



Social capital, individual responses to heat waves and climate change adaptation: An empirical study of two UK cities

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ABSTRACT

It has been claimed that high social capital contributes to both positive public health outcomes and to climate change adaptation. Strong social networks have been said to support individuals and collective initiatives of adaptation and enhance resilience. As a result, there is an expectation that social capital could reduce vulnerability to risks from the impacts of climate change in the health sector. This paper examines evidence on the role social networks play in individuals' responses to heat wave risk in a case study in the UK. Based on interviews with independently living elderly people and their primary social contacts in London and Norwich, we suggest that strong bonding networks could potentially exacerbate rather than reduce the vulnerability of elderly people to the effects of heat waves. Most respondents interviewed did not feel that heat waves posed a significant risk to them personally, and most said that they would be able to cope with hot weather. Bonding networks could perpetuate rather than challenge these narratives and therefore contribute to vulnerability rather than ameliorating it. These results suggest a complex rather than uniformly positive relationship between social capital, health and adaptation to climate change.

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1. Introduction

Observed climate change already has direct impacts on economies, ecosystems and human health (Stott et al., 2004; Parry et al., 2007; Rosenzweig et al., 2008). Projections suggest the increasing rates of the changing climate will have profound consequences in the future in all of these arenas. Projections for effects on human health suggest that deaths, disease and injury resulting from heat, floods, droughts, storms and fires are likely to increase (Confalonieri et al., 2007). The mechanisms by which impacts of climate change on health are brought about are both direct and indirect (Few, 2007), and adaptation to these impacts should occur in the public health sector and by altering individuals' behaviour. In Europe, periods of intense and prolonged heat are likely to become more frequent, more intense and longer (Christensen et al., 2007), with consequences for public health. The experience of the 2003 heat wave in Europe demonstrates that heat events have significant mortality among, for example, elderly and other vulnerable groups, raising questions about how best to reduce such impacts (Lagadec, 2004).

Generally, the aim of adaptation to climate change is to reduce vulnerability and increase resilience to impacts (Smit and Pilifosova, 2001). In adaptation processes, human well-being is interwoven with external risks, the social landscape of inequality and collective resources. Kinney et al. (2008) explore different methods for assessing future health impacts of heat and emphasize a need to better understand what role adaptation can play in reducing morbidity and mortality. The heat wave of 2003 suggests that adaptation is not occurring successfully in some vulnerable population groups. Currently, public health efforts in response to heat focus primarily on reactive measures to cope with heat (see, e.g. Department of Health, 2008) rather than long term adaptation to recurring heat waves.

Health factors that have been identified to contribute to being vulnerable to the effects of heat are mediated by social circumstances. These factors, include being above 75 years of age, suffering from chronic illnesses such as chronic obstructive pulmonary disease (COPD), and taking medications such as diuretics (Koppe et al., 2004; Kovats and Jendritzky, 2006). For example, social isolation and living alone have been found to be significant factors compounding vulnerability to heat stress among elderly people in North America (Semenza et al., 1996; Smoyer, 1998; Klinenberg, 2002; Naughton et al., 2002).

Reviews of social capital indicate that the presence of bridging social capital (links between distinct groups), bonding social capital (relationships between individuals who share social

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identity) or linking social capital (networks of trust across authority gradients) may, albeit not necessarily, lead to an increase in resilience in societies, and that both are associated with survival and recovery from natural disasters (Adger, 2003; Pelling, 2003; Pelling and High, 2005). Cumulated public health evidence raises an expectation that the presence of social capital improves health outcomes and may as a result decrease vulnerability to ill health (e.g. Kawachi et al., 1999; Veenstra, 2000, 2002; Cattell, 2001). But it leaves unclear in which circumstances it may be counter-productive and may increase vulnerability.

This case study examined how members of one of the groups vulnerable to the effects of heat, the elderly, perceive risks from heat, and examined the role social contacts of elderly play in responding to heat. The study brings research on risk perception together with investigations of the role of social capital in fostering adaptation to climate change and reducing vulnerability and is novel in the integration of these elements. In interviews conducted during the summer, but not during or following a heat wave, we explore elements of networks associated with bonding social capital, focusing on elderly people's social contacts. This article argues that bonding networks transmit narratives about elderly people's ability to cope with heat stress that may exacerbate rather than reduce vulnerability to the effects of heat. Social capital therefore does not necessarily nor unidirectionally effect improvements in vulnerability. As a result, adaptation to climate change cannot rely on efficacy in existing networks to improve health outcomes.

2. Social capital and health outcomes

In the social sciences, there is general consensus that social vulnerability to hazards and risks is in part determined by the social capital of the population (Cutter et al., 2003). Low social capital is found as a factor in shaping the vulnerability of population groups who are excluded from, for example, access to resources or decision making (Pelling, 1998, 2003; Adger, 2003; Pelling and High, 2005). The prolific literature on social capital and health has begun to stimulate thought in the public health arena, perhaps because, as Szreter and Woolcock (2004) point out, other attempts at improving long standing public health issues have a less than impressive record of improving the status quo. According to Szreter and Woolcock, three distinct approaches can be identified among the different views expressed on how social capital can be a helpful concept in public health settings. The first school of thought centres on support networks as evidence of social relationships and associated norms of reciprocity which may have positive effects on health (cf., e.g. Forbes and Wainwright, 2001). The second approach focuses on economic and social inequalities as a key source of poor health outcomes (cf., e.g. Wilkinson, 1996). The third approach concentrates on access to resources to explain poor health outcomes (cf., e.g. Muntaner et al., 2000).

A significant body of evidence drawing on each of the three approaches suggests that there are positive links between social capital (in the form of, e.g. individual levels of social trust, participation in associations, civic engagement and others) and health. It has been suggested that lack of involvement in social networks means lower life expectancy (Swedish minority groups in Finland, Hyyppä and Mäki, 2003). A lack of reciprocity and civic mistrust have been linked to poorer self-rated health (US-German comparison of adults aged 60+, Pollack and von dem Knesebeck, 2004). Poortinga (2006) concludes that bonding social capital collectively contributes to people's self-rated health, and does so over and above the beneficial effects of personal social networks and support. Rose (*Russian self-rated health*, 2000; similarly Barefoot et al., 1998) shows that involvement in formal and

informal networks, having friends to rely on when ill, having control over one's own life, and trust are indicators of social capital which contribute to better self-rated health. Evidence on heat mortality in North America implies that belonging to a strong social network can have a protective effect against heat illness (cf., e.g. Semenza et al., 1996; Naughton et al., 2002). There has, however, been no in-depth analysis of the role of social networks in European heat mortality.

Some research, however, argues against a positive association between social capital and improved health at the individual (compositional) level. The findings among two published studies suggest that while social capital in the form of membership in associations and trust contributes to aggregate health, it is unrelated to individual health. For example, Veenstra (2000) finds little evidence for a compositional effect of social capital on individuals' health in Saskatchewan, Canada. A Scottish survey by Ellaway and Macintyre (2000) suggests that the link between involvement in community networks and health is found not at the individual but at the aggregate (collective) level. Longitudinal research investigating obesity suggests that social networks play a significant role in spreading obesity (Christakis and Fowler, 2007).

Szreter and Woolcock (2004), and indeed literature on risk perception points out that culturally constructed perceptions in part determine whether a risk is interpreted as threatening, and that perceived risks are highly context specific (Slovic and Peters, 2006; Whitmarsh, 2008). In the context of heat waves it may well be the perceptions of those who are at risk from heat stress, and the perceptions of those who provide support and advice to those at risk, that play a key role in influencing response behaviour, and therefore affect public health outcomes.

Risk perception has both affective-experiential and rational dimensions, and while the two systems interact, the nature of their interaction is as yet poorly understood (Slovic et al., 2004). A number of underlying cognitive mechanisms have been well established to govern risk perception and response in other areas (Festinger, 1957; Rachlinski, 2000; Stoll-Kleemann et al., 2001; Keller et al., 2006; Lorenzoni et al., 2007). Cognitive dissonance (realising that the household is at risk while continuing to live in the risk area), availability heuristic (recent events foster easier recall of potential risks), and biased assimilation (knowledge is retained selectively based on related pre-existing beliefs) all operate to prevent a change in practice in individuals.

3. Study design

The aim of the study was to investigate how independently living elderly people perceive their own vulnerability to the effects of heat waves, and how this might influence their adaptive behaviour. In particular, we were interested in exploring whether perceptions of vulnerability and heat risk may act as barriers to adaptation. In order to explore respondents' perceptions of heat risk in depth, we deployed a qualitative study design relying on semi-structured interviews and open-ended questions with a limited sample in two locations, Norwich and London, UK. The sample is similar in size to other qualitative studies investigating the effect of individuals' perceptions within a group of people with a shared characteristic (see, e.g. Becker et al., 1997; Pooley et al., 2001; Chambers et al., 2009). The results are therefore in depth and exploratory, and are robust within this group of independently living elderly aged 75 and above in the two cities.

The interviews were conducted in Norwich and London with independently living elderly people aged between 72 and 94 (referred to below as the primary respondents) and their nominated social contact, totalling 105 respondents. Three trained interviewers used a written interview protocol developed jointly with the study by Abrahamson et al. (2009). The locations were

chosen to sample London, worst affected city by the 2003 heat wave in England, and Norwich as another English city to complement. Of these 105 respondents, 65 elderly were recruited as patients from general practices in most and least deprived neighbourhoods using the index of multiple deprivation (IMD) based on postcode. The remaining 40 respondents were social contacts.

In collaboration with GP practices, patients aged 75 and above were selected from GP databases. The initial list was screened by the GPs to remove any patients they felt inappropriate to contact (e.g. recent bereavement or, serious illness). From the remaining patients, those with a postcode in either IMD1, 2, 4 or 5 were mailed an invitation letter by their GP on behalf of the research team, inviting them to participate in an interview in their home. Interested participants contacted the research team by phone or mail. Selecting participants through their GP practices allowed easy selection by age and simplified acquiring permission from patients to access their medical files.

Most elderly primary respondents were independent and all lived in the community (in owner occupied or council/housing association homes). None lived in care homes. Nine primary respondents required some assistance with daily domestic activities, and six had full-time carers. Of these six, only three carers were available for interview. Therefore, as the sample is largely of independent elderly, the results are intended to reflect neither the views of elderly people who are in need of formal care nor those who provide it.

Elderly were asked to whom they turn for advice or assistance when needed. In most cases, the person named in response to this question was interviewed as the elderly social contact. In two cases, however, the elderly felt this person was too busy to participate in the study and suggested someone close to them who is available to provide support to them and would likely have time to participate. The respondents interviewed as social contacts included spouses (among them 18 inter-dependent couples who elected joint interviews), children and grandchildren, siblings, neighbours and friends (see Table 1 for a summary). The core of the social networks of elderly are what some call the 'support network', a group of between five to seven people close to the elderly (Wenger, 1984). Most of the social contacts interviewed here arguably belong to this core support network because they were identified by the elderly interviewee as providing assistance or being available to do so. Their role, unlike that of the larger social network, which is counted on only in emergencies, is important because members of the support network provide help with daily needs when necessary (Wenger, 1992: 167). While these key contacts are important, this study did not sample the full range of social contacts of the elderly. Suggestions for future research that would consider an expanded range of social contacts are discussed in the conclusion.

The majority of respondents were fully independent and did not have or need a carer. Thus we refer to 'social contact' as the person

identified by the elderly participant as being available to provide support, advice or assistance (including reciprocally between spouses). We use the term 'social contacts' as persons who provided daily support, that is, people providing anticipatory, preventive and supervisory care activities (Bowers, 1987; Nolan et al., 1995; Ekwall et al., 2004).

The interviews took place from late-July to mid-September of 2007, a period during which there was no period of weather which constitutes a heat wave in the UK context. While one consequence of interviewing while there was no heat wave may be that primary respondents did not as easily relate to the effects of heat, this provided an opportunity to explore anticipatory adaptation, i.e. adjustments made in preparation for an event, rather than coping during an event. It also provided opportunity to explore how strategies used previously are recalled, further indicating how events are anticipated and prepared for in relation to previous similar events. Interviews were conducted in primary respondents' homes and explored people's daily routine, physical activity, socialisation habits, actual and hypothetical behavioural changes in response to very hot weather, barriers encountered to changing behaviour, knowledge of health effects of heat and affected groups, belief in warming weather, medical conditions and medications, and type of housing.

Our analysis explores themes emerging from primary respondents' elaborations by coding text in an iterative fashion, following grounded theory practice (Glaser and Strauss, 1967). The interviews were recorded electronically, transcribed verbatim and added as text documents into qualitative analysis software (NVivo). Using the text coding function, the interviews were examined for themes that were labelled as theme categories. After open coding (Strauss and Corbin, 1990) the text, the emerging theme categories were condensed and refined using iterative axial coding (Glaser and Strauss, 1967; Ezzzy, 2002), merging, expanding and adding categories where necessary. The data presented in this article focus on the emerging themes that concern the relationship between elderly and their social contacts as an element of social capital, the perception of risk from heat and the approaches to dealing with heat now and hypothetically in the future. There was no difference between respondents from London and Norwich, or between respondents of different socio-economic status as measured by the IMD, and the analysis and discussion here applies to respondents across both locations.

4. Perceptions and knowledge of elderly and social contacts

4.1. "Older people, not me!": elderly people's perceptions and knowledge

In general, most of the primary respondents did not perceive heat as a personal threat. Primary respondents articulated either that they liked and enjoyed hot weather or reported feeling listless and staying out of the sun to avoid sun burn and other effects of UV

Table 1
Summary of social contacts' relationship to elderly, age range and location.

Relationship to elderly respondent	Number of social contacts	Social contacts' age range	Elderly age range	Location of social contact
Spouse	18	65–87	72–86	Live together
Daughter/son	14 (7 daughters, 7 sons)	30–63	75–94	Within the same city: 8, within same region: 5, in UK: 1 ^a
Grandchild	1	24	76	Same city
Friend	5	62–73	76–93	Same city
Sibling	1	79	79	Same region
Neighbour	1	59	87	Same city
Total	40	24–87	72–94	

^a One elderly respondent identified her social contact as her child who lives in northern Scotland while she lives in Norwich.

radiation. Some elderly named groups they thought to be vulnerable to the effects of extreme heat, for example, babies and children, older people, or outdoor workers, but the elderly did not acknowledge that they belonged to such a group. Primary respondents pointed to ages above their own to define an 'old', 'older' or 'elderly' person, and added other characteristics such as most commonly being mobility impaired or disabled, being frail and living alone. Very few respondents suggested that they feel the heat more now than they used to when they were young. These findings resonate with studies on perceived risk from falls among elderly, which suggest that while elderly associate the risk of having a fall with being older, they do not associate this risk with themselves directly (Hughes et al., 2008; Braun, 1998).

While there seemed to be broad knowledge among some primary respondents of the health effects of extreme heat, such as tiredness and exhaustion, risk of dehydration and health conditions that have been found to exacerbate vulnerability to heat stress (cf., e.g. Koppe et al., 2004; Kovats and Jendritzky, 2006) were less well known. Primary respondents were generally unaware of medications that exacerbate risk from heat, as for example diuretics; the only exception to this was a retired medical doctor. The effects of heat on health were not well understood because of confusion about the effects of UV radiation versus the effects of heat. Primary respondents who did feel affected by heat articulated that they coped well and that little could be done to prevent effects. Others suggested that heat simply required being sensible and avoiding direct exposure to sunlight. Respondents unanimously felt that preparing for heat events in the long term is unnecessary in the UK. This can be explained in part by the mixed beliefs about warming weather generally. In response to the question "Do you think the weather is getting warmer year on year?" only about half of the respondents articulated that the weather during their lifetime is getting warmer. Many suggested that primarily winters were warmer now than they used to be. None of the elderly respondents indicated that they believed that heat waves are becoming more common.

These results, summarised in Table 2 below, suggest that in general elderly primary respondents in this research did not perceive themselves at risk from, or vulnerable to, the effects of extreme heat. When primary respondents reported adjusting to

heat, this involved having a cool shower, drinking plenty, avoiding direct sun, and changing the daily routine to delay activities to a cooler time of day. Only a few primary respondents did not perceive the need to change their daily routine; these reported that they would not change it whatever the weather, and would do little to adjust to very hot weather. Thus most of the reported behavioural changes were in response to heat, rather than proactively aimed at preventing heat stress. For example, elderly tended to use electric fans to cool down once it is already hot. We found little evidence that primary respondents thought about the possibility of and prepared for future heat waves through anticipatory and proactive actions. In fact, long term and anticipatory responses to heat were perceived as largely unnecessary because of a belief that heat waves are and will remain rather uncommon in the UK. A number of primary respondents articulated that one cannot know that a hot spell is imminent until it starts. And some elderly declined help offered by their social contacts, such as one who refused to have air conditioning installed. These responses suggest that many elderly perceived dealing with heat as "common sense", and that additional help would be perceived as unnecessary and possibly patronising. Indeed, this common perception that responding to heat risks is about being sensible was articulated by one respondent thus: "I don't think there's much you can do about it, I mean just common sense things, like, you know, wear loose clothing and I suppose drink plenty of water, um, stay out of the sun." (London primary respondent, female, age 75). These results are congruent with recent findings from the US, where the majority of elderly respondents felt that heat was not a risk to them personally (Sheridan, 2007).

Primary respondents described that they would draw on (and offer) reciprocal support from (or to) peers or social contacts when they felt unable to cope. Social support networks therefore are utilised when primary respondents are already affected by heat and feel they have exhausted their own abilities to respond. Consequently, it seems likely that support is not engaged to help prepare for a heat event but rather to cope after primary respondents may already be suffering from the effects of heat. In addition, some primary respondents, especially couples, maintained they relied on peers of similar age. In principle, these

Table 2
Summary of elderly and social contacts' perceptions and knowledge of heat risks.

<p><i>Heat is not perceived as a threat,</i></p> <ul style="list-style-type: none"> • It is enjoyed; or • Endured when it occurs. 	<p>"It doesn't really worry me all that much, to be absolutely honest." (London primary respondent, male, 79)</p> <p>"Well, I enjoy the heat, yes." (Norwich, primary respondent, female, 81)</p> <p>"You just put up with it." (Norwich, primary respondent, male, 77)</p>
<p><i>Serious health effects of heat are poorly understood;</i></p> <ul style="list-style-type: none"> • Heat and UV radiation are poorly differentiated, and • Medical conditions and medications that exacerbate heat stress are poorly understood. 	<p>Interviewer: "Can you think of any ways that hot weather can affect your health?"</p> <p>"Melanoma, oh yes." (London primary respondent, female, 78)</p> <p>"Exhaustion I should think. [...] I don't really know." (London primary respondent, female, 78)</p>
<p><i>Groups of people perceived as vulnerable to heat stress include</i></p> <ul style="list-style-type: none"> • Babies; • People older than the interviewee; • Disabled and ill people; • Outdoor workers. 	<p>"Babies are more affected [...] and I would have said probably elderly people." (London primary respondent, female, 87)</p> <p>"People that have very high blood pressure, or people with [...] rheumatoid arthritis" (Norwich primary respondent, female, 77)</p> <p>"People who are more affected are older or not very well and can't get around." (Norwich social contact, female, 80)</p> <p>"I am thinking of people who are outdoor workers." (London primary respondent, male, 79)</p>
<p><i>Strategies to adjust and long term preparation, are perceived as low priority either because</i></p> <ul style="list-style-type: none"> • Little can be done about heat except avoiding it • Common sense strategies are sufficient, or <p>Heat waves are unusual events in the UK.</p>	<p>"I don't think there's anything you can do about the heat. You can just keep out." (Norwich primary respondent, female, 78)</p> <p>"I think the elderly should not exert themselves in the heat." (London primary respondent, male, 79)</p> <p>"I mean here in England the temperature is always pretty, pretty reasonable." (London social contact, male, 79)</p> <p>"This is not an issue really. Heat waves is not something that we experience on a regular basis." (Norwich social contact, female, 56)</p>

elderly fall into a vulnerable group and may therefore also be affected by heat at the same time. This raises questions about the efficacy of reciprocal support among peers. The role played by these interactions between primary respondents and social contacts is explained further in the next section.

4.2. “She’s quite sensible!”: social contacts’ knowledge and perceptions

While we did not sample elderly people’s social networks exhaustively, our results do show that the social context in which elderly people act can be an important factor in their vulnerability to heat events. A combination of factors is at play. We find that the perceptions of elderly and their social contacts interact to shape narratives of resilience and independence of elderly that are transmitted by social networks which primarily rely on bonding social capital. This section elaborates on the role social contacts’ knowledge and perceptions of responding to heat play in shaping these narratives.

Social contacts’ knowledge about heat, its health effects and preventive measures was varied and often showed only very broad knowledge of the effects of heat on health. This is relevant because the social contacts were nominated by the elderly respondents as those from whom they would gain advice or assistance and who form the core of their support networks (cf. Wenger, 1992). For example, social contacts did not generally identify dehydration and prolonged exposure to heat overnight as key issues. Despite reporting strategies to keep themselves cool, a number of social contacts identified few additional ways they could use to help the elderly person to stay cool. Some social contacts implied that their help would be seen as unnecessary and would impinge on the independence of the elderly, a finding common among spouses. The majority of suggested responses to heat were reactive attempts to reduce its effects when it is already hot. Some of the suggestions could be counterproductive in alleviating heat stress, for example, by encouraging the elderly to drink tea and coffee rather than water or juice. A minority of social contacts bought fans for the elderly person.

While these results suggest that many of the social contacts interviewed had limited knowledge about the effects of heat, this does not mean that information provision alone could address this gap (cf. Hughes et al., 2008). The underlying perception that heat is not a high priority prevents the uptake of relevant information to avert heat stress, simply because it is seen as unnecessary. We suggest that unless those at risk are able to identify themselves as such and feel able to take action,

merely disseminating information about preventive strategies has limited value.

Individuals’ independence, and when and how it is asserted, is an important factor in shaping perceptions of elderly and social contacts about heat risk. Social contacts were aware of and acknowledged the independence of the elderly and, perhaps rightly, valued it. In the circumstances of a heat wave, however, failure to constructively challenge this independence could conceivably contribute to the vulnerability of elderly people. In our sample, few elderly reported that they willingly ask for help; they tended to do so only after feeling affected. This implies that some social contacts relied on the elderly person to identify a problem and tell them about it, which not all elderly maintained they were willing to do. Of those social contacts who reported having bought fans, for example, a number did so only after the elderly asked for help. One social contact was worried about their relative’s illness which was exacerbated by the heat, and had in the past acted on it. Another social contact was concerned about heat risks because of the direct experience of the elderly having suffered from heat stroke some years ago. Social contacts of those primary respondents who felt affected, but believed that little could be done about heat, did not usually challenge this view or offer strategies to prepare for heat. The underlying reasons for this behaviour were not explored in our interviews. It was clear, however, that independence was seen as a beneficial trait in elderly people. Combined with the finding that elderly do not perceive themselves as at risk from heat illness, perceived independence is therefore a key factor that helps maintain narratives of elderly people’s ability to cope. These results are very similar to elderly people’s perception of heat risk and are jointly summarised in Table 2 above.

The dominant, although not uniform, perception among social contacts of the elderly seems to be one of resilience and common sense compromised only by serious illness, reduced mobility and/or disability. Evidence for this is well demonstrated by the exemplary quote “She’s quite sensible regarding the heat!” (Norwich primary respondent, female, age 57, about her 80-year-old parent). The quote encapsulates the notion that most elderly people, as long as they are sensible, cope well with heat. Some contacts who expressed concern about how their relative/friend would cope in hot weather related this to previous illness in hot weather or, in one case, COPD. As shown in the section above, many elderly feel the same way; to them, coping with heat is a matter of “common sense” adjustments anyone sensible should be aware of. The narrative constructed in this way by the majority of respondents is one of elderly capability and sound judgement. This

Table 3
Summary of social contacts’ perceptions of heat risks to elderly.

Heat is only a problem when elderly are Mobility impaired, Unable to care for themselves, or Seriously ill and infirm.	“People who are more affected are older or who are not very well and can’t get around.” (Norwich social contact, female, 80) “The elderly that can’t get about to get their drinks and have to rely on other people to change their clothes and things” (Norwich social contact, female, 65) “I mean, if you’re vastly obese or if you’ve got heart conditions, emphysema, anything like that, they do obviously make a difference. Asthma probably, too...” (London social contact, female, 76)
Elderly cope well provided they Are sensible, Independent, and Stay out of direct sunlight.	Interviewer: “Did you do anything in particular during very hot weather to help keep your mum comfortable in the heat?” “No. No. Only because she’s quite capable of looking after herself.” (Norwich social contact, male, 53) “No, because she’s sensible enough to do whatever it is...” (Norwich social contact, female, 45) “The answer is just to get out of it, you know, keep out of it, it’s a sort of common sense thing” (London social contact, male, age 79)
Other than routine contact no other help from social contacts is required provided that Elderly are not ill, or Have not asked for help.	“If I came and found her needing medical attention then [...] I would contact somebody” (Norwich social contact, female, 56) Interviewer: “Is there anything you would like to do but are unable to do for your mum?” “Well, unable doesn’t really come into it. It’s whatever she wants and if she wants anything she can get in touch.” (Norwich social contact, male, 46)

construction does not acknowledge that in circumstances of extreme heat, elderly are personally at risk due to their age alone and should consider preventive strategies. In conceptualising responses to heat as ‘common sense’ and focusing on resilience and independence, this narrative is at odds with the vulnerability that is attributed to people aged 75 and above in the epidemiological literature. Table 3 below summarises how social contacts view heat risk to their elderly.

Among spouses, siblings and friends, a complicating factor is often their own vulnerability. Many of those interviewed, especially spouses, fell into the same age group as the primary respondent and may be as vulnerable to the effects of heat. However, they did not perceive themselves as such. Younger social contacts, such as children, grandchildren and younger neighbours and friends, on the other hand perceived the effects of heat often differently, enjoying higher summer temperatures, and did less to prevent health effects of heat. While some of these social contacts knew of vulnerable groups and might include older people among them, not many attributed their elderly (or themselves) to this group. In either case, among both peers and younger social contacts, the primary narrative describes capable, competent and independent elderly people who are well equipped to take care of themselves in the face of heat risk. Social contacts did not generally challenge the perceptions of their relatives or friends relating to resilience and independence.

5. Networks and narratives

As outlined in Section 2, the social support networks literature, in work such as Kawachi (1999), Eckersley et al. (2001), and Forbes and Wainwright (2001), raises an expectation that involvement in social networks contributes to positive health outcomes. The sections above indicate that among the elderly and social contacts interviewed here, strong narratives of independence, resilience and sound common sense shape elderly people’s responses to extreme heat events. This section argues that one approach to understanding the reported beliefs and behaviours of the primary respondents and their social contacts is to explore the strong bonding networks between them.

5.1. Bonding networks

Bonding networks, as articulated by Szreter and Woolcock (2004), are trusting and supportive relationships among people who see themselves as sharing a social identity (pp. 654–655). The relationships between the elderly primary respondents and their social contacts are bonding networks because of the shared trust and support, but also the shared social identities between them. Couples, but also friends and siblings, interviewed here were of similar age, and hence, of the same generation—they shared not only their life history but also the socio-cultural history of their time which in part shapes their identity. These networks, sometimes accompanied by norms of reciprocal care between peers, sustain a discourse that entertains ideas of independence in the face of health risks from heat waves. Social contacts who not only accepted, but engaged in, rather than critically questioned the perceptions of elderly, support this discourse, perhaps because of the familial ties involved. As a result, bonding networks act as vehicles of narratives that uphold the lack of prevention and legitimise the reactive approach so prevalent among elderly responses to heat waves. The narratives are founded in perceptions that do not regard heat as a significant threat and are constructed by passing information which supports reactive strategies to heat. Combined with a knowledge deficit, and attitudes that encourage independence, these narratives could heighten vulnerability and potentially prevent anticipatory adaptation to the effects of heat waves.

It has been suggested that not all networks founded in mutual trust serve the best interests of wider society, or necessarily those of all members of the network (Portes, 1998). In particular, those networks that lack vertical linkages and linkages to people on the outside of the network, who may not share similar social identities, have been pointed to as sources of potential conflict, albeit this may not be a robust finding to date (cf. Szreter and Woolcock, 2004). The networks evidenced in this research lack perspectives that are critical of the dominant narrative. The interviews suggest that this is because their membership largely subscribes to the same views about whether heat constitutes a risk to elderly and about the value of independence of elderly people. An alternative explanation for this lack of criticism could be that the nature of the relationships in effect does not encourage criticism on the issue in question—the capabilities and independence of elderly people. As shown in Section 2, much literature supports claims about the benefits of social networks for health outcomes. Bonding networks, by their very definition as supportive links among people with shared identities are therefore highly unlikely platforms for challenging each other. In addition, dominant cultural discourses about aging, not only in the UK, but arguably in many western societies (cf., e.g. Ng and McCreanor, 1999; Ungerson, 2004), emphasise independence as a key asset in maintaining overall well-being (cf. also Cordingley and Webb, 1997; Secker et al., 2003; Hughes et al., 2008). While the results presented here are drawn from a study of a single risk to a particular vulnerable population, they suggest that among those interviewed, the lack of perceived risk and need to prepare may contribute to rather than reduce the vulnerability of this population.

5.2. Narratives in context

The bonding networks evidenced in this research probably exist in a context of other types of networks. Individuals interviewed here may engage in other types of social capital which could potentially counteract the narratives transmitted through bonding networks. In particular, vertical linkages, or linking social capital, that introduce narratives more critical of elderly and social contacts’ perceptions of heat, could challenge these views. Although it was not the aim of this study to explore social networks exhaustively, it is clear that the messages described above are at odds with epidemiological literature discussed in Section 2.

Our results indicate that narratives that could have a detrimental effect on elderly overall well-being in the face of heat risk can be perpetuated by bonding social networks. This outcome by no means indicates intentional negligence, but rather that neither elderly nor many social contacts perceive the severity of risks of heat waves to elderly and as a result do not communicate nor act upon such perceived risks. In fact, it seems that risk from heat waves is viewed to be of low priority when compared to other risks, such as cold winters and fuel poverty. In this respect, the responses of this group of independent elderly and their social contacts may be considered in terms of their perspectives about a rare event. Heat risk is complex, dependent upon a multi-factorial combination of, among others, co-morbidity, medication, exposure, structural environment and appropriate responses, the latter being influenced heavily by perceptions of risk (Wolf et al., 2009). As a result, it may be insufficient to rely upon bonding social capital and common sense to prepare for and respond effectively to heat waves. These findings also demonstrate that perceptions of vulnerability by those who are vulnerable are important in shaping health outcomes and therefore support research by Satterfield et al. (2004) in highlighting that an in-depth appreciation of these perceptions is necessary to understand responses to perceived risks.

A limitation of this study is that GPs may have screened out the most vulnerable patients, for example those who were ill or mobility impaired. Self-selection bias of respondents may have also excluded those elderly most at risk. Despite this, the results are robust across the Norwich and London population of independently living elderly over 75 years of age, many of whom would be considered vulnerable not on due to their age (see Abrahamson et al., 2009). Another limitation relates to the limited sampling of social contacts. Having sampled the views of only one social contact per elderly participant, these results need to be understood as a limited perspective on the role bonding capital, exemplified in personal networks, may play in mediating risk and risk perception. However, arguably all but two social contacts (those who were named after the primary respondent had ruled out their primary support contact for participation) sampled here are an early if not first point of contact and a primary source of support to otherwise independent individuals. Therefore, while the sample is limited and further research is required to corroborate these results across a broader spectrum of social support networks, this study points to a specific source of social vulnerability to risks such as climate change that is currently understudied. In light of projected changes in climate, this research is an important and necessary, if first, step in highlighting the need for comprehensive examination of the role bonding social networks play in shaping vulnerability.

5.3. Implications for adaptation to climate change

It has been argued that adaptation to climate change depends in part on the types of social networks available to individuals (e.g. Adger, 2003). Unlike other cases of adaptation that are more closely tied to, for example, natural resource management and related policies and institutions, the case of adapting to heat wave risks is related to how health and social welfare institutions are managing and indeed preparing for these risks. Arguably, individual well-being is in part bound up by how these institutions mediate and respond to risk. But this research shows that regardless of any institutional responses, personal perceptions of the risks are a crucial determinant in shaping which, if any, strategies to avoid heat risks are employed. In particular, when no threat is perceived, and little if any preventive adjustments are seen as required, adaptation is perceived as unnecessary. The result is that any strategies to respond to heat are purely reactive adjustments when it is already hot and elderly are already at risk of significant exposure. This result implies that even if formal social and health institutions were to manage and prepare for heat wave risk, individuals' perceptions that found the types of narratives described here could potentially counteract effective intervention. Bonding networks give the narratives of independence and resilience a permanence that prevents proactive anticipatory and longer term adaptation. Therefore, the results here provide evidence that significant barriers to adaptation emerge from perceptions of vulnerability and the socio-cultural discourses supporting these perceptions.

Given the importance of independence to overall perceived well-being, any challenge to the narratives examined here would need to appeal to individuals' sense of independence rather than countering it. Our research therefore suggests that policies aimed at preventing heat morbidity and mortality would be well advised to adopt a multipronged communication approach. This would include the provision of advice for the whole population, ensuring that it reaches independent elderly people who may not perceive that targeted advice is relevant to them, in combination with tailored messages for specific groups of vulnerable people, such as those aged over 75. If formal or informal institutions, such as social or health services, and local community groups, were to provide

bridging and linking social capital that could challenge the dominant narratives within bonding networks, it seems that the advantages of social networks could work to elderly people's benefit. For example, the recently released London Climate Change Adaptation Strategy (Mayor of London, 2008) would benefit from an explicit consideration of social networks in its response to and preparation for future heat waves.

The results presented here also reflect on matters closely linked to the governance of adaptation. Because the analysis suggests that respondents had limited motivation to act and did not perceive themselves at risk, and their social networks did not challenge these perceptions, the underlying responsibility for adaptation is that of formal institutions. In particular, if one objective of adaptation is to protect those who are most vulnerable, and this study, along with others (Sheridan, 2007), suggests that the most vulnerable do not perceive themselves as such, the responsibility for this should rest primarily with government agencies. Much capacity to address extreme events is developed by governments, for example, through early warning systems and by opening cooling centres during heat waves. At times, however, government action tends to crowd out social capital (Ostrom, 2000), making informal efforts by civil society groups redundant. Therefore, it would be helpful to foster synergy between individualist, networks and government driven responses in order to reconcile the discrepancies between these different approaches, as suggested also by Evans (1996). Knowledge of and access to government resources in response to heat events is a key element of adaptation.

In the context of climate change adaptation, our results raise questions about perceived risk and social networks' narratives in other settings such as flood risk. Direct experience with flooding is a crucial determinant in shaping acceptance in individuals that flooding is a real personal risk (Keller et al., 2006). However, such experience, or living in a flood plain and therefore being at risk from flooding, does not necessarily result in behavioural responses to flood risk (e.g. Wong and Zhao, 2001). Further, flooding and climate change are conceived of as separate issues, even by those who have been affected by flooding (Whitmarsh, 2008), suggesting that individuals perceive no clear causal link between the two, obscuring the perceived likelihood of reoccurrences. Visceral experience can effect a realisation of longer term personal risk but this does not necessarily result in response. When a link between climate change and flooding is absent, these results make at least plausible that an underlying lack of perceived risk could be at play here. Therefore, similar to elderly perceptions of risk from heat waves, it seems at least possible that those vulnerable to flood risk do not perceive themselves at risk. The cognitive mechanisms that have been well established to govern risk perception and response in other areas are situated within individuals' cognitive systems and therefore likely cut across different risks (Festinger, 1957; Rachlinski, 2000; Stoll-Kleemann et al., 2001; Keller et al., 2006; Lorenzoni et al., 2007). These cognitive mechanisms pose a fundamental issue for policy, not least because government action also typically occurs in response to the direct experience of an acute risk.

Since the characteristics of bonding social networks seem to determine the nature of interactions between members, and these characteristics seem unlikely to vary across settings, the bonding networks of those vulnerable to flooding could perpetuate the perceptions of those at risk rather than challenge them. The results cast new light on the effects of social networks and further inquiry in other settings is warranted to confirm the role networks might play in shaping responses.

6. Conclusions

This article argues that in the case of elderly people's vulnerability to heat waves, there is a highly complex and not

necessarily constructive relationship between the presence of and involvement in bonding social networks and health outcomes. Knowledge and perception of heat effects by both elderly and their social contacts, the transmission of narratives about coping strategies between them, and perceptions of personal independence and resilience, all play important roles in contributing to vulnerability through strong bonding networks.

Elderly people in this study valued their independence and some expressed reluctance to ask for help. Many did not regard heat as a significant problem and felt that “common sense” strategies were an adequate response and prevention largely unnecessary. The social contacts of the elderly expressed similar views and often reiterated that their elderly relative/friend is independent and sensible. However, it seems that in this research, these views, when unchallenged, produce powerful narratives of independence, capability and common sense coping strategies that could avert preventive measures which would constitute anticipatory adaptation. Therefore, elderly people's perception of heat risk as low priority, and lack of knowledge among social contacts and accepting attitude of the views of the elderly, are important factors that could add to the vulnerability of elderly in the face of heat events.

Further research is required to clarify the role of social capital for climate change adaptation, in particular health adaptation. There is significant scope for more detailed and extensive work examining in particular how pervasive the views of the primary social contact interviewed here are among the wider social network of elderly. Such work could be broadened by interviewing as many members of the core ‘support network’ (Wenger, 1984) per elderly as possible. This could also include ethnographic work and other in-depth methods that could examine in detail the mechanisms by which the narratives described here are transmitted, legitimised and reified. A more extensive examination of the broader social networks of elderly beyond the immediate and more personal support network would help identify whether these views persist among this wider community. This could draw on techniques that map and characterise social networks in more detail than was possible here. Also important is a better understanding of what factors may counteract these narratives. For example, it would be useful to examine whether a close and affective experience with heat stroke in the family or circle of friends shapes views that could challenge the narratives outlined here more effectively than information provision to social contacts on how to avoid heat stress in elderly.

The evidence presented here points to a less than straightforward relationship between social capital, vulnerability reduction and increasing resilience. Bonding social capital, depending on context, could play a particular role in shaping vulnerability, potentially even compromising adaptation. But theoretically it seems that this effect could be counteracted by stronger linking and bridging social capital. Bridging ties to distinct groups, with different values and perspectives, and linking ties upward through authority gradients could perhaps challenge the views perpetuated by bonding networks. The differing roles played by various types of social capital, their interactions and their bearing on health outcomes in the context of heat waves, and indeed other risks, deserve additional in-depth attention. While the results here attest the importance of social capital to health outcomes, they call into question the direction in which this influence may act. Clearly, an uncritical assumption that the influence of social capital necessarily leads to improved health outcomes seems unfounded in the context of this study.

The implications for climate change adaptation of this research are threefold. Social networks play an important role in shaping responses to climate related events, whether they are perceived to be related to climate change or not. Consequently, research and policy on adaptation would be well advised to consider how social

networks shape perceptions explicitly. Further, this research suggests that barriers to adaptation can be shaped by social networks. Elderly and social contacts' perceptions of health risks from heat waves, and their consequences, are an example of barriers to proactive anticipatory adaptation that seem inherent in both individual cognitive characteristics and the social mechanisms that perpetuate counterproductive narratives. This study adds to a growing body of evidence that highlights that despite high adaptive capacity, developed countries such as the UK need to address such barriers in adaptation planning if anticipatory adaptation is to take place (O'Brien et al., 2006). In order to support rather than crowd out social capital, government initiatives could emphasise financing local social development, for example, to provide space and resources for community groups which support and empower the elderly. Finally, given the importance of social networks (and the socio-cultural norms they help perpetuate) in shaping which, if any, adaptive strategies are employed, adaptation research and policy could benefit from a more explicit account of which norms and values support what type of adaptation, and which do not. Such analysis could not only enlighten current adaptation research but also inform policy responses to climate change, such as the UK heat wave plan and the London Climate Change Adaptation Strategy. Without being informed by the role of social networks and norms, such efforts are at risk of failing to engage and protect those most vulnerable to the effects of climate change.

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