**Urban Flood**

**Overview**

Urban floods can arise from extreme thunderstorms or from river overflow. Both rapid rise and slow rise floods can have a significant impact on public health in an urban area.1 While the adverse health effects of flooding include direct impacts on human health, the pathways can be complicated and indirect.

**Health impacts**

**Disruption to essential health care.** Treatment for serious illnesses, such as cancer, can be disrupted by flooding, due to transport infrastructure being knocked out for prolonged periods of time.2 Health care practitioners may also become overwhelmed by the increased demand for services.1

**Drowning or physical trauma.** Rapid rise floods can cause sudden changes to the environment, increasing the risk of drowning and injuries.3 Slow rise floods can also be deadly when there is a lack of preparedness.1

**Illnesses.** Diseases can be spread from undisinfected groundwaters by the onset of flooding.4 Increased instances of cholera5, diarrheal diseases5, hepatitis A and E5, leptospirosis5, melioidosis6, respiratory infections7, and typhoid5 have been observed after floods in urban areas.

**Malaria.** Epidemics in the wake of flooding in tropical regions can occur due to clogging of storm water drains, causing stagnant water to allow genesis of vectors of malaria.7,8

**Malnutrition** Damage to infrastructure, and disruption to food systems can cause malnutrition, with children and the elderly particularly vulnerable.9

**Psychological distress.** The mental health effects of a flood can last long after the flood itself, with reports of increased prevalence of psychological morbidity (including depression, anxiety, PTSD) in residents up to 1 year after floods, particularly if residents are displaced.10,11

**Deliverables**

**Potential projects with improved forecasting**

**Wildfire**

**Overview**

Uncontrolled spread of wildfire can originate from bush, vegetation, forest, heath and grass. Wildfires predominantly occur in countries with warmer climates, they have been known to occur from uncontrolled burning of vegetation in temperature climates such as in the UK.12

**Health impacts**

**Burns.** Direct flame and thermal burns can result from a wildfire. The great increase in burns victims in a short time puts significant pressure on health care burns units, which can overwhelming these specialist centres.12

**Carbon monoxide poisoning.** This is mainly a risk to those who are in the immediate vicinity of the fire, such as firefighters. It can cause hypoxic injury, nervous system damage, and death.

**Eye irritation.** Those living close to the wild fires can experience eye irritation, as well as reduced general visibility due to ambient smoke, which can make vehicular accidents more likely.13 Corneal abrasions can also result from the eyes’ exposure to wildfire smoke.14

**Heat-induced illness.** Working in hot and humid conditions can cause many health issues (see ‘Urban Heat Waves and Pollution’). Firefighters can be particularly vulnerable when attempting to deal with the controlling the extent of the fires.

**Particulate matter inhalation.** Burning of organic material can produce several varieties of particulate matter. PM10 (particles under 10µm in diameter) can pass through the upper respiratory tract and are deposited in airways.12 PM2.5 (particles under 2.5 µm in diameter) can penetrate even deeper into the lungs and deposited where gaseous exchange takes place.12 Short-term exposure leads to increases in hospital admissions for respiratory conditions.15 Exposure to particulate matter will cause long-term health problems, and is a known risk factor for cardiopulmonary and lung cancer mortality.16,17

**Psychological distress.** Wildfires can cause the complete destruction of homes and livelihoods. This in turn can lead to depression, anxiety, and PTSD.18

**Respiratory complications.** Breathing in bushfire smoke will exacerbate breathing problems for both children and adults. [ref]

**Water and land contamination.** Large concentrations heavy metals (such as arsenic, cadmium, copper, and lead) have been found deposited in soil from ash debris after a wildfire, which can cause various long-term health effects.19

**Deliverables**

**Potential projects with improved forecasting**

**Localised Extreme Wind**

**Overview**

20 **Health impacts**

**Injuries from debris** Buildings and trees

**Road accidents**

**Psychological distress**

**Sea spray**

**Deliverables**

**Potential projects with improved forecasting**

**Disruptive Winter Weather**

**Overview**

**Health impacts**

**Deliverables**

**Potential projects with improved forecasting**

**Urban Heat Waves and Air Pollution**

**Overview**

**Health impacts**

**Deliverables**

**Potential projects with improved forecasting**

**References**

1 Hajat S, Ebi KL, Kovats RS, Menne B, Edwards S, Haines A. The human health consequences of flooding in Europe: A review. *Extrem Weather Events Public Heal Responses* 2005; : 185–96.

2 Bennet G. Bristol floods 1968. Controlled survey of effects on health of local community disaster. *Br Med J* 1970; **3**: 454–8.

3 French J, Ing R, Von Allmen S, Wood R. Mortality from flash floods: a review of national weather service reports, 1969-81. *Public Health Rep* 1983; **98**: 584–8.

4 Miettinen IT, Zacheus O, Bonsdorff C-H von, Vartiainen T. Waterborne epidemics in Finland in 1998-1999. *Water Sci Technol* 2001; **43**: 67–71.

5 Watson JT, Gayer M, Connolly MA. Epidemics after Natural Disasters. *Emerg Infect Dis* 2007; **13**: 1–5.

6 Munckhof WJ, Mayo MJ, Scott I, Currie BJ. Fatal human melioidosis acquired in a subtropical australian city. *Am J Trop Med Hyg* 2001; **65**: 325–8.

7 Baqir M, Sobani ZA, Bhamani A, *et al.* Infectious diseases in the aftermath of monsoon flooding in Pakistan. *Asian Pac J Trop Biomed* 2012; **2**: 76–9.

8 Srivastava A, Nagpal BN, Saxena R, *et al.* Malaria epidemicity of Mewat region, District Gurgaon, Haryana, India: A GIS-based study. *Curr Sci* 2004; **86**: 1297–303.

9 Brabant M. Six months after floods struck, malnutrition hits hard in affected areas of Pakistan. UNICEF. 2011. https://www.unicef.org/emergencies/pakistan\_57553.html.

10 Munro A, Kovats RS, Rubin GJ, *et al.* Effect of evacuation and displacement on the association between flooding and mental health outcomes: a cross-sectional analysis of UK survey data. *Lancet Planet Heal* 2017; **1**: e134–41.

11 Waite TD, Chaintarli K, Beck CR, *et al.* The English national cohort study of flooding and health: cross-sectional analysis of mental health outcomes at year one. *BMC Public Health* 2017; **17**: 129.

12 Finlay SE, Moffat A, Gazzard R, Baker D, Murray V. Health impacts of wildfires. *PLoS Curr* 2012; : 1–23.

13 Hänninen OO, Salonen RO, Koistinen K, Lanki T, Barregard L, Jantunen M. Population exposure to fine particles and estimated excess mortality in Finland from an East European wildfire episode. *J Expo Sci Environ Epidemiol* 2009; **19**: 414–22.

14 Shustermann D, Kaplan JZ, Canabarro C. Immediate Health-Effects of an Urban Wildfire. *West J Med* 1993; **158**: 133–8.

15 Morgan G, Sheppeard V, Khalaj B, *et al.* Effects of bushfire smoke on daily mortality and hospital admissions in Sydney, Australia. *Epidemiology* 2010; **21**: 47–55.

16 Pope III CA, Burnett RT, Thun MJ, Calle EE, Krewski D, Thurston GD. Lung Cancer, Cardiopulmonary Mortality, and Long-term Exposure to Fine Particulate Air Pollution. *J Am Med Assoc* 2002; **287**: 1132–41.

17 Katsouyanni K, Touloumi G, Spix C, *et al.* Short-term effects of ambient sulphur dioxide and particulate matter on mortality in 12 European cities: results from time series data from the APHEA project. Air Pollution and Health: a European Approach. *BMJ* 1997; **314**: 1658–63.

18 American Psychological Association. Recovering From Wildfires. 2011. http://www.apa.org/helpcenter/wildfire.aspx.

19 Wittig V, Williams S, DuTeaux SB. Public Health Impacts of Residential Wildfires: Analysis of Ash and Debris from the 2007 Southern California Fires. *Epidemiology* 2008; **19**: S207.

20 Goldman A, Eggen B, Golding B, Murray V. The health impacts of windstorms: A systematic literature review. *Public Health* 2014; **128**: 3–28.