



Public Health  
England

Protecting and improving the nation's health

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Epidemiological preparedness and response to  
environmental disasters

# National Study of Flooding and Health

## First year results



Environmental Epidemiology Group, Public Health England

# Acknowledgements

- The National Institute for Health Research Health Protection Research Unit in Emergency Preparedness and Response at King's College London
- The National Institute for Health Research Health Protection Research Unit in Environmental Change and Health at London School of Hygiene and Tropical Medicine
- The National Institute for Health Research Health Protection Research Unit in Evaluation of Interventions at University of Bristol
- Study management group (Waite T, Chaintarli K, Beck CR, Bone A, Amlôt, Kovats S, Reacher M, Armstrong B, Leonardi G, Rubin GJ, Oliver I)
- Stakeholder oversight group
- PHE staff
- Participants

# Governance arrangements

- PHE led collaboration with 3 Health Protection Research Units:
  - Emergency Preparedness and response at King's College London
  - Environmental change at LSHTM
  - Evaluation of Health protection Interventions at University of Bristol
- Sponsored by PHE
- Ethics committee approval from King's College Research Ethics Committee
- Study management group including 3 HPRUs accountable through PHE management arrangements and the respective HPRU governance arrangements
- Wider stakeholder group provides scrutiny and feedback



# Aims of the study

To determine the medium - long term impact of flooding on mental health and wellbeing to inform preventive actions and reduce harm.

Our objectives in the first year of the study were to:

- 1) To determine the prevalence of depression, anxiety, and post-traumatic stress disorder (PTSD) among individuals exposed to flooding compared to those unexposed
- 2) Identify personal and sociodemographic characteristics associated with psychological morbidity
- 3) To establish a cohort that can be used to support studies on the impact of flooding on health.



# Study design

- Longitudinal, observational cohort open study
- Data collection through a questionnaire with postal recruitment with response by post or online
- Adults only at this stage (18 or over)

## Sampling strategy:

- Lists of postcodes affected by flooding between 1 December 2013 and 31 March 2014 obtained from 6 local authorities
- Royal Mail Postcode Address File used to generate a list of all residential properties in each postcode area

# Questionnaire

The 36-item questionnaire including:

- Bespoke 19 item exposure assessment tool
  - Extent and duration of flooding, evacuation, disruption to services, impact on work and access to services
- Validated instruments to assess mental health outcomes
  - Outcomes: depression, anxiety, PTSD, wellbeing
  - Instruments used: PHQ4, PCL6, SWEMWBS
- Secondary stressors / effect modifiers
- Confounders
- Help seeking behaviour
- Consent form including consent to access medical records

# Exposure assessment

- Unaffected participants, who reported no flooding or disruption to their lives from flooding in their area
- Disrupted participants, defined as those who reported no floodwater in the liveable rooms of their home and at least one of the following disruptions:
  - Evacuation
  - Flooding of non-liveable areas, garages, gardens or the street
  - Interruption to household utilities (electricity, gas, oil, water, drainage, septic tank)
  - Loss of communications (postal or telecommunications)
  - Interruption to health or social care access, in or away from the home
  - Difficulty accessing work, own or children's education
  - Interruption to other amenity e.g. getting to shops or social activities
- Flooded participants, who reported floodwater in at least one liveable room of their home



# Establishment of the cohort

- Recruitment packs distributed w/c 12<sup>th</sup> January 2015
- Two reminders
- We sent recruitment packs to 8761 households.
- Responses were received from 2126 participants from 2014 households (23%). 251 (12.5%) responded online.
- Exposure classification could be assigned for 2006 participants. In total, 285 (14.2%) were classified as unaffected, 622 (31.0%) as flooded and 1099 (54.8%) as disrupted





# Statistical methods

- Prevalence of mental health outcome: percentage of the total for each exposure category.
- Odds ratios for each mental health outcome in each exposed group relative to the unaffected group, adjusting by logistic regression for potential confounders (age group, sex, local authority, ethnicity, marital status, education level, employment, and deprivation score).
- For ordered sub-groups of exposure (e.g. by depth of flooding): Wald test for the trend over odds ratios, ignoring the reference (unaffected) group.
- Participants who provided inadequate data to allow exposure categorisation were excluded from further analysis. Participants who did not complete an outcome instrument were excluded from analysis of that measure only.
- Data were entered using Epidata (Epidata Association, Denmark). The online questionnaire was designed using SelectSurvey (ClassApps, USA). Analyses were performed using Stata 12 (Statacorp, USA).

# Cohort characteristics

Characteristic	Cohort	Unaffected	Disrupted	Flooded
<b>Female</b>	1176 (55.3%)	142 (49.8%)	606 (55.1%)	366 (58.8%)
<b>White</b>	2009 (94.5%)	275 (96.5%)	1042 (94.8%)	592 (95.2%)
<b>Married/ cohabiting</b>	1396 (65.7%)	182 (63.9%)	724 (65.9%)	431 (69.2%)
<b>Home owner</b>	1816 (85.4%)	245 (86.0%)	930 (84.6%)	562 (90.4%)
<b>University educated</b>	791 (37.2%)	115 (40.4%)	421 (38.3%)	230 (37.0%)
<b>Pre-existing illness</b>	476 (22.4%)	59 (20.7%)	258 (23.5%)	137 (22.0%)
<b>IMD quintile 1 (least deprived)</b>	908 (42.7%)	102 (35.8%)	454 (41.3%)	311 (50.0%)
<b>Total cohort</b>	2126	285 (14.2%)	1099 (54.8%)	622 (31.0%)

# Prevalence of mental health outcomes

Outcome	Overall cohort	Exposure group		
		Unaffected	Disrupted	Flooded
Probable depression	250/1929 (12.6%)	16/278 (5.8%)	102/1058 (9.6%)	125/593 (20.1%)
Probable anxiety	300/1927 (15.6%)	18/278 (6.5%)	113/1052 (10.7%)	169/597 (28.3%)
Probable PTSD	396/1925 (20.6%)	22/278 (7.9%)	160/1056 (15.2%)	214/591 (36.2%)

## Crude and adjusted odds ratios of mental health outcome amongst disrupted and flooded participants compared with unaffected participants

Outcome	Crude OR (95%CI)	aOR* (95% CI)
<b>Probable depression</b>		
<b>Disrupted</b>	1.75 (1.01-3.01)	1.56 (0.88-2.76)
<b>Flooded</b>	4.37 (2.54-7.52)	5.91 (3.17-10.99)
<b>Probable Anxiety</b>		
<b>Disrupted</b>	1.74 (1.04-2.91)	1.61 (0.94-2.77)
<b>Flooded</b>	5.70 (3.43-9.49)	6.50 (3.77-11.24)
<b>Probable PTSD</b>		
<b>Disrupted</b>	2.08 (1.30-3.31)	2.06 (1.27-3.35)
<b>Flooded</b>	6.61 (4.14-10.53)	7.19 (4.33-11.93)

\*Adjusted odds ratios are adjusted for age, sex, pre-existing illness, deprivation, local authority, ethnicity, marital, education and employment statuses.

# Association between psychological morbidity and floodwater

Factors associated with adverse outcomes:

- Depth of flooding was observed for each outcome.
- Evacuation and displacement
- The small number who had not yet regained use of all liveable rooms of their home had markedly higher odds of all outcomes
- Duration of floodwater in the home
- Disruption to utilities and access to health and social care

Explanatory variable	Total	Outcome								
		Depression			Anxiety			PTSD		
		n	aOR	(95% CI)	n	aOR	(95% CI)	n	aOR	(95% CI)
Unaffected	285	16	1.00		18	1.00		22	1.00	
Flooded	622	125	5.91	(3.17-10.99)	169	6.50	(3.77-11.24)	214	7.19	(4.33-11.93)
Depth										
Depth <30cm	376	59	** 4.58	(2.38-8.80)	86	** 5.28	(3.00-9.32)	110	** 5.72	(3.39-9.63)
30-100cm	191	51	** 8.48	(4.21-17.10)	66	** 8.97	(4.86-16.57)	85	** 10.12	(5.74-17.87)
>100cm	27	10	** 14.71	(4.45-48.62)	11	** 11.40	(3.93-33.08)	16	** 17.79	(6.33-50.01)

# Association between psychological morbidity and disruption

Disruption to services among participants whose homes were not flooded was associated with significantly increased odds of psychological morbidity compared with unaffected participants

- Health and social care
- Work and education
- Shops or social activities

	N	Outcome								
		Depression			Anxiety			PTSD		
Explanatory variable		N	aOR	(95% CI)	n	aOR	(95% CI)	n	aOR	(95% CI)
Unaffected	285	16	1.00		18	1.00		22	1.00	
Disrupted but did not lose access to health and care	131	16	* 1.70	(0.79-.66)	17	* 1.56	(0.75-3.24)	32	3.05	(1.65-5.65)
Disrupted and lost access to health and social care	271	46	* 3.28	(1.73-6.19)	44	* 2.86	(1.55-5.27)	57	3.50	(2.01-6.10)

\* indicates inter-group heterogeneity significant at  $p < 0.1$ , \*\* at  $p < 0.05$  and \*\*\* at  $p < 0.01$

# Limitations

- Lack of registers of people affected by flooding
- Potential for non-response bias
- Generalisability is linked to the characteristics of the population studied and the characteristics of the flooding experienced
- Many statistical tests of association undertaken
- Odds ratios for disruption type were not mutually adjusted

# Conclusions and recommendations

- Rates of psychological morbidity one year after flooding were high. Levels of depression and PTSD in flooded people were comparable to those following major incidents.
- An elevated risk was also observed amongst those whose homes were not flooded but their lives were disrupted.
- Flooding is likely to exacerbate the challenge of poor mental health. Commissioners and providers of primary, community and mental health services as well as emergency planners should prepare for an increased need for services in areas affected, or likely to be affected, by flooding. A proactive approach to identifying individuals affected may be appropriate.
- Disruption to health and social care access increased the risk of psychological morbidity as did disruption to work and education.
- Reinstating access to these activities may thus reduce mental health impacts as well as supporting community recovery more generally.



# Next steps

- Ongoing detailed analyses
  - Development of an exposure assessment model for flooding
  - Impact of secondary stressors
  - Impact of evacuation
  - Help-seeking behaviour
  - Non-response analysis
- Year 2 questionnaires will be sent 1 February
- Extension of the cohort to people affected by flooding in the North of England this winter
- Outputs in year 1
  - Full scientific report will be published in the PHE website
  - Policy paper
  - Publications in peer-reviewed journals

# Thank you

