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The anticipated emotional consequences of adaptive behaviour – impacts on the take-up of household flood-protection protective measures

Abstract

When considering householder responses to flood risk, researchers and policy-makers have perhaps focussed too much on the influence of risk perceptions and concerns about material costs and benefits. Using secondary analysis of a survey data from UK households who had experienced flooding or were at risk of flooding, this paper presents evidence to suggest that protective behaviour may be influenced less by material and financial considerations than by concerns about feelings of anxiety and insecurity. It also looks at the role of beliefs about protection and flooding in mediating the impacts of flood experience and suggests that experience reduces confidence in the ameliorative capacity of insurance and promotes the belief that protective measures increase anxiety about flooding. The paper concludes that more research should be carried out on the role of anticipated emotions in risk response and that policy-makers and the designers of protection products should pay more attention to the emotional barriers and incentives to adaptation.

Key words: flooding; self-protection; experience; risk perception

The issue of household flood protection

The issue of individual adaptive behaviour in the face of flood risk is of acute policy relevance. European governments in countries such as the UK and Germany have begun to accept that floods cannot always be prevented and that resilience requires adaptive action not

only by the state but also by individual citizens (Defra, 2005; Johnson and Priest, 2008; Socher and Böhme-Korn, 2008). Where the benefit-cost ratio of large-scale flood defence is considered too small, householders and businesses are increasingly expected to take their own, small-scale, measures to protect themselves and their properties. For example, while in 1993 the Environment Agency in England prioritised flood warnings and flood defence in its floods strategy (Environment Agency, 1993), by 2005 the national government was insisting that it include the promotion of property-level measures as part of an "integrated portfolio of approaches" to flood risk (Defra, 2005, p.8) and influential independent commentators were encouraging a similar approach (e.g. Pitt, 2008).

This change of policy direction reflects a more general trend toward the responsibilisation of individuals by the state (Rose 1999), but also the recognition that the conventional approach to reducing flood risk, *flood defence*, had become insufficient to the scale and nature of the problem. As reported in Harries and Penning-Rowsell (2011), this was the result of two factors. A number of large and serious UK floods had caused what Krasner (1988) calls *exogenous shocks*, shaking the legitimacy of the previous policy regime (see Johnson et al., 2005). At the same time, there was an emerging consensus that climate change and increases in demand for land would increase the UK's exposure to flood risk and a Government-sponsored study predicted that by 2080 the number of residents in high-risk areas of England and Wales would increase from 1.4 million to between 2 and 3.9 million (Evans et al, 2004a; 2004b).

While the number of deaths and affected households is relatively low in the UK compared to figures globally (see CDED, 2010), floods represent an important policy issue for UK governments. In spite of public spending of approximately £700 million per year on managing the risk, flood damage costs the UK economy an average of £1 billion per annum and if defence expenditure remains constant, this could increase by between 60% and 2,900%

over the next seventy years (Evans et al, 2004a; 2004b). Although the indirect effects are less well understood, it is known that floods cause loss of physical and mental health (Ohl *et al* 2000; Tunstall *et al* 2006).

Furthermore, the UK insurance industry's agreement to provide flood cover for households in high-risk areas expires in 2013 (Defra 2010). Concerns that this might leave large numbers of households financially vulnerable to the impact of flooding have added impetus to the government's efforts to promote the notion of property-level protection against floods – e.g. the installation of airbrick covers and deployable door-guards, and the sealing of entry points for water pipes, electricity supplies etc (Figure 1). Defra is now working with the insurance industry to find ways of using the promise of continued insurance, or improved insurance terms, to incentivise individual households to take practical steps to protect their properties from future floods.

Figure 1 Examples of protection measures: a home-made door-board, a commercial door-board and commercial airbrick covers

However, in spite of the wide-spread and well-publicised availability of household-level protection measures (Environment Agency, 2010; National Flood Forum, 2010), take-up remains lower than policy-makers would like and does not seem to be increasing. In 2004/5 6% of risk-aware, un-flooded, households and 39% of previously flooded households had

77 taken steps to increase their resilience to flooding (Harries 2008a) and by 2008 the equivalent
78 figures remained almost unchanged at 9% and 34% (Thurston et al, 2008). This lack of any
79 significant growth in the use of protection measures led to an acceptance that awareness-
80 raising and information-provision were inadequate to the task and that a more interventionist
81 policy was necessary. Furthermore, a professional culture heretofore dominated by a
82 technical, engineering approach to flood risk management (Harries and Penning-Rowsell,
83 2011) is now giving way to one in which there is recognition of the importance of the social
84 and psychological aspects of behaviour change. For example, the UK government recently
85 launched a grant scheme for a thousand homes across England to promote flood protection by
86 normalising its use and reducing anxieties about its effectiveness (Defra 2008; 2009). This
87 acceptance of the importance of norms illustrates the gradual acceptance, by policy makers,
88 of a model of householder behaviour that incorporates drivers other than financial rationality.

89 Most previous research on responses to environmental hazards has focused on the role of risk
90 perception and demographic predictors such as education, income and social grade (e.g.
91 Armaş, 2006; Flynn *et al*, 1994; Grothmann and Reusswig, 2006; Kreibich et al, 2009; Laska,
92 1990; Rundmo, 2002). However, although it has been established that there is a connection
93 between risk perception and adaptation, the findings of research into the effect of
94 demographic factors have been largely inconclusive (see Lindell and Perry, 2000).

95 More recently, some attention has been paid to people's beliefs about adaptation measures
96 themselves (e.g. Lindell and Hwang, 2008; Terpestra and Gutteling, 2008; Siegrist and
97 Gutscher, 2008). For example analysis of householders' discursive behaviour (Harries 2008a;
98 b) suggests that anticipated negative emotional impacts can act as deterrents to the use of
99 flood protection. Similarly, survey research by Zaalberg et al (2009) established a statistical
100 association between reported adaptation and beliefs about its affective outcomes. This paper
101 complements and develops these studies by analysing the relationships between actual

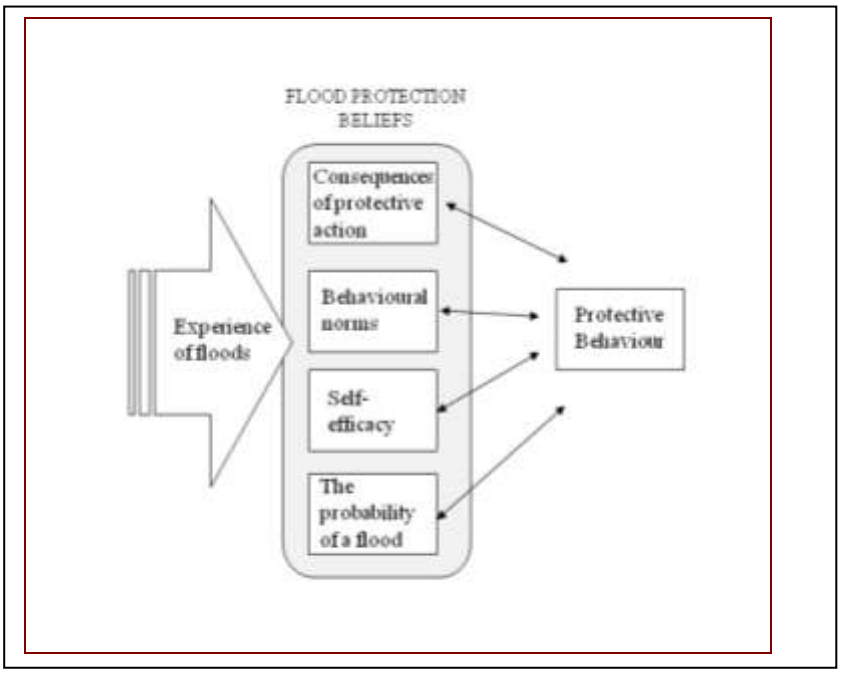
102 behaviour, risk perception and a range of the rhetorical belief positions identified by Harries,
103 including beliefs about the emotional consequences of implementing flood protection
104 measures.

105 **Modelling the relationship between expressed beliefs and flood protection**

106 The conceptual framework behind the research is depicted in Figure 2. This indicates that
107 experience of flooding influences expressed beliefs and that these beliefs have an impact on
108 protective behaviour. The model also suggests that beliefs and protective behaviours are
109 mutually co-producing. Not only do beliefs influence behaviour. In order to avoid cognitive
110 dissonance and provide *post-hoc* justification for their actions, people adjust their beliefs
111 about flooding and flood protection in line with the outcomes of their behaviours.

112

Figure 2 Simplified model of the relationship between reported beliefs and protective behaviour



To aid interpretation of the model, the terms within it require clarification. In contrast with some other research the topic of flood risk adaptation (e.g. Zaalberg et al, 2009) the focus here is on reported behaviour rather than behavioural intentions. *Flood experience*, too, is used in different ways in the literature. Here, the term denotes the experience of floodwater gaining ingress within the boundaries of the home. The term *beliefs* is here used to describe the answers given by research respondents to survey questions. These beliefs are distinguished from the attitudinal, abstract beliefs used in some other research by the fact that they relate specifically to respondents' own particular situations. For example, respondents are asked to agree / disagree with the notion that protection measures "would make me feel safer".

This paper looks at the mediating role of beliefs on the impact of experience on protective behaviours. The impact of experience on protective behaviour is widely recognised in the literature (Grothmann and Reusswig, 2006; Kates, 1976; Kunreuther and Slovic, 1986; Laska, 1990; O'Riordan, 1986; Siegrist and Gutscher, 2008; Weinstein, 1989; White, 1973;

Whitmarsh, 2008) but the factors mediating this influence are rarely explained. This paper attempts to begin to fill that gap by looking at four types of belief (see Figure 2): beliefs about the consequences of taking protective action, about norms around protective action, about their own self-efficacy on the issue of protective action and about the likelihood that their home will be flooded in the future.

Householders' beliefs about the material outcomes of protective action rarely coincide with those held by professionals and policy-makers. The flooding of an unprotected UK home causes an average of £30,000 damage (RPA et al 2004) and a full set of protection measures, while costing approximately £2,900 per home (Defra 2008), can reduce the financial cost of damage by between 65% and 84% (Thurston et al, 2008). This means that protection measures would be financially cost-beneficial for the average householder wherever there was a greater than 4% annual chance of experiencing a flood (ibid) (this is known amongst flood risk management professionals as a *return period* of 1-in-25). However, this kind of data is rarely in the possession of individual householders and when it is, the veracity of the underlying assumptions is sometimes doubted (Harries 2008a).

It is sometimes argued that the role of beliefs about material outcomes is further reduced by the fact that people often give more importance to the possible emotional outcomes of flooding and flood protection. While emotions themselves are essentially relational (Bondi, 2005) and in part non-representational (see Thrift, 2004), the cognitive anticipation of emotions (what Bagozzi et al, 2000, call *anticipated emotions*) operates at the level of the individual as well as the group and relates to thoughts *about* emotion rather than the experience of emotion or its direct expression. When faced with anticipated emotional impacts people focus less on material considerations (Loewenstein, 1996; Paton et al, 2005; and for evidence of this phenomenon amongst UK householders in flood-risk areas Harries, 2008a; b).

165 The second category of *belief* shown in the model relates to the argument that individuals are
166 influenced more by perceived *behavioural norms* than by arguments about effectiveness,
167 safety or material gain (e.g. Cialdini and Goldstein, 2004). Research participants often
168 underestimate the influence of norms on their behaviour, so it is rarely reported in interviews
169 and remains "underdetected" in much of the academic literature (Nolan et al, 2008). However
170 people's behaviours tend to conform to those that they believe characterise prototypical
171 members of salient in-groups (Abrams and Hogg, 1990; Goldstein et al, 2008; Nolan et al,
172 2008). When the in-group norm is the absence of action, fear of stigmatisation and blame act
173 as disincentives to action (see Jones and Berglas 1978; Tykocinski and Pittman 1998;
174 Zeelenberg et al 2002 – but see Rabinovich, 2010, for exceptions to this tendency). At
175 present, flood protection is not the norm in most at risk communities, so people who do not
176 take such action are seen as innocent victims and are not, in general, blamed for their
177 inaction. Furthermore, because the negative consequences of acting against the norm are
178 more immediate and certain than the potential benefits of action, the former tend to be given
179 more weight than the latter.

180 The third category of beliefs, *perceived self-efficacy*, is frequently referred to as a critical
181 element in the determination of behaviours such as risk response (Ajzen and Fishbein, 1980;
182 Bandura, 1982; Lazarus, 1966; Morton et al, in press; Witte and Allen, 2000). Self-efficacy
183 involves the organisation of cognitive, social and behavioural skills into integrated courses of
184 action (Bandura, 1982). People are said to avoid behaviours that they believe might take them
185 beyond the limits of their efficacy and expose them to possible failure and blame, and beliefs
186 about self-efficacy determine how much effort they spend on a task and how easily they are
187 deterred by obstacles and challenges (ibid). Zaalberg et al (2009) found perceived self-
188 efficacy to be correlated with people's expressed intentions to respond to immanent floods

189 (e.g. by moving furniture upstairs) but not with intentions to implement long-term protective
190 measures.

191 The fourth variety of belief in the model, *risk perception*, has been the focus of much
192 conventional risk research (Slovic, 2000; van der Pligt, 1996) and is a core component of
193 most models of the behavioural response to risky situations (Brewer et al, 2007). Risk
194 perceptions are sometimes assumed to be the product of the rational processing of
195 information (Brown and Damery 2002) and this assumption can lead to an reliance on the use
196 of targeted information campaigns (e.g. Atman et al 1994; Bostrom et al 1992; Siudak 2001).
197 However, as socially constructed representations of reality (Burningham, 2008; Homan,
198 2001), risk perceptions are resistant to the influence of abstract information (e.g. Kates 1976;
199 Loewenstein 1996; see also Abric, 2001) and are more likely to be affected by information
200 that is associated with direct experience and that is therefore more vivid (Weinstein, 1989).
201 Furthermore, risk perception provides a far from complete explanation of lay response to
202 risks (Breakwell, 2007). Meta-analyses of risk behaviour studies show its influence to be
203 statistically significant, but small (Brewer et al, 2007).

204 **Empirical method**

205 This paper looks at the relationship between expressed beliefs, experience and protective
206 behaviour by presenting secondary analysis of data generated in a telephone survey. This
207 survey was commissioned by Defra in 2007 and was originally reported on by Thurston et al
208 (2008).

209 In the survey, householders in areas at high risk of flooding were asked to express their
210 agreement or disagreement with statements designed to reflect beliefs identified as salient in
211 interviews with flood risk management professionals and in a review of the literature.
212 Respondents were also asked about their awareness, knowledge and experience of protection

measures, whether they had used such measures themselves and about any experience of flooding. Figure 3 shows the question wording used for the variables used in this paper. A full copy of the questionnaire is available in Thurston et al (2008) or from the author of this paper.

Figure 3 Survey questions relating to key variables in this paper

QC2: There are a number of ways in which people can protect their homes from flooding or reduce the damage caused by a flood. I'm going to talk you through 2 options. Please listen to the description and answer the questions that follow.

(a) *Option 1:* You could fit guards to doors, external air bricks etc. to prevent or reduce the entry of floodwater into your home.

I'm going to read you a list of such measures to you. Do you have…?
1. Door guards
2. Air brick covers
3. Vent covers

QC3: (a) People have given reasons for NOT putting in place measures to minimise the damage to their homes from flooding. I'm going to read out a list of these reasons. Please say whether you agree, disagree or don't know.

(i) I didn't know you could do anything
(ii) I don't think it's my responsibility
(iii) I feel it would be too expensive
(iv) It would make my house look odd
(v) I don't think I'm going to live here much longer
(vi) I don't want to be reminded of the risk of flooding
(vii) When I sell my home, I don't want potential buyers to see it's at risk of flooding
(viii) I don't think I would be able to choose the right way to protect my home
(ix) My home is covered by insurance so I don't need to worry
(x) It would make my home feel less comfortable and attractive
(xi) Collective flood protection measures have already been put in place for this area
(xii) Any other reasons? PLEASE SPECIFY

QC3: (b) I'm now going to read out a list of reasons that people give for saying that they DO want to put in place measures to minimise the damage of any future floods. Please say whether you agree, disagree or don't know?

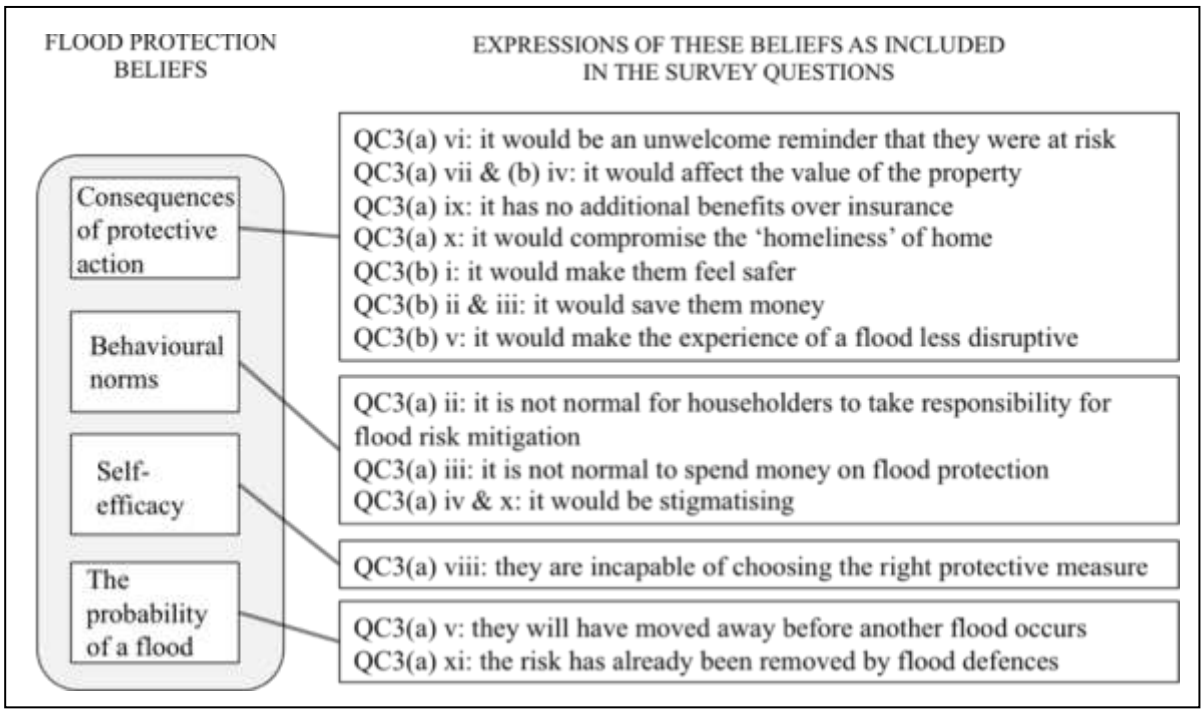
(i) It would make me feel safer
(ii) It would save me money in the long term
(iii) My insurance premiums would go down or not go up so much
(iv) It would increase the value of my property
(v) It would decrease the hassle / disruption if there was a flood
(vi) Any other reasons? PLEASE SPECIFY

QC8 Looking 10 *years* ahead now, instead of just twelve months, do you think you are likely to be flooded in the next 10 years?
YES/ MAYBE/ POSSIBLY
NO
DON'T KNOW

Figure 4 goes on to show which of the variables listed in Figure 3 relate to each of the belief types in the model that was tested in the secondary analysis reported here. Some of these

relationships are not immediately obvious. For example, objections on the grounds of expense are not necessarily based on issues of affordability and may be more closely related to the issue of on what items it is considered normal for householders to spend their money – see QC3(a)iii.

Figure 4 How variables in the survey operationalise the model



As is often the case in secondary analysis, the fit between the data and the analysis suffers from a few imperfections. Principle among these is the uneven distribution of the belief variables between the four categories outlined in the model; with only one, for example, indicating beliefs about self-efficacy.

The sample frame for the survey comprised home telephone numbers for postcodes from across England that had a greater than 80% concentration of properties in high-risk areas – i.e. areas with a flooding return period of 1:75 or higher as identified by the Environment Agency's National Flood Risk Assessment (NaFRA) 2006 Postcode Flood Likelihood Category Database.

Households were telephoned on week-days between 9am and 7pm. Of the 6,000 numbers called, 3,000 households did not respond and a further 1,000 were excluded from participation when people claimed not to be aware that they lived in a flood risk area. A total of 555 of the remaining 2,000 agreed to take part in the survey – representing an interview completion rate of 28%.

Of the final sample, a quarter had experienced the ingress of floodwater into their homes and just under 10% had taken property-level protection measures.

A thorough test of the representativeness of the achieved sample was rendered impossible by the absence of data on the research population as a whole: at-risk householders across the UK. Instead, key demographic variables were compared with those of the entire population of England and Wales (ONS 2001;2010) and with those of datasets from two previous surveys of UK flood risk households to which the author had access (see Risk & Policy Analysts et al, 2004; Tunstall et al, 2006). The variables used for this comparison (type of housing, housing tenure, household composition and employment status of the highest earner) were chosen because of their likely association with flood risk response and because they related to the level of analysis – the household.

The comparison of the survey dataset with these other populations revealed that the sample differed in a number of ways from the comparator datasets (Table 1):

- Compared to the earlier surveys, a higher proportion of respondents lived in bungalows, flats and mobile homes and fewer lived in households with children
- Compared to the national average, fewer were social tenants. This, in spite of the fact that people from poorer social classes are as well represented as others in flood risk areas – Walker et al, 2006. In addition, a higher proportion was self-employed and a higher proportion was economically inactive.

Some of these anomalies can be explained by mode effects. For example, due the growth in popularity of mobile telecommunications, surveys focussing on fixed-line telephones have lower response rates amongst young, low-income groups (Blumberg and Luke 2007). In addition, telephone surveys are often less convenient than face-to-face surveys for people with young children and evidence from the USA indicates that calls from unknown numbers are increasingly being screened out by parents with older children (Tuckell and O'Neill 2002). Similarly, the over-representation of the self-employed and economically inactive is likely to be the result of the fact that most of the phone calls were made to home phone lines and during the day.

Table 1 Comparative demographic profile of the survey sample (all figures are percentages)

	Survey sample *N* = 555	ONS data – England and Wales*		Other surveys of flood-risk areas in England & Wales	
		2001 Census	2008 labour market statistics*	RPA	FHRC
Type of housing					
House	78			86	92
Detached	28			13	37
Semi-detached	27			24	25
Terraced	23			49	30
Bungalow	10			5	3
Flat/maisonette	10			4	1
Mobile home	2			0	0
Tenure					
Tenant	12	31		18	9
- Social landlord	8	19		10	
- Private landlord	4	12		8	
Owner-occupier	88	69		82	91
Household composition					
No children	82			70	
Lone parent	2	6.5		5	
2+ adults with child/ children	16			25	
Employment status of highest earner					
Self-employed	11		7		
Employed	34		52		

Economically inactive	55	41	

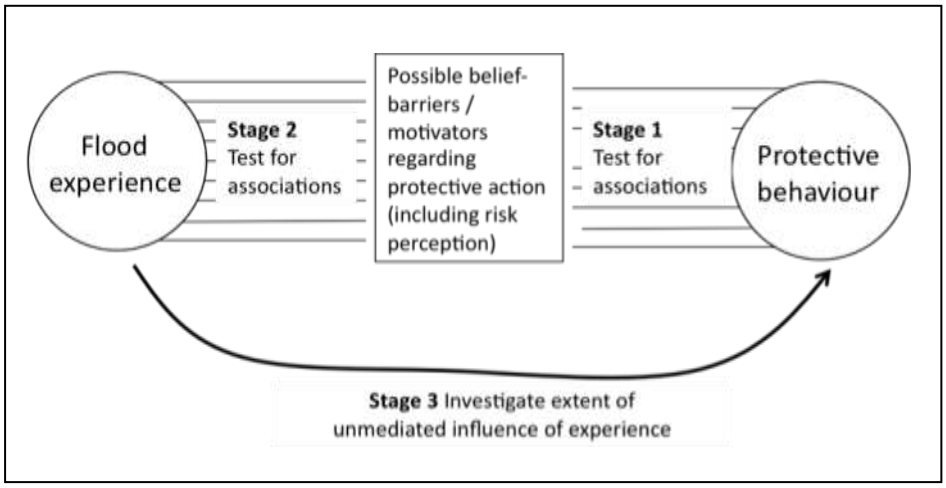
* ONS (2001; 2010)

To assess the significance of these features of the sample for the validity of the research, bivariate analyses were carried out to determine whether the variables in question were correlated with protective behaviour. In keeping with the findings of much of the literature on natural hazards (e.g. Armaş, 2006; Flynn et al, 1994; Lindell and Perry, 2000; Rundmo, 2002) no statistically significant relationships were identified between these variables and protective behaviour.

Analysis

The subsequent statistical analysis of the survey data was conducted in three stages (see Figure 5). Stage 1 looked for associations between protective behaviour and beliefs. Stage 2 sought to identify the influence of flood experience on the beliefs that Stage 1 had found to be significant. Stage 3 looked at what proportion of the relationship between experience and behaviour was mediated by these beliefs.

Figure 5 Stages of the statistical analysis



All three stages employed multivariate logistic regression. Multivariate techniques reduce the effect of spurious associations and discriminate between direct associations and associations via intervening variables, allowing the analyst "to estimate the relative importance of several

hypothesised predictors" (Bohrnstedt and Knoke 1996 p263). The logistic transformation ensures that error terms are normally distributed and therefore allows compliance with the conditions of regression analysis even when outcome variables are categorical (ibid).

It is also important, however, to note the limitations of this method. Even where there are significant relationships between behaviour and expressed beliefs, due to the correlational nature of regression analyses these do not, of themselves, indicate the direction of causality. Rather, assumptions about causal direction rely on the analyst's understanding of the situation being researched. In the case of this study, for example, it was deemed unlikely that inhabitants' beliefs would affect the likelihood of a flood occurring, so it was assumed that any correlation between flood experience and beliefs was caused by the experience variable. In contrast, although it is possible that expressed beliefs influence behaviour, it is also plausible to argue the reverse (see, for example, the work of Festinger, 1957, and Goffman 1959), so in this case no assumption was made about the direction of causality.

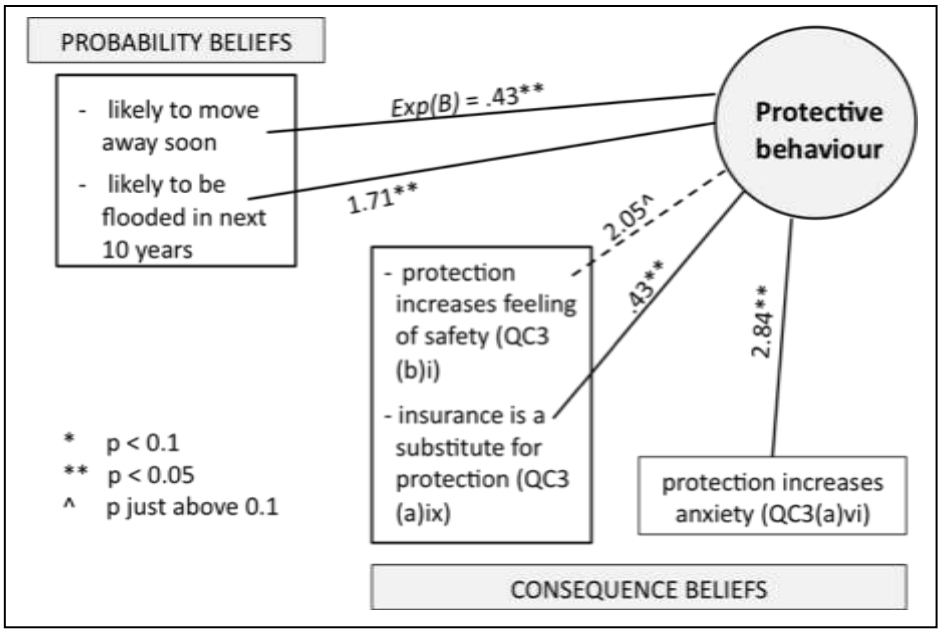
A further problem with regression is the danger that excessive multicollinearity between variables will generate false results. As recommended by Field (2005), therefore, multicollinearity values were assumed to be within acceptable levels only if the degree of collinearity was acceptable (i.e. if the *tolerance* of each of the variables was greater than .2) and if collinearity did not lead to over-inflation of the standard error (i.e. if the average *VIF* was close to 1.00).

Stage 1 analysis: belief-behaviour correlations

Table 2 shows the results of the first stage of the analysis, which are summarised in Figure 6 and discussed below for each of the categories of belief used in the model. Four beliefs were found to be significantly correlated with protective behaviour ($p < .05$): beliefs about the likelihood of being flooded in the next ten years (risk perception); beliefs about future

duration of residence; beliefs about the consequences of protective measures for anxiety, and beliefs about insurance. A further belief, about the potential for protection measures to increase feelings of safety, fell just short of statistical significance.

Figure 6 Significant and near-significant belief-variables identified in stage 1



Consequences of protective action

Of the two belief-variables in the analysis that can be interpreted as indicating anticipated emotions, only QC3(a)vi ("I don't want to be reminded of the risk of flooding") was found to be a significant predictor of protective behaviour (*Exp(B)* = 2.89). Given the uncertainty about causal direction mentioned above, this can be interpreted in one of two ways: 1/ protective behaviour prompts a greater desire to avoid visible reminders of the risk or 2/ people who want to avoid being reminded of the risk are more likely to take protective measures. Work by Harries (2008b) lends support to the former interpretation is provided by Harries (2008b), who found evidence in people's discourse about flood protection that suggests an association between protection and increased anxiety. This would suggest that protective action increases concerns about the added anxiety that such measures bring.

An equally strong finding concerned beliefs about insurance. Those who expressed the belief that that insurance was a panacea to the flood risk were less than half as likely to have taken any protective measures.

The belief that protective measures increase feelings of safety (QC3(b)i) is included in Figure 6 in spite of the fact that it fell just short of statistical significance (p = 0.101; *Exp(B)* = 2.05). Although belief in such a benefit might increase the likelihood of people taking protective action, it is also possible that once people have taken such action they will find that this expectation is not met and will therefore cease to hold this belief. Were this true, the latter phenomenon would obscure the former in any statistical test of association. Any more valid test of the importance of beliefs about feelings of safety would require a number of surveys over a period long enough to allow participants to implement flood protection measures and experience their emotional impacts.

Table 2 Logistic regression with 'use of protection' as the outcome variable

Independent variables (comparison groups in brackets) – see Figure 3	N	Std. Error	Wald	Exp(B)	95% C.I. for Exp(B)	
					Lower	Upper
"I feel it would be too expensive"						
(disagree / don't know)	205					
Agree	270	.29	1.03	1.33	.76	2.33
"It would make my house look odd"						
(disagree / don't know)	349					
Agree	126	.36	.11	.89	.44	1.80
"I don't think it's my responsibility"						
(disagree / don't know)	379					
Agree	96	.37	1.60	.62	.30	1.30
"I don't think I'm going to live here much longer" (disagree / don't know)	380					
Agree	95	.41	4.47	**.43****	.19	1.94
"I don't want to be reminded of the risk of flooding" (disagree / don't know)	395					
Agree	80	.37	7.79	**2.84****	1.36	5.90
"When I sell my home, I don't want potential buyers to see it's at risk of flooding"						
(disagree / don't know)	362					
Agree	113	.35	1.09	.70	.36	1.37
"I don't think I would be able to choose the right way to protect my home"						
(disagree / don't know)	345					
Agree	130	.32	.00	1.00	.53	1.87
"My home is covered by insurance so I don't need to worry" (disagree / don't know)	351					

Agree	124	.37	5.27	**.43****	.21	.88
"It would make my home feel less comfortable and attractive" (disagree / don't know)	350					
Agree	125	.34	.09	.90	.48	1.75
"Collective flood protection measures have already been put in place for this area" (disagree / don't know)	268					
Agree	207	.28	1.08	.75	.43	1.30
"It would make me feel safer" (disagree / don't know)	117					
Agree	358	.44	2.69	2.05	.87	4.85
"It would save me money in the long-term" (disagree / don't know)	185					
Agree	290	.33	.24	.85	.45	1.62
"My insurance premiums would go down or not go up so much" (disagree / don't know)	299					
Agree	176	.29	1.99	1.50	.85	2.64
"It would increase the value of my property" (disagree / don't know)	315					
Agree	160	.30	.78	.77	.43	1.38
"It would decrease the hassle / disruption if there was a flood" (disagree / don't know)	104					
Agree	371	.39	1.04	1.49	.70	3.18
Do you think you are likely to be flooded in the next 10 years? (No / don't know)	356					
Yes	115	.27	3.87	**1.71****	1.00	2.91
Constant		.53	27.42	.06		
		Hosmer & Lemeshow R^2 = 0.79				

* $p < .1$ ** $p < .05$

As well as looking at the predictor variables that were statistically significant predictors of protective behaviour, it is also worth reflecting on those found *not* to have any relationship with protective behaviour. For example, although the literature suggests that residents consider non-monetary impacts such as disruption as more important than monetary ones (Green, 1988 and Parker et al, 1983), there was no significant correlation between protective behaviour and beliefs about the consequences of protection for the levels of disruption that floods would cause.

Similarly, with the exception of the insurance variable mentioned above, no correlations were found between protective behaviour and beliefs about financial losses and gains. This suggests either that benefit-cost comparisons are not significant to the decision-making process or that the experience of having protective measures in place discourages the belief that they bring financial rewards. Harries (2008a) argues that cost arguments are mainly

rhetorical and that they act as proxies for other arguments whose use would contravene conversational norms (see Grice, 1975). He suggests that interviewer probing of participants who use the cost discourse will sometimes show their real concern to be issues of social justice. The existence of a significant positive correlation between perceptions of expense and responsibility data supports this interpretation (N = 527; $d.f.$ = 2; $p < .05$; χ^2 = 7.52; OR = 1.95).

Behavioural norms

None of the predictor variables relating to perceived norms were found to be significant. In keeping with the findings of a recent study on flood risk (Terpestra and Gutteling, 2008) but in contrast to findings for other natural hazards (e.g. Duval and Mulilis, 1999; Lindell and Whitney, 2000; Paton et al, 2005), perceived norms regarding responsibility ("I don't think it's my responsibility") were not associated with behaviour. Neither were concerns about stigma found to be significant ("It would make my house look odd"; "It would make my home feel less comfortable and attractive"), nor perceived expense ("I feel it would be too expensive").

Self-efficacy

As discussed above, the operationalisation of self-efficacy with only one variable defines the concept too narrowly for a test of self-efficacy to be conclusive. None-the-less, the absence of significance for the one self-efficacy variable ("I don't think I would be able to choose the right way to protect my home") provides some support for Zaalberg et al's (2009) findings in this regard.

Perceived flood probability

The role of the fourth and final type of belief, risk perception, was addressed in the analysis by looking at whether respondents believed that their homes were likely to flood over the

coming twelve months and whether they expected to still be living in the same location for much longer. Both these dimensions of risk perception were found to be correlated with protective behaviour. Furthermore, as they are not correlated with each other (N = 515, χ^2 = .86, d.f. = 1, p = .35), they can be assumed to be independent dimensions of risk perception.

Stages 2 and 3 of the analysis – the mediating effects of flood experience

The second stage of the analysis (Table 3) showed that three of the variables significant in Stage 1 were also correlated with experience of household flooding. Probability perception, anxiety avoidance and belief in the adequacy of insurance as a substitute for protection were all predicted by experience of flooding. These variables can, therefore, be described as mediators of the impact of experience on protective behaviour. Experience increases the tendency to take protective measures because (or to be more accurate, partly because) it increases their perception of the likelihood that they will be flooded again and because it increases their dependence on insurance. At the same time, it also reduces this tendency by increasing the salience of anxiety avoidance.

Table 3 Logistic regression with flood experience as the dependent variable

Independent variables (comparison groups in brackets)	N	Std. Error	Wald	Exp(B)	95% C.I. for Exp(B) Lower	Upper
Do you think you are likely to be flooded in the next 10 years? (No)	147					
Yes / don't know	328	.25	7.80	**2.00****	1.23	3.26
"I don't think I'm going to live here much longer" (disagree / don't know)	380					
Agree	95	.27	.29	.87	.51	1.47
"I don't want to be reminded of the risk of flooding" (disagree / don't know)	395					
Agree	80	.27	8.56	**2.22*****	1.30	3.78
"My home is covered by insurance so I don't need to worry" (disagree / don't know)	351					
Agree	124	.26	7.31	**.49****	.29	.82
"It would make me feel safer" (disagree / don't know)	113					
Agree	362	.27	2.70	1.55	.92	2.62
Constant		.42	23.92	.13		

** $p < .05$ *** $p < 0.005$

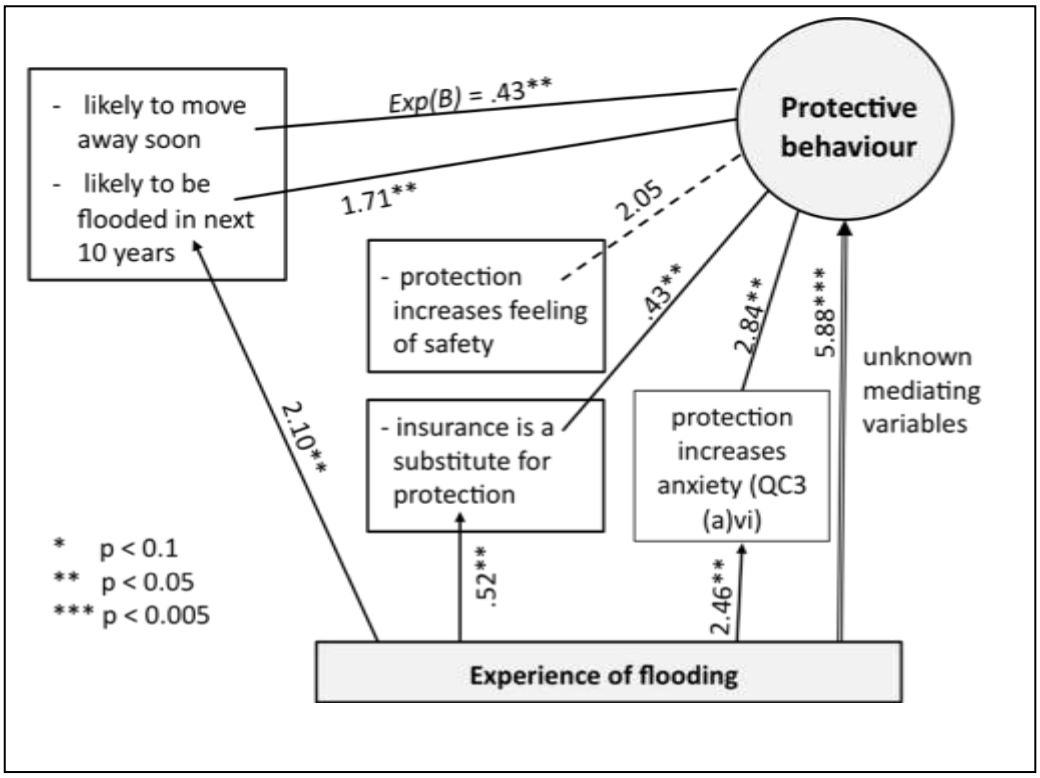
The third and final stage of the analysis reveals, however, that these three mediating variables only explain the smaller part of the relationship between experience and behaviour. As shown in Table 4, when these variables are controlled for, people who have implemented protection measures are still almost six times more likely to have experienced a flood. (See Figure 7.)

Table 4 Logistic regression of flood experience onto flood protection, controlling for the mediating beliefs identified in Stage 2

Independent variables (comparison groups in brackets)	N	Std. Error	Wald	Exp(B)	95% C.I. for Exp(B) Lower	Upper
Do you think you are likely to be flooded in the next 10 years? (No)	142					
Yes / don't know	328	.26	6.01	**1.88****	3.41	10.13
"I don't want to be reminded of the risk of flooding" (disagree / don't know)	390					
Agree	80	.29	4.58	**1.84****	1.14	3.13
"My home is covered by insurance so I don't need to worry" (disagree / don't know)	347					
Agree	123	.27	3.25	**.61****	1.05	3.21
Flood protection measure implemented? (No)	396					
Yes	74	.28	40.70	**5.88*****	.36	1.04
Constant		.25	49.12	.18		

** $p < .05$ *** $p < 0.005$

Figure 7 Summary of findings



Discussion

Using secondary analysis of an existing survey dataset, this study drew two main conclusions from its exploration of the relationship between protective behaviour, experience of flooding and a range of beliefs about floods and flood protection. Firstly, whilst confirming the importance of risk perception for protective behaviour, the analysis challenges the pre-eminence often accorded it in the literature, indicating that beliefs about the impact of protection measures on anxiety and feelings deserve more attention than they have previously received. Secondly, it suggests that the impact of experience might be better understood by looking at the mediating role played by beliefs.

As expected, risk perceptions and beliefs about the effects of protective action were significantly associated with protective behaviour. People who said they expected to be flooded in the next ten years were almost twice as likely as others to have taken protective measures and those that said they expected to move away from at-risk areas were less than

half as likely to have done so. Similarly, protective behaviour was correlated with beliefs about anxiety and reliance on insurance. Beliefs about feelings of safety were not found to be statistically significant, but it was argued, above, that this finding might be the result of the absence of temporality in the data.

Some of the expressed beliefs that were found to be correlated with behaviour were themselves associated with experience of flooding. Respondents who had experienced flooding in their home were significantly less likely to believe that insurance was an adequate substitute for protection, more likely to emphasise anxiety avoidance and more likely to say that they expected to be flooded in the next ten years. This suggests that these beliefs mediate the impact of experience on protective behaviour. However, the analysis fails to explain the largest part of the influence of experience on behaviour, and this suggests that its effects are also mediated by other, unknown, variables not included in the survey questionnaire.

A second key element of the findings is the lack of any correlation between protective behaviour and expressed beliefs about its financial implications (the cost of the measures, the promise of long-term savings and the impact on insurance terms). The case of insurance seems, at first, to provide evidence of the importance of financial consideration. Financially motivated moral hazard is often cited as a key influence on risk behaviour (see Baker, 2002; Grubel, 1971; Johnson et al 1993; Kunreuther and Heal, 2003) and the finding of a negative correlation between protection and insurance (confirmed elsewhere in the literature – e.g. Cutter, 2006) seems to support this conclusion. However, the absence of significance for the other financial beliefs in this study should prompt a reinterpretation of these findings. It can, for example, by argued that the real nature of the moral hazard may be psychological rather than financial and that psychological denial is an important factor. After all, it has been argued previously that the desire to feel secure can be a stronger influence on behaviour than

480 the desire to actually be secure (Harries, 2008b; Tobin, 1995), so the illusion of protection
481 will sometimes substitute for actual protection.

482 Indeed, householders' frequent emotional framing of flood protection contrasts more
483 generally with that used by policymakers in the UK. The author's involvement in the
484 formulation of government policy in this area[1] suggests that cost-benefit calculations rarely
485 take such considerations into account and his participant observation in training courses for
486 Environment Agency staff[2] reveals that non-material losses and gains are not usually
487 incorporated into formal decision-making processes at the strategic level. The revealed
488 importance of anticipated emotions for decisions about flood protection indicates that policy-
489 makers ought to be concentrating more on promoting the emotional benefits of adaptation
490 and that if protection products are not to provoke increased risk awareness and anxiety,
491 manufacturers of should ensure that they are better adapted to the architectural and domestic
492 contexts within which they are used.

493 However, these conclusions must remain tentative for the time being, for the research
494 presented in this paper contains a number of weaknesses. This is, in part, due its reliance on
495 the analysis of data originally collected for a different purpose. Although secondary analysis
496 has the advantage of minimising inconvenience to respondent groups and reducing the need
497 for time- and resource-consuming data collection (Dale et al 1988), it requires the researcher
498 to use data that might be imperfectly suited to the research question. In this study, the dataset
499 did not cover all the elements of the model equally thoroughly and the questions had not been
500 cognitively tested before being included in the survey (see Schwarz and Sudman 1996).

501 A further consideration is the survey methodology. Although the evidence on differences in
502 data quality between telephone and face-to-face surveys is contradictory, it is thought that the

[1] During an ESRC Placement Fellowship at Defra in 2007 and 2008
[2] Performed as part of a study reported in Harries and Penning-Rowsell (2011)

503 inability to use visual prompts constrains the complexity of questions used (Tourangeau,
504 2000). In addition, although recruitment quotas were used for the numbers of flooded and un-
505 flooded households in the sample, the absence of demographic quotas is likely to have been
506 responsible for the over-representation of retired and self-employed people and the
507 underrepresentation of families with older children (see the discussion above).

508 Furthermore, as noted throughout the above discussion, it is difficult to learn about causality
509 from correlational statistics. This made it impossible to establish which of the statistically
510 significant beliefs have an influence *on* protective behaviour and which are influenced *by* that
511 behaviour. The correlational approach may also, as argued above with regard to beliefs about
512 stigma, have caused some false negative. Before any firm recommendations can be made
513 regarding public policy, this shortfall in the analysis should be remedied either by further
514 qualitative work or by time-series analyses of sets of survey data collected from the same
515 households before and after the occurrence of floods.

516 **Conclusion**

517 Further exploration of the role of insurance is important for the development of policy in this
518 area. Policy-makers tend to assume that moral hazard is the result of perverse financial
519 incentives and that reducing insurance cover for flood damage would increase take-up of
520 protection measures. If the relationship between insurance and flood protection is actually
521 explained by emotional considerations, attempts to reduce the available financial cover might
522 have no affect on the take-up of protection measures and only lead to a search for alternative
523 strategies that can support psychological denial.

524 Given the financial and practical challenges inherent in longitudinal survey research, the next
525 step in understanding the predictors of protective responses to flood risk should probably be
526 further qualitative investigation. This should seek to establish a more complete understanding

of the relationship between protective behaviour and the beliefs identified, in this study, as significant for protective behaviour. It should also investigate how and why experience influences these beliefs and to identify the other mediators of its impact on behaviour.

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