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Flood risk perceptions and coping capacities among the retired population, with implications for risk communication: A study of residents in a north Wales coastal town, UK

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ARTICLE INFO

Keywords:
Older adults
Risk communication
Disaster risk reduction
Flood
Retired
Vulnerability

ABSTRACT

Flood risk communication strategies have been ineffective for older adults as they have failed to accommodate diversity, viewing retired populations as homogenous. There have been calls from academics and NGOs to develop more detailed understandings of older adults’ risk experiences to inform disaster risk reduction (DRR) and communication approaches. We conducted in-depth interviews with twelve members of the retired population, of which the majority happened to be members of a local church, in a flood risk area of north Wales, UK, in 2018 to ascertain risk perceptions, coping capacities, and risk communication preferences to inform more age-centred approaches. Results present retired population are a diverse group with varying perceptions and capacities. While personal risk perceptions were low overall, coping capacities varied and were primarily social in nature, which can be sustained despite mobility or other limitations typical of older age. Participants expressed preference for traditional/interpersonal risk communication methods, such as telephone calls or home visits. A key recommendation from this study is that risk communication and DRR practices should adopt people-centric approaches that are co-produced and respect the differentiated vulnerabilities, capacities and needs of at-risk populations. This study and its findings are important is providing a more nuanced picture of the vulnerabilities and capacities of the particularly at-risk population of older adults. We must ensure that future DRR research, policies and practices focus on all experiences of at-risk populations, not only the dominant narratives or extremes of groups, to capture differences within groups’ abilities to support more effective community DRR.

1. Introduction

Natural hazard and climate-related disasters are on the rise [1], with wide-ranging impacts on societies. Hazard events, such as cyclones, floods, or bushfires, do not become a disaster until they intersect with a vulnerable population [2]. Vulnerability to disaster is widely understood as a social construct, and is closely linked to systemic inequalities and marginalisation [2,3]. Consequently, socially-marginalised groups are also some of the most vulnerable to, and disproportionately impacted by, disasters, such as the economically poor [4], migrants [5], sexual and gender minorities [6], the homeless [7], people with disabilities [8] or the elderly [9].

To effectively reduce losses from disasters, recent scholarship and international policies inform that we need strategies centred on understanding vulnerabilities, reducing risk, and building community resilience and coping capacities. International disaster management has shifted away from a sole focus on emergency response towards reducing vulnerabilities, preparing communities, and disaster risk reduction (DRR) (e.g. Ref. [10]. Emphasis is placed on resilience—i.e. the processes and outcomes related to increasing communities’ abilities to cope with disruption [10]. Building resilience involves understanding risk and uncertainty, effective communication, social cohesion, empowerment and capacity building [11].

However, research shows policies and practice have been until

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recently mainly focused on predominant groups in society (Eriksen 2014), inadequately capturing the needs of some groups (e.g. Ref. [5]). Invisibility of vulnerable groups is associated with inadequate DRR [7]. Where they have been considered, research and policies have tended to treat minorities as homogenous, overlooking diversity of experiences and vulnerability within marginalised groups [12] and intersectionality [13].

This is applicable to older adults and retired populations. Older adults are often disproportionately impacted during disasters with higher mortality and morbidity rates reported compared to the general public [4], in part owing to reduced social capital, physical and mental health, and access to economic resources [9,14]. Disproportionate effects are likely to be exacerbated as global populations become older and climate change continues [13], especially impacting on older adult health through food and water insecurity, higher morbidity and mortality in temperature extremes, susceptibility to air pollution, and flooding [16–18]. There have been suggestions of such patterns repeating in the debates and consequences of the COVID-19 pandemic where the lives of elderly people are sometimes valued less than younger people in prioritising treatments [19–21].

The vulnerability of older adults is often viewed as part of a ‘collective vulnerability’ that groups them with other vulnerable demographic groups, such as the disabled, young children and ethnic groups [22,23]. Disaster management organisations tend to treat older adults as a uniform group, and individual needs are often not well-considered [24]. This results in underrepresentation of the unique vulnerabilities and capacities of older adults, and contributes to ineffective DRR, disaster preparedness and risk communication strategies. There is urgent need to explore the experiences of older adults as world populations continue to age and the numbers of reported disasters increase [25].

Risk communication is an intrinsic part of DRR, aiming to inform the public about potential hazard impacts and how they can take action to mitigate negative outcomes [26,27]. Risk communication occurs during all stages of disaster management and takes myriad of forms, with various measures and degrees of effectiveness [28]. Effective communication is linked to resilience [11], whereby locally-relevant [29], two-way risk communication delivers resources to communities, alongside providing intelligence regarding community needs to authorities [30]. However, current standard risk communication approaches aimed at predominant groups are inadequate for older adults. While some recommendations have been made to improve risk communication for the diversity of populations, such as utilising a range of different communication methods/technologies to engage varied audiences [31,32], older adults have rarely been consulted in studies assessing risk communication effectiveness. Further work is needed to determine specific features and methods of risk communication most suitable for older adults. Moreover, research needs to expose the heterogeneity of vulnerability and capacities within older and retired populations to inform more comprehensive risk communication and DRR strategies. DRR approaches need to see beyond vulnerabilities and better-accommodate and value the resilience capacities of older adults, such as mental coping abilities formed through previous experiences of disaster or adversity [33,34].

In this article we endeavour to contribute to what we perceive as a lacuna in research, policy and practice relating to older adults, vulnerability, resilience capacities, and risk communication. We do this through qualitative interviews with retired people in a flood-prone town in north Wales, United Kingdom (UK). We aim to analyse the self-reported flood risk communication needs, expectations, and capacities of retired people, while recognising diversity within this broadly vulnerable group, and explore the contributions retired people can make to DRR for coastal flooding.

Throughout this article we understand risk as the ‘effect of uncertainty on objectives’ [35]. This allows risk to be neither positive nor negative but the consequences experienced of living in proximity to a hazard [36]. Definitions of ‘flood risk’ vary depending on context and location. We understand it as a ‘combination of the probability and the potential consequences of flooding …’ that incorporates the consequences of flooding on individuals’ social, as well as physical, assets [37]. Therefore, individuals may be at risk of flooding even if their homes are secure if their local amenities, support networks, or other aspects of their lives are affected.

The rest of the article is structured as follows. First, we explore existing literature on older adults’ vulnerability and resilience, and risk communication. Then, we present the study methods, including details of the study site, participants, and interview data analysis. A combined results and discussion section follows, addressing our study aims and research, policy and practice gaps, with particular emphasis on future recommendations. We conclude with a reflection on older adults’ capacities alongside their vulnerabilities, and advocate for more age-centred approaches to risk communication and DRR.

2. Background: older adults, disaster vulnerability, and risk communication

The investigation of older adults and disasters is limited. Past work primarily focuses on post-disaster recovery, rather than preparedness, risk communication, or capacities [22,38]. Most studies explore the experiences of older adults from the perspective of professionals who work with them, rather than older adults themselves [39–41], although this has begun to change in more recent scholarship (see Refs. [42,43]. Further, the lower age limit of older adults is not consistent in literature, ranging from 60 to 75 years old, potentially limiting comparisons [34]. Besides, chronological age does not necessarily equate to ‘biological age’, and thus capacity rather than age is a better measure of individual ability [44]. Most studies investigating risk communication and preparedness do not differentiate ages [40]. Those that do focus on older adults’ preparedness levels suggest that they are generally unprepared for disasters, but this is typical of the wider public [45,46]. Some demonstrate that age alongside characteristics such as living with family or a long residency provide indicators of preparedness, but general levels remain relatively low [45].

2.1. Vulnerability, capacities, and intersectionality

The vulnerabilities of older adults were clearly demonstrated in the disproportionate mortality rates of 49% for older adults in Louisiana following Hurricane Katrina, considering that older adults only represented 6% of the total population [47]. This high rate has been attributed to evacuation challenges and invisibility of older adults to emergency services [47]. This high rate is a typical pattern, especially in the US [48].

The root causes of older adults’ vulnerability differ across geriatric literature. Firstly, perceived vulnerabilities can be related to physical limitations and impairments (Duggan et al. 2010). Reduced mobility or chronic health conditions affect older adults’ ability to adequately prepare for and respond to disasters [49]. Secondly, the social constraints typical of older adults’ lives within and outside of disaster contexts, such as social exclusion reduced social connectedness [50], or inadequate provision within policies lead to disadvantage and marginalisation. Thirdly, some authors combine the social and physical limitations,
recognising their simultaneous impacts and interconnectedness [9,51,52]. For instance, older adults may not receive warnings, either through incapacity to comprehend messages (due to cognitive and physical limitations) or having limited social networks for message sharing [44,53].

Environmental gerontology can be instructive for understanding older people’s experiences of vulnerability and resilience, especially in the context of climate change hazards [54]. Attributes of the physical and social environments of older people, such as accessibility, safety, and control, both shape risk and limit risk management, and climate change vulnerability needs to be considered further in adaptations to these environments [54]. Through analysis of coastal climate change, Krawchenko et al. [55] advocate for greater attention on vulnerability and linking age friendly initiatives with planning practices. Hag [15] describes how pre-existing well-being factors influence older people’s flood impacts, and Campbell [56] informs that disaster recovery measures that focus on finances and material resources are inadequate for older people as they fail to recognise the importance of social environments.

Older adults’ disaster capacities remain relatively under-investigated (Banks 2013). Capacity is a key feature of resilience [57]. Enhancing older adults’ capacities in the social context is viewed as a means of increasing individual and community resilience, both increasingly important elements of DRR [10].

Older adults often hold a wealth of knowledge regarding their local environment that could aid DRR [58]. Their life experiences may provide resources, such as useful local knowledge, to cope with current or future adverse situations [25,59]. As many older adults are not engaged in day-to-day economic activities they may be able to invest more time on DRR activities in their community [58].

However, as with vulnerability, capacities vary among the older adult population. For instance, those more connected to society or family are often seen as better-able to cope with disruption compared to older adults without such support networks [59]. Additionally, many older adults provide support to others in their community. Over 2 million older adults in the UK are carers, and over half of these have a disability or health condition themselves, and therefore many need additional support during evacuation or preparedness activities [60].

But older adults’ capacities do not negate their specific vulnerabilities or limitations. While vulnerability and resilience are related concepts, they are not simple opposites [61]. While resilience has its own complex history and critiques, these are not the focus of our article (for more detailed discussions on these topics see Refs. [62,63]). Here we want instead to highlight conceptual differences of importance for understanding our study on older adults and their disaster vulnerability and capacities. Vulnerability informs that everyday social and economic circumstances construct differing experiences of hazard exposure and disaster impacts [61]. Reducing vulnerability, therefore, involves mitigating short term conditions, such as poor mobility or evacuation access for older adults, as well as addressing historical, political, and socio-economic root causes [2]. Resilience, on the other hand, refers to capacities and processes to enable fast and effective response and recovery from disruption, such as disasters [64]. Thus, one can be simultaneously vulnerable and resilient in different ways; reducing vulnerability does not necessarily increase resilience, and vice versa. This is particularly important in the context of older adults. While capacities do need to be given more attention and value, the conditions that create vulnerability – i.e., part of the reason why older adults need to be more resilient – remain, and can be continually reinforced unless the root causes of vulnerability are addressed. Working towards recognising, valuing, and building resilience capacities is vital for effective DRR, but does not mean we can overlook the complexities of vulnerability.

When dissecting the complexities of vulnerability and resilience capacities, we should also consider the notion of intersectionality [13]. Intersectionality originates from feminist studies theorising the relationship between different social categories such as gender, race, and sexuality, among others [65,66]. Intersectionality is often viewed as the way that any particular individual stands at a crossroad of multiple groups with a combination of identities influencing the individual’s experiences and relative advantage/disadvantage [67]. Age alone doesn’t define the experiences of older adults. Hopkins and Pain [68] argue that some markers intersect with age in meaningful ways, such as gender, as gender role expectations often differ between generations. Thus older adults are not only older but also belong to a specific gender or previous job/home role. A significant intersection for older adults is disability (Gibson & Hayunga 2015). The UN estimates that more than 46% of older adults have a disability, with much resulting from an accumulation of health risks across a lifespan of disease, injury and chronic illness [69]. These factors lead to considerable attitudinal, environmental and institutional barriers preventing equal participation in all aspects of life [69]. Although there are experiences unique to both groups, where they intersect they should be addressed together to improve processes which could benefit both groups and the wider public through making risk communication more comprehensible and action-able. Some vulnerability mapping assessments examining older adults’ flood risk have also considered social elements of poverty, disability, and physical vulnerabilities to provide a more comprehensive picture [70]. Such changes are being encouraged in other fields, such as urban planning through promotion of age-friendly cities that would allow aging in place for older adults through easier mobility around the city, with benefits for others, such as people with disabilities or families with prams [71].

It is important to ensure that conclusions drawn from incomplete pictures do not lead to disempowering stereotypes (such as that all older adults are frail; [72], which can be an unintended consequence of vulnerability analyses [73,74]). Older adults should be treated as a heterogeneous group, while recognising particular limitations are generally likely to increase with age [72].

2.2. Older adults and risk communication

Risk communication aims to increase at-risk populations’ risk perception and awareness, and promote preventative measures for risk reduction [27]. Risk perception refers to an individual’s interpretation or impression based on an understanding of a particular threat that may potentially cause loss of life or property [75]. These perceptions at individual and community levels form an important societal component of disaster risk management for determining responses to warnings and efforts to increase community preparedness [75]. Raaijmakers et al. [76] demonstrates how perceptions and preparedness are linked by a set of risk characteristics that form perceptions; awareness, worry, and preparedness. An increase in awareness can lead to heightened worry, leading to increased likelihood of preparedness activities [76]. O’Sullivan [57] expands this concept, suggesting that increases in preparedness lead to social resilience, and risk communication that attempts to increase awareness or worry should also aim to increase resilience through capacity building. Therefore, understanding retired populations’ risk perceptions can improve risk communication.

Brown and Huan [77] argue difficulties associated with disaster preparation of older adults stem from top-down design and implementation of risk communication strategies that do not fully consider the range of issues faced by target audiences. For earthquake preparedness, for example, messages such as ‘drop, cover and hold’ can be inappropriate for older adults as they do not consider reduced physical abilities or fear of falling [40]. For evacuations, older adults may not be able to comply with notices due to not having access to vehicles or inability to leave if living in care homes, or lack of appropriate care in evacuation centres [14,53]. Stay-at-home preparedness kits can be difficult to maintain for older adults and those with low incomes [78]. Disaster programme development is often undertaken by people lacking in understanding of aging and older adults and consequently plans and policies do not address their specific needs and circumstances in risk...
communication [77]. Therefore, it may prove more difficult for older adults to personalise general risk messages, which is an important step in the process of responding to a warning [79,80]. While shifts have occurred in academia towards less top-down and more two-way and people-centred risk communication approaches (e.g. Ref. [81], many organisations continue to operate an ‘information-deficit’ top-down risk communication model in practice [82].

The effectiveness of risk communication is often challenged due to universally low risk awareness and preparedness levels [83]. Communicating risk is a complicated social process influenced by multiple factors, including characteristics of the message, the sender, the audience, the hazard itself, the social context of the communication, the mode of delivery, source credibility and applicability to the receiver(s) [84,85]. A significant barrier to effective risk communication is failure to disseminate information to the population that require it [86]. This failure can occur due to the patchiness in geographical coverage of official warning systems; inability to adequately forecast a hazard; or the inability of individuals to receive or personalise warnings [87]. The latter is important when considering older adults as impairments may limit message comprehension [44]. Current best practice to address some of these issues is to use multiple channels to ensure messages are disseminated as widely as possible and to reinforce them through consistent exposure [32].

Risk communication for the general public can also be improved by improving risk communication for a specific vulnerable group, such as older adults. Improving the readability and usefulness of messages may aid those who share similar vulnerabilities and capacities, such as young children with low literacy, refugees and migrants who do not speak the language of the messages, or those with disabilities [44,88]. Primarily, an age-centred risk communication strategy could aid in reducing risk for everyone through improving communication accessibility [44].

Some studies recommend technical design elements of risk messages that could be implemented to improve risk communication for older adults. Mayhorn [44] recommends designers tailor the physical characteristics of messages to compensate for age-related changes in perceptions. Simple changes such as using sans serif typefaces could improve legibility, or testing audibility in the environment messages will be heard, can improve effectiveness [44,88]. Others suggest using pictographs to reduce cognitive demands, improve recall of information, and increase readability for those with low literacy skills [77].

The geriatric-related disaster literature provides some insights into the experiences of older adults in DRR but continues to call for further research [53]. The predominance of studies focusing on the experience of older adults from the point of view of professionals and those at the extremes has led to an incomplete picture of the vulnerabilities and capacities of older adults. The low level of engagement with risk communication and preparedness among older adults highlights the need for more effective approaches.

3. Methods

3.1. Case study background

Floods are one of the highest reported disasters worldwide and account for one third of economic disaster losses [89]. The potential for damage from alluvial flooding is projected to increase by a factor of 20 globally by the end of the century if not mitigated, as steady economic and population growth continue alongside climate change in flood prone areas [90,91]. This trend is likely to increase as global climate change exacerbates flood-related hazards [92]. Low flood risk awareness and reach of flood warnings in the UK indicate flood risk communication requires improvement [93,94]. Flood warnings can allow for potential victims to save their lives and valued possessions, lessen negative impacts, and reduce associated trauma [95].

Rhyl in north Wales (Fig. 1; population 25,149 in 2011) is an instructive case study as it has both a high proportion of retired residents and significant flood risk [96]. Rhyl is susceptible to flooding, with some areas within Natural Resources Wales’ (NRW) Flood Zone 3. This zone classification represents a 0.5% (1 in 200) chance or greater of flooding occurring from the sea in any given year [97]. A relatively flat topography and high proportion of bungalows occupied by retirees contribute to flood vulnerability in the local area [96]. Rhyl has experienced major flooding twice in the last 30 years, with the most recent event in December 2013 causing severe flood damage to 155 properties,

![Fig. 1. Location map of Rhyl in north Wales, UK.](image-url)
indirectly effecting 160 properties, loss of power and phone connections to an estimated 350 properties, and evacuation orders for residents of over 400 properties [98].

3.2. Participants

Participants were recruited through a purposive sampling method, a typical method in disaster research [99]. One author utilised personal networks to identify participants with the aid of key informants. Although this may have led to a bias of including engaged participants and a form of gatekeeping, this was a necessary trade-off with ensuring that a sufficient number of individuals were interviewed. The participation criteria included: at least 65 years of age (minimum pensionable age in the UK), not in full-time employment (as it was felt those in employment would have different support networks to rely upon), able to communicate, and a study area resident (to ensure participants were at risk of flooding to some degree and had local experience). A relatively flexible participation criteria allowed for capturing unexpected demographics of the study area, reflecting the intention to demonstrate heterogeneity among the age group.

In total 12 individuals were interviewed in June 2018, ranging in age from 65 to 88 with a median of 78.5. There was an uneven gender distribution, with three male and nine female participants. However, this reflects the general demographic composition of the older population in the UK [100]. Five participants reported direct flooding experience flooding, four indirect experience, and three had no flood experience. Two thirds of the participants happened to be members of a local church in the study area, which may have introduced an unintended bias into the findings as social connectedness may be higher in church-attending older adults compared to others.

While we acknowledge the sample size and study area do not allow us to make broad claims representative of all retired people and flood prone areas, we consider the participants key informants and experts in their own experience of flood, vulnerability, and risk communication. Thus, the participant sample is appropriate for the contribution our study seeks to make and does not detract from the value of discussing specific issues faced and risk communication preferences directly with individuals of an at-risk group.

3.3. Interviews and data analysis

Semi-structured interviews were adopted over other qualitative research methods, such as surveys or focus groups, to ensure participants were not influenced by others’ responses, to allow opportunities for participants to raise unexpected topics of interest, and for the interviewer to clarify responses. Interviews were conducted in semi-public space (to balance ethical safety concerns and ensuring participants felt comfortable to discuss freely) in two church halls in the study area, and lasted up to 45 min (balancing the need for in-depth discussion and avoiding participant fatigue). The fieldwork period during the summer meant that the flood risk in the area was low, meaning participants’ views may represent the pre-disaster or post-disaster stage and access to participants was easier than if a flood had recently occurred. All participants were asked the same base questions to ensure consistency and enable comparisons between participants, broadly covering themes of risk perceptions, coping capacities, and experience with risk communication. Interview questions were pilot-tested prior to data collection. To mitigate social desirability bias [101] multiple questions on the same topic were asked in different ways and key topics were broken down into sub-questions to observe if different answers were given in a different context [102]. Interviews were recorded and transcribed verbatim by one author to ensure to ensure consistency, comprehensiveness and data familiarisation [103], with results verified by the second author. Interviews were analysed using thematic content analysis, as guided by Braun and Clarke’s method, allowing for elucidation of meaningful themes directly from the transcripts.

3.4. Challenges faced

The following section will present the interview results and accompanying discussion. First, the diversity of challenges and vulnerabilities described by participants will be presented. Then, varied risk perceptions are explored, followed by coping capacities with a particular focus on older adults’ ability to support others, and subsequently a discussion of preferred risk communication methods. Finally, we present recommendations for the field of disaster management.

4.1. Challenges faced

Any consideration for the capacities of older adults and risk communication must be accompanied by an understanding of the specific challenges that they face to ensure vulnerabilities are addressed in improved risk communication strategies. This section summarises the challenges raised by participants.

4.1.1. Relying on others

A considerable challenge for some participants was their need to rely on others to undertake DRR activities. Transport and vehicle access was important, with many participants being without their own vehicle. This reliance on others could result in inadequate and inefficient flood response and evacuation for older adults. These issues can be compounded if those people the older adults rely on are also impacted by floods, or also vulnerable, such as other older adults in a neighbourhood or friendship network. Provisions should be made to ensure that older residents are adequately considered and informed regarding evacuation protocols, ensuring that older residents and their support networks can pre-plan access to transport and other vital resources. Additionally, those without such informal support networks, who are furthermore vulnerable, will require support through other means, such as volunteer organisations.

4.1.2. Poor health

Poor health is not necessarily a feature of the experience of a retired person, as there are many older adults who are healthy and continue to move with relative ease. However, ‘biological’ aging will eventually affect everyone, and thus poor health is a problem for many within this demographic [44]. For the participants who experienced this, reduction in mobility was of greatest concern. Two participants relied on rollators and others felt that reduction in mobility affected their ability to respond quickly to potential flooding. They were unable to move items higher as they were too heavy, or they did not have upper floors due to living in a bungalow. In this way, the recommended flood preparations were not achievable for many members of the retired population [104–106]. Addressing these limitations for older adults would prove beneficial for other groups who face similar challenges, such as those with disabilities.

Some participants with limitations had made adaptions which could also prepare them for a crisis event, such as carrying a panic-button, keeping a torch close-to-hand at night to aid declining eyesight, or having a packed bag ready for unexpected hospital visits, potentially speeding up evacuation. Therefore, adaptions in one part of an older adult’s life may increase flood preparedness in ways not seen for other demographics.

4.1.3. Temporality

The experiences of the retired population are not consistent or static. Temporality is a significant feature in the lives of older adults, which...
often prompts adoptions in their lives, as they are more susceptible to unexpected or adverse changes, such as degenerative diseases or reduction in mobility, that limit their capacities to interpret messages, personalise information and implement DRR actions (Golant 2003). Participants were aware of the likelihood of these changes and the importance of time. These changes can also affect the families and social networks of older adults. One participant mentioned how the change in her husband’s health and his eventual hospitalisation with Alzheimer’s disease had altered her attitude to risk, as it became a more tangible issue for her. Where a spouse moves into care for health reasons, the remaining resident may be in a more vulnerable position as they may not have agency or capacity to act upon information, if that was not their responsibility previously. This issue could be more present in the current older generations which tend to have more rigidly defined gender roles and expectations, with the man’s role viewed as the worker and the woman’s as carer for children and home [107]. Though, this is certainly not the case for all families and individuals.

4.2. Risk perceptions in the retired population

Two broad types of risk perceptions were displayed. Some participants had low personal risk perceptions due to feeling secure or the priority of other concerns, such as poor health. Conversely, others had high risk perceptions due to previous flooding experience or higher awareness of related environmental conditions. Participants also described variable risk perception at different times of year, such as relating to seasons or tides. Each of these variations in risk perception can have implications for the timing, content, and effectiveness of risk communication strategies.

4.2.1. Low personal risk perception

Following from Raajimakers et al. [76]; lack of concern about flooding was viewed as an indication of low risk perception. Most participants were not personally concerned about flooding and felt secure. This sense of security was born from either no history of flooding in their home, narrowly avoiding flooding in previous events, or their current living arrangements, such as living in a second floor flat with lower flood risk. Other reasons for feeling safe were trust in authorities to provide support and a low frequency of flooding in the region. More unique to the experiences of older adults, for some of the participants, health concerns, such as overcoming illness and reduction of mobility following falls, were of greater concern than flood, as seen in Table 1.

4.2.2. High risk perceptions

High risk perceptions were less prevalent with just two participants expressing personal concern about flooding. The first resides in very close proximity to the sea. The close proximity meant that, for their household, they had to accept the risk of flooding or they would have to leave their home. This acceptance of risk had led them to prepare and mitigate as far as they could within limitations of cost, likelihood and political systems. The second participant had previously experienced flood in 1990. They had not been concerned prior to that event, but concerns have risen since. However, concern has not transferred into preparedness, as they also displayed avoidance tactics in their responses; they did not wish to receive flood warnings and said they would respond with panic and alarm. For some older adults, previous experience may increase concern about the hazard and event, but not translate into action due to a lack of awareness of how to adequately respond within their limitations.

In contrast to the infrequency of floods described in the previous section, the inevitability of flood was raised as an issue by some participants (Table 2). They felt that nature and water specifically were uncontrollable and if there was a flood it would occur with or without preventative measures. They were unlikely to prepare as they felt powerless against its effects.

Thus, although participants were concerned about flooding, their perceptions had a negative impact on their likelihood to adopt preparedness measures. In these cases, there is a need to address the concerns of flooding and demonstrate the benefits of protective measures, including evacuating at appropriate times.

4.2.3. Awareness of local vulnerability

Participants demonstrated good understanding of factors contributing to local flood susceptibility and disaster risk, including geographic features such as flat topography, high numbers of vulnerable people and bungalows, and comparatively low number of people able to help prior to or during a flood. The individuals identified by participants as most vulnerable were fellow retirees, older residents with disabilities, people with disabilities generally, and those living close to the sea.

Many participants showed greater concern for their wider community than for themselves (Table 3). This is indicative of unrealistic optimism bias; as they felt that others in their community were at higher risk of flooding [108,109], despite sharing many risk factors, such as age, reduced mobility and location. Some older adults may overestimate their own abilities while underestimating others’ capacities, demonstrating the strength that perceptions of age can hold for those who are older, as well as causing them to devalue the contribution they can make towards flood preparedness and DRR.

4.2.4. Previous experience

For many participants, previous experience, direct or indirect, of flooding was used as a frame to view future outcomes of floods, and thus is a significant factor informing flood and flood warning responses. When asked how floods would affect them, those that had experienced past flooding expected that a future flood would have the same effects. One participant had remained away from their home for six weeks during the flood recovery and expected they would have to leave for the same length of time if flooding occurred again. For others, they felt that their previous experience gave them a better understanding of the conditions that led to the coast flooding.

Those without direct experience of flooding relied on others’

| Table 2 | Participants describing their perceptions of flood inevitability. |
|---------|---------------------------------------------------------------|
| Jennifer (82)          | “Flooding is something that is, is quite devastating because there is nothing that you can stop it. Because you can’t say ‘oh well be careful don’t start a fire or whatever’. Flooding when it comes is something that you can’t do anything about isn’t it?” |
| Mary (69)               | “if a flood is going to come a flood is going to come.” |
| Jane (70)               | “It’s very sad but you can’t do nothing about the weather can we.” |
| Martha (67)             | “I would sacrifice, I wouldn’t attempt to – I know the power of water there is [no] trying to stop it. You can slow it down but if it wants to come in, it will come in.” |
| Frank (65)              | “it would probably affect me less actually. Affect us less because we accept, you know, that we are close to the sea, and if we can’t accept that, err we can’t live there.” |
experiences to estimate how they would respond. Some participants expressed sympathy for people experiencing flooding in other areas of the UK during the interview period (summertime 2018), demonstrating expressed sympathy for people experiencing flooding in other areas of during flood preparation and response.

### 4.3. Coping capacities among the retired population

The main capacity participants highlighted was an ability to support each other through social and practical means, as illustrated in Table 4. This mutual-aid was considered possible regardless of any health conditions, for example, that may limit physical mobility. Others were or had been directly responsible for the care of others, either in or outside their household, demonstrating willingness to work around limitations and reduced capacities to provide care and remain active in social networks, which may have been stronger for those participants that were members of the church. Utilising these capacities among already established networks could provide opportunities to foster flood preparedness more widely in communities.

Retired people commonly have more free time compared to other age groups, which can be used for both formal and informal volunteering activities. In the UK, older adults between the ages of 65 and 75 form the highest proportion of volunteers [110]. Younger people may have other priorities or time-commitments, constraining the amount of time they can devote to such efforts [110]. Volunteering can provide a means for retirees to structure their time and continue to engage with social activities, in turn reducing isolation [110,111]. More than half of the study participants engaged in some form of volunteering, including as flood wardens. Regardless of the activity, it has been noted that volunteering has a positive impact on the well-being of older adults (Marrow-Howell et al. 2003). Engaging the retired population’s capacity for volunteering may present opportunities to foster community DRR in addition to individual benefits.

### 4.4. Risk communication

The experiences of older adults provide useful insights for improved risk communication. The following section presents discussion on the participants’ responses to flooding and preferences for risk communication, and implications for DRR strategies.

### 4.4.1. Flood response/evacuation

The participants expressed desire to leave their home to minimise risk during floods, but overall participant responses reflected a lack of awareness of practical steps that could be taken before evacuating to minimise losses. Participants described different modes of and triggers for evacuation (Table 5). Many were unaware of evacuation destinations. Risk communication needs to address these differing perceptions to ensure resources can be flexibly directed where necessary to assist those who cannot leave without support. Addressing the appropriate means, timing and location of evacuation within a personal flood

### Table 3

Participants describing concern for others in their community.

| Participant | Concern for others |
|-------------|-------------------|
| Martha (67) | “A lot of people in that part of the world are disabled as well because it’s very flat area and I do think they feel frightened. I know from talking to people who live over there when is a big and really bad storm. They don’t go to bed.” |
| Frank (65)  | “The concerns are that there are a lot of people in our neighbourhood that are elderly, but are fit also. So the priority is to get them out, or make sure that someone knows where they are.” |
| Ruth (75)   | “I would concern myself with people around me because some of them are … they have disabilities of different types. So I would want to know that they were safe. Whereas I’m lucky enough to be able to get around.” |
| Catherine (76) | “I’m worried that there are a lot of elderly people around who aren’t as fit as am. I know I could be considered elderly but I’m fairly fit. Um … I have a neighbour who uses a wheelchair … and you wonder how they would cope and if they would panic and how they would get to safety sometimes if they were (Pause). As there are quite a few around. So which one would you go to first?” |
| Jennifer (82) | “There are people of our age that are more vulnerable than we are because they haven’t got vehicles or they are on their own and would just that they were aware of the situation.” |
| Rhiannon (84) | “I would be concerned for people’s immediate welfare.” |
| Alice (88)  | “…because I care about the community (Pause). And I really, I am] really distressed for people who have suffered in this way because, because that’s who I am.” |

### Table 4

Participants describing how they try to support others in their community during flood preparation and response.

| Supporting others | Description |
|-------------------|-------------|
| Andrew (83)       | “It’s more or less what we would do for people in general without floods. We do help when we can. So more so if we had warnings …” |
| Alice (88)        | “Yes, communication and I do try and do that and I try and … ring people or write to them and things like that because that is my practice.” |
| Jane (70)         | “I’ve got to say there are between 8 and 10 [flood] wardens and we’re all given a plan of who we look after. But we cover for other people, like I’m only supposed to do 5 so I said I don’t want to do really but they said ‘come on’. So I also help along the coast road. Ah, both sides because I’ve got friends there. So I pass it on to them.” |
| Catherine (76)    | “… probably check the neighbours were okay first thing.” |
| Ruth (75)         | “… the neighbours know if they need a lift or, they want something they can shout me.” |
| Martha (67)       | “I want to be a member of the Church who are on their own. We help each other out, yeah … well we just provide support and if they need practical help we would provide practical help.” |

### Table 5

Participants describing when they would decide to evacuate their homes.

| Evacuation triggers | Description |
|---------------------|-------------|
| Alison (87)         | “Well if it was water coming in and it was inches deep. I wouldn’t stay in.” |
| Catherine (76)      | “If I thought there was any danger getting … above waist level that sort of thing … I’d probably stick out till then.” |
| Mary (69)           | “If I was told to go I’d have to go.” |
| Martha (67)         | “Inevitable danger. I wouldn’t be bothered if it was on the road or something like that. But if it was getting within a few feet of the property. If I was getting to the stage where it was looking like I couldn’t get out in the car. Then I would be worried and I would go. As long as I can get the car up the road I would be quite happy.” |
| Alice (88)          | “Well if the water was coming through the door and it was rising, yes I would.” |
| Frank (65)          | “Yeah, it depends on what they say, isn’t it. Again, I think I would still leave it to my own judgement to [assess] what’s happening.” |
| Ruth (75)           | “… I don’t think, unless there is an utter emergency that we should be calling on the emergency services to tell us, would you mind getting ready to leave your home.” |
| Rhiannon (84)       | “Evacuate as quickly as you can and wait until someone tells you where to go and what to do.” |
response plan, which are encouraged by emergency agencies, that is embedded in the local context, would reduce uncertainty.

4.4.2. Preparedness and preparedness information

Self-reported preparedness levels were low amongst participants. Lack of preparedness can be linked to participants’ low risk perception. However, other barriers such as health constraints also influence preparedness.

Various sources and methods are utilised to communicate flood preparedness information for flooding in the UK. These include traditional media, online messaging, and flood packs delivered to homes [112]. The latter is the way that eight participants received information. This form of dissemination appeared ineffective to participants as it was often discarded as junk mail, as described by Rhiannon (84), “Oh trustworthy, erm, well I suspect the pamphlet that you get from your local authority. And if you bother to read them because they come in the junk mail, don’t they?” Although those that did recall reading the material felt it was straightforward and simple, they could not remember if they had implemented any of the advice due to it being received many years ago (Table 6).

For participants that had not received preparedness information, there was a general feeling that information was distributed unevenly, preferring those who had previously experienced a flood. This was highlighted by Martha (67), “I think we should all be told, yeah. Even if we’re not, our own property is affected, we’ve all got family and friends who could be and that. I think they should really be giving more information to everybody in the community not just certain streets, which is how it appears to be.” Some participants lived outside the areas covered by flood warden programmes, and thus were concerned they were missing out on important information. However, the lack of actions by those who had received information suggests availability is not the only barrier to engagement (Table 7). As previously highlighted, risk perceptions and capacities to act upon information are important.

4.4.3. Age-centred flood risk communication

Participants wanted flood warnings to be issued in sufficient time and to include the predicted time of the flood. This would allow for a differentiated level of response, from simply evacuating to collecting and protecting treasured items (Table 8).

For those that experienced flooding in 2013, a common complaint was that no warning was given because flooding was expected at another area, and therefore people did not have adequate time to respond [98]. The significance of time reflects the additional time the at-risk population requires in preparing for floods. As reduced mobility and physical incapacity lead to slower response times, or inability to complete actions themselves, retirees may require assistance in evacuation preparation.

Echoing others in the literature, participants of this study felt that flood warnings should include the magnitude and location(s) of events (e.g. Ref. [113], although this is currently challenging due to the complex processes that lead to flooding. The use of a colour coding and scale system was also discussed with participants. Within the UK there are three levels of flood warnings [114]. Most participants were unaware of the scaling system but felt that any system would be useful as it would provide context for the warning given. Some would change their response based on the level of warning given, such as Mary (69), “If it was the highest warning I’d be round to the house like a shot to check, to make sure everything was alright.” Attaching a known understandable scale to warnings, and ensuring that individuals are aware of the meaning of the scale, could aid in instigating an appropriate response from any aged at-risk population. Warnings and messages can be co-produced with at-risk populations to ensure messages are relevant [44,88].

Most organisations that engage in risk communication use multi-channel and -directional means of communicating risk, such as traditional and social media, automated telephone calls and SMS to mobile phones [28,32]. The Met Office and NRW use similar methods to ensure warnings are disseminated widely [112]. The use of multiple channels was seen as beneficial by most participants as it reinforced the importance of the message and increased the likelihood of warnings being received (Table 9). The added benefit of an SMS for some was that if they weren’t home when the warning was issued they could still respond appropriately.

Some participants felt that the severity of the expected flood should also change the method of warning, such as if a large localised flood was due loud hailers could be used to inform residents. Jennifer (82) said, “well if there was a big local [flood], I think there would be loud hailers going round the streets,” and Ruth (75) “… I would expect them, if it was really imminent to come round and use a megaphone to let people know.” Additionally, some felt residents should be informed by door knocking. These methods of risk communication are more traditional in nature, supporting the need for continued use of multiple and traditional methods [31] to ensure that everyone within at-risk communities receives warnings.

Table 6 Participants’ recall of preparedness information.

| Preparedness information | Ruth (74) | Frank (65) | Rhiannon (84) | Alison (87) | Jane (70) |
|--------------------------|-----------|------------|---------------|-------------|-----------|
| “Yes, very useful. You learnt quite a lot.” | “It laid out formally what you probably should be doing anyway, you know. And from memory, it’s been a few years behind us.” | “I’m sure it would be, I’m sure it would be. It’s pretty straightforward and very basic.” | “Yes, I read it at the time but it’s such a long time since, I just don’t remember.” | “Some of it is a bit long winded, you know, it does tell you how to be prepared and what to do.” |

Table 7 Participants’ lack of action after receiving preparedness information.

| Lack of action | Alison (87) | Rhiannon (84) |
|----------------|-------------|---------------|
| “It’s in the draw. I never look at it.” | “Well I read it and thought ‘oh yes that sounds sensible’, you know. But I don’t know what I’ve done with it.” |

Table 8 Influence of time on responses.

| Time | Jennifer (82) | Jane (70) | Rhiannon (84) | Alice (88) | Mary (69) |
|------|---------------|-----------|---------------|------------|-----------|
| “… have we got time to go to the shops? Do we need anything; extra milk or stuff.” | “… not to be told at last minute to get out.” | “What time to expect it [flood]. How long have we got to get out. And if they say it’s coming in 6 h you’ve got some lee to get all those precious things together. But if they say it will be there in half an hour just go, just go.” | “… I would like, if that was to happen I would like to know as much in advance if possible. But, you know, I could put certain things together I suppose. And hopefully be rescued if that were the case.” | “The time to expect the water to arrive.” |

Table 9 Participants’ desire for multiple communication channels.

| Multiple channels | Frank (65) | Jane (70) | Ruth (75) |
|-------------------|-----------|-----------|-----------|
| “… I think the only way to is through text and the way it works at the moment is better to receive something any way you can rather than nothing. So, house phone, messages, text and a mobile phone message and that’s probably catch you on one or the other.” | “… landline and the mobile is very handy ‘cos if you’re out somewhere and got one you can think I better go home.” | “I’m quite happy really. It comes through on the phone so, you’ve got the mobile and the house phone and our house phone always has the answer phone on. So one way or another we will get that warning …” |
Many participants’ preferred communication methods were interpersonal in nature, such as a telephone call or knock on the door. The latter of these could also be beneficial for communicating preparedness information as it would compensate for issues in comprehension and sensory limitations, and in personalising the content. Directly conversing with retired individuals could prove most effective to ensure information is received and understood. It would also aid in reducing anxiety and uncertainty as the information could be questioned directly, allowing for two-way dialogue, which should underpin all risk communication [113]. However, such approaches are time and resource intensive and may prove challenging to implement, particularly at scale.

Effectiveness of risk communication is closely associated with trustworthiness of the source [115,116]. Participants felt that emergency services and local authorities were trustworthy sources of flood warnings and preparedness information. Participants would turn to these sources for information seeking during a flood emergency. However, there was some confusion and uncertainty about trustworthy sources. Many mentioned the Police or Coast Guard as emergency services providing flood warnings but this is not the responsibility of either. Risk communication should address organisations’ roles to ensure that the public are aware of who will be available and responsible during crises. Interviews also suggested that older adults are more trusting of locally-focused information and may find messages that are related to their specific area more actionable.

In light of the above, an age-centred flood risk communication strategy should be underpinned by actionable messages that are primarily delivered by interpersonal means. The actionable messages should be personalised to older adults with various needs and embedded in local contexts [117]. Messages applicable to bungalow residents or with alternatives to lifting items would help some older adults to better-prepare. Additionally, messages could use the retired population’s perceptions of community risk to help them relate risks back to themselves, increasing relatability and potentially prompting risk reduction behaviours.

4.5. Recommendations and future research directions

The findings of this study suggest a number of potential improvements for risk communication and DRR concerning retired populations, especially in the context of coastal flooding, and societies broadly. In this section we first provide recommendations for DRR policy and practice, before suggesting areas for further research.

4.5.1. Recommendations for DRR

First, age-centred, differentiated risk communication strategies should be adopted whenever possible to ensure more effective and tailored, personally-relevant and actionable messages are delivered. Actionable messages communicated need to be specifically designed and for the target population, which for older adults may mean accommodating for potential mobility limitations or dwelling type (i.e. one storey bungalow), for example.

Second, older adults should be consulted. Personal and face-to-face engagement was a preferred communication method among the study population, and this approach, while potentially time and resource intensive, can reduce anxieties, uncertainty, and ensure people are aware of risk, hazard response procedures, and available support. A consultative approach will also facilitate identification of capacities among older adult populations for contributing to community DRR.

Third, intersectional approaches should be taken regarding vulnerable populations, including older adults. Age is not the only determinant of capacities and vulnerabilities. Intersections between age and health conditions were important among participants of this study, among others, adding to the complexity and diversity of experiences of vulnerability. The variety of conditions among retired populations needs further investigation, not just the extremes of the young, very old, or very ill [68]. Generalisations about the frail or disabled elderly applied to all other adults should be avoided.

Fourth, risk communicators should promote awareness and preparedness activities at times when concern is at its greatest to capitalise on already-heightened interest. This could be during winter or when floods occurring elsewhere are being covered by the media, for example. Older adults that are socially connected often have groups that are ready made for such interventions, for example local groups connected to Churches, community or age centres often hold weekly informative talks which could be communicators to share practical preparedness advice [60].

Lastly, the responsibilities of emergency services, authorities and other organisations for hazards, emergency response and DRR must be clearly articulated to at-risk communities. This has previously been recommended by NRW [98] and O’Sullivan et al. [57] and is an area requiring further attention. Older adults in this study expressed mixed understandings of who are responsible for DRR and emergency activities, potentially impacting their ability to receive and follow accurate information and make informed DRR decisions.

4.5.2. Future research directions

The field of risk communication is continually evolving. Following the findings of this study, future research could explore similar issues in differing contexts, focusing on a different region, or different hazards, such as alluvial flooding or fires, to observe whether similar conclusions can be drawn. Additionally, as the retired population was found to be heterogeneous, more focused studies on subsets of the group, such as veterans, carers or those that live in sheltered accommodation, could further uncover how experiences of vulnerability and risk communication vary. Conducting oral histories with older adults could provide further valuable and rich knowledge [118]. More time extensive methods would allow for further trust to be developed, enabling discussion of more sensitive topics, such as effects of flooding on financial assets or family relationships.

There is a need to investigate further the effects of the digital divide within the retired population and its implications for risk communication and inclusion, as we continue to live in an increasingly digital world [119]. While older adults are the fastest growing user group on social media, for instance, which are technologies likely to play an increasingly important role in future risk communication strategies [120,121], variation in online technology access, literacy and usage patterns among the retired population need further elucidation. Following the increased use of communication technology amongst older adults during the COVID-19 pandemic, it may be interesting to explore whether there is now a generation of older adults who know how to use technology or whether uneven use of digital technology persists. We hypothesise there might be an increase in comfort for using communication technologies among older adults but divides between those more and less connected will remain. Similarly, exploring the long term effect of the pandemic on community cohesion and its benefits for communication could be an interesting area of future research. As other technologies (e.g. geographic information systems for spatial analysis) continue to change, these may also become increasingly relevant for assessing and mapping older adults’ vulnerabilities and communication needs [70].

Finally, the sampling method drawing on the author’s social network resulted in the majority of the participants being members of a church, and thus studies exploring a more diverse retired population should be undertaken. In this study, the church group sample may have presented a bias of religious or spiritual individuals into the study, seen sometimes as a source of disaster resilience [122], although faith was only mentioned by two of the participants as a source of support. Regardless, there is the potential omission of social connectedness as an issue in the retired population as a church community can provide this. Other older adults may not have similar communities or support structures. The relationship between social connectedness, vulnerability, and DRR needs to be considered outside of a group of predominately religious older adults. Despite their church attendance, the capacities of the
participants were similar, suggesting they were generational rather than influenced by church membership; those participants unaffiliated with the church were some of the most active people in the community, including by acting as flood wardens. We hypothesise that research into older adults who experience mobility issues or are less socially connected, such as those who are not members of churches, will highlight different issues to issues to address for more effective community DRR.

5. Conclusion

Conclusions need to be considered carefully within the parameters of this study, being based on interviews with 12 participants, many of whom were church members, in a coastal flooding context in the UK. Some of the findings presented above may not relate to a wider at-risk retired population – either with less social connections or in a context dissimilar to Rhyl. However, the insights provided by the participants are useful in providing more nuanced discussions of older adults’ disaster preparation experiences and risk communication needs. Through this analysis of older adults and flood risk in Rhyl, we have added to the to-date limited data and scholarship on disaster risk perceptions, coping capacities, and risk communication needs for older adults.

Our findings demonstrate that vulnerabilities, capacities, and risk perceptions of older adults in relation to disasters are diverse and dynamic. The coping capacities of participants varied, with some able to socially support others, and others exhibiting limited means to prepare themselves for floods. Some were highly concerned and aware of the risk they faced, while others showed no concern and/or limited awareness. There was more in common in expectations and requirements of risk communication, such as preferring the information and warnings to be communicated by interpersonal methods.

A ‘one-size-fits-all’ approach to risk communication is ineffective for heterogeneous populations [123]. This includes the retired population, who may be demographically similar, but have diverse vulnerabilities and capacities. Collectively grouping individuals as vulnerable without also investigating their divergent experiences and capacities may lead to overlooking their contributions to DRR [22]. Risk communication should be sensitive to, and address, differential capacities through actionable messages that allow individuals to better prepare within their individual limitations [117]. This requires consultation with those who have differing abilities to discover the challenges they face in implementing preparedness actions.

Methodologically, the findings of this study support ensuring at-risk populations and groups are consulted to expound vulnerabilities, capacities and risk communication needs. Future research will benefit from a larger, diverse participant sample, and consultation with medical professionals, social workers or home-carers that are aware of the conditions that affect at-risk subgroups or minorities. This is especially important for those who lack the agency to speak for themselves, such as those with advanced dementia or speech-affecting disabilities. A combination of approaches will produce a more nuanced picture of the vulnerabilities and capacities of a particularly at-risk population of older adults. We must ensure that future DRR research, policies and practices focus on all experiences of at-risk populations, not only the dominant narratives or extremes of groups, to capture differences within groups’ abilities to support more effective community DRR.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgements

We thank the editor, Dr Sébastien Pennellen Boret, three anonymous reviewers and the study participants.

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