



Built Infrastructure for Older People's Care in Conditions of Climate Change (BIOPICCC)

Summary of Key Findings for Horsham District Council and West Sussex County Council

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Prototype BIOPICCC Toolkit:

<http://www.dur.ac.uk/geography/research/researchprojects/biopiccc/toolkit/>

Executive Summary

It is recognised that around the country it will be necessary to develop local plans for adaptation of health and social care services to climate change (Defra 2012; Hames & Vardoulakis 2012; NHS SDU 2012).

This report presents a review of information relevant for climate change adaptation in Horsham District, produced as part of a research project on *Built Infrastructure for Older People's Care in Conditions of Climate Change (BIOPICCC)*, carried out by Durham and Heriot-Watt Universities, and funded by the Engineering and Physical Sciences Research Council (EPSRC).

The wider aim of BIOPICCC is to develop, trial and disseminate tools for adaptation to make the built infrastructure supporting older people's health and social care in England more resilient to the effects of extreme weather.

Horsham District has provided an important case study for BIOPICCC and the Universities are grateful to all of the participants from Horsham District who took part in this study and helped to provide parts of the information reported below.

Key messages for Horsham District from this review are as follows:

- **Action at the scale of county councils, local authorities and local communities is needed to** make health and social care systems more resilient to extreme weather-related hazards and to plan for likely changes in our climate.
- We have considered how the situation in Horsham District compares with other parts of England in terms of present and projected future weather-related hazards and vulnerabilities (Section 1 of this report).
- Through a series of consultative workshops and discussions with key informants from service agencies and local communities we have built up a picture of local knowledge about risks of extreme weather events and how they vary across Horsham District, focusing on three local case study areas in particular. We have demonstrated innovative ways to help to exchange and share knowledge from different informants (Section 2).
- Our key informants indicated that built infrastructure was an important part of the system of health and social care for older people. Built infrastructure systems are complex, and extend beyond individual buildings to include utilities and road networks. We explored how to develop a more 'joined up' approach to adaption of built infrastructure supporting older people's care in Horsham District. Our progress has been limited here due to the lack of availability of the data required. The challenges faced are outlined in Section 3, with an example of what can be modelled if the utility data are available.
- The learning from the case study work in Horsham District has helped to inform national adaptation policy, including guidance published by the NHS Sustainable Development Unit and a toolkit developed by the BIOPICCC Team to support local level resilience planning in other localities with support from the Cabinet Office. The BIOPICCC toolkit is an online resource (see link above), about to be released by Durham University which draws partly on the research reported here, making the learning widely available. Horsham District and West Sussex County Council are also involved in the 'Climate Local' initiative to support strategic planning.
- Adaptation is not only about planning action during emergencies – it is also important to develop preparedness and resilience measures;
- This report may provide material to be used for wider dissemination and awareness raising though the community.

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1. Weather-related hazard and vulnerability: Comparison of Horsham District with other areas of England

Key messages for Horsham District

- The Foresight Flood and Coastal Defence Project (Environment Agency 2004) suggests some areas in England will experience an increase in flooding, in particular some areas in the South East, the East of England and the Yorkshire and Humber region. Parts of Horsham are susceptible to growing risks of river and surface water flooding.
- Like other local authority areas in southern England, Horsham District can expect more heatwave events in the future (up to 2050), though the latest weather projection models do not give precise estimates of these events. Heatwave conditions may be associated with greater mortality, illness and health service demand among the older population. Given the large population of older people in Horsham, it is important that Horsham District Council (HDC) and West Sussex County Council (WSCC) keep heatwave planning under review.
- While winters are projected to become warmer and wetter on average, coldwaves may continue to cause disruption, placing extra pressure on health and social care systems for older people. It is therefore important that HDC and WSCC continue to give attention to coldwave plans for health and social care and build on lessons learned from previous winters (see, for example, the 2010 [Snow Summit](#)).
- Changes in storm patterns are difficult to predict into the future but could also be disruptive.
- The large and growing population of older people in Horsham District means that vulnerability of the population to weather-related hazards, especially among those who are frail, will continue to be a significant issue.
- The vulnerability of the older population to weather-related hazards depends on a range of population characteristics, including health status (related to age).
- Economic, social and cultural factors can also be important for vulnerability, for example, in terms of risk of fuel poverty, lack of social support and challenges for adapting behaviour to cope with extreme weather. We have reviewed sources of routinely available indicators relating to present characteristics of the older population in Horsham District that are particularly relevant to inform robust planning and adaptation at the local level.

1.1 Hazard and Vulnerability: approach to risk assessment

The research has produced information on weather-related hazard and vulnerability across England. This allows us to 'benchmark' Horsham District in comparison with other parts of England. Horsham District has several attributes which suggest that it is among those local authorities in England where it will be particularly important to plan for climate change impacts on older people's care.

Our approach is informed by a model of **risk assessment** which considers **hazards** (presented by more frequent extreme weather events impacting on infrastructure supporting older people's care, and on the population using these services). The impact of these hazards will depend on the **vulnerability** of health and social care infrastructure and the populations concerned. Risk

assessment can support responses to build resilience including **adaptation** to infrastructure and to human behaviour (see Figure 1.1).

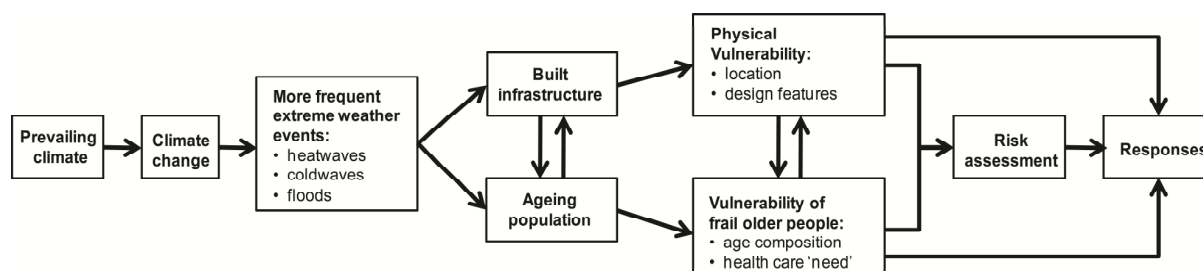


Figure 1.1 Model of Risk Assessment. Source: Oven et al. (2012: 17).

1.2 Weather-related hazards

The weather-related hazards considered in this report are coldwaves, heatwaves and flooding. To assess future heatwave and coldwave hazards, we conducted an analysis of regional variations in daily temperature projections across England for the 2030s, using the latest UK Climate Projections 2009 Weather Generator tool. The hazard maps in Figure 1.2 show broad regional variation in the projected likelihood of weather-related events. Where the probability of occurrence is highest, extreme weather events, requiring special measures, are likely to occur most frequently in future. The maps also show projected changes in the probability of these hazards. Areas projected to see the most significant increases in the probability of these hazards are likely to need to adapt most quickly, making forward planning especially important. While the weather generator results give a broad indication of relative risks of these events in different parts of the country, they do not provide sufficiently precise predictions to be able to anticipate the exact probabilities or return periods of these extreme weather events for the future. Also we tested whether the weather generator produced different extreme temperature predictions for areas within the Horsham District, but for this relatively small geographical area, there were no significant local variations. Also, as the weather generator is being continually updated, future versions of the model may not give exactly the same results.

The maps suggest the greatest likelihood of **heatwaves** to be in the South and South West of England. South West of England, heatwave conditions may be associated with greater mortality, illness and health service demand among older population. Horsham District may need to give attention to how it will execute heatwave plans for health and social care (see: NHS 2012).

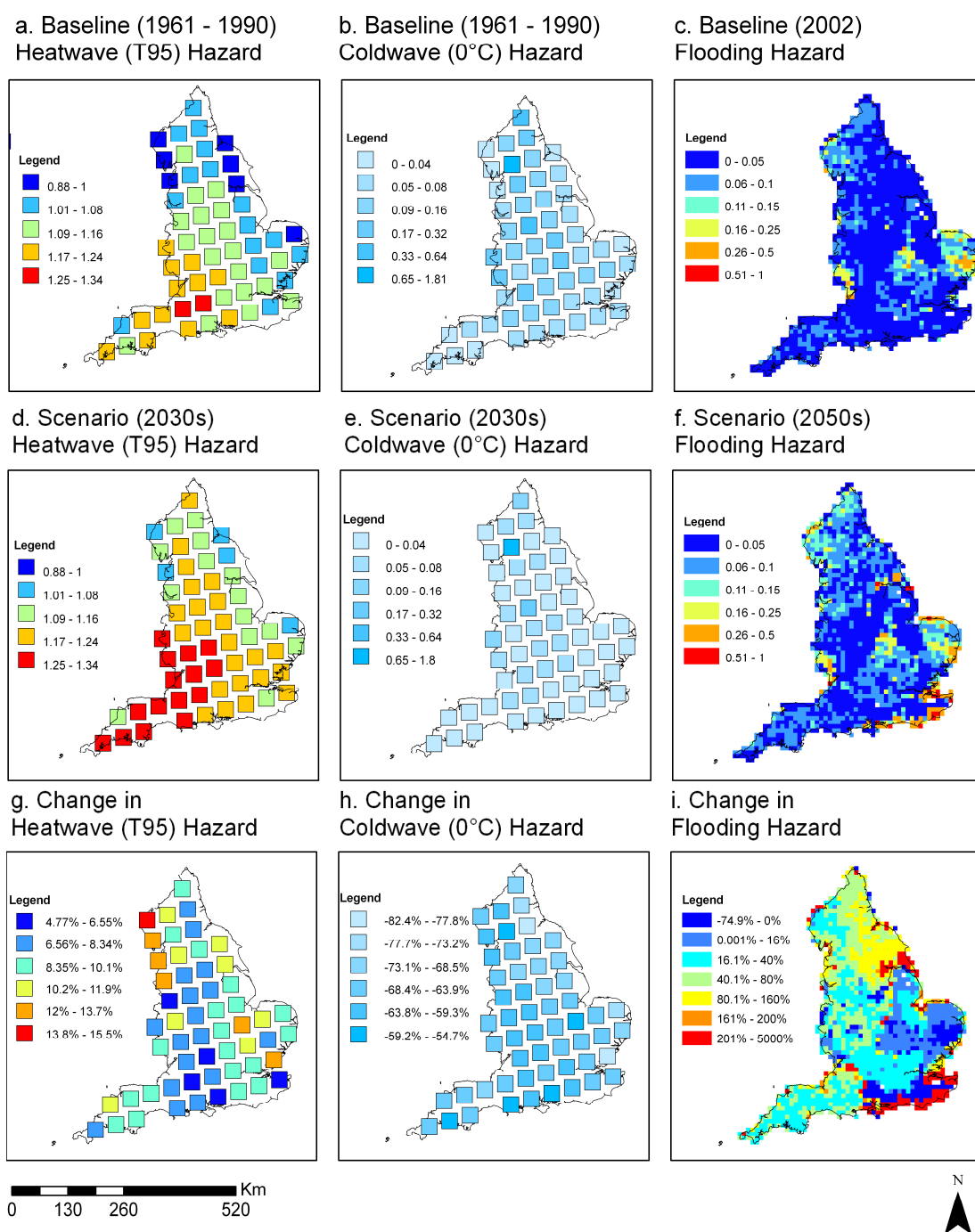


Figure 1.2 Hazard maps for England showing the annual probabilities for the baseline (1961-1990), scenario (2030s/2050s) and percentage change in heatwave hazard (a, d and g) coldwave hazard (b, e and h) and flood hazard (c, f and i). Data for the heatwave and coldwave maps were derived from the UKCP09 Weather Generator (Version 2) under the medium emissions scenario. Heatwaves were defined as events with temperatures at the extreme range (top 5%) of the projected range of prevailing temperatures for the period. Flood maps c and f, and the data derived for map i, were sourced from the UK Government's Foresight Flood and Coastal Defence Project under the high emissions scenario (Environment Agency, 2004). Source: Owen et al. (2012: 21).

In Horsham District, as in other parts of the country, the risk of coldwaves with temperatures at or below freezing for a period of time is projected to decrease. However, coldwaves may continue to cause disruption and extra pressure for care systems for older people (as recorded in later sections of this report). Horsham District may need to give attention to how it will execute coldwave plans for health and social care (See: Department of Health 2011). Changes in storm patterns are difficult to predict into the future but could also be disruptive.

Flood hazard projections based on outputs from the Foresight Flood and Coastal Defence Project 2004 (Environment Agency 2004) suggest flood risks will also increase in some parts of England. Some areas will experience increased susceptibility to flooding (for example, due the human occupation of flood plains) and sea-level rise, in particular some coastal areas in the South East, the East of England and the Yorkshire and Humber region. Horsham's Strategic Flood Risk Assessment (Scott Wilson 2010) highlights that the District is susceptibility to flooding from the River Arun and the River Adur, which can rise quickly when there is heavy rainfall, due to the steep topography and impermeable clay. The summer 2012 floods, which occurred after our local investigations were completed, also highlighted the susceptibility of Horsham District to surface water flooding, resulting from extremely heavy rainfall beyond the capacity of the existing drainage system.

Our research using the weather generator underlined the need for more advanced versions to make local long range forecasting more precise and reliable for purposes of local adaptation planning. The research undertaken for the BIOPICCC project has given consideration to heatwaves, coldwaves and floods, with the modelling research focusing on flooding, in particular.

1.3 Vulnerability of older people to extreme weather-related hazards

The vulnerability of the older population to weather-related hazards depends on a range of population characteristics, including health status (related to age) and social and economic factors. Older people who are 'vulnerable' are especially affected when extreme weather-related hazards cause disruption to health and social care systems and their own health may also be affected by the weather. Examples are presented later in this report (Section 2).

There are various ways that older people and those caring for them can act to help build resilience to extreme weather hazards. Examples of these are presented in Section 2 of this report. Those who are ill or frail are most at risk, so that those in the **oldest age groups** are most likely to be affected.

Horsham District already has a high proportion of older people, with more than 17% of the population aged 65 years and over (ONS 2007). In addition, the population data from the Office for National Statistics (ONS 2007) suggest that the number of older people is projected to almost double between now and 2031, a rapid growth compared with many other areas in England (Table 1.1). By 2031, the projected proportion of people aged 65 years and over is 27%. Local concentrations of older people in Horsham are affected by residential mobility so the population changes due to in- and out- migration, as well as long term residents who are aging. Some people of retirement age are attracted to the area as a retirement location and some we interviewed had moved into the area to care for older relatives already living in Horsham.

We have also generated population projection maps which weight different age groups in the population over 65 years, with highest weights for the oldest groups. The weights are based on NHS formulae for resource allocation, reflecting current estimates of average need to use health services in different age groups (Department of Health 2008). These maps show that growth in the oldest age groups will be relatively high in comparison to other parts of the country, with Horsham ranked in the top 20% of local authorities (Table 1.1 and Figure 1.3). In future, helping people who are aging to remain at home as long as possible in spite of frailty will cause growing demands on infrastructure for health and social care in the community as well as in hospitals.

Table 1.1 Measures of future growth in older populations (aged 65 years and over) and social dimensions of the population in Horsham District, ranked in comparison with other local authority areas in England.

<i>Indicator</i>	<i>Value</i>	<i>Rank out of 352 LAs* (1 = highest value)</i>
Projected population aged 65 years and over in 2031 ^a	42,900	95
Relative change in the older population (2006-2031) ^a	0.93	39
Relative change in the projected proportion of older people (weighted) (2006-2031) ^a	0.56	68
IMD rank ^b		337
Proportion of the older population that is non-white British	4.06	168

*Analysis undertaken to the level of 352 local authority areas in England (two local authority areas with very small resident populations were excluded) with the exception of the IMD.

^a2006-based sub-national population projections (ONS 2007)

^bThe Index of Multiple Deprivation (DCLG 2008)

^cExperimental population estimates by ethnic group for local authority districts and higher administrative areas in England and Wales for 2007 (ONS 2010)

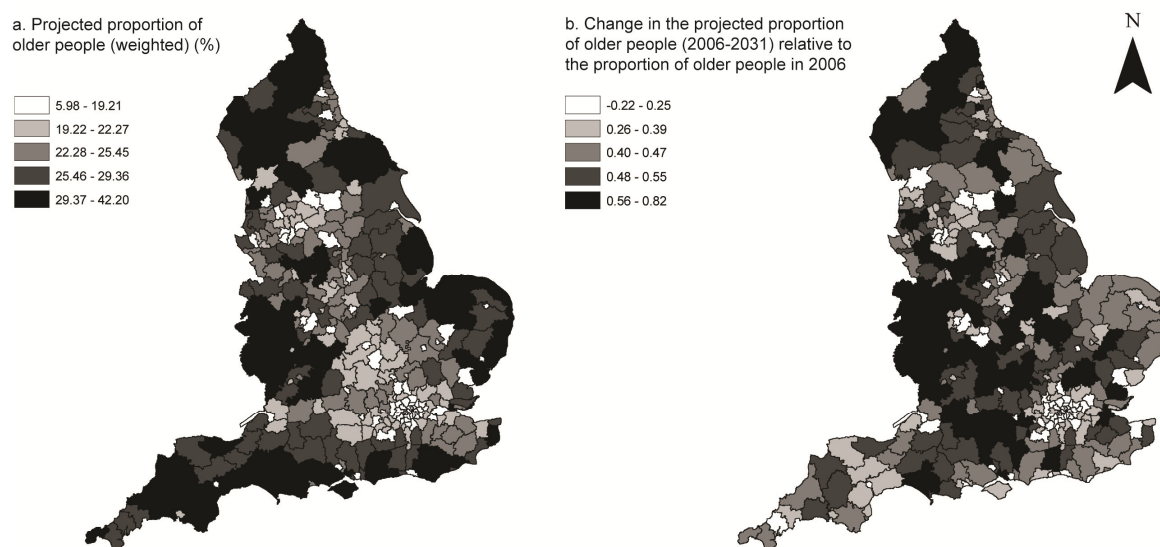


Figure 1.3 Maps of local authority areas in England showing a) the projected and weighted proportion of older people in the population by 2031 and b) the projected change in weighted population of older people (2006-2031) relative to the proportion of older people in 2006. In both examples the older population has been weighted by age-related differences in the likely need to use health care. Analysis based on 2006-subnational population projections by age group at local authority level (ONS 2007). Source: Oven et al. (2012: 22).

Economic, social and cultural factors can also be important for vulnerability, for example, in terms of risk of fuel poverty, lack of social support and challenges for adapting behaviour to cope with extreme weather. Overall, Horsham District ranks among the more socio-economically privileged areas of the country in terms of the Index of Multiple Deprivation (DCLG 2008), being ranked among the lowest third of authorities on this measure. Horsham District is also among those local authorities with relatively small proportions of people from minority ethnic groups whose cultural background may be important for their response to extreme weather events (Table 1.1).

1.4 Local variation in vulnerability

There is local variation in demographic and socio-economic and cultural characteristics of the older population living in Horsham District today, which may continue into the future. For example, at the lower super output area level (LSOA) pockets of relative deprivation amongst the older population are evident, with some LSOAs ranked within the top 12% of small areas nationally within the Income Deprivation Affecting Older People Index (IDAOP)¹, including areas around Horsham Town. There are also parts of the local authority with local concentrations of ethnic minority groups. This means

¹ Within the IDAOP, the highest ranking LSOA within Horsham District is ranked 3981 out of 32482 LSOAs nationally.

that it will be important to plan for varying needs in the older population likely to be vulnerable to weather-related hazards.

Levels of urban development are relatively low compared with other parts of England. Defra (2009) have classified Horsham District as a predominantly rural District where between 50% and 80% of the population resides in rural census output areas. However, a cluster of LSOAs in the north of the District are characterised as urban, with a high proportion of older people and relatively high levels of deprivation amongst the older population.

Vulnerability of built infrastructure supporting older people's care is dependent on local conditions and the configuration of local infrastructure as illustrated in Sections 2 and 3 below. We therefore chose some local areas of Horsham District to examine in detail, as case studies of the different conditions that apply across the local authority. These are described in the following sections of this report.

2. Health and social care systems within Horsham District: Case study findings and implications for adaptation and resilience planning

2.1 Introduction

The aims of the case study research were to:

- i. develop and test ways to collect information from service providers and older people and engage these groups in discussions around climate change adaptation and resilience planning;
- ii. explore how infrastructure and service provision might be made more resilient to extreme weather events;
- iii. explore how individuals, communities and service providers can take action to help maintain health and social care service delivery during extreme weather events.

The research began with a cross-sector meeting at the local authority area level to bring together representatives from a range of organisations responsible for health and social care delivery, climate change adaptation and resilience planning. This helped us to identify three case study areas with varying local conditions for more in-depth research. These selected case study areas were given the pseudonyms: 'Market Town'; 'Village Hub'; and 'Rural Area'.

In total, 37 older people, with a range of health and social care needs, were interviewed across the case study areas (Table 2.1). In addition, 18 frontline service providers including representatives from the county, district and parish councils; emergency services; and the community and voluntary sectors participated in group discussions facilitated by members of the BIOPICCC Team.

Research governance and ethics approval was sought through the University Research Ethics Committees; a NHS Research Ethics Committee; local NHS Research and Development Committees and local Adult Social Care Research Governance Committees. Through this process we considered, and responded to, a wide variety of issues in relation to the data collection and wider approach to the research. Information sheets and consent forms were prepared outlining the aims and objectives of the discussion groups, the duration and nature of the research and the role of participants. Following an introductory presentation, participants were given the opportunity to ask the research team questions prior to signing consent forms agreeing to the use of anonymised

Table 2.1 Health and social care needs of the research participants

No. of Participants	Gender	Age range	Health care needs	Older carer
1	Female	80s	Arthritis and high blood pressure	No
1	Female	60s	Parkinson's and bowel disease	Former carer
1	Male	80s	Active older person	No
2	Male + female	70s	Active older woman; husband recovering from a stroke	Yes
1	Female	60s	Reasonably active older person with severe arthritis	Former
4	Male + female	70s	Two active older women; one man with mobility issues; one man unable to speak following a stroke	Yes
1	Female	60s	Active older person	Yes
1	Male	70s	Reasonably active older person	No
1	Female	Younger older	Active older person	No
1	Male	Older	Chronic obstructive pulmonary disease	No
1	Male	Older	Mobility issues	Yes
1	Female	80s	Active older person	No
1	Female	80s	Active older person	No
1	Male	Younger older	Chronic obstructive pulmonary disease	No
1	Female	70s	Fibromyalgia	No
1	Male	90s	Reasonably active - some mobility issues	Former
1	Female	80s	Older lady with some memory issues	No
7	Male + female	60s-80s	Stroke sufferers and other health conditions	No
9	Male + female	60s-80s	Stroke sufferers and other health conditions	Some

information in the study. We have used pseudonyms for places to protect confidentiality in this document.

The anonymised quotes we include in this report illustrate individual experiences. These help us to see how extreme weather has impacted on different people and to identify examples of good practice in the context of climate change adaptation and resilience planning. Further details of the methods are available from the authors of this report.

2.2 Discussion at the local authority level to select case study localities in Horsham District

In June 2011 the BIOPICCC project held a cross-sectoral meeting with representatives from various agencies in the local authority area with responsibility for delivering health and social care, climate change planning and emergency response. The aim of the meeting was four-fold: (1) to identify key parts of the health and social care system within Horsham District; (2) to examine how extreme weather events may affect these systems; (3) to explore how elements in the system connect and depend on each other; and (4) to identify suitable sites for more detailed case study work. Appendix 1 summarises the role-types of the people invited to this meeting.

The following **key issues** were raised during the group discussions and are relevant to future planning within Horsham District:

1. It is important to plan for climate change across all types of geographical setting. Recent flood events taking place after this research was carried out have further emphasised the need for continued work on adaptation planning. In Horsham District, particular consideration also needs to be given to rural areas, most impacted by extreme weather events. This type of local setting presents a challenge for both health and social care delivery across Horsham District, and emergency planning during extreme weather events. Road access is particularly important to formal and informal networks of care, with market towns identified as important hubs for these networks.
2. Planning for, and responding to, weather related emergencies is challenging due to the plurality of providers involved in local service delivery across Horsham District.
3. Strategic planning across geographical and organisational boundaries was emphasised as a key area for development in order to make older people's health and social care more resilient to climate change.

4. Climate change adaptation should be integrated into the planning of older people's future health and social care, through Joint Strategic Needs Assessments, the Health and Wellbeing Board and the Sussex Local Resilience Forum.
5. Parish Councils were considered to be well placed to co-ordinate and undertake local level resilience planning, as exemplified in some Parishes within Horsham District.
6. Sussex Resilience Forum and Emergency Planning agencies within HDC recognise the need to empower communities to be better prepared for extreme weather events, through risk assessment and response planning.
7. Personalisation of Adult Social Care presents both challenges and opportunities for resilience building. The local authority has less control over the social care workforce and emergency/contingency planning is more complex as a result. However, personalisation could lead to a more localised workforce which is better placed to ensure continuity of care during extreme weather.

Participants worked with base maps of the local authority (Figure 2.1), including maps provided by [NHS SHAPE](#) (Strategic Health Asset Planning and Evaluation) showing the location of NHS facilities e.g. hospitals and GP surgeries, to identify possible local areas (wards/parishes) suitable for local level consultation.



Figure 2.1 Identifying key health and social care infrastructures at the local authority level: example participatory maps.

The areas selected have high concentrations of older people (and/or are projected to have high concentrations in the future) and are susceptible to extreme weather events, having been impacted by extreme weather events in the past, in particular, coldwaves and flooding. Groups were asked to consider the social diversity of communities; levels of activity among community groups; and different levels of local emergency planning.

Participants suggested that the BIOPICCC research team select case study sites which capture the characteristics of the local authority. The following categories emerged:

- wards within a larger towns where there are relatively large concentrations of older people living in more deprived conditions (e.g. Denne and Roffey South);
- large village market hubs (e.g. Storrington, Pulborough and Henfield);
- small villages in rural areas (e.g. Shermanbury and Shipley).

For the purposes of the local level consultation, we selected three localities for more in-depth research. These localities are referred to by the following pseudonyms: 'Market Town', 'Village Hub', and 'Rural Area'. These illustrated the settlement types identified above; are susceptible to weather-related hazards; and represent a variety of social and organisational settings/characteristics.

2.3 Perceptions of extreme weather events and climate change

In general, the older people interviewed feel that Horsham District has a moderate climate, neither too hot nor too cold, but they recognised that extreme weather events do occur in the locality. Examples given included the 1976 heatwave, the severe winter of 1962/63 and the 1987 hurricane. Comparisons were made with more recent extreme events including the severe winters of 2009/10 and 2010/11.

For some older people, these recent weather events suggested a change in frequency of extreme weather:

"...fortunately, down this neck of the woods ... you don't know it's winter, most years. You know, we don't generally get snow. If we do it's wet and gone, you know, but the actual likelihood of it sticking around for three or four weeks like it did. I mean, that was exceptional. And then we got it the next year and you think 'oh well is this going to happen every year?'" (Older person participating in the research)

Others perceived very little change in the occurrence of extreme weather events. As summarised by one respondent:

“Extreme weather events have been happening for years...we are unlikely to meet anything we haven’t met before” (Older person participating in the research)

The older people interviewed, therefore, **had mixed views about climate change and global warming**. Some thought climate change might explain recent weather patterns, while others were sceptical. Some respondents felt that the weather was changing but that this may be due to natural variability rather than anthropogenic climate change.

Despite an awareness of events involving drought and water shortages in the South of England (for example, the summer of 2012), the recent extended periods of snow and ice dominated conversations with older people. During the coldwave conditions respondents reported that it was difficult to leave the house as they were worried about falling on the ice. This resulted in some older people being housebound for a number of weeks. The research was completed before the wet summer of 2012.

For the older people interviewed, heatwaves were not a cause for concern and there was broad agreement that *“we don’t have summers like we used to”*. In general, older people welcomed spells of warmer weather and there was a relatively low level of concern about the impact of heat on older people’s health. However, a number of older people in quite good health reported feeling uncomfortable in hot weather. Those with health conditions such as Chronic Obstructive Pulmonary Disease (COPD) found extremes of all weather types (including heat) exacerbated their existing conditions. Also, a number of service providers reflected on the vulnerability of older people to hot weather and discussed contingencies for these events.

Heavy rain and storms can also cause weather-related hazards in Horsham. Localised flooding was an issue in and around ‘Village Hub’ and across parts of ‘Rural Area’, where important access routes are prone to flooding. Alternative routes are available but have resulted in much longer journey times.

Key messages for policy:

- It may be easier to engage local communities in discussions about preparing for extreme weather events now and in future rather than in discussions of ‘climate change’.
- Older people can remember extreme weather events occurring in the past, over a long period.
- Older people are adversely affected by coldwaves and disruptive flooding and may be more concerned about these events than heatwaves.

2.4 'Everyday' use of health and social care systems

We discussed the range of services older people rely on routinely. These include health and social care and other local services. Horsham District is predominantly rural, close to the coast and is seen as having a relatively mild climate. The area is attractive to older people for this reason. It is also important to people that the larger settlements have a good range of services and amenities that are accessible and affordable for older people.

Participant 1 *"I love it, love it!"*

Participant 2 *"So near the coast it's lovely... warm and..."*

Participant 1 *"Apart from all the shops shutting, which is sad, it's a lovely place to live..."*
(Group discussion in 'Market Town')

"... I think most of the things you need are here; there's a Waitrose and there's a Boots and... things like that... Obviously, you know, other things you do have to travel out for, but I think if you couldn't get anywhere else, then you could manage getting most of the things you need there."
(Older resident in 'Village Hub')

Some older people we interviewed have grown up in Horsham District or nearby, while others moved to the area on retirement in older age. Some have moved to the area to be near family members, or to take on a caring role themselves, looking after an older relative. The growing numbers of older people in the area already places pressure on services and this is projected to increase as the population gets older. Older people rely on complex networks of 'informal' care and support as well as 'formal' health and social care services, as discussed below.

'Informal care' by family, friends and voluntary organisations in Horsham District

Our research highlighted the importance of 'informal care' networks including family, friends and neighbours and voluntary organisations. Many older people cited a family member, living locally, as their main carer. However, others noted that their families are spread across the district or the county, and may be in other parts of the UK or even overseas. Older people without 'informal carers' living locally, and who require help, may rely on formal services or be isolated from sources of support:

"..we're [personally] in a very privileged situation because we've got family to back up. I did feel desperately for people on their own...especially if they have illness or disabilities, it makes it very, very difficult for them unless they have a relative nearby who can help out. There are some that don't have back-up. It must be very hard for them. I only hope that they get the help that they really need."
(Older person in 'Market Town')

“...we have people with dementia... it’s such an isolating illness anyway... friends and relatives disappear into the sunset, you know, as soon as there’s a diagnosis...”
(Service provider in ‘Market Town’)

Our participants described how the ‘informal sector’ is both extensive and active in all the case study areas. The older people we interviewed talked about the importance of social activities, including lunch clubs and coffee mornings which are often organised through churches, charities and community groups. Through these groups, older people have the opportunity to meet people in similar positions to themselves and can support each other. Information about available services and activities is provided at the District level for older people and at the Parish level for more local services and activities. These are important resources that older people refer to, as discussed in a number of interviews.

It was also apparent that a number of active older people, as well as younger residents, volunteer to provide support to older people in their community. As the demographic profile changes, their role will be increasingly important and growing needs for volunteer support are anticipated. This can include calling on older people for a chat, picking up their shopping, running older people’s groups and luncheon clubs or driving the local minibus. The findings have highlighted the importance of volunteers in meeting older people’s health and social care needs. As one respondent noted:

“If it weren’t for the people who cared for the people who need it, voluntary carers who don’t get paid, I can’t think what the country would be like. There’s just an army of them.”
(Older person in ‘Market Town’)

In most of the localities where the study was undertaken neighbourliness was a big asset. However, not all older residents find it possible to be equally involved in community action. It was noted that many villages are expanding, with new housing developments and new families moving in, so the community dynamic is changing and in some cases becoming less cohesive. Older people thought local communities benefitted from incoming populations (both in terms of sustaining communities and services), but there were also questions about future social support mechanisms as the younger generation were seen to be less able or willing to participate in community activities.

- Participant 4 *“... without the newcomers we wouldn’t have any services at all, we wouldn’t have any... like the health scheme, the minibus it’s all run by people that have moved into the area but the local ones who are the [residents of local origin]... they don’t do it... in the parish council room, a lot of people don’t even know that... there’s these deprived areas ... they don’t look at it.”*
- Participant 3 *“[Village Hub has] got quite deprived areas, yeah.”*
- Participant 2 *“Yeah but they don’t accept that, you know.”*

- Participant 3 *"... [It is] mostly older people that are volunteers ... but the problem is they are now getting very old themselves... and they are trying to hand the things on ... and they can't because I'm afraid that the...younger generation...obviously nowadays you probably need two incomes to support a mortgage round here ... so where's the time going to come? They certainly can't take time off in the day and their wives are probably working so it is a problem, it is a problem."*
- Participant 1 *"...you haven't got the homes for the young people, the local people and they have to move away to be able to afford to buy something 'cause it's the only way..."*
- Participant 3 *"That's a problem with house prices everywhere..."*

A growing proportion of older people in Horsham Districts may in future live in 'sheltered' housing schemes and some of our respondents commented on the benefits of support available in these environments.

"I think, well, I should be thankful being here because of the complex ... it's a retirement complex you do you know the services are already there for you it's all set up and you feel that you... you are being looked after which is good."
(Older person from 'Village Hub')

At the same time, it was recognised that growing provision of this type increases the level of demand for care in the area.

"In a funny sort of way we've got so many elderly people's flats coming on in ['Village Hub'] that you wonder how they'll cope with those..."
(Older person from 'Village Hub')

It was also noted that with an expanding number of 'silver surfers' the internet will become more important for communication and support to older people in future.

Key messages for policy:

- Family, neighbours and formal community organisations play a vital role in care and support of frail older people.
- Changes in society and living arrangements for older people need to be considered in policies to support and develop this 'informal care' sector in future.
- It is important to include 'informal carers' and their representatives in planning for extreme weather events within health and social care.

Health and social care services provided by the public and private sectors in Horsham District

The older people interviewed use a range of 'formal' health and social care services both within and outside the District, provided through the public and private sectors.

Sources of health and social care are **widely distributed** across the county. For example, people in Horsham use a small community hospital but also need to go to larger acute hospitals outside the District. Consequently, many of the older people with long-term health conditions, and those visiting family and friends receiving treatment, had to travel relatively long distances. Journeys involved can be difficult, especially for older people who do not have access to a car, so rely on public transport and other transport services.

This was discussed in a focus group with frontline services providers in the south of the district:

- Participant 1 *"Where do people in 'Village Hub' see themselves in relation to in-patient NHS services?"*
- Participant 2 *"In-patient? Either Chichester or Worthing."*
- Participant 3 *"Worthing? Really?"*
- Participant 4 *"Worthing really. And actually they've got a hospital in Horsham really but although we are in Horsham District most people have never been to Horsham really. You always graduated towards Worthing."*
- (Discussion group in 'Village Hub')

Although domiciliary care agencies try to organize their operations so that care staff provide for clients living in the same locality, we found that, especially in smaller settlements, service users may rely on a **non-localised workforce** of social care providers who must travel some distance to reach their clients. This was reported especially by some participants in 'Rural Area' and 'Village Hub'. As one older carer explained:

"...if you have them [domiciliary carers] from social services they don't come from the village... they travel down...they can come from parts anywhere. They are generally not from the local village. So that's a real problem."

(Older person from 'Rural Area' looking after a frail relative)

Key messages for policy

- Older people often have diverse health and social care needs requiring access to facilities which may be located some distance from their home in Horsham District or other parts of the county.
- Domiciliary care providers may also travel some distance to reach their clients' homes.
- This underlines the need for coordinated planning across West Sussex, at county, district and local scales to ensure service continuity/contingency arrangements over quite large distances during extreme weather events when transportation systems may be disrupted.

It was emphasised at several of the discussions that coordination is a challenge since in Horsham **a large number of providers of health and social care services operating in the independent as well as public sectors**. Most care homes and some domiciliary services are operating in the independent care sector.

In discussion groups, local community advocates called for greater co-ordination of services to avoid fragmentation of care systems and for this to be led by local councils (at County, District and Parish levels).

The need for coordination was also underlined by comments from some service users. **Services can seem fragmented and difficult to understand for some service users.** For example, Box 3.1 presents some comments by older residents who felt unsure about sources of care available to them.

Box 2.1 Examples of comments from older residents and carers illustrating complex systems of care which older people may need to use and the potential for lack of information/ coordination between different parts of the system

"... Age UK ... they do a visiting service... 'Help At Home'... that helps them with cleaning and other things... It helps them if they want to go shopping... Then you've got British Red Cross which does help from hospital... it's a six weeks free service. Now there's another visiting service although it's based in 'Nearby Town', they will cover the whole of 'Market Town' as well. There's a 'Nearby Town' visiting service. Age UK obviously have a day centre as well and they do shopping services."

(Service provider in 'Market Town' discussing the range of providers for home care services)

Participant 1: *"...District Nurses are obviously coming in from the health centre, from ... GPs... But meals on wheels, all the other bits and pieces are they all coming in from outside?"*

Participant 2: *"I don't know much about the meals..."*

Participant 3: *"I think meals on wheels ...for 'Village Hub' I have to make contact with Hayward's Heath."*

(Discussion among older residents in 'Village Hub')

"I didn't come under Horsham [for health services]... we'd have somebody come and give us a talk from somewhere or other, and she'd say "I'll look into this, into that". When I used to say [Village where participant lives], [the response was] "oh no we don't come under [Village]."

(Older resident in a village in 'Rural Area' suffering from COPD)

Participant 1: *"What we've got to do is get it recognised so that we get more money coming in at local level to be able to do things."*

Participant 2: *"We could do with a 'Rural Area' parishes council, not individual councils... (but then you're going back to the old days when we did have the ['Rural Area' Council]) but that's what we really need, so you bring all the parishes in and say 'Come on organise yourselves, you're all using... that bit', you know..."*

(Older residents from Rural Area)

Also older people often have complicated journeys to reach hospital inpatient and outpatient services they need to use. Box 2.2 illustrates some comments from our informants on this issue.

Further challenges to service provision are likely to arise due to **increasing intensity and complexity of care needs of service users, combined with potential cuts in public spending**. The perception among some of our informants was that cuts in public expenditure mean that only older people classified as having 'high' health and social care needs are able to attend services such as day centres. As one older person commented:

"It's only those with 'high', I think that's what they call it, 'high needs' that are getting any sort of help you know." (Older resident in 'Village Hub')

Box 2.2 Discussion about use of hospital services in areas outside Horsham District

- Facilitator: *"Where do people in ['Village Hub'] see themselves in relation to in-patient NHS services?"*
- Participant 2: *"In-patient, either Chichester or Worthing...actually they've got a hospital in Horsham ... but... although we're in Horsham district most people in ['Village Hub'] have never been to Horsham really... you always graduated towards Worthing."*
- Participant 1: *"I think .. Horsham's where people go for rehabilitation ..."*
- Participant 3: *"...I don't know, I've always been referred to Worthing."*
- Participant 2: *"... but a lot of [patients from Nearby Town] go to Chichester ... if you live in [Another Village], mind you, you have to go to ... Worthing... or Redhill ... which is a horrendous drive."*
- Participant 4: *"I've been going to Hayward's Heath."*
- Participant 2: *"... you see, you've got long journeys and 'cause we haven't got the station, this is one of your big bugbears if you go anywhere...you can't just get on a train you've got to get the bus to get to [Nearby Station]."*
- Participant 3: *"And of course each hospital has it's specialist units ... so I know with my wife's mother we used to have to take her to Brighton Hospital, Worthing Hospital and Hayward's Heath Hospital... and Chichester as well so, you know... that's fine because I'm not working and I can drive ... but if you don't drive ..."*
- Participant 2: *"If you don't drive it's a nightmare..."*
- Facilitator: *"... transport seems to be quite an underpinning issue ... what happens in 'Village Hub' about transport? Obviously you've mentioned about this dial-a-ride, about volunteers..."*
- Participant 2: *"Well you've got this help scheme but having said that a lot of the drivers that drive for that are in their 80s...and they won't drive to Brighton... Brighton frightens them really."*

Participants reported a potential conflict between the aspiration to deliver more care in the community and the retrenchment of care services:

Participant 2 "And then you've got the people [informal carers] that are looking after people with dementia and illnesses, stroke things like that ... they don't get out... they don't get that much help...I know [the domiciliary nurses] can't be everywhere at once to get people up but when they come in late morning to get you up and then they call about 4 o'clock to put you to bed it's a short day really."

Participant 1 “What you have to realise...is that they’re one of hundreds and hundreds and hundreds and they prioritise it as best they can.”

Participant 2 “But it is still a problem ...”

Participant 4 “They want people to stay in their own homes as long as possible ...but the facilities aren’t there to cope with it.”

(Discussion among older residents in ‘Village Hub’)

Reference was made by older people, carers and local frontline providers to the impact of cuts in public spending which have resulted in loss of services. Concern was raised by some frontline service providers in the District about the notable lack of facilities for the care of frail older people in rural areas.

These issues will intensify as the size of the older population and the range of service providers in Horsham increase in future.

Key messages for Policy:

- Growing diversity of health and social care providers in different sectors may make services increasingly difficult to coordinate and more difficult for users to understand. It is important to ensure that for users and providers on the ground in different parts of Horsham, services are well integrated and ‘joined up’.
- Services are already seen to be under some pressure as formal care is provided to a growing number of older people with particularly intensive and complex care needs.
- These challenges of service integration and resource pressures on the health and social care sector are raising new issues for plans to prepare for continuity and contingency when services are disrupted during extreme weather events.

2.5 The impact of extreme weather on health and social care delivery

Our research in Horsham district collected several illustrations of personal experiences of the impacts of extreme weather events. These included short- and long-term disruptions to older people’s everyday routines and to continuity in the services they rely upon. Several examples were given of ways that local residents, community organisations and service agencies responded to limit disruption. These could help to inform efforts to improve preparedness for extreme weather events. The examples suggest action that can be taken by individuals and local communities, as well as District and County planners and ‘formal’ providers of health and social care, utilities and other essential services. We include in this part of the report ‘vignettes’ of personal experiences that may help to prompt discussion and planning.

Coldwaves and flooding or storm damage have been most disruptive

All of the older people we spoke to considered the snow and ice, recently experienced during two prolonged coldwaves in 2009/10 and 2010/11, to have caused the greatest disruption to health and social care delivery in Horsham District. The impact of these coldwave conditions was partly due to the extended period of time the disruption lasted, with older people reporting that they were housebound for between two and four weeks in 2010/11.

Localised flooding was also reported to have impacts in some rural areas, in particular through disruption to the road network. Strong winds were reported to cause some disruption to electricity and telephone networks, especially in rural areas. The interviews with older people took place prior to the 2012 floods across West Sussex, so this event does not feature in our discussions.

In general, hazards due to high and prolonged temperatures were thought to be less disruptive.

Disruptions to formal and informal networks of care

It was reported that the most significant disruptions to health and social care were caused by the impact of extreme weather (snow, ice and flooding) on the road network. This caused problems for domiciliary care teams travelling around the District. Supermarkets delivering food were stretched during the extended period of cold weather, and had no way of prioritising people most in need. Some local community groups supporting older people with health conditions were forced to close during the very cold weather.

Participants described the disruption to local road traffic during recent coldwaves; main roads were cleared of snow by the Council but not the side roads or pavements.

Participant 3 *"... the county keep... open... the 283 and then they keep the B2139 open and they keep the B2139... that's it and then every other road in the area unless you've got a 4 wheel drive you're in trouble.."*

Participant 2 *"I mean [Local Estate] was diabolical; it was just like a skating rink all round... you couldn't go round in a car, definitely."*

(Discussion among residents in 'Village Hub')

Flooding has also been disruptive to road networks in Horsham District:

"Well I was quite horrified, having worked in 'Rural Area' where the river floods...both sides, ... and we were told to turn round so I had to do like a 30 mile round trip to get all the way back down."

(Discussion among providers in 'Village Hub')

"...practically every road out of ['Market Town'] has to go through ... boggy ground and it often does get flooded on the roads into and out of ['Market Town']..."

(Resident in 'Market Town')

Many older people highlighted the importance of family in providing help when required due to extreme weather disruptions. As one respondent explained:

"...I can call on my nephew, he's only a few miles away....he's got a biggish, heavy car so he'd keep me supplied if necessary."

(Older resident in 'Market Town')

In the more rural areas where this study was undertaken, respondents talked about people rallying together during difficult times. As one younger older carer said:

"[If I required help] I would call on people. Yeah I would. For instance, you see people have got four-wheel-drives and things like that. I know there's an agricultural contractor and I think people typically help each other in things like that....People do rally."

(Older resident in 'Rural Area')

Due to dedicated work of care providers, the disruption caused delays, rather than non-delivery of services in most cases. For example, local domiciliary care teams still managed to visit their clients on foot. As one older person, who relied on a visiting carer to help with his wife, said:

"...she comes by car ...about a mile and a half....but during the bad weather she walked and she's ... good. She couldn't use her car and we admired her ... she didn't let any of her clients down."

(Older resident in 'Market Town')

However, not all older residents have relatives or friends living close by to assist them. Also support networks were weakened because older people who normally support their neighbours were unable to do so while routes were unusable due to the compacted snow and ice.

"...here ... you can walk to the shops because it's downhill ..well last year and the year before [during extended coldwave] they couldn't even do that so ... the carers couldn't get to them so ...that's when you have to rely on neighbours to go and help them get out of bed and get dressed and things because you can't leave them can you? I think we need to be aware of our neighbours and what their problems are and what their needs are and we should be there for each other..."

(Local service provider in 'Village Hub')

Older people were often worried that they might fall and injure themselves. Being confined at home during bad weather can lead to a sense of social isolation. As one older person explained:

"Last year when the snow came it was just too deep where we live. Nobody moved out of the road so it was just too deep. So he just stayed in for a week or more."
(Resident in Village Hub')

The issue of older people being housebound during extreme weather events was discussed in the context of both cold spells and heatwaves:

"If that [heatwave] came you'd get people in nursing homes and that sort of... perspiring it's so hot...and you'd get heat stroke...They couldn't get, they wouldn't be able to get out....so older people would be confined to barracks again"
(Discussion with care providers in 'Market Town')

There was a lack of awareness about local emergency plans or information on who to call during an emergency, and few people knew where the rest centres were located.

"..I expect they [Parish Council] have [an emergency plan] but I don't know what it is....It'll probably be, they put notices in the library, it'll probably be in the library or somewhere like that."
(Older Resident in 'Village Hub')

This reinforces the point that in extreme weather emergencies, telephone, radio, TV and internet connections become very important to ensure older people could at least be in touch with others. However, some participants in our research also remembered storms or heavy rainfall events when power lines and telephone connections had been severed. This can potentially cause interruption to the telephone alarms used as a safety measure by many frail older people living at home.

Participant 1: " Well if the power's gone off all of these units have back-up batteries for 30 hours. The only thing that will stop them working is because they're telephone bases... if anything happens to the telephone... and it's only a few weeks ago there was something wrong with the cables and 2000 people were affected in Horsham."

Participant 2: "But that doesn't have to be weather-related... we have a long... telephone..."

Participant 1: "No this was... water in the cables. When you start to get a lot of wet... you get water in the cables."

Participant 2: "We had one of our main telephone lines into our village where the wind... we had such strong wind... And the whole of our village lost its telephones."

(Discussion with care providers in 'Market Town')

Power supplies are also important to run local health and social care facilities and to operate domestic heating systems or medical equipment that some older people rely on in their homes.

Key messages for policy:

- Discussion with local residents and ‘frontline’ service providers can provide local intelligence about the parts of the health and social system that are most likely to be disrupted by extreme weather events.
- As well as preventing continuity of services that some older people depend on routinely, extended periods of disruption can cause social isolation and lack of contact to monitor the condition of frail older people.
- Disruption to health and social care is often caused because transport and utility networks are interrupted, so that preparedness for extreme weather events needs to take into account these parts of the infrastructure system.
- Not all older residents are aware of existing emergency plans in their communities and it is important to maintain communication links and provide information to older people during extreme weather events.

2.6 Preparedness and planning for extreme weather

In view of the potential disruptions caused by extreme weather events, preparedness and planning is important. Older people and their carers reported that they take measures to protect themselves and to be comfortable as possible during extreme weather events that may interrupt access to services. Also service agencies discussed a number of measures that they can take to improve resilience to extreme weather. These are presented here as ‘examples’ which could be used to help communities engage local residents in preparedness planning or to inform more strategic level planning among the key service agencies.

Individual adaptations

In general, the older people interviewed had a stoic attitude towards the weather and the disruption it causes. As one older man said, “*you just have to plod on, you know?*” In referencing the past, older people often noted that life is easier now than when they were younger and they have a lot of experience and resilience to draw upon. Older people themselves reported that they are planning ways they can act themselves to try to minimise the impact of disruption due to extreme weather. Box 2.3 shows examples of the kinds of preparations that some older people may consider (though they would not be feasible for everyone).

Box 2.3 Planning for extreme weather events

Action 'Elsie' and 'Joyce' were taking to prepare for extreme weather events

Recent experience of extreme weather conditions may have encouraged older people to think ahead and prepare for such events. Some of our informants, such as Elsie and Joyce described action they were taking for themselves. Such action will not be feasible for all individuals, so we should not expect these kinds of preparation to be possible for everyone. Nevertheless, these examples might give some other older people ideas about actions they could take.

"From my point of view we got caught short in that we didn't have ourselves prepared for winter.... I mean we managed but this year now I'm thinking it could come at anytime so we are getting ourselves prepared early."

(Resident interviewed in 'Rural Area')

Some of the older people we spoke to in Horsham District emphasised that they felt more resilient in adversity than the younger generation and they described their strategies for coping with extreme weather. Elsie (not her real name) is an older person living in 'Market Town'. Joyce lives in 'Village Hub'

"I'm adaptable. I mean when I grew up there was only one cold water tap coming into the house, the lavatory was across the yard... and you had a fire in the sitting room, no heating in the bedrooms at all and you used to get that lovely frosty condensation going into lovely frosty patterns so you grew up used to it..." (Elsie)

"...people today.... they've been cosseted with all the central heating and everything... they're not built ... for this cold weather or, you know, not used to it or can't cope with it. But... we had the war you see, we're strong people. Oh we haven't had it cushy, well when we were younger it wasn't easy was it? You know it's a matter of surviving... Everyone has it easy now...so I think we were, we were a bit tougher than that.." (Joyce)

Elsie and Joyce explained that they have got used to stocking up with essential food, medicines and other necessities in case they are unable to leave their homes due to the weather.

"I always have plenty of non-perishables in, I start stockpiling about August so I've always got tins and packets and toilet-rolls and things like that and I get them on... when they come into special offer so I keep a stock of that and cough medicines and all that. I always make sure I've got that at the start of the winter." (Elsie)

"...the flat I was in had no central heating so it was very cold but also when it did... it was in a close so when we had that bad snow ... you couldn't get out of the road... but if you knew it was coming, I used to stock up, you know..." (Joyce)

However, this strategy of 'stocking up' may not be feasible for all older people, as discussed by a group of older people in 'Rural Area' who were active in helping to organise voluntary services in their community:

Participant 4: *"Well I think... people with dementia...won't have a clue and they forget to eat ...and if somebody brings food in for them they eat it all at once, and you know... if things like that..."*

Participant 2: *"But then that should be the carer's responsibility then."*

Participant 4: *"... but you see they haven't all got carers, some of them just have meals on wheels."*

Participant 1: *“... people living on a fixed income, particularly at the moment are being hit all the time by things costing more and what they’re doing is, they’re retrenching and therefore instead of buying a couple of packets of something they’ll buy one, when they’ve got to the end of that if they couldn’t get out and they haven’t got anything... they can’t afford it; they won’t do it.”*

Elsie and Joyce thought about what they might do to keep warm if the electricity supply failed:

“... without [electricity] and without being able to boil water for the hot water bottle it would be a bit chilly but as I say I’d probably just tuck into... the bed ... if I couldn’t get a hot drink I’d drink plenty of water to stay hydrated.” (Elsie)

“I make sure I’ve got torches in certain places in each room I’ve got candles that in the dark I could put my hands on and I’ve got a lighter to light them with so... because I’ve experienced it, till you’ve experienced it you don’t realise how difficult it is; also if because we’re all electric here and I do have, ... a little camping gas stove, so if there’s, if there’s a power cut no electric for so... I’ve got that, I can boil kettle.” (Joyce)

Local service providers from a discussion group in ‘Market Town’ also talked about the use of ‘wind up’ devices during power cuts.

Elsie and Joyce talked about the benefits for older people who adapt their homes to make them more thermally efficient, control ventilation in hot or cold weather, or use cooler spaces in hot weather:

“I think one of the single most important things is to see that people have double-glazing and cavity wall insulation; that makes such a difference.” (Elsie)

“[If] it does get a bit hot... then I go outside and sit in the shade if it’s too hot indoors you know there are ways around it but yes it does get warm and now I’m, you know, if I get too hot or cold I’ll shut the window, you know... there are ways around it. ...things like having a fan; you need to have a fan when the weather gets really bad because of the heat, as well as the cold, and you need a fan, you have to make sure ... you drink plenty of water things like that... you’ve got to keep hydrated, you’ve got to keep cool.” (Joyce)

Sharing knowledge and information about adaptation can support resilience. Elsie and Joyce had ideas about sources of information, from notice boards in community centres, and in public announcements on local radio during extreme weather events:

“I normally listen to Classic FM but if there is bad weather I’ll switch onto the local radio and they’ll give you all the information needed.” (Elsie)

Actions to improve preparedness of service agencies

In our discussions with participants who were service providers, as well as with local residents a number of examples were given of actions to take to adapt health and social care systems and prepare better for extreme weather events. Box 2.4 shows illustrations of these.

Box 2.4 Planning for extreme weather events

Action by local service providers and other organisations to prepare for extreme weather events

It is important to provide information to older people in the community during extreme weather events. Television and radio are good ways to communicate information to keep people informed. Some older people also use the internet regularly to help with day-to-day tasks, for example, food shopping.

Ensure consistently available information at the local level including emergency contacts, distributed by local community organisations. Telephone local Age UK representatives to keep in touch with older people in local communities.

Ensure robust telephone/internet communications. Use internet/mobile phones vs. landlines for some communications during extreme weather. Plan contingency phone networks for care system. This may include coordinators working from their personal phones at home. Also consider importance of phone links as part of home alarm systems.

Develop better local coordination of services between sectors; organisational changes may give rise to confusion about emergency planning responsibilities.

Local coordination of adaptation strategies varies and extra effort may need to be concentrated in some places. For example, Age UK is piloting a 'village agent' scheme in some parts of Horsham District. We also noted that the 'Pride of Place' seminars might be used to help develop local awareness of the issues. Sharing examples of good practice among local communities may be helpful.

Make plans for domiciliary carers to visit older people living close to them if they cannot travel to their usual clients. Adult social care workers to arrange to visit clients near their home if they cannot reach their usual clients.

Have a well considered strategy for road and pathway gritting in cold weather e.g. grit boxes with local key holders.

Plan housing, local services and transport with ease of access to services in mind (especially for those without car transport).

Ensure that power supplies and road access to residential care homes and hospitals are protected as far as possible from disruption in extreme weather.

Road drainage maintenance is important; improvements to flood drainage of local roads has reduced flood disruption, though these depend on culverts being cleared regularly by the County Council maintenance service.

Explore the potential for more coordinated cross sector arrangements to make use of local capacity e.g. local military bases for personnel, vehicles and equipment; emergency shared access to 4x4 vehicles for domiciliary care providers during floods/snowy conditions.

Consider how to co-ordinate information in 'at risk' lists giving the location of vulnerable people drawn up on the basis of local knowledge as well as records of statutory agencies. There are issues of confidentiality and risk in sharing personal data on 'at risk' registers relating to vulnerability of individuals, which may need to be reviewed. Also some of those with significant needs do not figure on existing registers and are socially isolated, which is a significant issue for effective resilience planning.

Service commissioning and procurement criteria should include preparedness for extreme weather.

Key messages

- The participants in this study showed that there is considerable local knowledge and initiative that can be drawn upon to improve local resilience planning and preparedness for extreme weather events.
- Examples of specific experiences of local people and service providers, in their own words, may provide more powerful messages to encourage community action than general accounts.
- These examples would need to be discussed and adapted to suit local conditions, rather than trying to apply the same solutions in all settings.
- The examples presented here suggest that there is a need for 'multi-scalar' and 'multi-sectoral' preparedness planning, linking up action of individuals, local communities and parish councils, District and County Authority agencies, as well as other services such as utility companies.
- Preparedness planning is not only about emergency planning; it also requires long term adaptation strategies.

3. Developing approaches towards mapping and modelling built infrastructure supporting older people's care

Key messages for Horsham District

- Participatory mapping exercises identified parts of the built infrastructure that are important for the delivery of older people's health and social care; these include a range of buildings and facilities, not limited to NHS/Local Authority properties.
- Built infrastructure extends beyond buildings – the utilities and transport networks linking buildings are essential to their function. These networks can, in principle, be modelled as whole systems of nodes and links using engineering models. They seem particularly relevant since electricity supply and road transport networks were identified as critical in several consultative workshops.
- In some cases, during extreme weather events, certain buildings take on new functions to act as central parts of the network to ensure resilience.
- Resilience planning may involve weighing up alternative adaptation strategies (e.g. flood-proofing electricity substations vs. installation of emergency generators to supply key buildings for older people's care during weather-related emergencies involving loss of power).
- We have developed a computer programme to model to examine the networks of infrastructure (water, gas and electricity) which support services for older people's care and how they may be affected by disruption due to extreme weather events.
- We were unable to gather data relating to key utility networks including water, gas and electricity in Horsham District and as a result have been unable to run the model.
- The difficulties encountered in terms of gathering the breadth and resolution of data required to run the models brings into question the feasibility of achieving this through the limited resources available on a relatively short-term research project. However, the work indicates potential for future development, with collaboration between Horsham District, West Sussex CC and utility suppliers, to better understand how key utilities like electricity are delivered to end nodes such as health and social care facilities and possible future adaptation strategies to ensure continuity of supply.
- This project is part of a wider research programme on Adaptation and Resilience to Climate Change, including other studies which have examined adaptation of transport networks, hospital buildings and domestic houses. Our findings suggest that these might also have relevance for Horsham District.

3.1 Mapping the range of services that older people use in the case study localities

We asked local participants to identify infrastructure that is especially important in their locality. Working with maps and structured questions we undertook a number of 'participatory mapping' exercises in the case study areas with older people and service providers. Participatory mapping is

designed to enable informants to become directly involved in deciding what information is important to record, while researchers take on the role of facilitator/observer, learning about local conditions and the reality on the ground (Pain *et al.* 2012).

Examples of the types of infrastructure identified are: health and social care services; care homes; pharmacies; shops; and emergency services. A summary list of services for 'Village Hub' is included in Table 3.1. Figure 3.1 shows an example participatory map including the location of some of these services. To construct the local maps we drew on Horsham District Observatory mapping capacity.

Table 3.1 Important services for older people identified in 'Village Hub' through participatory mapping (lists of individual buildings in these categories were provided and these could be located on maps that can be linked to other information relevant to assessing extreme weather risk and vulnerability)

Health and social care facilities:

Medical Centre and GP surgeries
Day care centres for older people
Care homes
Pharmacies
Carers' support
Village hall
Sport and leisure centre

Retail services:

Local Post Office and retail outlets for essentials

Emergency and highways services etc:

Fire station



Figure 3.1 An example participatory map of 'Village Hub' produced during a discussion with frontline service providers.

3.2 Steps towards engineering models of infrastructure (including utilities) providing services to key buildings

The BIOPICCC project also aimed to explore the potential for engineering computer models to examine the networks of infrastructure that support services for older people's care and how they may be affected by disruption due to extreme weather events. In Horsham district we have had difficulties collecting data. However, a computer programme is in place that will allow the representation of local infrastructures should data become available in the future. For this, we have built up our knowledge of the network based on the concept of *nodes* and *links*.

Nodes are points where a process happens (such as water being pumped) or where two or more utilities join together. For example, electricity supplies link to other utilities in nodes such as water pumping stations. **Links** are the connections between these nodes where utilities flow, such as a water pipe or an electricity cable.

Our model has developed as the project progressed. We initially sought to collect the following information:

- the location of important nodes (this information is required to estimate the flood risk at each node);
- how the nodes work (information required on, for example, capacity, storage, production, max flows);
- how the nodes are connected (information required to understand the links between nodes and how they feed into the network);
- the areas served by these nodes (this information is required to understand when a node fails, which places will be without the service (electricity, water, gas) and will be affected by this failure); and
- how networks work individually and together (e.g. how the electricity network supplies power to the other networks).

‘Demand nodes’ are points, or groups of points, where commodities such as power are consumed to allow the provision of health and social care. As explained above (Section 3.1), through interviews, focus groups, and participatory mapping, we compiled a list of important facilities in each of the case study areas for the well being of older people during extreme weather events. By mapping these points, we then examined likely **supply routes** for utilities (i.e. the nodes and links outlined above), though we could not verify these.

The infrastructure model is intended for use in situations where normal conditions have been affected by weather-related hazards. For example, when an area floods, different parts of the infrastructure are susceptible to different kinds of risk. This could be, for example, a flood event resulting from intense and prolonged rainfall.

Furthermore, and also as a consequence of flooding, the normal pattern of consumption may change. For example, certain demand nodes might be situated in areas where there is a high risk of flooding and thus older people might need to be evacuated from those areas. This decreases the need to supply key resources (water, electricity etc) to evacuated areas. However, it increases the need in areas and buildings not normally used to deliver care that are receiving evacuees and might suddenly require extra resources. One of the novel aspects of the infrastructure model is its capacity to deal with such

situations during the restoration of services to normal conditions. Essentially, demand nodes can be 'tuned' to allow more resources to flow to areas where the cost failure is the greatest (this is illustrated in Figure 3.2).

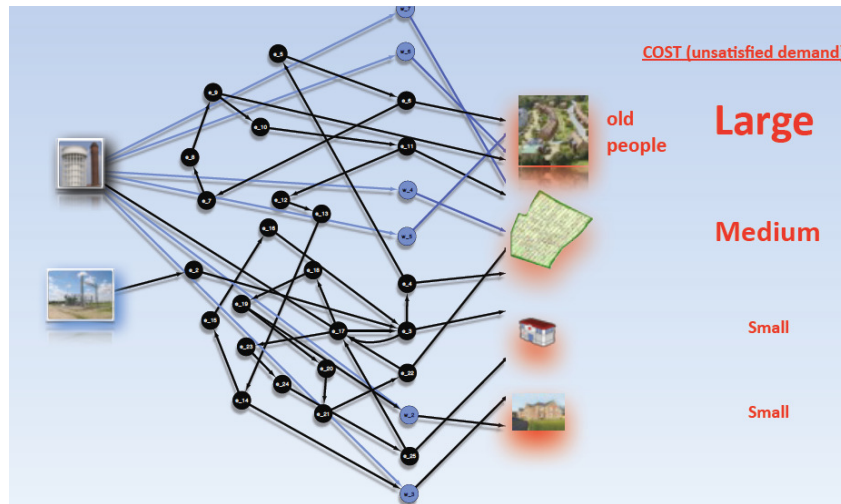


Figure 3.2 Demand nodes can be 'tuned' to allow more resources to flow their way by including larger 'cost' parameters in the model.

Figure 3.3 shows an example of an Environment Agency flood zone in 'Village Hub'. Electrical substations and important demand nodes (identified through interviews and participatory mapping) have been located on this map. However, we were unable to identify the links between these nodes (as described above) and, therefore, could not identify which buildings the substations provide electricity to.



Figure 3.3 An example of a flood zone, electricity substations and demand nodes in 'Village Hub'.

3.3 Modelling utility networks: the example of 'Port Town'

As explained below, once the key data are collected, we can estimate which utility nodes can supply the main demand nodes that are important for older people's care. Here we share an example of the modelling work undertaken in another locality referred to here as 'Port Town' where some data collection was possible. Based on the findings from the interviews and focus groups with older people and service providers, we focused the modelling work on the electricity network in particular. This approach could be relevant in Horsham District where power cuts have been linked to extreme weather events in the past, with electricity considered essential for the delivery of care.

Electricity

The Electricity Utility Company serving 'Port Town' supplied the as-built drawings for the electricity network in 'Port Town'. Based on the connections shown on these drawings, we can be reasonably sure of how the electricity network is connected in 'Port Town'. We have identified most substations in 'Port Town' from Ordnance Survey maps. We can then assess the risk of flood related electricity failure, based on the location of each substation in relation to flood-risk areas.

In 'Port Town' we have had to estimate the groups of 'demand nodes' (houses, hospitals, other facilities) supplied by each substation. Although this is not ideal and would need to be confirmed prior to modelling to ensure the engineering judgements are correct, we suggest this network and location of demand nodes are useful starting points for understanding the vulnerability of the electricity system, and the services depending on it, to floods.

Our models are provisional and for illustrative purposes only. We caution against using them as representing the real situation, for planning purposes, because we have not been able to confirm all of the data.

Water Supply

In discussion with the local Water Supply Operations Team of the Water Utility Company, we suggest the **water supply network** is resilient in 'Port Town' for the following reasons. Firstly, both the main supply and secondary (backup) water treatment works are located outside 'Port Town' and are therefore not in the flood risk zone used in the research. Secondly, conversations with the Water Utility Company have informed us that no water supply pumping stations are located in 'Port Town' which

means the water supply network within the town does not rely on the electricity network. Finally, as the water supply areas are set up in a resilient way; if water fails in one area of 'Port Town', the supply can be moved from another area with no reliance on the local electricity supply.

Gas

We were unable to find evidence of interaction between the gas network and electricity network, as the gas network provider was not in a position to supply the information needed. As we have not been provided with the gas network, we are unsure how the gas network functions or where the nodes and links relating to gas supply are located. We assume that the gas network is resilient to flooding, based on two factors: there is no evidence that local electricity input affects the gas supply and there were no reports from discussions with our key informants to suggest that gas had failed in past flood or coldwave events.

In order that engineering models can be effectively applied, they must be used in the context of appropriate local knowledge detailing the actual infrastructure in a given locality. Only then can we use the model to estimate realistically the risk of damage of essential infrastructure assets (e.g., electricity substation, water treatment plant, water pumping station) for a particular hazard scenario (e.g., flood) to gauge the effects of this damage on commodities supplied to important nodes in terms of the delivery of care. We have summarised the kind of data that are required in order to achieve this and have also highlighted data availability in Horsham District. Despite many attempts to gather the data required for the network model, we are still missing a number of key values that the model requires in order to run. The missing data are summarised in Table 3.2. Although we could estimate these values, the outputs are likely to be unrealistic and imprecise.

Table 3.2 Summary of essential data required for case study localities in Horsham district

Infrastructure Type	Variable/parameter in model	Possible data source	Were data supplied to the research team?		
Electricity	Supply point	Power Utility Company (PUC)	No		
	Links between nodes				
	Areas served by nodes				
	Max flow				
	Max capacity				
	Max storage (generator fuel)				
	Max production (generators)				
	Demand required				
	Usual stored volume (fuel for generators)				
	Production coefficient			PUC and information derived from discussions with utility experts	No
	Cost of flow (links)				
	Cost of storage				
	Cost of production				
	Penalty for unsatisfied demand	Data derived from discussions with older people and frontline service providers	Yes – some data supplied		
Water	Supply point	Water Utility Company (WUC)	No		
	Links between nodes				
	Areas served by nodes				
	Max flow (in water pipes)				
	Max capacity (at water treatment works, pumping stations, etc)				
	Usual stored volume				
	Max production				
	Demand required				
	Production coefficient			WUC and information derived from discussions with utility experts	No
	Cost of flow (links)				
	Cost of storage				
	Cost of production				
	Penalty for unsatisfied demand	Data derived from discussions with older people and frontline service providers	Yes – some data supplied		

Infrastructure Type	Variable/parameter in model	Possible data source	Were data supplied to the research team?
Wastewater	Supply point	WUC	No
	Links between nodes		
	Areas served by transmission nodes		
	Max flow		
	Max capacity		
	Max storage		
	Max production		
	Demand required	WUC	Can be estimated – will need to be confirmed
	Usual stored volume	WUC	No
	Production coefficient	WUC and information derived from discussions with utility experts	No
	Cost of flow (links)		
	Cost of storage		
	Cost of production		
Penalty for unsatisfied demand	Data derived from discussions with older people and frontline service providers	Yes – some data supplied	
Gas	Supply point	Unknown	No
	Links between nodes		
	Areas served by transmission nodes		
	Max flow		
	Max capacity		
	Max storage		
	Max production		
	Demand required		
	Usual stored volume		
	Production coefficient		
	Cost of flow (links)		
	Cost of storage		
	Cost of production		
Penalty for unsatisfied demand	Data derived from discussions with older people and frontline service providers	Yes – some data supplied	
Demand points	Information about the demand points including health and social care facilities e.g. hospitals, and care homes; emergency services e.g. fire stations; village halls and leisure centres; and retail services	Data gathered by the BIOPICCC team through discussions with older people and frontline service providers	Yes

3.4 Concluding comments on the scope for future developments in Horsham District

This section shows how we have developed engineering models to examine parts of the utility system which are crucial for the built infrastructure supporting older people's care. We show the kinds of information needed to develop these models. Unfortunately, for the case study areas in Horsham District, the model could not be realistically constructed because the majority of key information was not available to the Universities. However, preliminary results from another locality ('Port Town') demonstrate the potential of these models. We expect that in future this kind of modelling might be adopted by utility companies or local authorities to examine the performance of utilities during extreme weather events. There is scope to apply this kind of modelling to evaluate alternative adaptation solutions that will make the system more resilient in the face of extreme weather.

More generally in this report we have argued that future risks related to extreme weather events, such as flooding, are projected to increase due to climate change and that demand for health and social care in the older population will grow. It will be important to coordinate adaptation and resilience planning through the engagement a range of partners and to adopt a 'whole-systems' approach in the adaptation of the built infrastructure. This report provides some information and examples that can inform adaptation planning at different scales and illustrates some of the methods that HDC and WSCC may plan to apply in future in light of climate change scenarios.

References

- Defra. (2012). UK Climate Change Risk Assessment: Government Report. London: HM Government.
- Department of Health. (2008). Resource Allocation: Weighted Capitation Formula - Sixth Edition. Available online: http://www.dh.gov.uk/en/Publicationsandstatistics/Publications/PublicationsPolicyAndGuidance/DH_091849
- DCLG. (2008). The English Indices of Deprivation 2007. Department of Communities and Local Government. Available online: <http://webarchive.nationalarchives.gov.uk/+communities.gov.uk/communities/neighbourhoodrenewal/deprivation/deprivation07/>
- Department of Health. (2011). Cold Weather Plan for England: Protecting Health and Reducing Harm from Severe Cold Weather. London: Department of Health.
- Environment Agency. (2004). Foresight Flood and Coastal Defence Project. Bristol: Environment Agency.
- Hames, D., & Vardoulakis, S. (2012). Climate Change Risk Assessment for the Health Sector. London: Department for Environment, Food and Rural Affairs (Defra).
- NHS. (2012). Heatwave Plan for England 2012. Protecting Health and Reducing Harm from Severe Heat and Heatwaves. NHS. Available online: http://www.dh.gov.uk/prod_consum_dh/groups/dh_digitalassets/@dh/@en/documents/digitalasset/dh_134741.pdf
- NHS SDU. (2012). Adaptation to Climate Change for Health and Social Care Organisations. "Coordinated, Resilient, Prepared". NHS Sustainable Development Unit (NHS SDU). Available online: http://www.sdu.nhs.uk/documents/publications/Adaptation_Guidance_Final.pdf
- ONS. (2007). Sub-National Population Projections by the Office for National Statistics. 2006-based.
- ONS. (2010). Experimental Population Estimates by Ethnic Group for local authority districts and higher administrative areas in England and Wales for 2007. Published: 5 February 2010.
- Oven, K.J., Curtis, S.E., Reaney, S. *et al.* (2012) Climate Change and Health and Social Care: Defining Future Hazard, Vulnerability and Risk for Infrastructure Systems Supporting Older People's Health and Social Care in England. *Applied Geography*, 33: 16-24.
- Pain, R., Whitman, G., Milledge, D. *et al.* (2012). Participatory Action Research Toolkit: An Introduction to Using PAR as an Approach to Learning, Research and Action. Durham University/RELU/Lune Rivers Trust. Available online: <http://www.dur.ac.uk/resources/beacon/PARtoolkit.pdf>
- Scott Wilson (2012). Horsham District Council. Strategic Flood Risk Assessment. Final Report – revised 2010. Available online: http://www.horshamdistrictldf.info/Files/HorshamSFRA_RevApril10.pdf

Appendix 1 – Strategic level organogram

Local Government	NHS Trusts
<ul style="list-style-type: none"> • Adult Social Care (leads in the following areas: social work, residential care, day care, domiciliary care, telecare, personalisation, learning and physical disabilities, and mental health) • Emergency and resilience planning • Spatial planning/development control • Infrastructure planning • Climate change adaptation • Neighbourhood management • Community services (e.g. CVS liaison and leisure facilities) 	<p>Acute Trust</p> <ul style="list-style-type: none"> • General acute inpatient services • Geriatric inpatient care • Inpatient dementia and mental health Care • Accident and emergency • NHS estates <p>Community Trust (where applicable)</p> <p>Mental Health Trust</p>
<p style="text-align: center;">Coordinating Bodies</p> <ul style="list-style-type: none"> • Local Strategic Partnership • Local Resilience Forum • Sustainability Forums <p style="text-align: center;">Clinical Commissioning Groups and Health and Wellbeing Boards</p> <ul style="list-style-type: none"> • Public health intelligence • Joint planning and commissioning • Community care representative • GP representative 	
Utilities	Emergency Services
<ul style="list-style-type: none"> • Water company • Electricity company • Gas company • Telecommunications 	<ul style="list-style-type: none"> • Fire and Rescue Service • Police Force • Ambulance Service
Independent Care Sector	Other
<p>Community and Voluntary Sector</p> <ul style="list-style-type: none"> • Age UK • WRVS • CVS • Older people’s forum • Carers’ advisory groups • Alzheimer’s Society • ‘Other’ local user-led groups • Older people’s charter groups • British Red Cross <p>Private Care Providers</p> <ul style="list-style-type: none"> • Private care companies • Care homes • Care in the community schemes 	<p>Inspection and Regulation</p> <ul style="list-style-type: none"> • Environment Agency • Care Quality Commission <p>Transport</p> <ul style="list-style-type: none"> • Rail service providers • Network Rail • Local bus companies • Dial-a-ride schemes <p>Advocacy and Brokerage Groups</p> <ul style="list-style-type: none"> • Health-Watch <p>Social Housing Corporation/Major Housing Associations</p>