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## Global assessment of flood impact on emergency service provision to vulnerable populations under climate change

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Flooding is a major global hazard that accounts for one-third of all reported natural disasters and over 500,000 fatalities since 1980. Globally, vulnerable populations (very young, elderly, medical special needs individuals, etc.) are disproportionately affected by flooding and predominantly encompass the majority of flood associated injuries and fatalities. This is caused by their low self-reliance, weak political voice and insufficient inclusion into climate adaptation and emergency response plans.

Vulnerable individuals are largely reliant on Ambulance and Fire & Rescue Services due to flood induced injuries, exacerbated medical conditions, and requiring evacuative assistance. These services are primary emergency responders to flooding that provide rescue and relief efforts. However, during flood events, the demand for Ambulance and Fire & Rescue Service often exceeds the potential capacity and limits service provision, whilst flooded road networks and short emergency responder-timeframes decrease accessibility, service area and population coverage.

Therefore, an important step towards resolving these social inequalities and emergency responder strains from flooding is to understand the geographic, spatial, temporal, and demographic distributions of vulnerability. This will be undertaken by identifying vulnerability 'hotspots' of global populations in terms of emergency service provision during times of flooding of various magnitude under climate change.

The research will use Big Geographical and Climate Data and a 'hotspot' approach to investigate how the global extent and distribution of flood hazards and vulnerable population hotspots vary spatially and temporally, based on differing global fluvial and coastal flooding (at 10-year and 100-year return periods), and present and future flood conditions (present-day and 2050, under RCP 4.5 and RCP8.5 climate scenarios). Network Analysis modelling will be used to investigate the impact of this on Ambulance and Fire & Rescue accessibility from service stations to vulnerable populations based on restrictions of road network inundation and emergency response-times (8-, 15-, and 60- minutes). Finally, comparisons will be made to highlight how vulnerability and emergency service accessibility compares demographically between different vulnerable population groups.

It is expected that there will be significant geographical and temporal differences in social

vulnerability and emergency service provision between countries and regions globally. Although to what extent is currently unknown. Ultimately, the framework of this research may provide real-world applications for informing strategic planning of emergency response operations and resolving social inequalities to flood hazards. These applications could include the production of more detailed flood hazard and evacuation maps that highlight vulnerability hotspots, the prioritisation of vulnerable population groups in emergency response plans to minimise geographic and population disparities of flood injuries and fatalities, and the allocation of emergency service hubs in regions of high-vulnerability but low-emergency response provision.