World Health Organization Collaborating Centre on Investment for Health and Well-being

GIG CYMRU NHS WALES | Iechyd Cyhoeddus Cymru Public Health Wales

D5.3/P6.2 Flooding

Flooding can cause death and injury, and there is strong evidence of long term and severe impacts on mental health and wellbeing. Flooding also damages and disrupts critical infrastructure, access to services and education, along with negative economic impacts on individuals, businesses and public services.

Characterisation of impact of flooding on health and wellbeing

Intensity	Likelihood	Duration	Intensity	Likelihood	Duration
Positive impacts/opportunities			Negative impacts		
			✸✸✸	✓✓	S to L

✓✓ Confirmed ✓ Probable ? Possible ✸✸✸ Major ✸✸ Moderate ✸ Minimal S Short term M Medium term L Long term

How do climate change impacts on flooding affect health and wellbeing?

Positive impacts / opportunities

- Opportunity to build community resilience and cohesion
- Mutual aid
- Early warning systems
- Community engagement with regards to development and implementation of Flood and Coastal Erosion Risk Management policies and plans

Negative impacts

- Death or injury
- Long term and severe impacts on mental health and wellbeing including depression and Post-Traumatic Stress Disorder
- Economic impacts on incomes, livelihoods and employment
- Disruption to education
- Loss of valued places leading to emotional distress ("solastalgia")
- Damage to homes
- Disruption to access to services
- Illness arising from contaminated water
- Loss of tourism, recreational and leisure amenity
- Damage to cultural and heritage sites
- Damage and disruption to transport and infrastructure
- Loss of and damage to possessions
- Disruption to social support
- Stress and disruption from temporary or permanent displacement (See Section D3.2)

Pathways of impact arise from

- **Increased winter rainfall**
- **Extreme weather: rainfall/storms/wind**
- **Flooding**
- **Sea level rise**
- **Psychosocial and behavioural factors**

Current and future flooding in Wales

There are 245,000 properties currently at risk of flooding from all sources[1] in Wales (Natural Resources Wales, 2020a) and there is strong evidence that climate change will increase the number of properties and people at risk of flooding from all sources in Wales, including in areas that have previously not been at risk (Kovats and Brisley, 2021; Netherwood, 2021; Sayers et al., 2020a). For example, 148,000 people are currently exposed to frequent flooding (1 in 75 years or more frequent) in Wales, however by 2050 (in a scenario of 4°C warming and current level of adaptation in place) this is projected to increase by 35% to over 200,000 people (Sayers et al., 2020a). Flooding was perceived by expert stakeholders in the HIA as the most significant impact arising from climate change in Wales (Ints. 9 and 11[2]). The British Red Cross has recently highlighted that there is a higher proportion of households exposed to frequent flooding in Wales (1 in 21 households) than the rest of the UK (British Red Cross, 2022).

There are nine identified National Flood Risk Areas in Wales. These are areas where flood risk has been identified as *"significant to human health, the economy or the environment, including cultural heritage"* and flood risk management plans are required (Natural Resources Wales, 2020a). In Wales these include zones within the following locations:

- Monmouthshire
- Newport
- Cardiff
- South Wales Valleys
- Swansea Bay
- Gwynedd
- North Wales Coast
- Flintshire
- Wrexham

Flooding currently poses a risk to Wales' national infrastructure such as health, transport and energy services (Welsh Government, 2020a) (see also Sections D7.1, D8.1 and D8.2). A significant increase in flooding of infrastructure sites such as water treatment, energy and communication sites and key community facilities such as railway stations, landfill sites, hospitals and emergency services, care homes, GP surgeries, and schools is projected across the UK (Sayers et al., 2020a).

Direct Impacts of flooding on health and wellbeing

Deaths and injuries can occur because of flooding, for example, from drowning, falling into fast flowing water or car accidents (Kovats and Brisley, 2021). In addition, illness can arise related to contact with contaminated water from biological or chemical sources (Kovats and Brisley, 2021).

1 Flood sources are: from rivers (fluvial), the sea (coastal), surface water (pluvial) and groundwater.
2 Evidence from stakeholders is referenced in the appraisal sections as W1 and W2 for insights from participatory workshops, and Int.1 etc for evidence from expert interviews.

Indirect impacts on mental health and wellbeing

The UK Climate Change Risk Assessment identified that:

> ***"The greatest burden of ill health from flooding is likely to be due to the long term impacts on mental health"*** (Kovats and Brisley, 2021).

A high quality longitudinal study in England found that[3]:

- The risk of having probable depression, anxiety or Post-Traumatic Stress Disorder (PTSD) is approximately six times higher in people whose homes are flooded, than in those who are unaffected (Public Health England, 2017).
- The impacts on mental health arising from flooding are associated with the depth of floodwater and length of time a home is flooded (Public Health England, 2017).
- The percentage of people with probable depression, anxiety or PTSD was also elevated amongst those whose lives were disrupted by flooding but who did not have floodwater in the liveable part of their homes, although not to the same degree (Public Health England, 2020).
- Impacts on mental health arising from flooding can persist long term. For example, at one year post flooding the prevalence of probable depression amongst those whose homes were flooded in England was 20.1%; prevalence of anxiety was 28.3% and PTSD 36.2%. This compares with the general prevalence of depression amongst adults in Great Britain of 10% in 2019/20 (pre-COVID-19 pandemic) (Kovats and Brisley, 2021; Public Health England, 2020; ONS, 2020).
- Three years after flooding, the prevalence of negative mental health outcomes in affected persons is reduced but still significant (Mulchandani et al., 2020).
- Evacuation and displacement, ***particularly without warning***, increases the risk of anxiety and post-traumatic stress disorder (Munro et al., 2017).
- Many people experience persistent flood-related damage to their homes and this is associated with worse mental health outcomes (Mulchandani et al., 2020)

Flooding also has major impacts on the mental health and general wellbeing of children (Mort et al., 2016) including:

- Loss of valued personal and family possessions, friendship networks, familiar spaces, general education.
- Experience of fear, anxiety, poverty, isolation, unfairness, destruction, stress, uncertainty, being ignored/misunderstood.
- Feeling worried about the stress that adults are experiencing.
- Lack of sleep and recreation.
- Deterioration in diet, space and housing conditions.

As a result of the above evidence, support for mental health should be a key aspect of the emergency response to flooding. This should include action across all time phases of flood response planning including embedding preventative action such as mutual aid, early warnings and community resilience; support available during a response, and during the recovery stages. Cruz et al., (2020) state that ***"there is a need to consider how best to provide appropriate and effective psychological care at scale for people with a broader range of mental health symptoms"*** affected by flooding and the National Institute for Health and Care Excellence (2018) advises that planning for disasters should include 'a fully coordinated psychosocial response' (See Box 1).

3 Summary taken from Kovats and Brisley (2021) op cit.

Box 1: The NICE Guidelines on PTSD Section 1.8: Disaster Planning (NICE, 2018).

This states that it should be ensured that *"disaster plans provide a fully coordinated psychosocial response to the disaster. A disaster plan should include:*

- *immediate practical help,*
- *support for the affected communities in caring for those involved in the disaster,*
- *access to specialist mental health, evidence-based assessment and treatment services,*
- *clear roles and responsibilities for all professionals involved".*

Indirect impacts: access to essential services and economic impacts

Flooding also impacts health and wellbeing via disrupted access to critical infrastructure such as power and water; access to services, education and local amenities; and can incur major economic impacts for individual, businesses and the public sector (Kovats and Brisley, 2021; Sayers et al., 2020a).

Flood disadvantage and health inequalities

The National Strategy for Flood and Coastal Erosion Risk management in Wales (Welsh Government, 2020a) recognises that specific population groups are "…less able to cope with the effects of flooding" and these groups include: ***"…the very young, the elderly and disabled or already in poor health, who may require additional support during a flood event"***. In addition, socioeconomic factors such as access to adequate insurance, and unequal access to financial and other resources to prepare, respond and recover from flooding contribute to ***"flood disadvantage"*** and inequalities in the resulting impacts of flooding (Lindley et al., 2011; England and Knox, 2015; Sayers et al., 2017a) (see Box 2).

Box 2: Flood Disadvantage

"Flood disadvantage" arises due to a combination of exposure to flooding and social vulnerability and means that flooding may lead to a greater loss in wellbeing in "flood disadvantage" areas than elsewhere.

"Social vulnerability" in this context is caused by a range of "conversion factors" which can be grouped into:

- Personal factors (known as sensitivity) including age and health status.
- Social factors (known as adaptive capacity, or the ability to prepare, respond and recover), including income, tenure, mobility, social isolation, access to information and insurance.
- Environmental factors (which may increase or 'enhance' exposure to flooding) including housing and neighbourhood characteristics.

(Lindley et al., 2011; England and Knox, 2015; Sayers et al., 2017a)

A number of indices to measure or quantify the impacts of flooding and relative flood disadvantage have been developed to inform policy-making including the:

- **Neighbourhood Flood Vulnerability Index;** includes; age, health, income, information use, local knowledge, tenure, mobility, housing characteristics, direct flood experience, social networks, service availability (Sayers et al., 2017a; Sayers et al., 2017b).
- **Social Flood Risk Index;** combines social vulnerability and likely exposure to flooding to create a measure of "flood disadvantage" at a neighbourhood scale (Sayers et al., 2017a; Sayers et al., 2015).
- **Relative Economic Pain;** the ratio of uninsured loss from flooding to a person's income (Sayers et al., 2015).
- **Expected Annual Damages;** costs of direct economic damage to residential and non-residential properties and associated indirect damages (Sayers et al., 2015).

These measures provide the following insights into future impacts of flooding on different population groups in Wales:

- Five Welsh Local Authority areas are within the top 20 ranked Social Flood Risk Index for the UK (not accounting for population growth), where social vulnerability factors are combined with likely exposure to flooding. These are Rhonda Cynon Taf, Blaenau Gwent, Neath Port Talbot, Bridgend, and Caerphilly (Sayers et al., 2020a).
- Flood disadvantage as measured through the metric of Relative Economic Pain (REP) is greater, on average, in the Devolved Administrations than in England (Sayers et al., 2020a), meaning that financial pressures on individuals resulting from flooding will be greater.
- Those living in social rented accommodation are more likely to be on lower incomes and are less likely to have flood insurance. This combination increases the 'Relative Economic Pain' experienced when flooded (Sayers et al, 2020b).
- Socio-economic status and pre-existing health conditions are recognised as factors that increase the risk of adverse outcomes from flood events (Kovats and Brisley, 2021).
- Risk perception and coping capacity also affect the ability of communities to prepare for and manage flood risk (Rufat et al., 2015).
- Flood disadvantage exists across all flood types to some extent but is most acute in coastal areas (Sayers et al, 2020b).
- Flood disadvantage exists across all ethnicities, but Black and Other Minority Ethnic Groups are more likely to have lower income and more likely to be in rented accommodation. These two factors lead to significantly lower levels of flood insurance and higher levels of disadvantage in particular in the Black, African and Caribbean community (Sayers et al., 2020b).
- Those living in rural towns and smaller urban settlements experience more frequent flooding. The geographic disadvantage is exacerbated by lower levels of income and hence higher levels of Relative Economic Pain (Sayers et al., 2020b).

Impacts of flood related policy on health, wellbeing and inequalities

There are a number of examples of how process of development, implementation and communication and engagement with flood related policy can affect mental health and wellbeing (see also Section D4 on Mental health).

- The process of development, implementation and communication of flood adaptation policies, for example Shoreline Management Policies, can impact mental wellbeing, for example; by contributing to increased stress and anxiety amongst affected populations (Bennett-Lloyd et al., 2019; Environment Agency, 2019).
- An evidence review by the Environment Agency (England) on community engagement in climate adaptation, in particular in relation to flood and coastal erosion risk management (FCERM), found that there is a "*need to recognise that responses to information about flood and coastal erosion risk – or about options for managing this risk – can be influenced by complex feelings associated with prior experiences of flooding and recovery, connection to place and knowledge of future risks".* The importance of considering emotion and mental health in FCERM policy and practice is highlighted by the authors (Environment Agency, 2019).
- Early warning systems have an impact on mental health outcomes for people impacted by flooding. Data analysed from the Public Health England National Study of Flooding and Health found that outcome scores for depression and PTSD were significantly higher in people who were displaced and reported receiving no warning than those who had received a warning more than 12 hours in advance of flooding, however there was no significant differences in anxiety scores (Munro et al., 2017).
- The 'Relative Economic Pain' experienced when flooded is likely to impact more greatly on people in more socially vulnerable areas. This has important implications for policies that seek to mitigate the higher costs of insurance for those who have been flooded (e.g. Flood Re) (Sayers et al., 2015; Sayers et al., 2020a; 2020b).

Population groups affected

- **People who are affected by a flood or flood risk**
- **Children and young people**
- **Older adults**
- **People with young children**
- **Lone parents**
- **People with long term health conditions and disabilities**
- **Coastal areas**
- **Flood risk areas**
- **Urban and rural communities**
- **People on a low income**
- **People in rented accommodation**
- **People without local knowledge (e.g. students away from home, tourists, refugee and asylum seekers)**
- **People who are isolated**
- **Black and ethnic minority communities**
- **Tourists (e.g. camping and caravan sites at risk of flooding)**

Relevant statistics

- **245,000 properties are currently at risk of flooding across all sources in Wales (See Table 1)** (Natural Resources Wales, 2020a)**. This figure is made up of 117,000 at high risk, 44,668 at medium risk and 83,350 at low risk (See Table 2)** (Welsh Government, 2020a).
- **Between 2016 and 2019 there were over 1100 incidents of infrastructure flooding in Wales** (Natural Resources Wales, 2020a).
- **3,130 properties across Wales were flooded as a result of three major storms in February 2020, with the South Wales Valleys being the most severely impacted** (NRW, 2020b).
- **148,000 people are currently exposed to frequent flooding (1 in 75 years or more frequent) in Wales. By 2050 (in a scenario of 4°C warming and current level of adaptation in place) this is projected to increase by 35% to over 200,000 people** (Sayers et al., 2020a).
- **The total Expected Annual Damages in Wales resulting from flooding is projected to increase by 20% by 2050 (in a scenario of 4°C warming, low population growth and current level of adaptation in place) from a present day baseline of 266 million pounds** (Sayers et al., 2020a).
- **51 GP surgeries, 16 Hospital sites, 48 care homes and 81 emergency services are currently at risk of flooding in Wales, with increases projected by 2050 and 2080 especially for care homes** (Netherwood, 2021) (see Section D7.1).
- **Four Local Authorities in Wales rank within the top 20 in the UK for the projected highest levels of total Expected Annual Damage from flooding in the 2080s (assuming 4°C of warming, no population growth and a continuation of Current Levels of Adaptation): Rhonda Cynon Taf, Carmarthenshire, Neath Port Talbot and Newport** (Sayers et al., 2020).
- **Around 28 percent of caravan and camping sites (permanent and non-permanent) in England and Wales were estimated to be at flood risk from rivers and the sea** (DEFRA, 2012; Kovats and Brisley, 2021).

Table 1: Flood Risk Assessment Wales: 'at risk' property counts against source (rounded to the nearest 50) (Natural Resources Wales, 2020a).

	Residential	Non-residential	Total
Fluvial	77,850	12,300	90,150
Tidal	62,300	8,750	71,050
Pluvial	115,700	14,100	129,800
Overall total of properties at risk in Wales (including double/triple counting)			291,000
Overall total of properties at risk in Wales (excluding double/triple counting)			245,000

Table 2: Number of properties at combined risk of flooding with level of risk (not rounded) (Welsh Government, 2020a)

Number of properties at combined risk of flooding with level of risk (not rounded)	
Level of Combined Flood Risk	**Number of properties at risk**
High risk	117,100
Medium risk	44,668
Low risk	83,350
Total	245,118

Key Policy Documents

- **Flood and Water Management Act 2010**
- **National Strategy for Flood and Coastal Erosion Risk Management in Wales** (Welsh Government, 2020a)
- **Shoreline Management Plans (SMPs)** (Natural Resources Wales, 2022)
- **Planning Policy Wales** (Welsh Government, 2021a)
- **Local Development Plans**
- **National Development Framework** (Welsh Government, 2020b)
- **Technical Advice Note (TAN) 15** (Welsh Government, 2021b)
- **Flood and Coastal Erosion Risk Management Programme 2022 to 2023** (Welsh Government, 2022)

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