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ORIGINAL PAPER

The perceptions of social responsibility for community resilience to flooding: the impact of past experience, age, gender and ethnicity

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Abstract Community resilience to flooding depends, to a large extent, on the participation of community members to take more responsibility for enhancing their own resilience. The perception of social responsibility (SR) which is argued to be one of the antecedents influencing individual's willingness to undertake resilient behaviours can significantly contribute to community resilience through individual and collective actions. Understanding of factors influencing the perceptions of SR of individuals within community might help with developing strategies to increase the perceptions of SR. This research explores perceptions of SR in relation to flooding for householders and local businesses and establishes their relationships with experience of flooding and demographic factors of age, gender and ethnicity. The data were obtained via a questionnaire survey of three communities in Birmingham and one community in South East London, UK, three with experience of flooding and one without. A total of 414 responses were received and used in the multiple regression analysis. The analysis identified 'experience of flooding', 'age' and 'South Asian' ethnic group as significant variables, suggesting that older individuals from South Asian ethnic groups with previous experience of flooding are likely to be more socially responsible than others without these attributes.

Keywords Community · Resilience · Flooding · Perceptions · Social responsibility

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1 Introduction

Flooding is considered one of the biggest natural hazards, frequently experienced by communities in the UK (Fowler and Kilsby 2003; Harries 2013). Structural measures, such as flood defences, can fail if extreme floods exceed their design capacity and therefore cannot completely protect communities. The structural measures should be complemented by other measures which would require participation of members of community to take more responsibility for enhancing their resilience (DEFRA 2005; Pitt 2008). Community resilience, defined broadly, as the ability of a community to cope with the impacts, return to normal functioning, learn and adapt after a flood event (adapted from Adger 2000; Cutter et al. 2008; Norris et al. 2008), could be regarded as collective resilient behaviours of individuals and involves complex interrelationships between community members within a local social context. Exploring resilient behaviour in its context allows a better understanding of the perceptions that lead to these behaviours. The understanding is even more important as several studies have found that majority of individuals in European countries (including the Netherlands, Germany, Norway, Sweden and the UK) had not taken protective actions to prepare for floods (Krasovskaia 2005; Terpstra and Gutteling 2008; Kievik and Gutteling 2011). Specifically, Joseph et al. (2015) found that flooded homeowners in the UK were unclear about their responsibility and not confident with the ability of resistance/resilience measures to prevent flooding. Further, the nature of resilient behaviours and the perceptions that lead to these behaviours in the community are not well understood (Smit and Wandel 2006). From a thorough review of literature from a number of academic fields and policy research, the research reported in the paper proposes the concept of social responsibility (SR) as an alternative way of understanding the behaviours of individuals to contribute to collective actions for enhancing community resilience to flooding.

SR refers to a generic ethical framework relating to the relationships between the economic, environmental and social aspects of an individual or organisation activities that endeavour to benefit society (ISO 2010). The US Federal Emergency Management Agency (FEMA) recognised personal responsibility as being the key to building a resilient community (Colten et al. 2008). Personal responsibility for taking action is also an important factor in several psychological models for preparedness behaviours (Karanci 2013). Further, individual perception of their roles and responsibilities is important to climate change adaptation and climate change (Nicholson-Cole 2005). The term SR encompasses a broader individual's responsibility to contribute to collective actions for enhancing the resilience of community which they are part of. This definition is appropriate for this research given that achieving community resilience is considered as a concerted effort by individuals within that community. Ajzen (1991) stated that behaviour is determined by intention (i.e. the decision to engage in a particular behaviour). Intention itself is understood to be determined by an individual's motivational factors (Sinatra et al. 2012; Armitage and Conner 2001). It is recognised that perceptions are one of these key motivational factors, with their relevance varying between individuals and contexts of the behavioural intention (Sinatra et al. 2012; Collins and Chambers 2005; Corraliza and Berenguer 2000; Ajzen 1985). Thus, in terms of individual cognitive decision-making, behaviour intention is an intermediate link between perceptions and behaviour. It is important to note that perceptions of SR are only one of a number of perceptions which may affect behaviour in relation to community resilience to flooding. For example, the effect of perceptions of risk has been noted across a wide range of extreme weather events,

with higher perceived risk found to increase pro-environmental behaviour (Whitmarsh and O'Neill 2010; Floyd et al. 2000; Neuwirth et al. 2000) and lower perceived risk leading to a lack of pro-environmental behaviour (Whitmarsh 2011; Spittal et al. 2005; Johnston 1999; Harris 1996). This research is orientated towards the perceptions of SR and argues that individuals with higher perception of SR would display increased resilient behaviour, but individuals with lower perception of SR would display a lack of resilient behaviour.

Investigating the perceptions of SR would benefit from an understanding of factors influencing the perceptions of SR of individuals within community. This understanding might help with developing strategies to increase the perceptions of SR, which ultimately create a more desirable mindset within the key community groups that leads to the adoption of resilience measures. This understanding would also help to identify groups of individuals who tend to have lower perceptions of SR, so that appropriate targeted strategies could be developed and deployed. This is supported by Terpstra and Gutteling (2008), who highlighted the importance of increasing responsibility of, and motivating individuals who do not think that they are responsible to take protective actions. For example, demographic factors may help explain the reasons why two people from the same geographical community hold different perceptions of SR and display different behaviours when presented with the same flooding event. From reviews of research, Lindell and Perry (2000) and more recently, Lindell (2013) concluded that demographic factors can influence resilient behaviours to reduce the risk of environmental hazards and are included as influencing factors in a number of community resilience models (Tierney and Bruneau 2007; Cutter et al. 2008).

This paper reports an investigation on the effect of experience of flooding and the demographics of age, gender and ethnicity on the perceptions of SR in three communities in Birmingham and one in South East (SE) London, UK. In these four communities, householders and small businesses were invited to participate in a questionnaire survey as part of the research. 'Householder' refers to an individual who resides within the community, and 'small business' refers to either the owner, manager or a person of senior standing within the local area. Involvement in community actions by these community groups is vital for successful disaster management (Buckle et al. 2001; Tapsell et al. 2010). The questionnaire collated respondents' individual self-rated perceptions of SR and their demographic data. The responses were then analysed statistically. The following sections describe the concept of SR within the context of this investigation, the influence of disaster experience and demographic factors on the perception of SR, before research methods and findings are explained. They are followed by a discussion on the findings and implications, a conclusion and research limitations and areas for future research.

2 The perceptions of social responsibility and community resilience

2.1 The concept of social responsibility and community resilience

As the focus of the research is to explore the relationship between social aspects (SR) and environmental aspects (resilience to flooding), it is important to note different conceptualisations of SR for different application contexts. For example, conceptualisations of SR within the majority of literature have largely been business based, exploring corporate social responsibility (CSR) (Hahn 2012; Waddock 2008; Banerjee 2007). The rise in awareness of CSR emanated from the public demanding access to more information about

how companies were working, and the public are now being recognised by companies as a key stakeholder group (Waddock 2008; Horgan 2005; Clark 2000). SR has long been an important field of research for both academics and business practitioners and continues to provide a valuable research area for those wishing to investigate modern societal issues (Hahn 2012; Peterson and Jun 2007; Gorte 2005). SR has been the focus of research that investigated business SR by exploring and comparing the perspectives of business employees and social workers (Boehm 2009), investigated the relationship between perceptions of personal and SR and intrinsic motivation in the field of education (Li et al. 2008) and explored SR as a factor when investigating genetic and environmental components of pro-social attitudes (Rushton 2004). Some studies have explored the impact of socio-demographic factors on the perception of CSR from investors (Cheah et al. 2011), state residents (Panwar et al. 2010) and consumers (Wells et al. 2011); however, none has been found to examine the impact of the same on perception of SR in relation to flooding. Overall, these studies indicate that responsibility for behaviour is related to the perceptions that people hold. This adds further support to the idea that perceptions of SR and their effect upon decision-making and behaviour is an important area to explore, in relation to resilience to flooding. Exploring perceptions of SR for flooding will provide an excellent platform from which to investigate community resilience.

Protection against the impact of flooding is often perceived to be mainly the responsibility of government, with very little participation from members of community (Krasovskaia 2005; Terpstra and Gutteling 2008). Increasing impact of climate change and tightening public spending on physical flood protection measures have called individuals to be responsible for improving their own resilience by taking protective actions. Pitt's (2008) review highlighted the importance of community groups (householders and small businesses) to work together with the government in resilience-enhancing actions, for example, via local resilience forums. These initiatives can help to clarify what individuals are expected to do by themselves and what the government can support. Enhancing community resilience should be a collaborative effort between community groups and government. Thus, it is important to recognise that members of community can enhance their own resilience and, by doing so, can enhance the resilience of community. These individuals have a responsibility to increase their own resilience, and they can do so through the decisions they make about being aware of the risks, accepting these risks, seeking relevant information and taking protective actions. It is argued that individuals may differ in their perceptions of SR, based on their unique set of intrinsic factors (i.e. past experience of flooding and demographic variables of age, gender and ethnicity). The discussion of literature has so far highlighted age, gender and ethnicity as the most recurring and prominent of these factors. Here, the research is not stating that the other factors are not relevant, but simply that they were not the most relevant, given the review of literature conducted. In relation to socio-economic status, Whittaker et al. (2005) and Dunlap and Mertig (1995) suggested that affluence is not always a determining factor for environmental concern and a conservation ethos. Further, Bethel et al. (2013) found that the difference in disaster preparedness (measured by medication supplies) in eight states in the USA was not due to factors related to socio-economic status. Particularly for this investigation, socio-economic status was not considered to be one of the most relevant factors. This is because the participants within each case study area lived within the same radius of a flooding event. This proximity of living accommodation, the majority of which is similar in house type and therefore cost, was considered as a natural social leveller for socio-economic status amongst participants. It is recognised that socio-economic status may not only play a part in what people are able (or feel they are able) to achieve in relation to

resilience measures, but also impact on long-term mental health of flooded households (Lamond et al. 2015). However, given that there are not expected to be great differences between the socio-economic statuses of participants, then it is reasonable to suggest that this would not be the most important factor to explore within the research. The following section explains factors that may influence individual perceptions of SR included in this research.

2.2 Past experience of flooding

Research has found that experiencing a flooding event has long-term impacts upon people's lives (Tapsell et al. 2003, 2010; Tapsell 2000; Fordham 1998). A body of research suggests that personal experience of flooding can influence their awareness of risk, response and preparedness (Nicholson-Cole 2005; Tapsell et al. 2010; Delanty 2003; Valentine 2001; Pain et al. 2001), which in turn suggest that they may show higher perceptions of SR than people who have not experienced flooding. However, there has also been research which found that there was little difference between the climate change perceptions of individuals who had experienced flooding and those who had not (Whitmarsh 2008). One potential reason for this is that research has indicated that past behaviour can give an indication of future behaviour, as people are unwilling to deviate from regular routines (Quimby and Angelique 2011; Ouellette and Wood 1998). This is supported by Whitmarsh (2008) who noted that not a single participant in their study explicitly mentioned strategies to adapt to climate change and flooding. This suggests that experience of a flooding event may not be enough to instigate long-term behavioural change. This poses the question as to whether, in the same way that experience of a flooding event may alter an individual's perception of flood risk, would experience of flooding alter perceptions of SR? Furthermore, would these perceptions be altered in a positive manner, with a clear distinction between the perceptions held by those individuals that have experienced flooding and those who have not?

2.3 Age

Hakes and Viscusi (2004) found that older people estimated risks more precisely than younger people, i.e., their perceived estimation of risk is closer to the actual level of risk they are exposed to. This view is also supported by research which found that increasing age was related to greater protective behaviour in both seismic hazard adjustments (Lindell and Whitney 2000) and preparations for El Nino (Siegel et al. 2003). Wells et al. (2011) explored consumer responsibility and found that increasing age was related to an increase in general environmental responsiveness. Given these findings, it is reasonable to suggest that older participants would be more likely to engage in resilient behaviour than younger participants.

In contrast, Tanida (1996) indicated that younger people were more likely to survive an earthquake. This suggests that younger people are more resilient to extreme events. It may also be interpreted in another way. If younger people are more likely to survive an extreme event, then they may be less likely to take measures to become more resilient to extreme events. This is because people who perceive themselves to be most at risk from extreme events are more likely to take measures to counter that risk (Armas et al. 2003). This may explain the increased interest and uptake of resilient behaviour displayed by older people. There is also the third view that age does not affect climate change risk perception at all, as

found by Safi et al. (2012). These contrasting findings require further exploration of the effect of age on perceptions of SR related to flooding.

2.4 Gender

Early research indicated that females (particularly pregnant females) are more vulnerable to the effects of extreme weather events than males (Balbus and Malina 2009; Granger and Hayne 2001). Several researchers found that females are more concerned about the impact of climate change than men (Semenza et al. 2008; Sundblad et al. 2007; Leiserowitz 2006). This line of reasoning is also supported by the facts regarding the vulnerability of females during extreme events. The Women's Environment and Development Organization reported that women and children are 14 times more likely to die than men during disasters (Araujo and Quesada-Aguilar 2007). These gender influences have also been found to be present after two flooding events in Scotland, with females being affected more than males by changes within the community (Fordham 1998). Bartlett (2008) supported this early finding, indicating that females are more vulnerable to anger, frustration and violence associated with the upheaval during and after an extreme event. However, Adelekan and Asiyanbi (2016) found no significant effect of gender on feelings of worry and perceived vulnerability to flooding in Lagos. Similarly, Harvatt et al. (2011) found little evidence of gender differences in householder responses to flooding and sea level rise in three high-risk locations in England. Despite these contrasting findings, this suggests that, given the difference in responses and social reactions to flooding, there may also be gender influences in perceptions of SR, which may then affect decision-making and behaviour.

2.5 Ethnicity

Culture, generally defined as a set of beliefs, moral and values that are shared within an ethnic group, gives meaning of ethnicity to individuals and groups and is therefore considered as a basic building block of ethnicity (Nagel 1994). Potential ethnic differences in perceptions of SR related to flooding are supported by many researchers who found that perceptions of environmental and technological hazards can vary between cultures due to different perceptions (or world views) held by individuals within each culture (Kahan et al. 2010; Poortinga et al. 2002; Steg and Sievers 2000; Gyawali 1999; Slovic 1999; Ellis and Thompson 1997). Perceptions of risk can vary between different cultures because cultural norms shape which dangers are feared and what risks are taken (Douglas and Wildavsky 1982). These cultural norms influence this by entering into an individual's cognitive and social risk identification processes (Kahan et al. 2010). Cultural orientation has an impact on how people respond to climate change issues, and determines whether they are willing to take protective actions (Larson et al. 2011; Kahan et al. 2010; Myers 1994). This suggests that the willingness of individuals to improve resilience to flooding which is associated with high perception of SR may be affected by cultural differences. Thus, it is argued that cultural differences may create differences in the perception of SR between individuals of different ethnicities.

There are contrasting findings of the ethnicity influence on the perceptions of risk. In a large-scale opinion survey of risk perceptions conducted between June and September 2004 in the USA, Kahan et al. (2007) indicated that member of Black ethnic groups (i.e. African Americans) perceives risk higher than members of White ethnic groups. Hakes and Viscusi (2004) indicated that members of the White ethnic group would estimate the risks more precisely than other ethnic groups, suggesting that they would have had to take a

greater interest in those risks, which Myers (1994) suggested is linked to higher take-up of protective actions. However, Kahan et al. (2007) suggested that individuals from White ethnic group consider environmental risk less seriously than those from African Americans. This finding is linked to reduce take-up of protective actions. More specific ethnic differences related to flooding can be seen in research which suggests that individuals who regard themselves as belonging to the Asian ethnic group may hold different perceptions of a community's response to and recovery from an extreme flooding event (Tapsell 2000; Tapsell et al. 1999). However, despite the importance of ethnicity as a predictor of risk perception, Bourque et al. (2012) found that perceived risk was a weak predictor of preparedness behaviour. Mullins and Soetanto (2013) found ethnic differences in the perceptions of SR and suggested three different levels of resilience and their association with different ethnic groups. However, the statistical importance of ethnicity to SR score compared to the other intrinsic factors of experience of flooding, age and gender was not investigated and therefore is still not well understood. There is scant evidence that previous research in environmental risk communication for hazard adjustments has sufficiently assessed the importance of demographic variables compared to other variables in this manner (Lindell and Perry 2004). This paper significantly extends the previous work in Mullins and Soetanto (2013) and is intended to make a novel contribution by considering these intrinsic factors simultaneously in a multivariate analysis. Thus, the research question addressed in this paper is:

What are the extent and direction of the relationships between these intrinsic factors and the perception of SR?

The research intends to establish their relationships using multiple regression analysis so that the relative importance of the factors on the perception of SR could be ascertained. Case study areas and methods employed to investigate this relationship are explained in the following section.

3 Case study areas

These two largest UK cities, Birmingham and (South East/SE) London, were chosen because they contain communities which had experience of flooding. It is important to note that this research is not suggesting that either of these areas are more susceptible to flooding than other areas of the UK. However, these urban areas do contain a number of characteristics that make them appropriate as case study areas for the investigation. Four communities were chosen because they allowed comparisons between communities in different locations who faced different levels of risk, as well as between communities who had experienced flooding and those who had not.

3.1 Birmingham communities (Witton, Selly Park and Digbeth)

Birmingham is the second largest city in the UK with over 1 million people. Historically, Birmingham has been particularly susceptible to flooding (Be Birmingham 2011). Although Birmingham is around 500 feet above sea level, flooding still occurs, particularly in the area around the course of three main rivers (River Tame, River Rea and River Cole). Witton and Selly Park were chosen because they were urbanised areas that lie close to water sources within tributaries of River Tame and River Rea, respectively. Furthermore, both Witton and Selly Park have frequently experienced flooding including major flooding

in summer 2007. Witton was highlighted as being one of the worst affected communities, with multiple issues related to the flooding they experienced (Kotecha et al. 2008). It was reported that around 300 homes within the Brookvale Road of Witton (data collection area) were affected by extreme flooding in 2007 (Dayani 2007). To reduce flood risk, Environment Agency (2014) recommended to build and improve flood defences in the Brookvale Road area. There were estimated to be around 70 flood-affected properties in Selly Park during the 2007 flood, the largest flooding event in the area since 1927 (Clayton 2008). There are over 400 properties (in Southern and Northern areas of Selly Park) at risk of flooding from the River Rea, with several recorded flood events in this area, most recently in 2012 and June 2016. Flood defence schemes are being planned for both areas with implementation from Autumn 2016 (Rea Catchment Partnership 2016). Digbeth was chosen as a control group area as it had not experienced flooding in recent years, but theoretically still contains the potential to do so as it is also an urbanised area that is close to the River Rea. It should be noted that the community of Digbeth was not flooded during the summer 2007 floods and has not been known to have experienced a flooding event within the last 30 years.

3.2 London community (Thornton Heath)

The study chose Thornton Heath community in the London Borough of Croydon as a case study area. Croydon is the 4th highest ranked borough out of 4215 settlement areas with around 21,100 properties predicted to be at risk from surface water flooding (DEFRA 2009). It is also noted that there are a number of areas within Croydon which are at risk of sewer flooding from the Thames water and there have been a number of incidences of surface water flooding, in particular within the communities of Thornton Heath, Upper Norwood and Broad Green (Croydon SFRA 2009). The majority of flooding within London during the 2007 summer floods was from surface water flooding (City of London Corporation 2014). Thornton Heath contains the water source of Norbury Brook, whose river level is monitored by the Environment Agency. The community of Thornton Heath was flooded during summer 2007, with the highest ever recorded river level at that time. This flooding also caused disruptions to two of the four rail lines within South Croydon, due to landslips (Bannerman 2007). This experience of flooding in 2007 within the Thornton Heath community will allow direct comparison with the Birmingham communities of Witton and Selly Park. However, Thornton Heath have been identified as the most susceptible to groundwater flooding, as demonstrated by the summer 2007 floods located there (Croydon SFRA 2009). In addition, this was combined with a large amount of sewer flooding in Thornton Heath, due to the long lengths of culverted sewer in the borough (Croydon SFRA 2009). Furthermore, Thornton Heath receives greater amounts of water run-off due to the local topography of steep slopes in Coulsdon, Kenley and Upper Norwood, which channel water into the area (Croydon Council 2011). All these elements combined with the potential heavy precipitation have posed high level of flood risk in Thornton Heath.

4 Methods

4.1 Questionnaire design

Berkowitz and Lutterman's (1968) SR scale was modified and subsequently adopted in the research. The reason of adopting this SR scale was because it allowed the research to explore an individual's attitude in relation to SR and compare attitudinal SR scores between individuals and communities. The original SR questionnaire has provided a valid and reliable basis for researching SR since its creation. The original SR scale measured an individual's acceptance of the traditional values of their society. The aim of this questionnaire survey is to collate the perceptions of community groups in relation to flooding and as such the original questionnaire was extended and the attitudinal statements were modified. Table 1 presents a comparison between original and modified statements for the survey. The modified statements made specific reference to 'flooding', 'local community', 'neighbours', 'protection against floods' and 'climate change', thus ensuring their relevance to the investigation. A number of SR studies have adopted modified versions of the original scale (Reed et al. 2005; Megicks et al. 2005; Chacon et al. 1998; Frieden and Downs 1986). The final version of the questionnaire included 12 attitudinal statements.

The respondents were asked to indicate their agreement against these statements on a 4-point scale ranging from 'Strongly Agree' (4) to 'Strongly Disagree' (1). In the analysis, several statements were reverse scored to counter acquiescence bias. Each respondent had a potential total score ranging between 12, indicating a very low SR, and 48, indicating a very high SR. These attitudinal questions provide information about how each respondent perceives their own SR. Please note that because the questions are attitudinal, then simply examining the scores of individual questions could display too much bias, or not tell us very much when analysed individually. Thus, the scores for all 12 statements were aggregated. The reliability of the scores was confirmed by Cronbach's alpha coefficient of 0.801. Before this SR questionnaire, the respondents were asked to provide demographic data of age, gender and ethnicity. The respondents were to state their age in space provided, which represents ratio data. Gender and ethnicity were considered as nominal data with multiple choice answers provided in the questionnaire. Ethnicity groups were based on the 2001 UK Census, including 'White', 'Black', 'South Asian', 'Chinese', 'Mixed—White/Black', 'Mixed—White/South Asian' and 'others' answers (ONS 2001).

4.2 Data collection and respondents

The questionnaires were distributed and collected by hand in the communities of Witton, Selly Park and Digbeth in Birmingham and Thornton Heath in SE London. The sampling approach was used to designate target population (i.e. flooded or non-flooded communities) based on the geographical area of the case studies. For targeted flooded communities, the questionnaires were distributed to respondents in and around the worst affected areas of the community, ensuring that as many of the target population had direct experience of flooding. However, practical considerations of the sampling approach would mean that the responses from flooded communities may not necessarily be from individuals whose homes or businesses have been flooded. This could be considered a potential limitation of the sampling approach. Nevertheless, floods affect communities in many ways, and an individual is considered by this investigation to have experienced a flood within their community, regardless of whether they were directly or indirectly affected by the flood

Table 1 Comparison of original and modified statements for social responsibility questionnaires

No.	Original statements	Modified statements
1	It is no use worrying about current events or public affairs; I can't do anything about them anyway	It is no use worrying about flooding within the community as I can't do anything about it anyway
2	Every person should give some of his time for the good of his town or country	Every person should give some of their time for the good of their local community
3	Our country would be a lot better off if we didn't have so many elections and people didn't have to vote so often	Our country would be a lot better off if we didn't have so many rules
4	Letting your friends down is not so bad because you can't do good all the time for everybody	Letting your neighbours down is not so bad because you can't do good all the time for everybody
5	It is the duty of each person to do his job the very best he can	It is the duty of each member of a community to do the very best they can to increase their protection against floods
6	People would be a lot better off if they could live far away from other people and never have to do anything for them	People would be a lot better off if they could live far away from other people and have less interaction with each other
7	At school I usually volunteered for special projects	I would like to take part in a community volunteering project
8	I feel very bad when I have failed to finish a job I promised I would do	I feel very bad when I have failed to finish a job I promised I would do
9	–	I feel it is important to always tell the truth to others
10	–	I feel it is important to get on well with your neighbours
11	–	I do not feel that climate change is an important issue that will affect me
12	–	I feel that it is important that people should always obey the law

water within their own homes or businesses (their street, transport links, shops they use or friends and relatives may be flooded). Further, local groups in flooded communities (such as Selly Park South Neighbourhood Forum) which raise awareness of flood risk and promote resilience-enhancing actions could positively impact individual's perception of SR.

A total of 1200 questionnaires were distributed (300 for each community), and 414 completed questionnaires were received, representing a response rate of 34.5%. The responses are detailed in Table 2. The last two columns of Table 2 display gender distributions with 58% male and 42% female respondents. Table 3 shows the ethnic distribution for communities in Birmingham and SE London. Although this result is comparable to the ethnic distribution of communities within the UK based on UK Census in 2001 (ONS 2001), the result should be interpreted with caution due to non-probabilistic sampling of the respondents. There are sufficient numbers of 'White', 'Black' and 'South Asian' ethnic groups in order to investigate the influence of each on the perceptions of SR. The numbers of 'Chinese', 'White/Black', 'White/Asian', and 'other' ethnic groups are low. The mean, median and standard deviation of respondents' age were 34.62, 33.00 and 10.125,

Table 2 Number of participants and gender distribution for each community

Communities	No. of participants	Gender	
		Male	Female
Witton			
Householders	81	32	49
Small businesses	23	17	6
Selly Park			
Householders	94	38	56
Small businesses	28	18	10
Digbeth			
Householders	49	33	16
Small businesses	27	22	5
Thornton Heath			
Householders	89	61	28
Small businesses	23	19	4
All communities (%)	414 (100%)	240 (58%)	174 (42%)

Table 3 Ethnic distribution in Birmingham and London communities

Community	White	Black	Asian	Chinese	White/ Black	White/ Asian	Other
Witton	83	3	15	1	0	1	1
Selly Park	98	10	6	3	0	1	4
Digbeth	53	1	22	0	0	0	0
Thornton Heath	67	19	19	1	4	0	2
All communities (%)	301 (72.7%)	33 (8.0%)	62 (15.0%)	5 (1.2%)	4 (1.0%)	2 (0.5%)	7 (1.7%)

respectively. This near equal mean and median and observation of histogram suggest that distribution of respondent age is normal. The minimum and maximum ages were 19 and 64 years old.

4.3 Data analysis

An initial analysis of SR scores was conducted to obtain descriptive statistics (mean, median, standard deviation) and to explore whether there were differences between SR scores of different locations (Witton, Selly Park, Digbeth, Thornton Heath) and type of respondents (householders, small businesses). Two-way analysis of variance (ANOVA) tests were used because it allowed a comparison of the means of more than two samples at a time. When only two samples were being compared, *t* tests were applied. The analysis of SR scores confirmed that the parametric assumptions were met.

The primary aim of the analysis was to determine the effect of independent variables (experience of flooding, age, gender and ethnicity) on dependent variable (SR score). This was achieved by establishing relationships between the independent variables and

dependent variable, using multiple regression analysis which allowed variations in the dependent variable to be explained by variations in the independent variables. It was not the intention to predict the SR score, but to understand the relative importance of the independent variables against the dependent variable.

Multiple regression can include any combination of quantitative (i.e. interval) and qualitative/nominal independent variables (Hardy 1993). Experience of flooding and demographic variables of gender and ethnicity were considered as nominal variables. These variables were transformed into dummy variables in which one nominal variable is represented by several binary dummy variables in the form of 0 or 1 ('no' or 'yes'). Each dummy variable captures one piece of the categorical information from the original measure. Here, the information in the original variables is not fundamentally altered, instead an alternative form of representing that information is chosen (Hardy 1993). Therefore, these variables do not cause the regression estimates to lose any of their desirable properties (Lewis-Beck 1993) and are legitimately employed in the analysis (Bryman and Cramer 2011). Table 4 presents a list of independent variables with their category and measurement.

The analysis of residual confirms that regression assumptions of normality, constant variance and linearity have been met (Lewis-Beck 1993; Norusis 1995). The analysis was conducted using IBM SPSS Statistics version 22.

5 Results

Table 5 presents means, medians and standard deviations of SR scores in different locations for householders and small businesses. An observation of means shows that respondents from Witton, Selly Park and Thornton Heath (flooded communities) appear to have higher perceptions of SR than those from Digbeth (non-flooded community). In flooded communities, the SR scores of respondents from Thornton Heath were lower than those of Witton and Selly Park. Near equal means and medians is an indication that the data are normally distributed around a central point. The proportion of respondents from flooded communities (excluding Digbeth) is 81.6%. The two-way ANOVA results indicate that there is a significant difference ($p = 0.004$) between the means of SR scores reported by householders (Witton = 35.25, Selly Park = 35.17, Digbeth = 29.92, Thornton Heath = 32.03) and small businesses (Witton = 36.87, Selly Park = 36.86, Digbeth = 30.33, Thornton Heath = 33.39), although it was considered a 'small' effect

Table 4 Independent variables

Variable	Category/measurement
Age of respondent	Ratio variable: years
Experience of flooding	One binary variable: 1 = 'flooded'; 0 = 'never flooded'
Gender	One binary variable: 1 = 'male'; 0 = 'female'
Ethnicity	Six binary variables: assigned 1 if respondent chose 'Black', 'South Asian', 'Chinese', 'Mixed—White/Black', 'Mixed—White/South Asian', and 'Others'. 'White' was used as a reference (0)

Table 5 Descriptive statistics of SR scores in different locations for householders and small businesses

Location	Community group	SR scores			Respondents	
		Mean	Median	SD	Number	%
Witton	Householders	35.25	36.00	4.335	81	
	Small businesses	36.87	36.00	2.897	23	
	Total	35.61	36.00	4.104	104	25.1
Selly Park	Householders	35.17	35.00	3.600	94	
	Small businesses	36.86	36.50	3.240	28	
	Total	35.56	36.00	3.579	122	29.5
Digbeth	Householders	29.92	30.00	4.541	49	
	Small businesses	30.33	31.00	3.648	27	
	Total	30.07	30.00	4.225	76	18.4
Thornton Heath	Householders	32.03	32.00	3.383	89	
	Small businesses	33.39	33.00	3.041	23	
	Total	32.31	32.00	3.348	112	27.0
Overall	Householders	33.48	33.00	4.398	313	
	Small businesses	34.33	35.00	4.238	101	
	Total	33.68	33.50	4.370	414	100.0

(partial eta squared of 0.021). Furthermore, there is a significant difference ($p < 0.0005$) between the means of SR scores reported in different locations with a 'large' effect (partial eta squared of 0.241). However, there is no significant interaction ($p = 0.721$) between community groups and locations. This indicates that small businesses have significantly higher perception of SR than householders, although this difference is not as large as the difference between the perceptions of SR of communities in different locations. That flooded communities (SR scores' mean of 34.50) had higher perceptions of SR than non-flooded community (SR scores' mean of 30.07) was confirmed with a strong evidence by the result of t test ($p < 0.0005$).

Table 6 presents four multiple regression models which include more independent variables as the models progressively advance. Hierarchical multiple regression analysis allows an examination of contribution of each independent variable to the explanatory power of the model (Akerlof et al. 2013; van der Linden 2015). Model 1 evaluates the contribution of 'age of respondent' to the dependent variable (i.e. SR score). 'Age of respondent' is a significant variable and explains 18% (Adjusted R^2) of the variation of the perception of SR. In addition to 'age of respondent', model 2 includes 'experience of flooding' which markedly increases the explanatory power of the model by 24% (Δ adjusted R^2), bringing a total Adjusted R^2 of 42%. Model 3 suggests that 'gender' is not a significant variable and does not increase the explanatory power of the model (Δ adjusted R^2 of -0.001). The final model 4 includes several binary variables, resulting from transformation of ethnic group variable. 'White' ethnic group was not included as it was used as a reference variable to examine the impact of non-White ethnic groups. 'South Asian' ($\beta = 0.165$, $p < 0.0005$) and 'Chinese' ($\beta = 0.075$, $p = 0.042$) ethnic groups are significant variables. This suggests that people from 'South Asian' and 'Chinese' ethnic groups are likely to have higher perception of SR than those from 'White' ethnic group. People

Table 6 Perception of social responsibility regression models

Independent variable	Model 1		Model 2		Model 3		Model 4	
	β	p	β	p	β	p	β	p
Age of respondent	0.424	<0.0005	0.442	<0.0005	0.442	<0.0005	0.446	<0.0005
Exp. of flooding			0.492	<0.0005	0.489	<0.0005	0.502	<0.0005
Gender					−0.012	0.767	−0.035	0.360
Black							−0.057	0.128
South Asian							0.165	<0.0005
Chinese							0.075	0.042
White/Black							0.006	0.879
White/Asian							−0.003	0.927
Other							0.033	0.373
Adjusted R^2	0.178		0.419		0.418		0.447	
Δ adjusted R^2			0.241		−0.001		0.029	

β is standardised beta coefficient; p is significant level of independent variable, with t test

from 'Black' ethic group are likely to have a lower level of perception of SR than those of 'White' ethnic group, although it was not highly significant ($\beta = -0.057$, $p = 0.128$). The overall contribution of ethnic group variables to the explanatory power of the model is relatively low (with Δ adjusted R^2 of 0.029) in comparison with the contributions of 'age of respondent' and 'experience of flooding'.

The final model explains 45% (Adjusted R^2 of 0.447) of the variation in the perception of SR. The model indicates that 'experience of flooding' is the most important variable ($\beta = 0.502$), followed by 'age of respondent' ($\beta = 0.446$), 'South Asian' ($\beta = 0.165$) and 'Chinese' ($\beta = 0.075$) ethnic groups. Standardised beta coefficients (β) of 'age of respondent' and 'experience of flooding' are relatively stable across models 1–4. Higher β of these two variables in comparison with those of 'South Asian' and 'Chinese' confirms their strength as the main predictors of SR score. Due to small number of 'Chinese' respondents ($n = 5$), the significance of 'Chinese' ethnic group would need further investigation before it is included in the final model. The final model suggests that older individuals from South Asian group with previous experience of flooding are likely to be more socially responsible than those without these characteristics. This scenario potentially provides the highest perception of SR. Other scenarios with different combination of independent variables will bring lesser SR scores. For instance, an individual who is from White ethnic group, in their early twenties, and has experienced flooding, is likely to have a lower SR score than those with the characteristics in the previous scenario. However, it further acknowledges that the aim is not to predict the SR score, but to enhance understanding of the contribution of individual intrinsic factors as themselves, and in combination with the other significant factors. Nevertheless, the model has helped to settle some contrasting findings of the factors influencing risk/climate change-related perceptions and their potential relationship with a new concept of SR for community resilience to flooding.

6 Discussion

This research has provided a better understanding of factors influencing the perceptions of SR to flooding. There have been some research on social aspects of flooding, but there is very little knowledge on the perceptions of SR of key local community groups. Enhancing SR perception is important because higher perception of SR can lead to improved technical, organisational and economic resilience. The research explored not only the perceptions of SR of householders and local businesses in several communities, but also established their relationships with key intrinsic factors. The finding suggests that older community members with previous experience of flooding and from South Asian ethnic group are more likely to have higher perceptions of SR. Although it might be cases that they could be the first generation of older people with South Asian background in the UK, who were more likely to have experienced flooding in their home countries, the research did not investigate the origin of the respondents as the questionnaires were distributed to communities regardless of their ethnic background and origin, and therefore, this possible explanation cannot be ascertained.

The finding of experience of flooding supports previous research which has shown that (1) experience of a disaster can often have an influence upon an individual's motivation to cope with future risks (Siegrist and Gutscher 2008; Siegel et al. 2003), (2) personal experience can have a positive effect upon people's ability to visualise climate change risk and can alter perceptions of its importance, as well as perceptions of their ability to enhance their own resilience to it (Nicholson-Cole 2005; Akerlof et al. 2013), (3) experience of previous disaster was found to be a predictor of an individual's level of preparation for future disaster (Sattler et al. 2000), and (4) individuals who experience a high level of exposure to natural disasters are more likely to engage with the issue and create coping strategies (Spence et al. 2011; Fillmore et al. 2008; Work et al. 1999; Lave and Lave 1991).

There are potentially different reasons that could explain the significance of age. First, older people may be more vulnerable to extreme events (Armas 2006; Granger and Hayne 2001), and therefore, have higher inclination to take protective actions. Alternatively, they have lived through different socio-political eras that may have shaped their cultural perspective and brought a sense of belonging as part of community. As a consequence, they would display a greater interest to flood risk and uptake of resilience measures, which are representative of higher perceptions of SR. This supports previous research which found that greater pro-environmental behaviour was related to increasing age (Lindell and Whitney 2000; Siegel et al. 2003; Takahashi and Selfa 2015) and higher perceived risk (Whitmarsh and O'Neill 2010; Floyd et al. 2000; Neuwirth et al. 2000). The significance of South Asian ethnic group suggests that participants from the South Asian ethnic group displayed a greater awareness and acceptance of flood risk and were more likely to adopt resilience measures than participants from the White and Black ethnic groups. This finding is in line with previous research which has found that individuals who regard themselves as belonging to the South Asian ethnic group may hold different perceptions of a community's response to and recovery from a flooding event (Tapsell 2000; Tapsell et al. 1999). It is worth noting that although ethnicity differences in the perception of SR as found in Mullins and Soetanto (2013) are confirmed by this finding, the importance of ethnicity to the perception of SR ($\beta = 0.165$) is about three times less than those of 'experience of flooding' ($\beta = 0.502$) and 'age of respondent' ($\beta = 0.446$). This suggests that, in any initiatives to improve community resilience, younger members of community with no

experience of flooding should be the priority group whose SR perceptions should be raised. The non-significance of gender is in line with the findings of Harvatt et al. (2011) and Adelekan and Asiyanbi (2016). However, the perception of SR, as a novel concept in community resilience to flooding, is not deemed to be directly comparable to the perception of risk and vulnerability to environmental hazards as the subject of previous research.

6.1 Implications for risk communication strategies

The research underlines the need to develop strategies that can enhance the perception of SR of those community members who are likely to have lower perception of SR. They may be those who have no previous experience of flooding are younger and from non-South Asian ethnic group (in this research, they are majority from White and Black ethnic groups). Approaches for interventions which are aimed to change individual behaviour may be made through informational and structural strategies (Steg and Vlek 2009). Information strategies are aimed to change motivations, perceptions and norms, whereas structural strategies are aimed to change the circumstances under which behaviour choices/decisions are made. Although a combination of strategies may yield the most effective outcomes, informational strategies may be firstly adopted to enhance the perceptions of SR due to its persuasive influence on individual attitude for behavioural change (Lindell and Perry 2004). Further, the finding highlights the need for education and communication of resilience information and disaster responses, which should be targeted to these members of community. Informational strategies can (1) increase individual awareness of flood risks and knowledge of behaviour that can enhance community resilience, (2) persuade individuals to take actions and participate in their community and (3) provide social support and role models of effective behaviours (Steg and Vlek 2009). This strategy could be further enhanced by providing a mechanism to encourage community participation via, for example, community-based organisations (Karanci 2013), or local resilience forums in the UK. This would not only enhance individual's self-confidence and efficacy of their own actions, but also strengthen their sense of belonging as part of community. These strategies would also help to: (1) overcome the awareness barriers, (2) achieve a greater sense of empowerment and involvement for community groups and (3) reduce externalisation of responsibility to other parties (e.g. local governments and agencies).

In communicating risk information to the community, targeted and tailored strategies were found to yield more desirable outcomes (Abrahamse et al. 2007). For example, flood risk information could be disseminated to all, but 'tailored' to be more effective with different ethnic groups in certain geographical areas. Further, to reach younger members of community, specific forms and venues of dissemination of information should carefully be considered, including the use of internet and social media. Community-based organisations (such as local resilience forums) could hold regular meetings and events to foster two-way communication as an active and effective form of community engagement (Olofsson 2007). This engagement allows individual's concerns to be heard and discussed, and thus, helps to nurture a sense of belonging to the community. Continuous communication is required as people tend to forget the need to prepare for flooding after long period of non-flooding (Jha et al. 2012). Kievik and Gutteling (2011) recognised the need to induce high levels of flood risk perception and enhance self-efficacy belief to increase the intention to adopt resilient behaviours. Thus, communication regarding flood risk should not only inform the risks and actions that individuals should take, but also enhance individual's

confidence of the efficacy and positive impacts of resilient actions could have on the community resilience.

7 Conclusion

This research has made a contribution by enhancing the understanding of factors influencing the perception of SR, which is argued as one of the important motivators behind the willingness to undertake resilient behaviours. The research was conducted within the community, allowing behaviour of individuals to be contextualised within a social group. This has also permitted an exploration of interrelationships between different community groups and locations. The research found the significant effect of experience of flooding, age and ethnicity on the perception of SR. The knowledge generated will allow appropriate strategies to be developed and deployed to enhance the perception of SR. The finding points towards informational strategies for flood risk communication, in which information should be made available to all, but 'tailored' to be more effective for targeted audience who are likely to have lower perception of SR. The finding should also inform engagement with community groups and policy makers to improve institutional policies related to flooding and community resilience measures. The way in which policy makers engage with the community is important, and meetings could be held between all key community groups to specifically identify existing barriers within current policies, which may also be overcome through group meetings and the information exchange process. Age, experience and ethnicity should be given consideration when attempting to understand motivating factors for engagement with policies and agendas.

8 Limitations and recommendations for further research

The finding of this research is limited by non-probabilistic sampling of the respondents and unequal sample representation, especially for ethnic groups and age. Future research should apply stricter controls over different variable representation within the community groups. Larger sample sizes of each controlled community group would then provide even greater ability to explore perceptions within and between these groups. Future age research may wish to also include distinct age groups, which should include an over 65 age group to allow for exploration of extremes and the effects displayed within an even greater range of ages. This may also be partly responsible for the unexplained variations of the SR score (55%). These unexplained variations may be explained by another variables not included in this research. Future research should also consider the other potentially influencing variables (such as beliefs and religions). The finding underlines the need for an in-depth investigation on the nature of 'experience of flooding' (such as severity, frequency, duration and impact) and 'ethnicity' with underlying culture (such as individual origin, norms, beliefs, values).

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