CRUE
FLOODING ERA-NET

Understanding Uncertainty and Risk in Communicating about floods - URflood

Experiences of flood warning systems and preparedness for floods: survey findings.

Report for Scotland

THE MACAULAY LAND USE RESEARCH INSTITUTE

This report contains a description of the data collected and analysed from four locations across Scotland. This research has been locally-tailored to Scotland, but the issues reported on here are the same as those researched in other European countries for the URFlood CRUE-ERANET project. The results are relevant both to Scotland, and beyond.

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1. Case study site(s) description and methods

1.1. Case study description

Four case study areas were chosen in Scotland: Huntly, Glasgow, Moffat and Newburgh.

1. Huntly

The town of Huntly is situated approximately 65 kilometres north-west of Aberdeen. Several watercourses converge in or near to the town, compounding the potential risk of flooding. The River Deveron flows west to east, effectively forming the northern boundary of the town. The Ittingstone Burn joins the Deveron the west of the town, and the River Bogie joins the Deveron about 1km downstream of Huntly Castle. Between the town centre and the Deveron there is a flat low-lying area called "The Meadows", through which the Meadow Burn runs approximately parallel to the Deveron. In recent decades, this floodplain area has been developed for both housing and leisure purposes (Meadows Housing development, care home and Caravan Park). Huntly has experienced several significant flood events within living memory, and damage has been caused to many residential and commercial properties, with The Meadows area being particularly severely affected. The Meadows was flooded in September 1995, April 2000, October and November 2002, and most recently September and November 2009. After the 1995 event, a flood protection embankment was built on the south bank of the Deveron which affords protection against direct inundation from the Deveron; however the flooding mechanism in the area is complex, with overland flow from the Deveron upstream and the Ittingstone Burn also posing a significant risk to the Meadows.

The area was selected as it is prone to fluvial flooding and has a record of recent flooding events. Within one community there are areas of the town both at risk and been flooded and areas at risk that have not been flooded. "The Meadows" area was targeted as an area that was known to have experienced flooding, but an equal number of questionnaires were also distributed in other parts of the town.

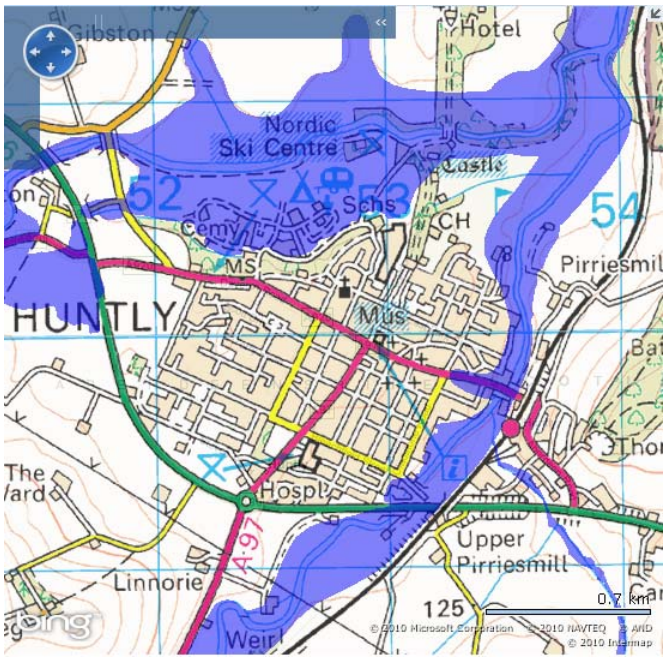

Figure 1 Flood vulnerable area to the north of Huntly (last flooded in 2009) and the area to the east of the town adjacent to the railway line as vulnerable to flooding but no flooding history.

2. Glasgow / White Cart

For nearly a century the White Cart Water has been the source of serious flooding on homes and other properties on the south side of Glasgow. This shallow, fast flowing river is prone to flash flooding and only 12 hours of rain can raise water levels by 6 metres.

Figure 2 The study area and the risk of fluvial flooding (as developed by SEPA) in the absence of any flood alleviation works.

Since the late 19th century this area has been developed as part of Glasgow's fast growing suburbs, changing drainage patterns as well as houses in risk zones. As a result, more than 20 significant floods have taken place since 1908 and in 1984 over 500 homes were inundated. Existing flood defences along the White Cart Water corridor are piecemeal and isolated. Major investment may be required to protect properties not only from current flood risks but also from more frequent inundations expected as a result of global climate change.

The threat of repeated flooding also presents major insurance difficulties for householders, businesses and the local economy. At the end of 2002 the insurance industry withdrew its guarantee of affordable flood insurance in high-risk areas. The industry confirmed it would have to consider charging higher insurance premiums or even refusing flood cover altogether. This could result in property values being greatly reduced

Hydro-BrakeFlow Control devices have been installed as part of the White Cart Water Flood Prevention scheme. During peak storms, the Hydro-Brake® Flow Controls will hold back the White Cart Water and its tributaries the Earn Water and Kittoch Water causing the storage areas to fill. Water will be released downstream at a controlled rate so that it does not overspill new flood defences being constructed in the City.

Upstream, a total of 90,000 sq metres of rich and diverse wetland habitats will be created. Downstream, the flow of water will be reduced by up to 45% during peak storms, achieving flood protection to a 1 in 200 year standard or a 0.5% probability of a flood occurring in any one year, when combined with the new flood defences.

The area was selected as a study site because of its past history of fluvial flooding and more recently the completion of extensive flood alleviation and flood defence works and the existence of residual risk.

3. Moffat

Moffat is a small rural town in SW Scotland approximately 60 km south of Glasgow and 20km North of Dumfries. The town has a history of both fluvial and pluvial flooding. The source of flooding is from the main watercourses of River Annan, Birnock Water and Crosslaw Burn. As these flow through urbanised areas there are a number of culverts, under capacity and development pressures. Flooding of residential properties are the major concern. The study was selected as the Scottish Flood forum offered to undertake the work as part of an ongoing programme of engagement with the community affected by the recent flooding.

1. Newburgh

Newburgh is a small rural community in NE Scotland approximately 20km north of Aberdeen. The village is at the mouth of the Ythan River and estuary. It has been identified by SEPA as vulnerable to both coastal and fluvial flooding. The main risk is to residential properties. There is no known history of flooding. Although recent research by Dundee University suggests that the combined effect of climate change and rising sea levels in this part of the Scottish coastline increase the risk of flooding in the future.

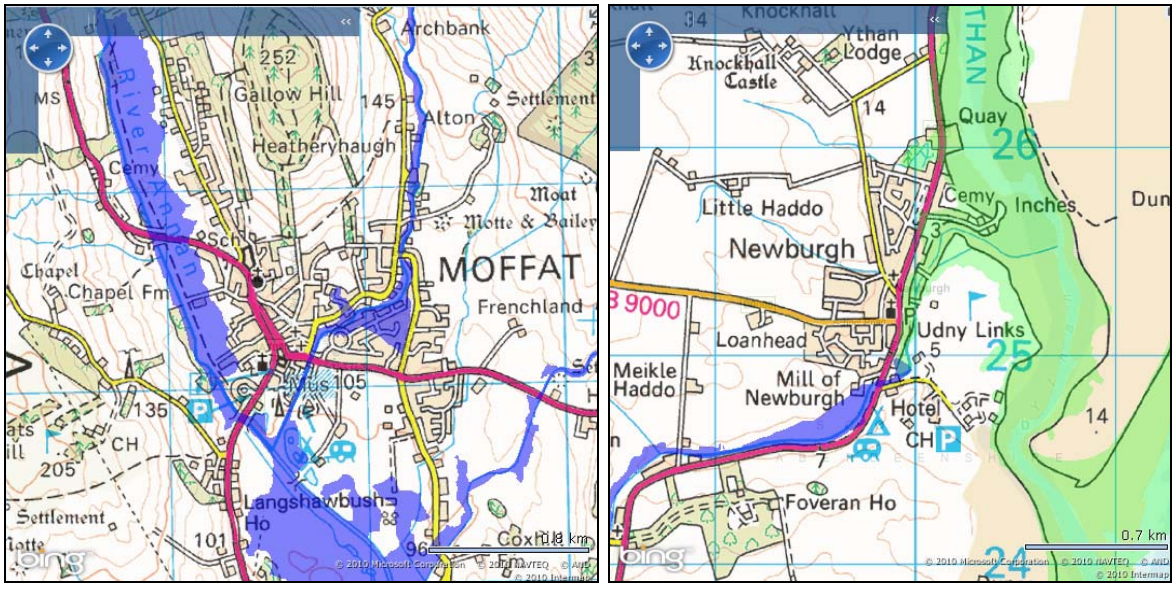

Figure 3 The Moffat study area and the risk of fluvial flooding (developed by SEPA).
Figure 4 The indicative combined fluvial and coastal and fluvial flood risk for Newburgh as developed by SEPA.

1.2. Methods

The starting point for the development of the questionnaire was the overall objective of URFlood and the common issues identified as of interest in all countries (see URFlood interim report). Any questionnaire must be accessible, intelligible and interesting. Without all these attributes, individuals may not decide to fill in the questionnaire, and or may give complete and meaningful responses. Therefore, the topics, length, questions and answer formats and question ordering were all carefully considered and subject to various iterations during pretesting.

Within each sampling area (see section 1.1) houses were selected randomly, by knocking on every door. Although all sample areas were selected as containing some houses that were at risk of flooding, in all areas questionnaires were also distributed to those that had not been flooded. Where no-one was at home to receive the questionnaire, and explanation sheet and questionnaire was posted through their door. In Huntly, some completed questionnaires were collected, but most questionnaires were posted back to the Macaulay in a pre-paid envelope. The response rate from questionnaires was approximately 35%. Data were stored in compliance with EU and data protection guidelines.

2. Results

2.1. Description of the sample

The final number of completed questionnaires returned was 144. Of these, the largest group came from the Huntly area (Figure 5).

Figure 5 The location of respondents to the survey (n=144). Rothiemay is a hamlet near to Huntly and reported as part of results from Huntly.

People who chose to respond the questionnaire came from all walks of life. For example, respondents' had a mix of educational experiences (Table 1).

Table 1 Highest level of education held by respondents (n=123).

Educational experience	Number of respondents	Percentage of respondents
Secondary school (until 16)	38	31%
Sixth form (until 18)	12	10%
HND or similar	22	18%
Bachelors-level degree	23	19%
Masters or postgraduate degree	28	23%

Similarly, respondents' employment status was varied.

Table 2 Employment status of respondents (n=129)

Educational experience	Number of respondents	Percentage of respondents
Employed full-time	43	33%
Employed part-time	15	12%
Self-employed	10	8%
Unemployed	3	2%
Retired	45	35%
Homemaker	7	5%
Other	6	5%

Responses came from a variety of age-groups (Figure 6) but younger people may be under-represented. There was a fairly even gender balance (54% men and 46% women).

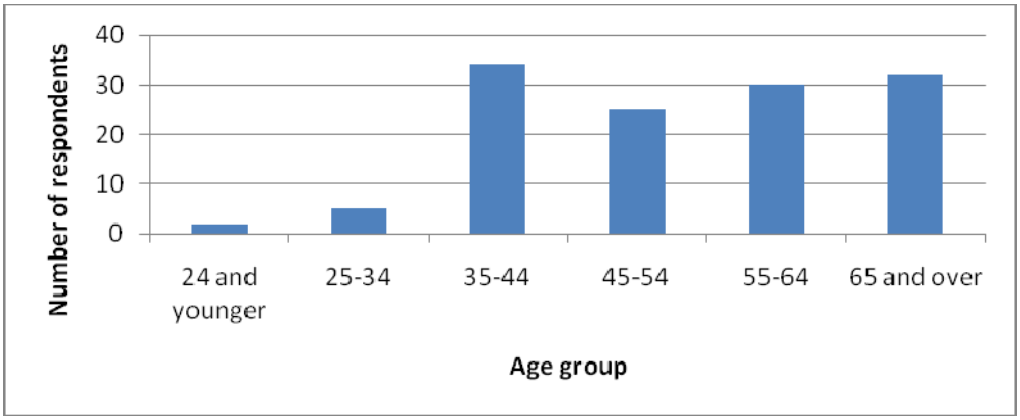

Figure 6 The age distribution of respondents (n=128).

There was an interesting distribution in the length of time that respondents had lived in their present location (Table 3). If anything, this can be characterised as bimodal, with one large group being people who lived under 5 years in the village/area, and the other group being people who had lived in one place for more than 30 years. The typical length of time spent one place varied according to location. The mean length of time lived in each location was significantly different (1-way Anova, $F_{3,126}=5.547$, $p=0.001$).

Table 3 The length of time for which respondents had lived in their current location (n=132).

Amount of time lived in location	Count of respondents	Percentage of respondents
Less than 5 years	37	28%
6-10 years	12	9%
11-15 years	22	17%
16-20 years	8	6%
21-25 years	6	5%
26-30 years	12	9%
More than 30 years	35	27%

There was a higher turnover rate in Glasgow and Moffat (Figure 7). Notably, there was nobody who had lived longer than 20 years in Moffat. This is of interest to flood communications, because not only are newcomers to an area less likely to recall formal communications about flooding, but they are also less likely to have informal local knowledge about past flood events. Only 5 of the 144 respondents were not first-language English speakers.

Most respondents were owner-occupiers of their home, with only 16% renting or with a housing association. Those who were not owners were likely to have lived in the area much less time than others (mean for owners was 23 years, mean for non-owners was 11 years, $t=3.7$, $df=48$, $p=0.001$).

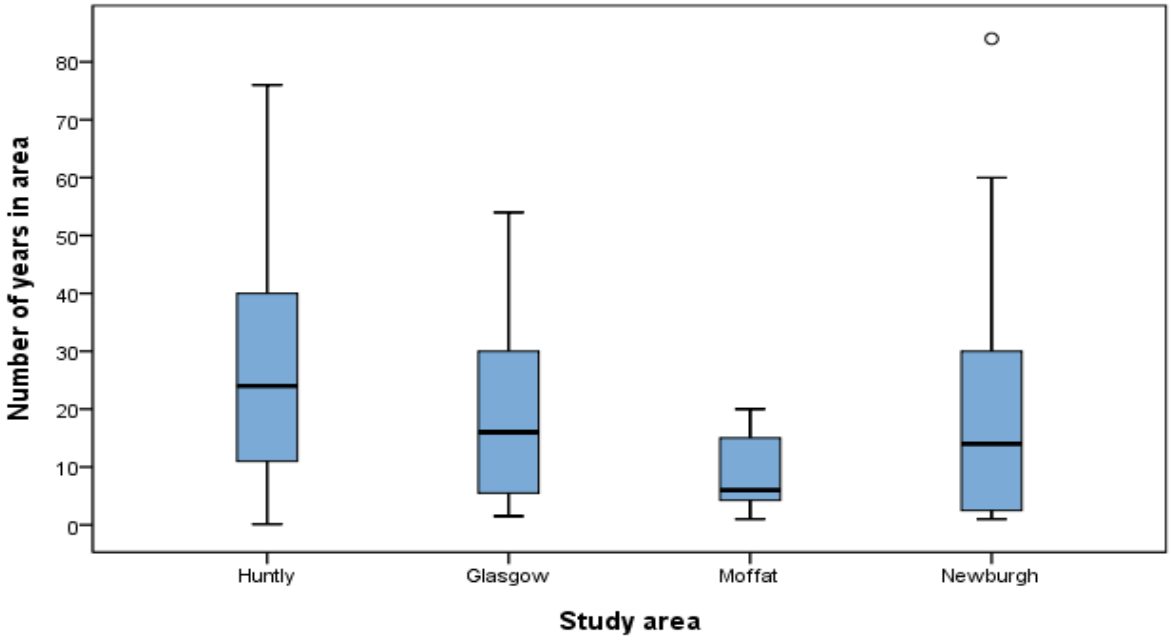

Figure 7 The amount of time respondents had lived in their area, according to location (n=132). The box plots represent the distribution of responses, with the centre line of each box representing the median value in each location, the box encompasses the first and third quartiles, whilst the top and bottom ends on the bar represent the maximum and minimum values.

2.2. Respondents' flood experiences and awareness

The majority of respondents had not been personally affected by flooding at their house (62%): that so many non-flooded took the time to return the questionnaire is perhaps indicative of the potential level of interest in this subject.

Fifteen respondents described their homes as having had flood waters reach their property, but without damage, whilst thirty-four said their homes had been damaged by floods. Unsurprisingly, the vast majority of those who had been flooded perceived their house to be in a flood risk area. Many who had not been personally affected by flooding also perceived themselves to be living in an area of flood-risk (Table 4).

Table 4 Answers to the question "Do you think your home is in a flood risk area?" n=134

Flood risk perceived	Damage	No damage	Not affected	Total
Yes	26	8	14	48
Probably	3	3	19	25
No	2	1	46	50
Don't know	2	2	7	11

When asked about the cause of past flooding, several different causes were selected, but heavy rainfall most often selected (n=37) followed by flooding from rivers (n=32) drainage failure (n=20) and failure of flood defences (n=10).

The perceived cause can vary with location, with 9 people in Huntly selecting failure of flood defences as one of the causes of flooding, but only 1 person in Moffat and none in Glasgow or Newburgh (Figure 8). 'Other' was offered as an alternative cause with 9 people from Huntly and 1 in Newburgh selecting this option. When 'other' was selected several people in Huntly blamed 'lack of river maintenance' and 'construction works on

the river', although 'climate change' was also mentioned. Understandings of flooding problems can be locally-specific.

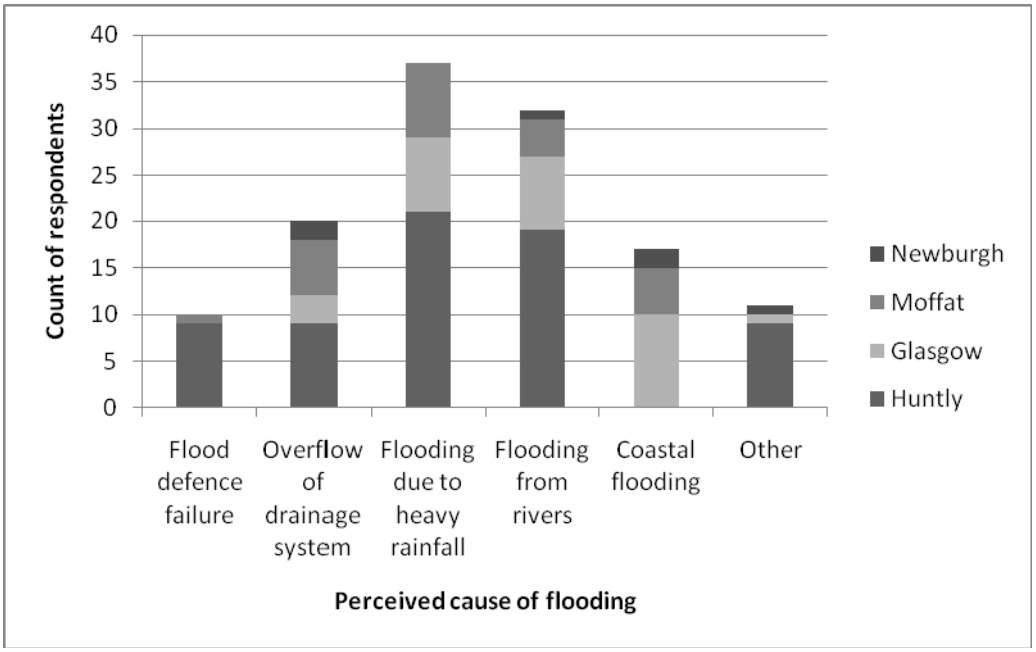

Figure 8 The perceived cause of flooding selected by respondents whose homes had been affected or damaged by flooding (n=49).

2.3. Before a flood: Preparedness

An essential element of preparedness is being familiar with flood warning systems that will be used.

The questionnaire illustrated and explained the SEPA four-level flood warning system, before asking if respondents were familiar with the scheme.

Flood watch	Flood Watch	Flooding possible. Be aware! Be prepared! Watch out!
Flood Warning	Flood Warning	Flooding expected, affecting homes, businesses and main roads. Act now!
Severe Flood Warning	Severe Flood Warning	Severe flooding expected, with imminent danger to life and property. Act now!
All Clear	All Clear	Water levels have peaked and receded

Amongst respondents that had been affected by flooding, 32% were familiar with this system. For those that had not been personally affected, only 19% were familiar. Regardless of experience the majority of both groups were unaware of the system and its meanings. More positively, for those that had heard of the system, each stage was typically judged to be have 'okay' reliability (as selected from a choice of 'poor', 'okay' or 'good'.

SEPA's website has a section on flooding, and a flood risk map, on its website. Awareness of these information sources was slightly better: 40% of respondents were familiar with the website, and 24% had heard of the flood risk map. Amongst those who had actually visited these sites, this information was generally perceived as adequate (Figure 9).

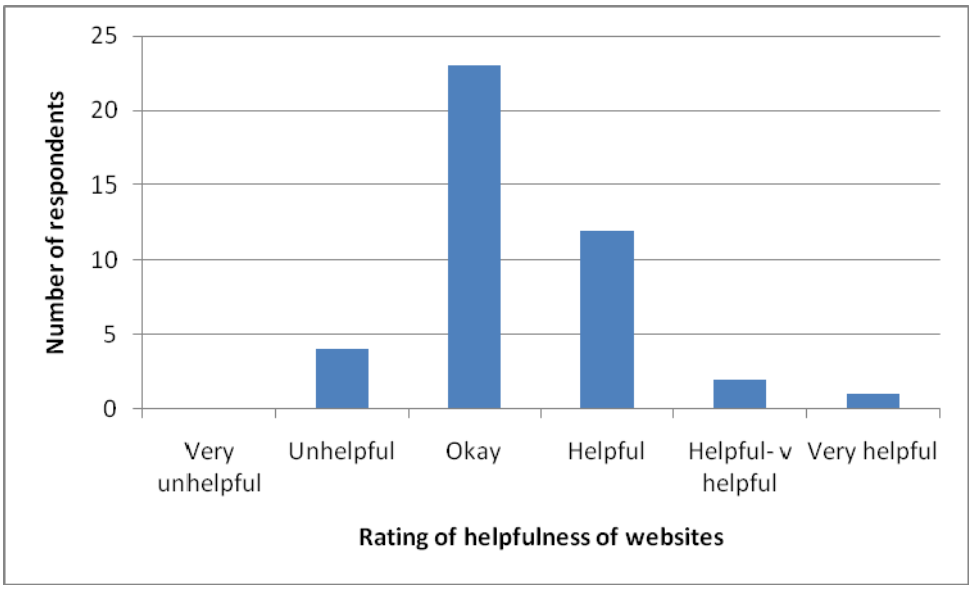

Figure 9 How helpful SEPA's website on flooding (http://www.sepa.org.uk/flooding.aspx) **and flood risk map** (http://www.sepa.org.uk/flooding/flood_map.aspx**) were deemed to be, as selected from a 5-point scale of 'very unhelpful' to 'very helpful.' n=42 Category 'helpful-very helpful' added to represent where respondent ticked both the helpful categories.**

The final source asked about was SEPA's Floodline Direct, a system that will automatically send warnings to registered landlines and mobile phones. Only 14% of respondents were familiar with this, but this is not suprising as it is a new system. Rather more - 77% - expressed interest in registering Floodline Direct, which suggests a great deal of potential enthusiasm for this scheme should it become more widely known. Of those people whose houses had been reached by flood water, only 3 said they would not register. Differences in education and age had no obvious effect on whether or not people were familiar with any of these systems.

The ultimate indicator of preparedness may be in what actions people took before a real flood, or what they think they might do. In general little action was taken. Although it is possible that people were prepared but did not receive warnings, and so did not have time to respond, it is quite possible that the lack of action reflects a low level of general preparedness. These actions (or lack thereof) are discussed in more detail in section 2.6 (reacting to flood warnings).

2.4. Receiving flood warnings

Only 13% of respondents recalled hearing a flood warning before the last flood event in their area. The awareness had been no higher amongst those whose homes had been affected or damaged by flooding: out of 45 flooded respondents, 33 said they did not know that a flood was coming and did not do anything, whilst 3 people did recall a warning but did not do anything.

The main reason for not acting was a lack of time (selected by 11 people) and being panicked (5 people), whilst 6 people explicitly said that they did not know what to do. Only 9 respondents said they recalled a warning and had taken action. This indicates respondents were often not aware of warnings, or were aware only shortly before properties were flooded. It also suggests that even when warnings were heard, people were ill-prepared for taking action, this is discussed further in section 2.6.

For those remembering warnings, the media (particularly TV and radio) was most frequently remembered as the source of warning information. Although count numbers are small, the media was also thought to be an *important* source of information.

Table 5 For the 19 respondents remembering hearing a flood warning, the sources from which they recalled hearing flood warnings, and which they judged to be most important (if any).

Source of warning	Number of respondents recalling as source of flood warnings	Number of respondents identifying it as most important source
TV	10	4
Radio	9	2
Neighbours	9	3
Internet	5	1
Newspapers	4	
Floodline	3	
SEPA	2	
Local authority	2	
Family	2	
Police	2	
Fire brigade	2	

In the study site of Huntly there had been awareness-raising and information about flood-risk delivered within the village in the three months piror to the questionnaire being distribution. The local authority, Aberdeenshire Council, has recently organised several public meetings informing people of the design of flood protection measures and their progress. On several occasions they have also attempted to communicate the flood warnings to all vulnerable households. There is also a local community based flood group run by a local woman who lives in the "Meadows" area and whose house was flooded. Huntly therefore allows us to explore the recall and effects of recent awareness-raising efforts.

Of the forty-nine respondents from Huntly (incl Rothiemay), only 32% recalled awareness-raising efforts in the last 3 months. The best awareness was of information received in the post (Table 6).

Table 6 The local sources of information about flooding, in the last 3 months, as recalled by the 49 respondents from the Huntly area.

Source of information/advice:	Flood awareness information	Flood warning arrangements
Direct mail via post	7	11
Advertising in local press	5	15
Floodline exhibition trailer	4	4
Information via community council	4	11
Visit to your home	2	4
Other source	3	0

The small numbers of people recalling any warnings or flooding information (in Huntly or across all locations) make it difficult to discern any effect of variables such as age, education, length of residence.

2.5. Processing flood warnings

The challenge when communicating about flood warnings is not just to transmit the warning, but do so in a manner and method that allows it to be processed by the receiver. The survey reflects on three important stages in the processing of a message: firstly the trustworthiness of a source; secondly the perceived reliability of a source; and lastly the intelligibility of concepts and words in messages.

A source must be perceived as trustworthy before its message will even be considered. Respondents were therefore asked about their trust in several agencies that can be involved in responding to flood events. The mean values (Table 7) indicate moderate to high levels of trust for most of the agencies, but particularly the fire service. Levels of trust were slightly lower for Scottish Water, Ambulance services and the Local Authority, for those that had been through a flooding event.

Table 7 Respondents' rating of trustworthiness of organisations involved in flood events, as scored on a 5-level scale from 1 (very low) to 5 (very high). Where a significant difference was detected using a t-test, test statistics are listed in the second column, whilst NS=non-significant difference in trust.

Agency	n	Mean rating for trustworthiness	Significantly lower trust if flooded?
SEPA	125	3.56 ± 1.03	NS
Scottish Water	126	3.30 ±0.97	t=-2.98,df=82,p<0.01
Fire service	132	3.95± 0.85	NS
Ambulance &medics	128	3.67±1.03	t=-2.04,df=77,p<0.05
Local authority	133	3.25±2.07	t=-2.12,df=127,p<0.05
Police	131	3.69±1.02	NS

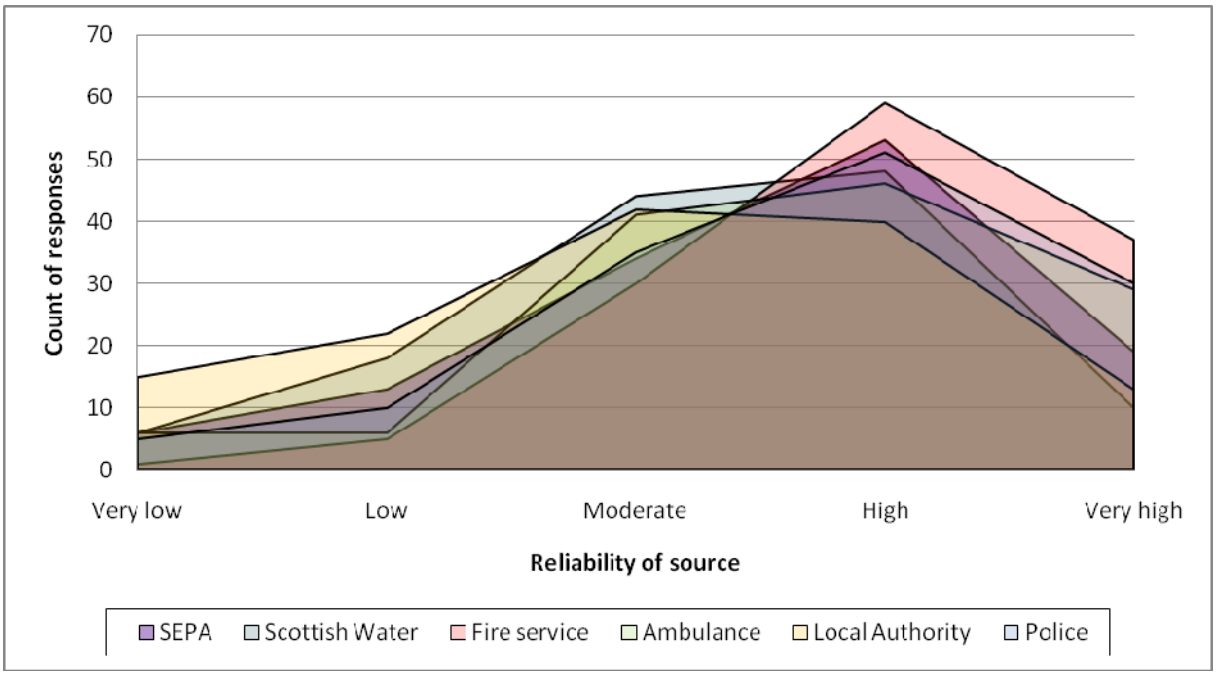

Figure 10 Perceived trustworthiness of difference agencies that potentially communicate messages about flood risk.

Even if trust is high, reliability is also needed. For example, neighbours are often well liked and trusted, but may not be perceived as particularly reliable sources of information. Reliability was asked about for a wide range of sources, and varied more

widely. Again, the fire service, along with the other emergency services, emerged as one of the most trusted sources (Table 8, Figure 11). The media may be an important source of information (section 2.4) but they are not perceived as very reliable (particularly newspapers).

Again, levels of reliability were perceived to be slightly lower, this time for Ambulance, TV and newspapers, for those that had been affected by a previous flood event (Table 8).

Table 8 Respondents' rating of reliability of various potential sources of information about flood warnings, as scored on a 5-level scales from 1 (very low) to 5 (very high). Where a significant difference was detected using a t-test, test statistics are listed in the second column, whilst NS=non-significant difference in trust.

Agency	n	Mean rating of reliability	Significantly lower trust if flooded?
SEPA	117	3.62±0.98	NS
Scottish Water	117	3.68±4.00	NS
Fire service	124	3.81±0.90	NS
Ambulance &medics	120	3.47±1.11	t=-2.97,df=70,p<0.01
Local authority	123	3.19±1.08	NS
Police	122	3.61±1.06	NS
Friends and family	120	3.22±1.11	NS
Neighbours	123	3.61±2.05	NS
Floodline	117	3.68±0.96	NS
Internet	112	3.12±1.02	NS
TV	121	3.21±0.09	t=-2.36,df=74,p<0.05
Radio	122	2.92±0.09	NS
Newspapers	117	2.57±1.03	t=-2.97,df=82,p<0.01

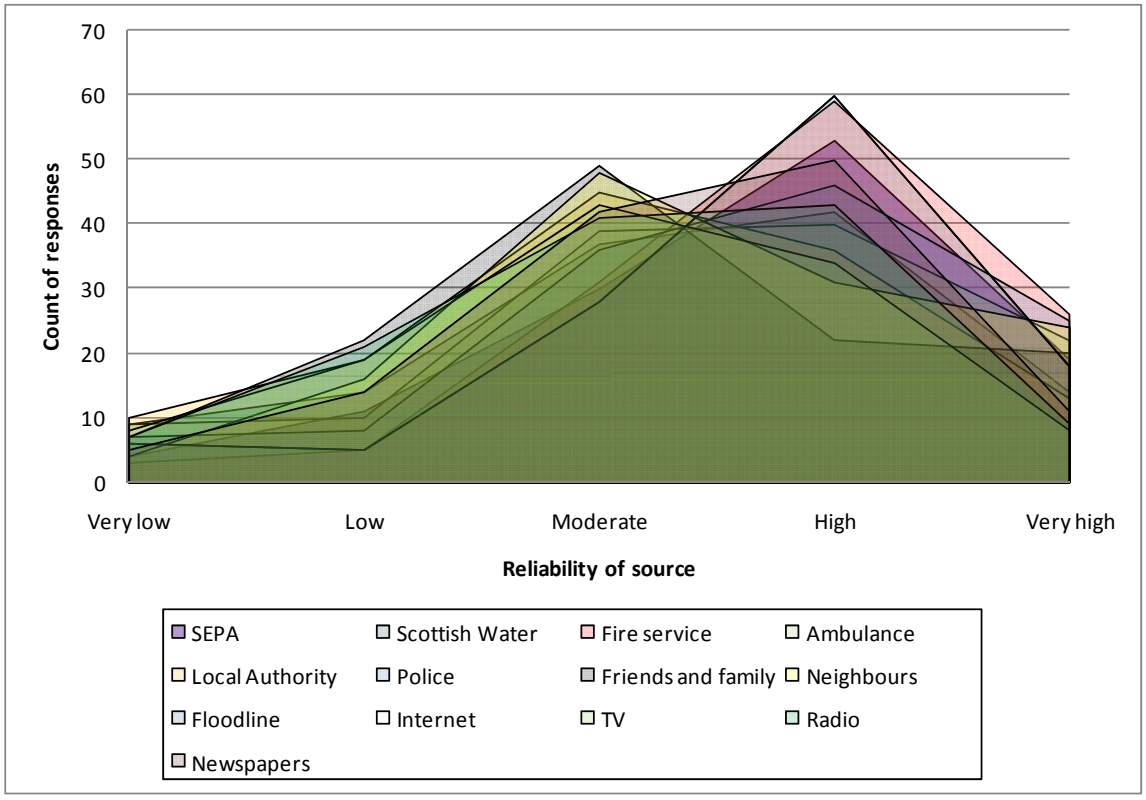

Figure 11 Perceived reliability of various potential sources of flood warning information.

A few of those who had been through a flooding event sometimes tried to contact and talk to an agency about their concerns and needs. Their ratings of these experiences were largely neutral (they were asked to indicate accessibility from a three-point scale, and the central category was most usually selected). Numbers are quite small, so not reported here. However, when asked to rate the accessibility of authorities in general (on a 4-point scale where 1=poor, 2=okay, 3=good and 4=very good), 24 respondents chose the first category, 18 the second category and only 3 selected 'good' or 'very good'. The perceived accessibility of relevant agencies could be improved.

Respondents' were invited to share their individual experiences of contacting agencies. Some examples are copied below.

"During the event no member of the local authority or Scottish Water visited the private householders, with help or advice. The fire service knocked at every household to check if everyone was ok or required evacuating in the early hours of the flooding and also revisited after the event to see if houses etc required pumping out."

"Last year when the flood happened my carer and sister were there and phoned the police and manager of their care co. and told them she was disabled. It took 4 hours before they came and when they did come they said it was a disabled person."

"If the drains in our area were reliable it would be ok but we have asked countless times and theres nothing done"

"Local Authority's plan is no good. Councillors arrived at Millbrae with a film crew and moved a couple of sand bags then left !!! Council foreman stuck plastic covers in drains that had the grill taken off to allow more water flow blocking them. The police and fire services had little knowledge of how the flooding happened, they took no notice of residents knowledge. General lack of knowledge and little done."

"Advised local authority re impending flood event (Glasgow City Council) - asked for sand bags - advised there would be a response to request, but no response ever materialised."

"More specific information if possible (to place e.g. river) and somewhere to phone for verification would be good."

"I have telephoned and emailed different agencies/persons in local authority - been passed from one to another."

"Authorities may be accessible e.g. Logging a report of flooding but not necessarily appearing until days afterwards! Prioritization is important but so is communicating what is happening whilst people wait for action to be taken. Also giving advice as to what is appropriate action in the interim."

Unintelligible messages, for example, are unlikely to be understood well or remembered. For example, there are sometimes concerns about the unnecessary use of jargon or complicated ideas. The survey therefore asked how respondents' felt about both some concepts and quantity of information communicated related to flooding (Table 9).

Table 9 Respondents' level of agreement with various statements related to understanding of concepts and communication about flood risks. Agreement was indicated on a 5-level scale from 1(no strongly disagree) to 5 (strongly agree).

Statement	Agreement
I do not understand talk about probabilities	2.47±1.34
I understand how risk is assessed	3.56±1.26
When communicating warnings it would be good to have more information about the uncertainty associated with the predictions	3.85±0.97
We get enough information: any more is simply confusing	2.45±1.36
Messages from authorities use too much technical jargon	3.25±1.39
A flood magnitude which is likely to be equalled or exceeded on average once in 50 years probably won't occur here in my lifetime.	3.03±1.83

It is striking that people generally had high confidence in their ability to understand probabilities and assessment of risk. Furthermore, 70% had heard of the phrase a "one in 100-year flood", although not so many felt confident enough to give an answer. Accordingly, they generally wanted to receive more information about flooding, and disagreed that the existing information was confusing.

Older and less well-educated people are often considered more vulnerable during flood events. As might be expected there was a correlation between increasing age and agreement that i) they did not understand talk of probabilities (Pearson correlation=0.231, N=120, $p<0.05$) and ii) more information would simply be confusing (Pearson correlation=0.199, N=119, $p<0.05$).

Similarly, those with more education were significantly more likely to say they understood probabilities (Pearson correlation=-0.388, N=116, $p<0.001$), did not find more information confusing (Pearson correlation=-0.221, N=118, $p<0.05$) and there was not too much jargon (Pearson correlation=0.223, N=117, $p<0.05$). Flooding experience did not affect agreement or disagreement with these statements.

2.6. Reacting to flood warnings

One initial reaction, on hearing about a warning, is to tell other people. Table 10 lists who respondents said they would tell.

Table 10 Who the respondent would tell after receiving a flood warning.

Statement	Agreement
Neighbour	132
Family and friends	87
Local authority	26
SEPA	11
Radio	9
Newspaper	9
TV	7

24% of respondents recalled receiving some kind of practical advice about actions to take to prepare for flooding, usually from the local authority (17 respondents) or SEPA (12 respondents). They generally found this advice of some use.

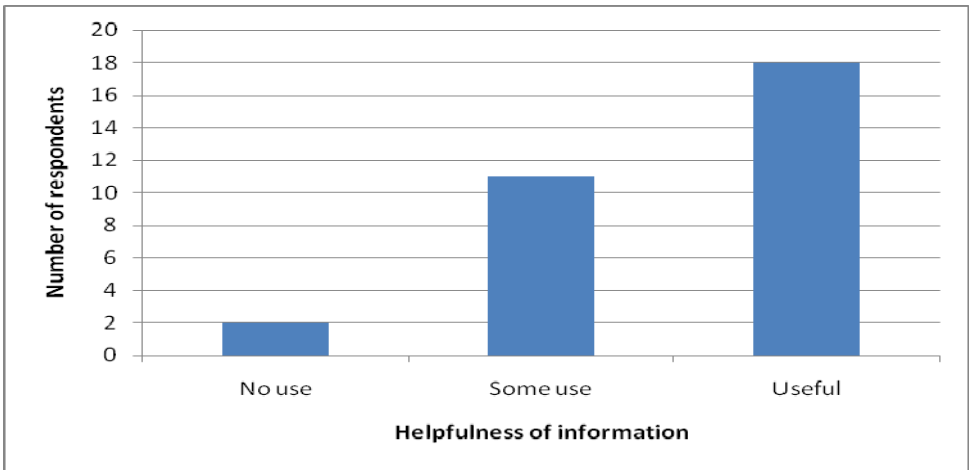

Figure 12 The helpfulness of information received about how to prepare for flood events (n=31).

However, as reported in section 2.4, only 9 respondents said they recalled a warning and had taken action beforehand. The actions taken are listed below, compared with the actions listed by those who were not flooded. Since many people who are not flooded say they would take actions, why have those actually flooded not often taken action? Two possible reasons may be forgetting recommended actions, during a period of stress and panic. A second reason may be not being aware of flood warnings, which gave those flooded no time to prepare.

Table 11 The actions to prepare for a flood by those that have been flooded, and actions that might be taken, by those that have not been flooded.

	Actions actually taken (n=9)	Actions that might be taken (n=99)
Move items of sentimental value	4	77
Move or protect costly things (e.g. fridge, furniture)	2	62
Block doorways/ airbricks	4	67
Put flood-boards or flood-gates in place	1	36
Prepare for loss of power (candles/ torches)	4	79
Switch off gas/ electricity	2	62
Block toilets	8	24
Watch the water levels	6	72
Listen to TV/radio for more information	4	75
Check the SEPA website or Floodline	6	56
Contact friends/ family for advice	3	53
Move myself and others to a safe place e.g. upstairs	2	75
Move pets /livestock to a safe place	6	48
Move cars to a safe place	4	60
Collect clothing, food, water or medication	1	63
Help neighbours	3	75
Evacuate property	1	39

Since only 9 respondents actually took actions, there is little further analysis of this data that can be done, to explore what influences affect likelihood of acting. This may be a key question for future research.

2.7. Preferences for communications about floods

Findings in section 2.5 suggest that respondents would generally prefer more information, not less. Respondents were also directly asked what they thought of the current amount of information available about i) how to prepare for a flood and ii) flood warnings. In both cases, most would like more information (Figure 14). Nobody said there was too much information on what actions to take. Interestingly, those who had not been directly flooded were even more likely to say they wanted more information about actions to take ($Chi^2=8.61, df=2, p<0.05$). Gender, age and education had no significant effect on preferences for information.

Table 12 displays the methods by which respondents said they would prefer to hear about i) how to prepare for a flood and ii) flood warnings. Phone calls and text messages to mobile phones are outstandingly preferred as the main way that people would like to hear about flood warnings (Figure 13). Age, gender and education had no effect on people's primary preference. This supports and explains the popularity of Floodline Direct (as reported in section 2.3). There is an interesting contrast with respondents' recall of what has actually happened before, when they were asked about from whom they recalled hearing about flood warnings. In past situations respondents had often recalled hearing these from the media (Table 5). However, the preferences reported in table 11 suggest that the media are not always preferred (perhaps due to their perceived unreliability – see section 2.5). The media can be a powerful way to reach people, but perhaps should not be relied upon as the only way to communicate about flooding.

Table 12 The methods respondents selected as preferred ways to hear about i) flood warnings and ii) receive information about actions to take. Respondents could suggest multiple methods. Respondents were also asked to select a single source as the most preferred source of information: this is represented in the 'preference' column.

Method	Flood warnings	Preference	Actions to take	Preference
Phone call	89	23	39	3
Text (SMS) to mobile phone	76	25	27	3
Website	38	1	29	5
Email	49	1	27	1
In-person visit	46	17	30	11
Radio	67	0	29	0
TV	70	1	36	0
Public announcement / tannoy	54	2	23	1

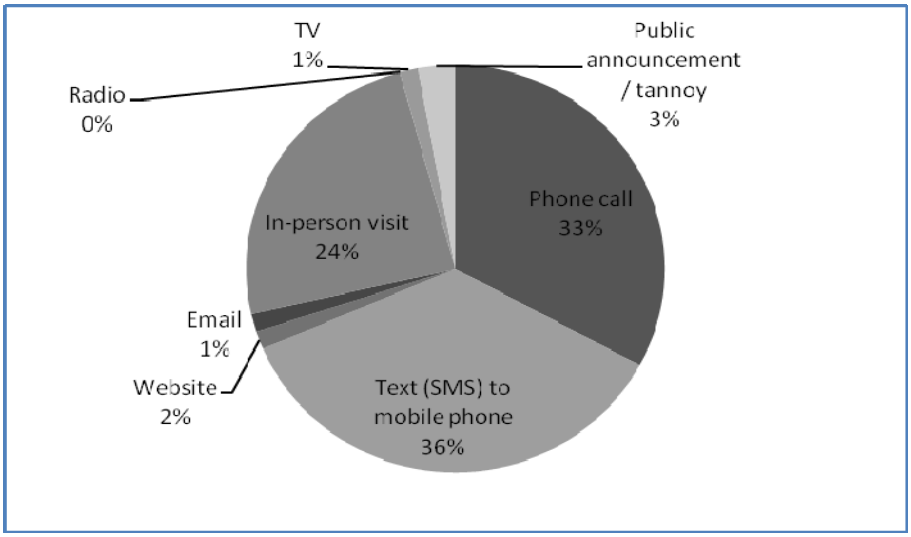

Figure 13 The preferred ways of hearing about flood warnings (n=70).

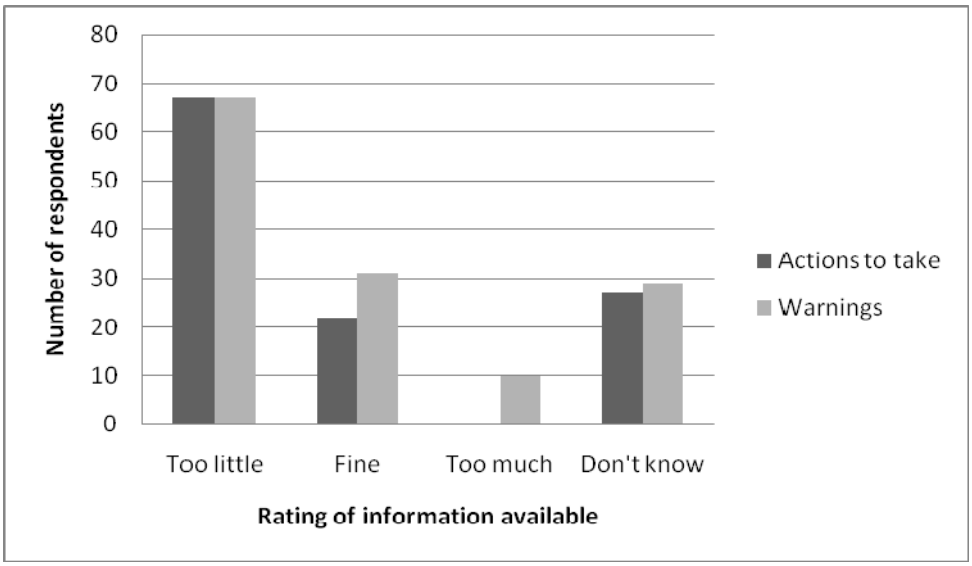

Figure 14 Respondents' rating of the amount of information about floods that is available at present (n=43).

Respondent's rating of the amount of information received was affected neither by their age nor by their gender, education-level or length of residence.

Age may affect the preferred method of hearing about flood warnings (Kruskall-Wallis 1-way, χ^2=14.84, df=6, p<0.05; Figure 15). In particular, in-person visits were more likely to be preferred by older people. Websites, TV, email and tannoys were selected by very few, it is not possible to conclude much about age trends for these groups.

No other demographic variables affected preferred method of hearing about warnings, and none affected preferred method of hearing about actions to take. It is interesting to note, that when discussing the way they would prefer to hear a warning 14 men but 9 women preferred a phone call, whereas only 8 men but 16 women preferred a SMS text.

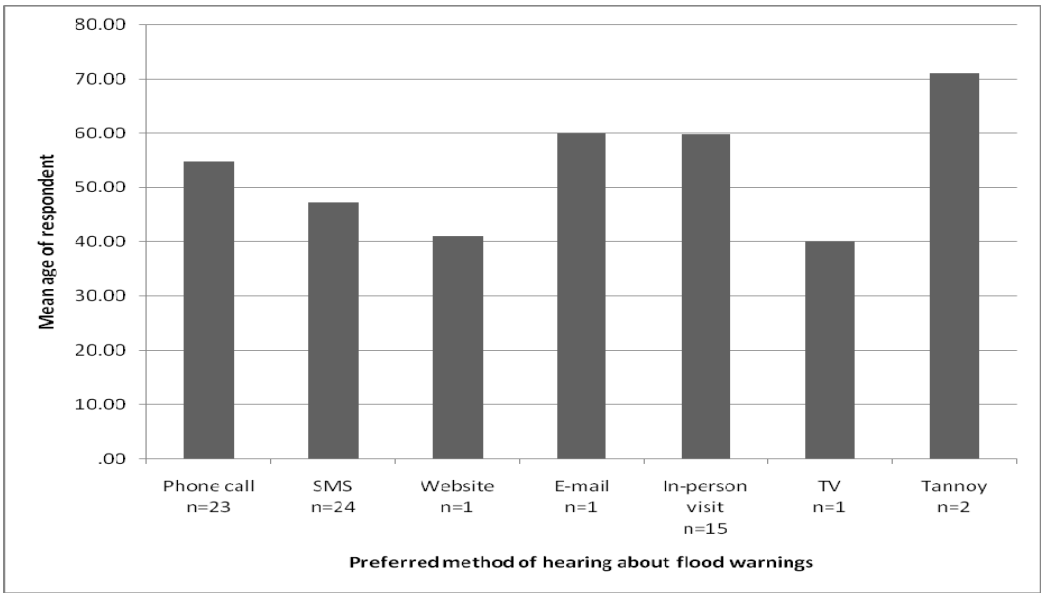

Figure 15 The average age of respondents selecting each preferred method of hearing flood warnings. The x-axis lists each method selected as preferred, together with the number of people choosing each.

3. Summary of findings and recommendations

3.1. Key findings and implications for potential flood warning systems

Summarise some of the key interesting things found in your country.
Summarise some key implications for designing new flood warning systems.

Respondent backgrounds and flood experiences

The sample of 144 people from four rural and urban areas in Scotland includes respondents with a broad range of educational backgrounds and employment status'. Men and women were included in roughly equal proportions, but younger people were under-represented. Just over a quarter of respondents (28%) had lived in their area for less than 5 years, whilst a similar amount (27%) had lived in their area for more than 35 years: differences in local knowledge and experience of flood warnings may be quite different for these two groups. Most respondents were owner-occupiers, and those that were not were also significantly more likely to have lived in their area for a much shorter time.

One third of respondents had been affected by flood water reaching their property, although only about one third of those (15 respondents) had had their houses damaged by the water. This allowed comparison between those who had and had not been flooded. Those who had seen a flood event identified various causes of the flooding, and these beliefs were sometimes locally specific (for example, the idea that failure of flood defences was mostly selected only in site, Huntly).

Preparedness before a flood and receiving flood warnings

There was low familiarity with systems used to warn about flooding. SEPA uses a 4-level flood warning system but only 32% of those that had been flooded recognised this; for those that had the figure was even lower (11%). There was slightly better awareness of SEPA's website (40%) though not the flood risk map (24%). All these information sources were generally judged as moderately useful, where known. The final system enquired about was the new 'Floodline' direct: unsurprisingly, it was not often known (14%) but the concept was very popular and 77% expressed interest in registering for it.

Few respondents recalled hearing a warning before the last flood event, usually recalling hearing from TV or radioWhere there have been known efforts at awareness-raising, using several methods in the last 3 months in Huntly, the information received in the post and advertising in the local press were most often recalled.

Processing and reacting to flood warnings

Respondents receiving a message must trust the source and its reliability, if they are likely to respond to it. Respondents were asked to rate the trust-worthiness and reliability of a variety of agencies and potential sources of information. Trust and reliability were generally high, although sometimes slightly lower in those that had experience of flooding. The fire service was perceived to be both the most trustworthy and the most reliable, and the media the least reliable.

Intelligibility of messages was discussed, since indecipherable messages cannot be understood or acted upon. Despite these worries, generally respondents did not express concerns about jargon or the quantities of information. For example, typically more information about uncertainty was requested. However, less educated groups and older people were less confident about understanding concepts of probability and coping with more information.

Low recall of flood warnings explained why very few people (9) had taken action to prepare before the last flood event, and it is therefore hard to discern patterns in the actions taken. Many more said what they might do in the event of flooding: preparing

for loss of power, moving items of sentimental value, listening to TV/radio for more information, and moving household members or helping neighbours were the most popular actions. Putting flood-baords or gates in place was rarely selected and these devices may not be well known.

Preferences for communications

Respondents were more likely to say there should be more information made available, about both flood warnings and general awareness of flood event. The strongest preferences for hearing about warnings was via phone calls and texts to mobile phones, which may explain the enthusiasm for registering with Floodline, which will communicate warnings this way. In-person visits were also quite popular, and also the most preferred way of learning about actions to take.

Implications

The plan to communicate warnings via SMS and text, via Floodline Direct, is likely to be popular. The media is often recalled as a prominent source of information in past events, but should not be the only source of information available, particularly as it perceived as one of the less reliable sources.

In less urgent situations, to communicate about actions to take and inculcate preparedness, post and personal visits may be more useful. Most people would welcome more information and detail about flood warnings and flood preparedness, so it is important that this information is available to those looking for it. However, ensuring good awareness of warnings scheme is not straightforward, as suggested by the low awareness of much existing information on flooding.

The perceptions of trust and reliability held for the fire services make it an obvious candidate for communicating about flood warnings and flood preparedness. Using a trusted service such as this may be particularly important for less educated and older residents, who may be less confident in interpreting or understanding information.

3.2. Next steps

Briefly note next steps.