develop and apply the pre-existing health PHE tool “national health register” to identify people affected by a flood event and follow them up, with linkage to routine data (prospective and retrospective).
- Intervention studies
 - analysis of a community before and after the implementation of flood protection measures could be a useful research strategy
 - Randomisation of interventions - although this may not be acceptable or feasible, depending on the context.
 - Evaluate if lessons have been learned if a community has been flooded, evaluated its response and then got flooded again.

- Natural experiments. May be possible to compare impacts with areas that did not get intervention(s) for some reason.
- Use of other geophysical hazards or traumatic events as an analogue.
 - Investigate the impacts of other extreme events associated with temporary displacement and loss of property.

Funding strategies

A multi-partner project is required to address a comprehensive range of questions regarding impacts and evaluation of responses. The group considered how this research could attract significant funding and agreed that any funding proposal should be ambitious. Discussion turned to the scale of the activity that is needed and whether the project should encompass more than flood hazards.

Some funding is currently available for flooding and health research, providing the project falls within the funder remit.

- Climate Ready may have a small amount of funding available for flood response and resilience.
- PHE may also have funds available for a partnership funding.
- DEFRA/EA have some fund allocated for research on flooding but with no specific allocation for health.
- Defra's Flood Resilience Community Pathfinder scheme is funding thirteen communities across the country to come up with innovative projects to protect homes and businesses from the risk of flooding¹
- ESRC has an open [Research Grants Open](#) for projects within ESRC remit². Evaluation or intervention studies could be funded under the ESRC-funded "What Works" Centres.
- Responsive-mode (RM) grant funding by the NERC. NERC also funds "Urgency Grants" which are fast tracked to respond to an urgent need/opportunity.
- Response mode funding by the MRC [Epidemiological studies can be submitted to the Population Health and Systems Medicine Board, and mental health studies can be submitted to the Neurosciences and Mental Health Board]
- Funding under the cross- council research theme "Lifelong Health and Wellbeing"³.

¹ <https://www.gov.uk/government/news/5-million-to-support-innovative-flood-defence-schemes>

² Advice can be obtained by contacting the remit queries service. Email: esrcremit@esrc.ac.uk

³ <http://www.mrc.ac.uk/Ourresearch/ResearchInitiatives/LLHW/index.htm>

Appendix A: Agenda

Chair: Virginia Murray

Rapporteur: Owen Landeg

2.00-2.30	Coffee available	
2.30-2.50.	Welcome, Meeting scope and purpose	Virginia Murray
2.50-3.00	Research Priorities - LWEC Flooding and Coastal Erosion Research Management Strategy	Andy Croxford
3.00-4.15	Brief overview of current research <ul style="list-style-type: none"> • Quantifying the impacts of flooding on health outcomes, including mental health • Economics of health effects of flooding • Flooding and social justice/inequalities <p>Followed by discussion</p>	Sari Kovats
4.15-4.30	Summing up. Meeting ends.	Virginia Murray

Appendix B: Participants

1. Andy Croxford	Environment Agency	Head of Research, Evidence Directorate
2. Kieron Stanley	Environment Agency	Evidence Directorate
3. Sean Longfield	Environment Agency	Evidence Directorate
4. Louise Newport	DH	Scientific Policy Manager: Climate Change (Adaptation) and Health Protection – Legislation and Environmental Hazards.
5. Anna Lorentzon	DEFRA	Analysis and Evidence team.
6. Matthew Westmore	NIHR	Health Services Research and Delivery Programme
7. Virginia Murray	Public Health England	Head, Extreme Events and Health Protection
8. Giovanni Leonardi	Public Health England	Head of Environmental Epidemiology
9. Angie Bone	Public Health England	Extreme Events and Health Protection
10. Tim Chadborn	Public Health England	Behavioural Insight Lead Researcher - Science and Strategic Information - Health and Wellbeing Directorate
11. Sunjai Gupta	Public Health England	Programme Improvement and Delivery
12. Owen Landeg	Public Health England	Extreme Events and Health Protection
13. Thomas Waite	Public Health England	Extreme Events and Health Protection
14. Helen Hunt	ESRC	
15. Sari Kovats	LWEC	Health Fellow
16. Susan Ballard	LWEC	Head of Impact and Communication
17. Edmund Penning-Rowsell	Oxford University	Professor of Geography
18. Ben Armstrong	LSHTM	Professor of Epidemiology and Statistics

Appendix C. Published Research Needs on Flooding and Health.

HPA/DH Health Effects of Climate Change [Stanke et al. 2012]	Flood 'life-cycle' analysis will facilitate better identification of and information on each flood event with effective surveillance and monitoring systems to facilitate better understanding of health impacts on populations at risk, as well as climate change adaptation evidence based recommendations.
	Better understanding of causes and types of flood-related adverse health effects with improved understanding of the longer term health effects of flooding, particularly on mortality risk, mental health care for flooded populations, and for vulnerable groups
	Research on the implications for persons with chronic diseases affected by the disruption to health services and infrastructure.
	Research on the causes and outcomes of population displacement via evacuation and relocation, including long term follow up of flooded households.
Floods: Health Effects and Prevention in the WHO European Region [WHO, 2013]	Prospective epidemiological studies and opportunistic retrospective studies should be conducted on the health effects of flooding. Epidemiological data on the health effects of flooding are incomplete. For future events, information should be obtained on health before, during and after floods.
	A standard reporting system of health effects should be used in each flood event, in order to build the evidence base on acute and chronic effects, from the immediate response to completion of recovery.
	Further work is needed to understand the immediate and longer-term mortality from flooding (e.g. to confirm the finding in UK (Bristol) of 50% increase in population mortality in flooded communities during the 12 subsequent months). Definitions should be established of direct and indirect, immediate and delayed deaths due to flooding.
	Information on the causes and types of injury incurred during flooding is incomplete. Work is required to prepare for, respond to and document these injuries more completely.
	Relatively few epidemiological studies have been undertaken on populations exposed to infectious diseases after flooding. The results reported so far are reassuring, but the methods to be used for confirming the findings should be agreed upon.
	Data on chemical contamination are incomplete, and further work is required; in particular, healthcare providers should be alerted to the risk for CO poisoning, and environmental experts should agree on sampling protocols
	Research on most effective tools and measures for investigating the mental health consequences of flood events and to plan an effective response. Few studies have addressed the long-term effects on mental health. Many different tools are used to measure mental health effects, making data interpretation complex; standardization of tools would be beneficial.
	Further research is required to understand vulnerability to flooding and to identify who is vulnerable and their health needs. While certain vulnerable groups have been recognized (e.g. dialysis patients after Hurricane Katrina) there is a paucity of data about others.
	More research is needed to understand the effects of flood resilience and recovery on vulnerability and whether they change the dynamics and boundaries of vulnerability.
	The management of chronically ill patients during a flood has received little consideration. The immediate and direct health consequences of floods for such patients should be studied further in order to identify effective strategies for their care during and after floods.
	Research on the health consequences of living in damp buildings for long periods after flooding.
	o disruption of health services and facilities during and after flooding, including the economic impact. The literature contains few accounts of disruption to health facilities and health services; most reports address disease and the health needs of affected groups, and many episodes may be unreported.
	o How early warning alerts are communicated to hospitals and health care facilities before a flood and how they should prepare to respond
	o How health services and facilities actually respond to flooding. Successful strategies could be replicated elsewhere and/or serve as a basis for authoritative guidance on the matter.
Power supply: health facilities should review the vulnerability of their electrical supply and equipment to flooding. Emergency generators and medical equipment should be placed above the reach of flood waters.	

	<p>Health information systems and patient records: backup systems for the retrieval of patient records and other relevant information systems should be devised. A robust electronic patient record system could ideally be accessed outside the principal facility, so that records are not lost if computers are destroyed or electricity is down</p> <p>Ambulance services: health authorities and providers should consider alternatives in the eventuality that ambulance fleets are temporarily disabled.</p> <p>Outreach and continuity of care: healthcare providers should design their strategies for the continuity of care in the event of flooding. Disruptions to outpatient and ambulance services can affect especially vulnerable groups (E.g. the homeless and drug addicts) and the chronically ill.</p> <p>Evacuation of hospitals and nursing homes: healthcare providers and nursing homes should evaluate their capacity to undertake a general evacuation before floods occur. Factors to plan for include timing, decision-making, patient and staff safety and sequence of events</p>
<p>LWEC Societal Challenge. [LWEC 2010]</p>	<ul style="list-style-type: none"> • enabling people to make sense of implications of future choices • understanding impact of climate change on different societal groups, related to equity and social justice • planning and modelling for social and economic dimensions • understanding society through longitudinal analysis of public beliefs, attitudes and social practices • psychological and sociological understanding of people's relationships with environment • improved weather, climate and seasonal forecasting approaches, linked to understanding behavioural responses to change • moving beyond reliance on technocentric standards and measurement • decision support tools
<p>Independent National Adaptation Programme for England. [Fankhauser et al. 2013.]</p>	<p>Low-Regret adaptation options. Measures to enhance societal resilience to deal with the direct and indirect impacts of climate 'shocks', such as flooding, heat waves and droughts.</p>
<p>Scoping report on public health activities in Scotland related to Extreme Weather Events and Climate Change [HPS 2012]</p>	<p><u>Gaps in knowledge:</u></p> <ul style="list-style-type: none"> • Gap in standard definitions of flooding-related health outcomes. • Gap in standard methodologies for surveillance of flooding-related health outcomes.

Appendix D. References

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