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Environmentally sustainable health and social care: Scoping review

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Glossary of terms/abbreviations

Adaptation - measures taken to adapt to climate change (or other environmental change), in order to maintain resilience or functionality

'Bottom up' carbon footprinting - calculating the carbon dioxide emissions generated by an organisation, product or activity using detailed local data on the individual processes undertaken and the emissions associated with these

CO_2 - carbon dioxide, the principal contributor to the greenhouse effect

CO_2e - carbon dioxide equivalent - a measure of production of the full range of greenhouse gases, expressed in terms of the equivalent amount of carbon dioxide

Environmental change - changes to the natural environment at a number of levels (local, regional, international etc). Within this definition we include climate change, depletion of natural resources such as water or fossil fuels, and higher utility prices resulting from this

Environmental impact - in this report this refers to the effect of the activities of the health and social care sector on the natural environment, through emissions of carbon dioxide, use of finite natural resources, creation of waste and other processes

Emissions factor - a standard multiplier used in carbon footprinting methodologies giving the volume of CO_2e emissions per unit of a specified activity

Health and social care - any services provided by the statutory or independent sector in support of a person's health or social care needs. Much of the research reported concerns the NHS and statutory social care provision, but the findings of the review should be understood as applying to the private and voluntary sector as well. Informal care provided by

individuals and families is not discussed explicitly, but can be considered as part of the same 'system'.

Integrated care - any approach which aims to provide better co-ordination of different elements of care, reducing the fragmentation or duplication of the services provided. This can take place at a number of levels, including closer co-ordination between health and social care, primary and secondary care, or mental and physical health care.

Mitigation - measures taken to reduce carbon dioxide emissions or other environmental impacts

Narrow-plan - building designs which have a high external surface area per unit volume, with few rooms lacking external walls

Sustainable - making use of financial, natural and social resources in a way such that current needs are met without jeopardising the ability of future generations to meet their needs. In some cases in the report, the term 'sustainable' is used as shorthand for 'environmentally sustainable', i.e. sustainable specifically with respect to use of natural resources and generation of environmental impacts.

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We would like to thank David Pencheon and Sonia Roschnik of the NHS Sustainable Development Unit, and Catherine Max of Catherine Max Consulting for their invaluable advice and support throughout the project.

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Executive Summary

Background

A sustainable approach to health and social care is one which is capable of meeting the needs both of today's population and of future generations. While the importance of financial sustainability is widely acknowledged, the idea that services must also be sustainable in terms of their use of natural resources, or in their ability to adapt to environmental change, is a more recent one. Nonetheless, it is an idea which has received increasing attention over the last decade.

A number of factors have contributed towards raising the profile of environmental sustainability within health and social care. The scale of the sector's activities means that it has a significant environmental impact, and is coming under increasing pressure to reduce this. At the same time, the environmental changes that can be anticipated over the coming decades can be expected to have multiple consequences for service provision and population needs.

There may also be positive reasons for the health and social care sector to engage with the issue of environmental sustainability, including potential co-benefits in terms of reduced costs, improved public health and quality of care, and reductions in health inequalities. As discussed below, there are close conceptual connections between environmental sustainability and other system objectives, in particular productivity, prevention and integration.

A growing number of managers and professionals are introducing changes to the way health and social care services are provided, with the objective of improving the sustainability of their activities. There is a need for rigorous evaluation of such innovation and for wider research to guide further developments.

Aims

This scoping review outlines a co-ordinated approach towards future research activities in this area, with a view to creating an evidence base

which supports the health and social care sector in adopting more environmentally sustainable approaches. It describes the existing research in this area and places environmental sustainability within the context of the financial challenges facing the health and social care system. Specific objectives were:

- To map the existing evidence base on environmental sustainability in health and social care
- To identify what research will be needed to support a more environmentally sustainable approach towards health and social care, and to develop a framework to coordinate future research
- To explore and highlight the connections between environmental sustainability and the productivity agenda

Methods

The scoping review had three components:

1. A review of published research and policy documents on environmental sustainability in health and social care. This included a review of articles from the business and management literature exploring how other sectors are aligning sustainability and productivity

2. Semi-structured interviews with 28 representatives of key stakeholder groups

3. An online Delphi exercise with over 60 contributors, in which participants were asked to prioritise research needs identified during the literature review and stakeholder interviews

The results from the three methodological strands are presented in an integrated way.

Results

<u>How is the health and social care sector performing on environmental sustainability?</u>

Health and social care have a significant environmental impact. Carbon dioxide emissions attributable to the NHS in England are greater than the annual emissions from all passenger flights departing from Heathrow airport. Less is known about environmental costs associated with social care, non-NHS health services, or particular service types, population groups or organisations.

Evidence suggests that environmental change may have a number of effects on health and social care needs in the UK, as well as direct effects on service delivery. However, limited attention appears to have been given by researchers or managers to the question of how services may need to adapt in order to improve resilience to these changes.

There appears to be a reasonably high strategic commitment to sustainability within many health and social care organisations, but there is wide variation, and less consistent evidence of strategy being translated into tangible action. Nonetheless, there are numerous cases of local projects within both health and social care where structural, operational or clinical changes have been made that have reduced environmental impacts. In many cases there is evidence that financial and other benefits have been achieved as well, although robust evaluation of these effects is often lacking.

The connection with other system objectives

There is a clear conceptual connection between environmental sustainability and the productivity challenge - both agendas call for a re-focusing on efficiency, value and prevention of avoidable activity. Modelling suggests there are a number of approaches which could generate considerable cost savings as well as reducing environmental impacts, and a growing number of case studies indicate that some of these predicted benefits can be realised in practice. There is some evidence from other businesses for a link between sustainability and profitability, although this is contested.

There is an emerging evidence base exploring potential health co-benefits related to environmentally sustainable approaches such as promoting active travel and reducing meat consumption. There are also potential co-benefits in terms of quality of care. For example, developing more integrated forms of care, making better use of new technologies such as telecare, delivering care in settings closer to service users' homes, or removing duplication or redundancy from care pathways all have the potential to reduce environmental impacts while at the same time improving patient experience and outcomes.

What would a more sustainable approach to health and social care look like?

Our review identified changes that may be needed at three levels:

- **Innovation** – changes to models of care, and to health and social care technologies
- **Behaviours, attitudes and cultures** – changes to organisational cultures, professional behaviours and attitudes within services, and public behaviours and attitudes in society at large
- **System governance and policies** – changes to the way the health and social care system is governed, and the policy levers used for this

Actions at each of these three levels are closely interdependent, and our overall conclusion is that substantial changes will be needed at all three levels if an environmentally sustainable approach to health and social care is to be successfully developed

Some progress can be made by improving the efficiency of existing processes, technologies and facilities and minimising unnecessary resource use at the day-to-day operational level. Though necessary, this alone is unlikely to be sufficient. The scale of the environmental challenge demands a more fundamental transformation in the way health and social care is provided.

To a large extent, the transformation needed is the same as that called for on financial and quality grounds. Services need to be redesigned to shift care upstream and place greater emphasis on primary care, prevention and self-management. A more integrated system providing well-coordinated support for people's multiple needs could be more sustainable from both an environmental and financial perspective if this reduces inefficient use of resources. In this sense, environmental sustainability provides a new lens through which to view existing problems in the health and social care system, and a new way of assessing existing policy solutions.

At the same time, some changes will be needed which are specifically related to environmental sustainability - such as work to improve the resilience of facilities and care systems to environmental change. A dual approach is therefore needed.

What are the research needs?

Research will be needed to support the development and implementation of more sustainable approaches. The report discusses a broad range of research needs at each of the three levels described above. Particular priorities will include:

- Developing a more detailed understanding of the scale of the problem posed by environmental sustainability. This will include measuring the environmental costs associated with units of care, and assessing the impact of environmental change on future care needs and services.
- Development and evaluation of metrics and methods for assessing environmental costs in health and social care. There is an immediate need for this in order to support the above.
- Research on the co-benefits of sustainable approaches. Robust measurement of the financial returns on investments in sustainable approaches will be a key part in this.
- Research focused on implementation - examining the individual, organisational and systemic barriers to change, or aiming to identify how existing policy goals can be delivered in the most sustainable way.
- Research on preventative approaches and whether these can reduce demand for formal care. This emerged as a major priority throughout all stages of our review and will be key to developing a more environmentally sustainable system.
- Improving our understanding of how procurement and commissioning processes can be used to drive sustainable practices in supply chains and service providers.
- Research on medicines management and prescribing practices aiming to reduce inefficient or wasteful use of pharmaceuticals.

In addition to funding specific research projects, we argue that sustainability should increasingly be included in wider research as a dimension of quality akin to access or equity. In particular, evaluations of the cost-effectiveness of new technologies, interventions or care pathways should quantify environmental costs and include these within the analysis.

Conclusions

The sustainability agenda is increasing in importance in the health and social care sector, and the research community needs to be able to respond to this. Building the evidence base will require a dual approach which includes commissioning research explicitly focused on environmental sustainability, while also exploiting opportunities for existing research programmes to create relevant knowledge. Research funders of all kinds need a clear understanding of what sustainable development is and how it impacts on their research programmes.

The Report

1 Introduction

1.1 What is sustainable health and social care?

Health and social care services must be planned, financed and delivered in ways that allow them to meet the needs both of today's population and of future generations. This is the core insight of the concept of sustainability, as applied to health and social care. The idea is not new - we are well accustomed to the notion that services must be financially sustainable. Consider, for example, the long-running debates on what would constitute a sustainable funding model for social care in the UK and elsewhere.

What we are less familiar with in the health and social care sector is the notion that sustainability extends beyond having a sound *financial* basis for the future. The most widely used framework from the field of sustainable development recognises three interdependent elements - economic development, social development and environmental protection - sometimes referred to as the triple bottom line. The implication of applying this framework to health and social care is that we should seek to have a system which is not only financially sustainable, but which also minimises adverse impacts on society and on the natural environment which could jeopardise the ability of future generations to meet their health and social care needs.

> *"Sustainability means more than merely lasting or surviving: it means designing and delivering health care that uses resources in ways that don't prejudice future health and wellbeing"*
>
> David Pencheon, Director, NHS Sustainable Development Unit (1)

The Department of Health has committed itself to sustainable practices in the delivery of services (2), and established the NHS Sustainable Development Unit (SDU) to drive this agenda forward within the NHS. There

have been similar developments within social care, such as the Sustainable Social Care programme delivered by the Social Care Institute for Excellence.

This scoping review is primarily concerned with *environmental* sustainability in health and social care. There are a number of reasons why this is an increasingly important issue. The scale of the health and social care sector means that it has a significant environmental impact (see sections 3.1 and 3.2). The NHS in particular is under increasing pressure to reduce its environmental impact as efforts to mitigate climate change gather pace. Under the terms of the 2008 Climate Change Act, the UK as a whole is committed to reducing carbon dioxide emissions by 34% by 2020, and reducing emissions of all greenhouse gases by 80% by 2050. As a significant contributor to emissions, the health and social care sector will be expected to play its part in meeting these targets, and a number of policy levers, such as the CRC Energy Efficiency Scheme, create a financial incentive to do so.

In addition to reducing the impact of care on the environment (commonly referred to as 'mitigation'), the health and social care sector will need to ensure it remains able to function in a changing environment ('adaptation'). The environmental changes that can be anticipated over the coming decades include changes to the climate, but also increasing scarcity of natural resources including fossil fuels and water (3;4). These changes will have direct consequences for service provision, and are also predicted to have effects on the population's health and social care needs (5) (see section 3.3). Sustainability means being prepared for these changing needs. This two-way relationship between environmental change and the health and social care sector is illustrated in figure 1.

There are also positive reasons driving the health and social care sector to engage with the issue of environmental sustainability. As described later in this review (section 4), there is an emerging literature on the potential synergies and co-benefits that exist at a number of levels:

- **Financial** co-benefits - where developing environmentally sustainable approaches to the delivery of health and social care also reduces direct costs, for example, by promoting efficiency of resource use
- **Health** co-benefits - where approaches which reduce adverse impacts on the environment also improve public health, for example, through promotion of walking or cycling instead of driving

- **Quality** co-benefits - where changes to health or social care services simultaneously improve quality and reduce environmental impact, for example, by reducing duplication and redundancy in care pathways

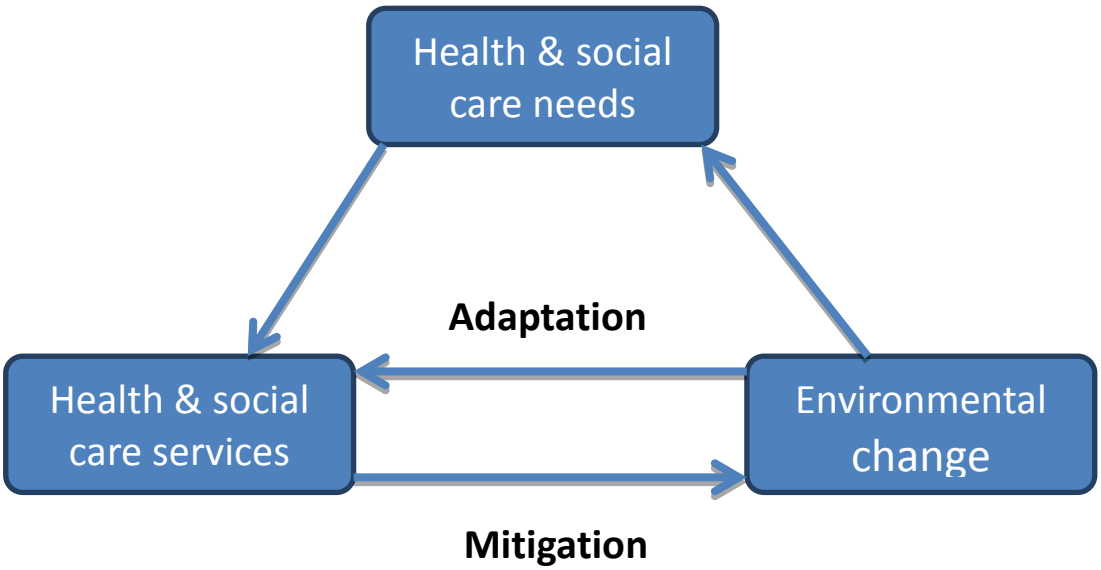

Figure 1. The two-way relationship between environmental change and health and social care

It is important to be clear about the scope of what constitutes environmentally sustainable care. In part it concerns actions that are explicitly about promoting sustainability - such as adopting new technologies in hospitals and other facilities which reduce the environmental impact of health and social care buildings. But more fundamentally, environmentally sustainable health and social care also means delivering care in a way which is as effective and efficient as possible. Ultimately, the most sustainable system is one which minimises unnecessary use of resources (financial or natural) by delivering the right care, in the right place, at the right time, and where possible by preventing care needs from arising at all.

There is therefore a close connection between environmental sustainability and efforts to improve productivity, for example, through the Quality, Innovation, Productivity and Prevention (QIPP) programme - both agendas call for a re-focusing on efficiency, value and prevention of avoidable activity. This review purposefully set out to explore this relationship and the research needs it implies. While prevention and, for example, more integrated ways of delivering health and social care may be able to lead to

more environmentally sustainable services, there is much still to be learnt in terms of the trade-offs involved and the cost-effectiveness of alternative approaches.

1.2 The scoping review

This report is based on a literature review and stakeholder consultation process (see section 2 for details on methodology). The findings from these two methodological components are presented in an integrated fashion. The purpose of the report is two-fold.

Firstly, it provides an overview of what is currently known about environmental sustainability in health and social care (sections 3 and 4), including an exploration of the connection with productivity and other potential co-benefits. It then discusses what changes may be needed to improve the sustainability of care (section 5).

Secondly, it identifies what research will be needed to support these changes and provides a framework to co-ordinate future research in this area (section 6). The report concludes with recommendations for research funders (section 7).

The review was jointly commissioned by the Service Delivery and Organisation programme of the National Institute for Health Research, and the Social Care Institute for Excellence, through its Sustainable Social Care programme.

Research objectives

- To map the existing evidence base on environmental sustainability in the health and social care sectors
- To identify what research will be needed to support a more environmentally sustainable approach towards health and social care, and to develop a framework to coordinate future research
- To explore and highlight the connections between sustainability and productivity

2 Methods

The scoping review had three components:

- A review of published research and policy documents on environmental sustainability in health and social care
- Semi-structured interviews with 28 representatives of key stakeholder groups
- An online Delphi exercise with over 60 contributors

These components are detailed below.

2.1 Literature and policy review

The search strategy targeted the following types of literature:

- Academic literature on environmental sustainability in health and social care
- Articles from the business and management literature exploring how other non-health/social care sectors are aligning sustainability and productivity/profitability
- Grey literature and policy documents taken from the websites of key organisations

Academic literature was identified by searching bibliographic databases (PubMed, Emerald Insight, NHS Evidence, Social Care Online, Cochrane library, King's Fund library database, SHEBA database). Multiple searches were conducted, using a range of search terms, including:

- Terms relating to environmental sustainability (e.g. sustainability, climate change, waste management, extreme weather)
- Terms relating to health and social care (including terms focusing on specific population groups e.g. older people)
- Terms relating to productivity/efficiency (e.g. efficiency, value for money, financial performance)

Articles identified through database searching were supplemented with others identified through web searching, using reference lists, and by seeking recommendations from experts in the field.

Inclusion criteria:

- To be relevant for inclusion in the review, articles had to focus either on environmental sustainability in the health or social care sector, or on the connection between sustainability and productivity/efficiency in other business sectors
- Published between 2001 and 2011
- Studies of all methodological types were included. Due to the nature and objectives of the study and the limited evidence-base existing on the subject area, we did not consider it appropriate to use a formal quality assessment tool in including/excluding studies from the review

In total, 217 articles and reports were identified as being relevant. The majority of these were short journalistic articles discussing the issue of sustainability in health and social care, or descriptive case studies highlighting good practice. Articles of this nature were not included formally in the review process, although some were read for background information. 78 of the articles identified were based either on original empirical research or a substantial review of existing studies. These 78 articles were reviewed in full and summarised using a standardised template, which recorded the scope and focus of each article (as given in appendix 1) plus a summary of the key messages of relevance to the review, and any research needs identified.

A meta-summary of these documents was then created and used as the basis of the material presented in this report. This analysis was structured using an adapted version of a framework developed by the NHS Sustainable Development Unit (6). The framework distinguished between changes needed at three levels (innovation; behaviours, attitudes and cultures; and system governance and policies), as well as between actions which are directly intended to improve environmental sustainability versus those which may have that effect without that necessarily being the primary rationale for action. Research needs were analysed using the same framework, with an additional category included to capture research on underlying drivers prompting changes at the three levels described. Further detail on the frameworks used is provided at the beginning of section 5 (see table 1) and section 6 (table 2).

2.2 Stakeholder interviews

Semi-structured interviews were conducted with 28 representatives of key stakeholder groups, including organisations active in the field of sustainable health and social care at the level of policy, research and practice. The sample was deliberately heterogenous and included a number of very senior individuals. Table 1 provides a summary of the main groups from which interview participants were drawn (note that the total does not equal 28 since a small number of participants fell into more than one category):

Table 1. Summary of expert interview participants

Participant type	Number
NHS and local authority managers	4
Frontline care staff	3
Public health professionals	3
Sustainability consultants	2
Academics	5
Experts in care facilities	2
National representative and policy organisations	8
Private and voluntary sector care providers	3
Health service management consultants / independent experts	2

The interview schedule explored stakeholders' perceptions of (i) how the delivery of health and social care services will need to change in the transition to a sustainable society and (ii) what research is needed to underpin this (see appendix 2). The interviews were also used to test key themes and potential research priorities emerging from the literature and policy review.

The interviews were analysed qualitatively using a thematic template, which followed the same structure as the interview schedule (appendix 2). The points made under each thematic area were summarised in a separate document for each interview, with supporting evidence included in the form of direct quotations. These summaries were then compared and contrasted, and used to construct a meta-summary document which described the

over-arching messages emerging, highlighting areas of consensus and divergence. This analysis was structured using the same framework used in the analysis of the published literature (see section 2.1).

2.3 Delphi exercise

The research needs identified through the literature review and stakeholder interviews were prioritised by means of an online Delphi exercise. Participants in this process included interviewees from the previous stage plus additional experts identified during the research. The exercise was also advertised openly in email bulletins distributed by the NHS Sustainable Development Unit, Social Care Institute for Excellence, and Sustainable Development Research Network. Table 2 provides an overview of the participants contributing to each stage of the Delphi exercise. A total of 63 people participated in stage one, and 67 in stage two (note that the numbers in the table do not add up to these values since a small number of participants fell into more than one category)

Table 2. Summary of Delphi exercise participants

Participant type	Stage 1	Stage 2
NHS and local authority managers	13	25
Frontline care staff	6	6
Public health professionals	3	3
Sustainability consultants / experts	7	6
Academics	21	18
Experts in care facilities	7	7
National representative and policy organisations	5	10
Other	3	2
Unknown	4	0

The Delphi method is a systematic means of consulting expert opinion which allows a consensus position to be built iteratively without being imposed by more powerful or influential groups (7). Participants took part in two stages.

In the first, they were presented with 26 suggested research areas in 4 categories, based on the framework referred to above:

- Research on innovative approaches to health and social care
- Research on behaviours, attitudes and cultures
- Systems-level and policy research
- Research on future needs and pressures

Within each of these categories, participants were invited to indicate which research areas should be given highest priority by research funders, as well as providing open-ended comments on the research areas and adding any additional evidence gaps. Participants selected a first, second and third choice in each category. Total scores were calculated for each area by awarding three points for a first priority, two points for second and one point for third. Scores from stage one are presented in appendix 3.

For the second stage, a small number of the research areas were merged or modified in response to comments given by participants in the first stage. This left 21 research areas which were presented in order of the total scores they received in the first stage. Participants were asked to repeat the prioritisation task. They were given information on the scores from the previous stage, including in a graphical format, and instructed that they may wish to take these scores into account when selecting their priorities.

Two stages were sufficient to identify a clear consensus in terms of which areas were being selected as priorities. The rank order of research areas after stage two did not differ from that after stage one, and the priority given to the highest scoring areas became more pronounced. Scores from stage two are presented in section 6.

3 How is the health and social care sector performing on environmental sustainability?

Key messages

- There is an increasingly clear picture of the environmental impact of the NHS as a whole, but less is known about individual service types, patient groups, or organisations.
- There is less evidence on the environmental impact of social care, or non-NHS health services.
- There is a reasonably high strategic commitment to sustainability within many health and social care organisations at the national and local level, but there is wide variation, and less consistent evidence of strategy being translated into tangible action. In some respects, less progress has been made in social care than in health.
- Most organisations are focusing on 'quick wins' rather than longer-term strategic change. Sustainability has rarely been embedded in standard managerial or clinical processes.
- There is a need for greater coordination and sharing of good practice across the sector. Many small-scale local projects appear to have demonstrated benefits but these are often not formally evaluated and are not yet being implemented at scale.

The sustainable development agenda has attracted increasing attention in the health and social care sector over the last decade, and much more is understood about the environmental impacts associated with delivering care than was known even five years ago. The NHS Sustainable Development Unit, established in 2008, has commissioned a number of studies measuring these impacts, and has published reports and guidance designed to support improvement. Much of this has focused on carbon dioxide emissions and climate change.

Below we review evidence on the environmental impact of the health and social care sectors, and the converse - the impact of environmental change on health and social care services through, for example, changes in population needs, and finally we consider the activities and strategies adopted by the health and social care sectors to date in promoting environmentally sustainable services.

3.1 The environmental impact of health care

It is perhaps of little surprise that an industry consuming close to one pound in ten of national GDP, with the largest property portfolio in Europe and directly employing over 1.7 million people across the UK should also have a significant impact on the environment. For example, the overall carbon footprint of the NHS in England in 2010 was around 19.7 million tonnes of CO_2e (see glossary) (8). This accounts for 25% of all public sector carbon emissions, or around 4% of total emissions in England, and is greater than the annual emissions from all passenger flights departing from Heathrow airport (9). Similar results have been found for NHS Scotland, which was estimated to have had an overall carbon footprint of around 2.6 million tonnes of CO_2e in 2004 (10).

The carbon footprint has grown over the last decade as the NHS has expanded its activities and workload - although it is important to note that the carbon *intensity* of healthcare (that is, emissions per unit expenditure) has fallen. Two thirds of these emissions are related to goods and services the NHS procures - notably pharmaceuticals and medical equipment - with the remainder attributable to direct energy use in NHS buildings (19%) and patient/staff travel (16%) (see figure 2). Emissions related to procurement can be further broken down into contributing sources (figure 3).

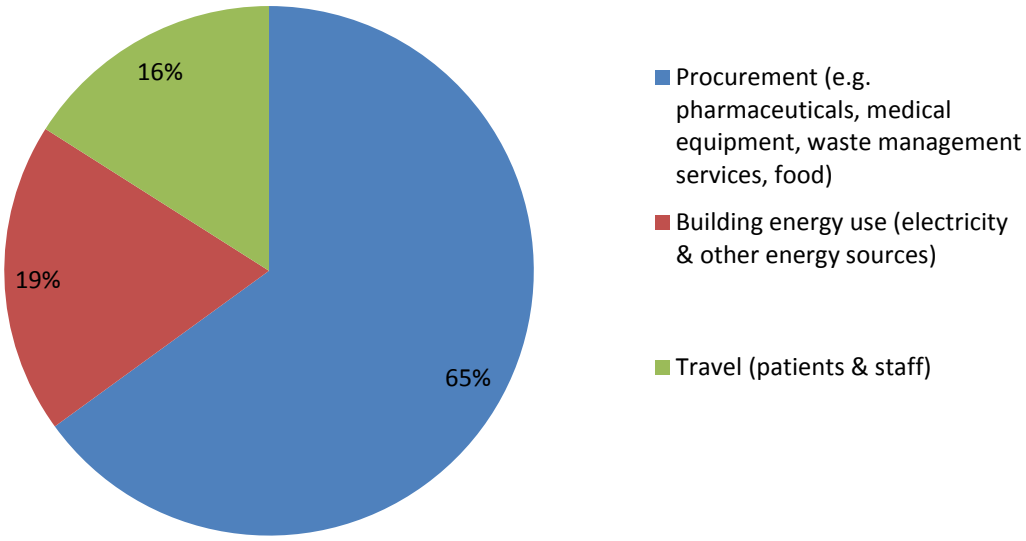

Figure 2. NHS England carbon dioxide emissions profile (source: NHS Carbon Reduction Strategy 2012 update (8))

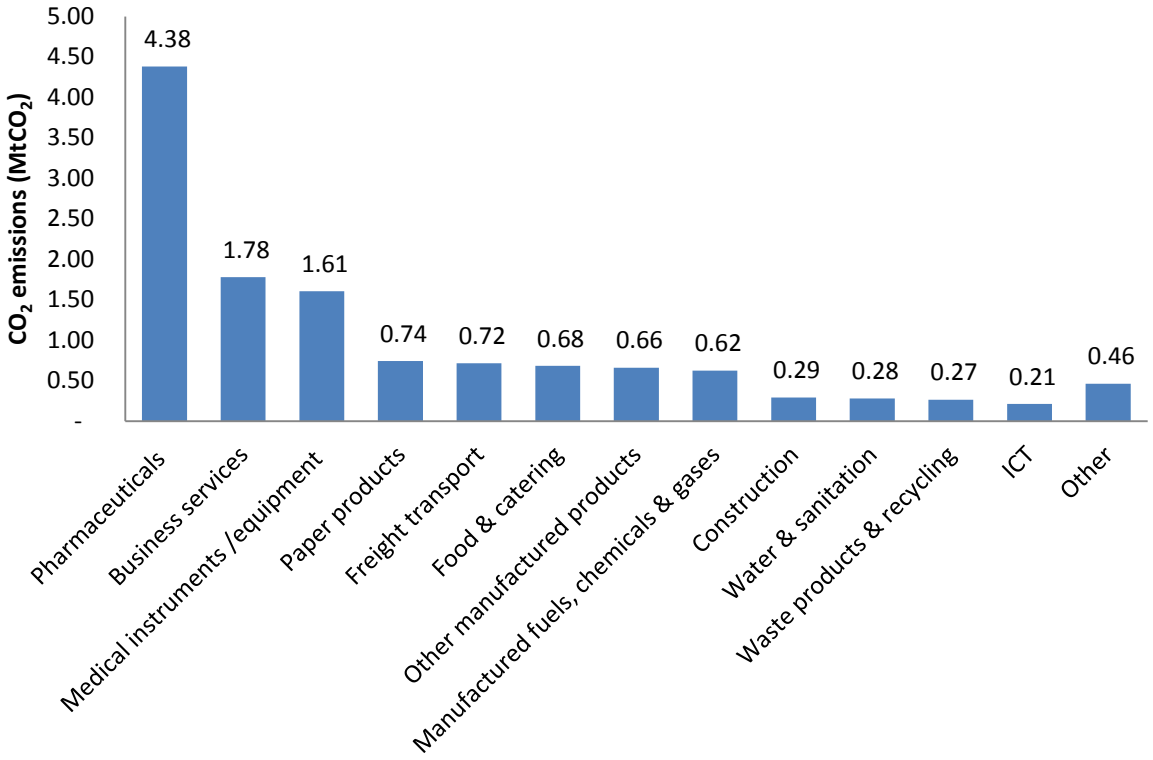

Figure 3. NHS England procurement-related carbon dioxide emissions (source: NHS Carbon Reduction Strategy 2012 Update (8))

A number of studies published over the last few years further demonstrate the scale of the environmental impacts related to health care in the UK:

- NHS England spends over £400m on electricity each year (11), with the majority of this being accounted for by space heating. IT systems also use considerable amounts of electricity in some facilities - this accounted for 20% of all electricity use in one Irish hospital (12) and was identified as a major contributor to the carbon footprint of Barts and the London NHS Trust (13).
- 5% of transport emissions in the UK are estimated to be accounted for by healthcare-related journeys (14)
- There are considerable 'food miles' associated with meals served in some health care facilities - ingredients in a steak and kidney pie served in one hospital had travelled a total of 31,000km (15)
- The NHS in England consumes 39 billion litres of water and produces 26 billion litres of sewage each year - enough to fill Wembley Stadium in London every 16 days (16)
- The NHS spent £73 million on waste management services in 2005/6 (17), with 1% of all domestic waste in England and Wales originating from NHS (16). The NHS produces

5.5kg of waste per patient in the UK. This figure is substantially higher than that for France (1.9kg) or Germany (0.4kg) (17)

- Global use of inhalation anaesthetics is responsible for CO2e emissions roughly equivalent to one coal-fired power station or one million passenger cars (18).
- Non-metabolised pharmaceutical products have been found in measurable concentrations in soil samples and drinking water (19).

Beneath these high-level figures, limited evidence has been published on the environmental impacts associated with specific organisations, service types or patient groups. Two studies were found in which NHS Trusts had calculated their carbon footprint using 'bottom-up' methods (see glossary). Barts and the London NHS Trust calculated that it emits 21.5 tonnes of CO_2 per staff member each year. Its emissions profile differed from the national average, with the travel-related emissions being lower but building-related emissions higher (13). The emissions profile for Cambridge University Hospitals NHS Foundation Trust was different again, with proportionately higher travel (23%) and buildings-related (30%) emissions, and proportionately lower emissions from procurement (47%) (20). These results highlight the need for more granular evidence to inform local decision-making.

Some attempts have been made to estimate typical impacts associated with standard units of care. For example, CO_2e emissions associated with an average inpatient admission have been placed at 380kg, with an extra 80kg for each additional bed day, and 50kg for an outpatient appointment(21).

Clearly, these figures do not reveal what are likely to be large variations between different types of care - for example, emissions attributable to renal beds have been estimated to be double the average for all bed types, at 161kg of CO_2e per bed day (22). Standard treatment for a renal patient has been estimated to generate 7.1 tonnes of CO_2e emissions per patient per year - equivalent to 79% of the average UK citizen's annual carbon footprint, or 7 return flights between London and New York. Healthcare-related environmental impacts are not distributed evenly across the population, and certain forms of high-intensity care have a particularly large impact (22;23). This points to potential equity and ethical issues which may have to be faced in the future as a result of efforts to mitigate climate change.

3.2 The environmental impact of social care

Little is known about the environmental impact of social care. Carbon Trust figures indicate that an average county council is responsible for approximately 30,000 tonnes of CO_2e emissions per year, but it is not clear what proportion of this is attributable to social care(24). In terms of expenditure, adult social care accounts for one third of councils' net budgets (25) - assuming that it also accounts for one third of their environmental impact, this would suggest that social care may contribute something in the region of 1.5 million tonnes of CO_2e towards the carbon footprint of England, in addition to the 21.5 million tonnes attributable to the NHS.

The characteristics of social care make an overall estimate of environmental impacts challenging to calculate. Services are provided by a wide range of organisations from the public, private and voluntary sector, and are delivered in diverse settings, including, increasingly, in service users' own homes.

The CO_2e emissions for social care are likely to differ from the profile for the NHS in terms of the main sources of emissions. The proportion of emissions attributable to procurement may be lower, given that NHS procurement-related CO_2 emissions are driven to a large extent by pharmaceuticals. However, other goods procured by social care organisations (such as food or assistive technologies) will have environmental impacts associated with their manufacture and transportation. Conversely, staff travel may account for a greater proportion of the environmental impact of social care, given the peripatetic nature of much social care work.

Despite the trend away from institutional care, it is likely that residential homes and other facilities still account for a significant proportion of the environmental impact of social care. For example, in Bristol, 60% of the total energy expenditure within the local authority's health and social care directorate was found to be attributable to residential homes (26).

It is important to note that in discussing the environmental impacts of care, the distinction between these sectors may not always be helpful. The actions of social care professionals have a major role in determining the environmental impacts of health care, and vice versa. For example, effective social care can reduce the need for highly intensive inpatient care in hospitals.

3.3 Predicted impact of environmental change on health and social care needs and services

The concept of environmental sustainability also encapsulates the notion of resilience to predicted environmental change. This depends critically on an understanding of how environmental change could affect health and social care needs in the population, or impact directly on the health system itself.

Several studies have assessed the impact of environmental change - climate change in particular - on the health and social care needs of the UK population. These include a review commissioned by the Department of Health (5) which recommended that measures be taken to improve preparedness for a range of possible effects, including:

- Exacerbations of chronic conditions caused by higher average temperatures, an increased frequency of heatwaves, and raised levels of air pollution during certain weather conditions. For example, mortality rates in Paris more than doubled during the 2003 European heat wave, largely as a result of excess deaths from respiratory and cardiovascular diseases (27).
- A potential increase in skin cancers related to raised exposure to UV radiation
- Psychosocial and other long-term effects of flooding - which may become more frequent in some parts of the country

A further possibility is increased needs – and increasingly complex needs – as a result of climate-related immigration, with the prospect of large areas of countries such as Bangladesh becoming flooded or otherwise uninhabitable by the middle of the century (28).

There is a high degree of uncertainty in specific predictions, in part because the ability of individuals and society to adapt to any changes is unknown. However, it can be said with some confidence that whatever effects are experienced, it is likely that the most marginalised groups in society are at greatest risk. There is some evidence that low social capital can have a detrimental effect on resilience to extreme weather events and other environmental exposures (29). Two reviews of the literature concluded that groups such as older people, children, and low-income families could be particularly vulnerable (29;30). This suggests there may be some risk of environmental change exacerbating health inequalities.

A report examining the relationship between demographic change and climate change suggested that older people may be more vulnerable to the risks associated with environmental change, as a result of barriers in accessing services (care services, transport, communication etc) and limited availability or access to money, knowledge and social networks (31). A mapping exercise found that older people in rural regions (particularly coastal regions) in the UK may be particularly vulnerable (32).

Alongside the possible effects on health and social care needs, environmental change may have direct operational-level consequences on the delivery of services. There have been several cases of extreme weather events disrupting the delivery of healthcare in recent years (33), and concerns that the risks of this happening may increase in some local areas as the climate changes. For example, the work of the London Climate Change Partnership has highlighted that nearly 10% of London's hospitals are at risk of river flooding (34). Reduced capacity in the health and social care system during extreme weather events could have serious consequences in terms of both the short-term response and longer-term recovery.

> *"In the short term, climate itself is unlikely to kill, but it is going to aggravate a number of clinical factors which drive people into the health service, which itself will be under pressure during extreme weather events"*
>
> Strategy Manager, local government

Increasing scarcity of critical resources - notably fossil fuels and water - would also have consequences for the delivery of health and social care. As a minimum, it can be expected that increasing energy prices will increase costs associated with delivering certain forms of care. Over time this could tip the balance in resource allocation decisions, with energy-intensive interventions becoming less cost-effective relative to approaches which are less reliant on consumption of natural resources. Some of our interviewees believed this may have a bigger effect on service delivery than the direct effects of climate change on health and care needs.

A risk assessment conducted by the London Climate Change Partnership suggested that the impact of environmental change on social care services may be particularly difficult to predict, as a result of the same characteristics mentioned previously that also make it difficult to measure the impact of social care on the environment (35).

3.4 How effective is the health and social care sector in promoting environmental sustainability?

The approach taken towards sustainability in the UK - and by the NHS in particular - has been unique internationally in terms of the breadth of its scope. While several countries have examined issues such as electricity consumption and waste generation in hospitals, few have developed comprehensive strategies which treat environmental sustainability as an organisational development challenge as much as a technical one. This approach is exemplified by the NHS Carbon Reduction Strategy for England (11) and similar carbon reduction plans in the devolved administrations.

There is evidence that at a strategic and corporate level, health and social care organisations are increasingly aware of the need to operate in a sustainable way:

- In a consultation conducted by the NHS Sustainable Development Unit, which required Board-approved responses, 95% of NHS organisations expressed strong support for the NHS taking a leadership role on environmental sustainability (36)
- 80% of NHS organisations signed up to the Sustainable Development Commission's Good Corporate Citizenship model (a sustainability self-assessment tool) (37)
- By May 2011, 74% of NHS trusts had a Board-approved sustainable development management plan (38)
- 87% of Local Area Agreements for 2008-2011 (now discontinued) included an indicator either on per capita reduction in CO_2 emissions across the local area, or reduction in emissions from Local Authority operations, and set targets for this. 37% included an indicator on climate change adaptation (39)
- Over 300 English councils signed the 'Nottingham Declaration on Climate Change' in 2000 indicating their political commitment to reduce emissions (40)
- A survey found that the NHS Carbon Reduction Strategy was widely known among NHS finance staff, and 97 per cent of those surveyed believed sustainability would become an increasingly high priority for finance teams over the coming years (41)
- Over 40 NHS trusts and foundation trusts and over 30 primary care trusts signed up to the 10:10 campaign pledge to cut carbon by 10 per cent in a year. They were joined by several of the royal colleges and professional bodies and a number of GP surgeries (42).

However, a consistent message from our expert interviews and from published research was that the profile of environmental sustainability varies markedly between organisations. For example, survey results indicate that there is wide variation in terms of what is reported at Board level, and how frequently (41;43).

A retrospective analysis of primary care trusts policies and practices on sustainability found that while almost all had strategies on sustainability, progress at translating this into tangible action appeared to be less consistent (44)- a finding mirrored in other studies (15;44;45). A review of the literature found that although there are several examples of successful implementation of sustainability policy, these are considerably outnumbered by examples of well-intended policies and strategies that appear not to have been implemented (30). A survey of primary care trusts reached a similar conclusion (45). Views expressed by several of our expert interviewees corroborated this picture of inconsistent implementation and a gap between strategy and tangible action on sustainability:

"The NHS leads the world in rhetoric on sustainability but in practice other countries like Norway are a thousand times better than us"

Health services management consultant

This strategy-implementation gap may go well beyond the health and social care sector. The National Audit Office found procurement teams across the public sector often failed to operationalise sustainability strategy successfully (46), and research conducted in the private sector indicates the problem may exist there as well (47).

Nonetheless, there are numerous cases of local projects within both health and social care where structural, operational or clinical changes have been made that have reduced environmental impacts – in some cases achieving wider benefits as well (see section 4). Examples include University College London Hospitals Foundation Trust and Bristol City Council, which have employed dedicated sustainability staff and introduced a range of changes described in greater depth later in this report (see boxes 1 and 2, both in section 4). Several PCTs have made efforts to extend action on sustainability into wider communities, through partnership working with local authorities, other local agencies, and businesses (44).

There is some concern that progress within social care has been less systematic. Many local authorities have engaged with the issue of sustainability and have promoted it across their local communities. Local authorities are arguably more attuned than NHS organisations to thinking about environmental impacts and the effect of these on health - indeed the Climate Change Act (2008) creates statutory duties for them to do so (48).

However, there is little evidence that this agenda has filtered down from the corporate level into social care departments. There has been less guidance or coordination of action – for example, there is no equivalent of the NHS Carbon Reduction Strategy for social care. To some extent this reflects the structure of the social care sector, with highly diverse provision, many small providers and a mixture of public and private ownership.

A common critique in both the literature and the expert interviews was that sustainability has not yet been 'mainstreamed' into standard business processes and is currently being driven by individual champions rather than the result of a broad organisation-wide commitment (15;48). Environmental sustainability has sometimes been seen as an issue primarily for Estates departments rather than an over-arching focus for the organisation (41). While Estates departments can make a crucial contribution, the carbon emissions profile illustrated in figure 2 indicates that environmental sustainability goes well beyond buildings and associated technologies.

A related issue is that many organisations appear to be addressing environmental sustainability by focusing on 'quick wins' which deliver a rapid return on investment, such as implementing energy management programmes in facilities. While this is a reasonable approach to take as a first step, it may not be sufficient on its own without asking more fundamental strategic questions about what sorts of services are provided and how care pathways and business models may need to be transformed (see section 5). A review of literature on sustainable business practices suggested that many organisations beyond the health and social care sector are taking a similar approach - identifying quick wins but making limited progress in terms of mainstreaming sustainability within core strategic planning processes (49).

There was a general consensus among our expert interviewees that while mitigation of environmental impacts is receiving some attention, fewer health and social care organisations are giving strategic attention to the issue of adaptation, for example, by assessing the possible impact of environmental change on local service delivery. There are some exceptions, for example, Hertfordshire Environmental Forum has conducted work on behalf of Hertfordshire County Council and the local NHS examining the impacts of climate change on health and social care needs in Hertfordshire (48). However, for many organisations the threat of environmental change was seen as too distant to really galvanise managers and other professionals into taking adaptation seriously.

"Most people in the health and social care sector have a very short time-horizon. Next week is strategic – the week after is the unimaginable future"

Senior health policy expert

Interviewees differed in terms of the relative emphasis they felt should be given to mitigation and adaptation efforts, but there was a consensus that a dual approach is needed, with greater attention than is currently given to adaptation.

Internationally, the sustainability agenda is also receiving increased attention within other health and social care systems. In Australia, the issue of adaptation has received much greater research attention, including through the Climate Change and Human Health Adaptation Research Network, part of the National Climate Change Adaptation Research Facility (50-52). This reflects the more immediate threats posed by climate change to many Australian communities. A number of articles published in the US have explored ways of developing 'greener' healthcare, with the focus often on waste and direct pollution rather than climate change (53).

Interviewees' overall assessment was that much more needs to be done to develop an environmentally sustainable approach to health and social care.

"There's no question that our delivery of healthcare has become unsustainable. And when something becomes unsustainable it doesn't just become financially unsustainable, it becomes unsustainable in all its aspects, including environmentally"

Chief Executive of private sector health care provider

4 Evidence on wider benefits of sustainable approaches

Key messages

- Environmental sustainability is highly congruent with imperatives to improve productivity, such as initiatives like QIPP and the 'right care' agenda - making sure patients get effective care at the right time in the most seamless manner possible without duplication or waste. At the core of sustainability is the idea of maximising efficiency and avoiding unnecessary activity and resource use.
- Some investments deliver a quick win while others take longer. There are a growing number of case studies providing examples of health and social care reducing environmental impacts and costs together, but more robust economic evidence is needed.
- Rising energy and carbon prices may make the financial case for investment in sustainable approaches clearer over time.
- There is some evidence for a link between sustainability and profitability from other business sectors. Firms perceive a number of benefits from engaging in sustainability.
- Adapting to what are currently considered extreme weather conditions may make the health and social care system more resilient to future trends.

In economic terms, the environmental impacts of care outlined in the previous section can be seen as negative externalities - that is, they are costs (or benefits - positive externalities) generated by the production of health and social care services which are not transmitted through the direct costs or prices of these services and, in general, borne by those not directly responsible for the actions which cause the externality. External costs on the environment arising from health and social care activities may of course also be felt by those responsible for production but not reflected in the direct costs of production or accounted for in their decision making, due, for example, to low values placed on future costs or straightforward myopia about the future.

Given this, one approach to dealing with externalities is to introduce mechanisms for internalising such costs. This is the basis of carbon trading schemes for example. But environmental impacts may also be ignored as a result of a lack of understanding or knowledge of the actual direct and indirect *positive* connections between such effects and decisions taken about the production and delivery of health and social care services. In particular, alternative ways of delivering services may not only have a positive impact on the main objectives of the health and social care system (improving health, reducing inefficiency etc), but also positive benefits or a reduction in negative externalities on the environment too.

The following reviews the evidence for such co-benefits at a number of levels. Firstly we examine the argument that environmentally sustainable approaches can promote efficiency and lead to financial benefits, drawing on evidence from within health and social care, as well as from other sectors. We then discuss potential co-benefits in terms of public health and quality of care.

4.1 Sustainability and the productivity challenge

In the face of fiscal tightening public services are under intense pressure to achieve better value for money. In the NHS this pressure has taken the form of the Quality, Innovation, Productivity and Prevention (QIPP) programme, which calls for improvements in productivity with an estimated value of £20 billion over four years to 2014/15. In social care the pressure is expected to be even greater as a consequence of a 28% real-terms cut in funding for local authorities over four years.

There is a clear connection between environmental sustainability and the QIPP challenge. Environmental impacts can be minimised by reducing avoidable or low-value activity and delivering efficient, effective care. This in turn implies a focus on evidence-based treatment and support, preventative and upstream approaches, and individualised care which generates maximum value for patients and clients. To this extent, sustainability provides an additional rationale for implementing many of the changes that are needed in health and social care for financial and quality reasons. One author concluded that climate change, the aging population and the fiscal crisis are all pushing in the same direction – the need to remodel services (48).

"Whenever there is wasted expenditure, there is avoidable environmental damage as well"

Sustainability consultant

"Anything we can do to achieve the QIPP agenda, which is all about reducing waste and inefficiency, is likely to improve sustainability at the same time"

Consultant renal physician

While the conceptual connection between sustainability and productivity is clear, in practice sustainable approaches will differ in terms of the return on

investment they can offer, and the period over which this will occur. The NHS Sustainable Development Unit has published a series of Marginal Abatement Cost Curves which plot financial investment against carbon savings for a number of carbon reduction measures. Measures were selected which would offer a rapid return on investment - often within two or three years - and were largely related to energy efficiency in buildings rather than transformative clinical change. If implemented across the NHS in England, the 29 measures assessed could save an estimated £180 million and over 800,000 tonnes of CO_2 per year. Changes offering the greatest financial return on investment included reducing drug wastage, installing combined heat and power generators in acute trusts, and reducing business travel through teleconferencing (54;55).

The current financial climate means that health and social care organisations will need to identify innovations capable of delivering financial returns within a limited time horizon - upfront investment may be difficult even where savings are expected in the medium or long term. For some products, suppliers are developing new financing vehicles which reduce upfront costs and bring forward anticipated future savings. However, there will still be a need for evidence that savings can be made in practice, not just in theory.

There are a number of case studies which go some way towards providing this evidence base. Changes implemented by organisations at the leading edge - such as Bristol City Council and University College London Hospitals - have delivered relatively quick financial returns (see boxes 1 and 2). Indeed, it was reported that in several local authorities the need to make cost savings was a primary motivation driving the adoption of more sustainable approaches (48). Our literature review identified a number of further examples, including:

- **Telecare** – North Yorkshire county council is reported to be saving around £1 million per year through using a telecare support package which is rated highly by service users and reduces travel-related CO_2 emissions. The package paid for itself in under 6 months (48;56).
- **Waste management** - Cardiff and Cornwall trusts both reported cost savings made by implementing waste management strategies (57). Segregating waste correctly would reduce the need for high-temperature incineration – potentially saving over £5 million per year across the UK and lowering CO_2 emissions (43).
- **Re-using drugs and devices** – Pharmaceuticals worth £75 million are returned to primary care each year, and an estimated 25% of these are suitable for re-use. The total pool of pharmaceuticals which could potentially be re-used may be much greater than this, pointing to opportunities to make carbon and cost savings (58). Increased re-processing of medical devices in the USA saved $1.4 million nationally in 2008 (59).

There are also direct financial costs now incurred by health and social care organisations created by environmental policy tools. For example, most NHS trusts and local authorities are obliged to participate in the government's CRC Energy Efficiency Scheme. At current prices, purchasing mandatory carbon credits for this scheme costs the NHS in England around £50 million per year. This is anticipated to increase over time as carbon prices rise and other policy tools are developed. Reducing the carbon footprint of the health and social care sector would decrease the costs incurred.

Box 1: Health and Social Care in Bristol City Council

Bristol has been a centre of innovation in developing environmentally sustainable approaches towards delivery of public services. There has been a long-standing commitment to sustainability across the public sector and high-level local political support, including a council-wide target of 40% emissions reductions by 2020.

Within the health and social care directorate, a number of developments have contributed towards improving environmental sustainability:

- Inclusion of the directorate in the scope of Bristol City Council's international standard environmental management and audit scheme (EMAS) since 2008. EMAS is used to monitor environmental impacts and help identify priority actions to reduce these.
- Development of a climate change risk register identifying which individuals and communities may be particularly vulnerable. The plan is to train social care professionals to discuss relevant issues with clients, for example, asking if they have insulation, how they would cope during a flood, whether they have a back-up food supply etc.
- Joint working with local NHS commissioners to explore how climate change will impact on service delivery.
- Recruitment of a half-time environmental advisor post within the social care directorate.

The outcomes achieved so far include a number of financial co-benefits, including:

- A saving of £30,000 per year on electricity and approximately £100,000 per year on gas and oil (from a total annual energy spend of £650,000), achieved through energy saving measures in care homes, day centres and other facilities, including improved lighting systems and insulation
- A 20% reduction in business mileage claims, estimated to be saving £100,000 a year across the health and social care directorate

Sources: (48;56)

Box 2: University College London Hospitals NHS Foundation Trust

UCLH has been a leading organisation within the NHS on environmental sustainability. The trust employs a dedicated sustainability development manager – a post funded entirely through savings made - and has established sustainability implementation groups, as well as working groups for specific sustainability themes and nominated trust-wide carbon champions to promote best practice across its various sites and activities.

Activities so far have been focused on seizing quick wins which deliver cost savings within a short time horizon, largely in relation to energy management. For example, installing software to automatically shut down office computers over weekends is predicted to save £100,000 per year by reducing electricity consumption.

The trust has developed low carbon menus by sourcing food locally, and has also developed 'NHS Re-use', a web-based tool to allow NHS trusts to re-use surplus and redundant office furniture and equipment https://www.nhsreuse.co.uk/. By March 2011 UCLH had saved £84,000 using this tool, while reducing carbon emissions and waste generation.

UCLH was among the first organisations to sign up to the high profile 10:10 campaign pledge to cut carbon by 10 per cent in a year. This target was exceeded, with a 14 per cent reduction having been achieved by the end of 2010/11.
http://www.sustainabilityforhealth.org/energycarbon/reports/uclh-draft-energy-reduction-action-plan-10-by-2010

4.2 Sustainability and profitability in other sectors

Outside of the health and social care sector, a number of business leaders have sought to align environmental sustainability with productivity or profitability. In one survey, 87% of Fortune 1000 Chief Executives reported that they believed environmental performance was important for profits, with 73% saying that a focus on sustainability was delivering cost savings in their businesses (60). There are some quantitative studies which test this relationship (61). One study found that firms adopting sustainability as a core part of their business strategy outperformed rivals in financial markets by 15% (62). However the evidence for this is not definitive, and the effect is certainly not universal or systematic, and is highly contested within the business community (47;63).

It has been suggested that the critical link between environmental sustainability and profitability may be commercial sophistication and far-sighted management – which may be vital for both economic and environmental success (64). Other authors argue that the challenge of improving environmental performance acts as a spur to promote creativity and innovation, describing sustainability as being "innovation's new frontier" (65).

Whatever the relationship between environmental sustainability and financial performance, it is clear that a growing number of business leaders perceive a number of benefits in adopting sustainable practices. The motivations can be multiple, even within a single company (61;66;67):

- Lower production costs due to improved efficiency
- Improved recruitment and retention and employee engagement. Some evidence suggests corporate social responsibility programmes can promote employee motivation, and is becoming an increasingly widely used tool for improving recruitment and retention (66;67).
- Adopting voluntary measures may make firms more nimble in responding to more onerous environmental legislation/regulation as it arises
- Learning - at an organisational and individual level. Using corporate social responsibility initiatives as "learning laboratories" and to help staff develop new skills e.g. in leadership.
- Reputational improvement
- Product differentiation, particularly when technological convergence means the cost/quality of rivals' products is similar (68)

Many of these benefits may also apply to health and social care organisations – although research would be needed to demonstrate this.

4.3 Health co-benefits

The potential health co-benefits of climate change mitigation measures emerged as a key opportunity from our expert interviews. There are a number of measures where there could be benefits in terms of both reducing environmental damage and improving public health, including:

- Promoting active travel (walking and cycling) in place of motorised transport
- Reducing meat consumption
- Improving insulation in housing
- Improving access to green spaces

Health and social care professionals are in a position to influence some of these behaviours and social determinants. In doing so, there may be opportunities to develop more sustainable practices while improving public health. Local authorities may be particularly crucial in this in future as they take on new responsibilities for improving the health of the populations they serve, including through the transfer of public health budgets from primary care trusts, and the creation of health and wellbeing boards.

One interviewee argued that the overlap between actions which promote environmental sustainability and those which promote public health is not a fortuitous coincidence, but is a product of the fact that the availability of cheap energy is a key driver of non-communicable disease:

> *"We're not going to solve many of the burdens of non-communicable diseases unless we move to a low carbon economy. With the exception of smoking, most of the risk-factors are related in some way to our profligate and unsustainable use of energy"*
>
> Professor of public health

A number of authors have highlighted the potential health co-benefits (69) and there is a small but growing evidence base examining these potential benefits empirically. For example, a series of articles in the Lancet assessed the public health impacts of a range of climate change mitigation measures. While these studies identified a number of opportunities, they also highlighted that mitigation measures could have adverse as well as positive impacts on health, depending on what measures are chosen and how these are implemented (70). More evidence will be required to develop greater clarity on these risks and opportunities.

The Sustainable Development Commission's submission to the Marmot review on health inequalities described multiple opportunities for co-benefits between sustainable development and health inequalities, but stressed that these would only be achieved if access to healthy, low carbon lifestyles is equitably distributed across the population. There is the risk that some measures, for example certain forms of carbon taxation, could be economically regressive (71).

4.4 Quality of care

There are also potential co-benefits in terms of quality of care. Many of the changes discussed in the following section could reduce environmental impacts of care while at the same time presenting the prospect of improving patient experience and outcomes. These include:

- Providing evidence-based care which achieves the best possible outcomes for the resources available
- Developing more integrated approaches which coordinate different elements of care effectively and remove duplication and redundancy from care pathways
- Making better use of new technologies such as telecare and telehealth tools

Delivering care in settings closer to service users' homes

If health and social care services were provided in such a way that service users experience an efficient journey through the system, obtain maximum value from every contact with professionals, and do not experience duplication (e.g. in assessment processes), this could be expected to improve quality of care while also being less wasteful in environmental terms.

"A lot of the policy aspirations that we have about reducing duplication, joining up services, offering more integrated services, would also produce sustainability benefits. So there's a question for me about is it about doing something completely different or is it about doing what we've already committed to?"

Social care policy expert

As yet there has been little empirical research assessing the strength of these potential co-benefits, although there is some evidence, described in the following section, that certain innovations (e.g. telecare and telehealth) - could have both quality and environmental benefits.

4.5 Conclusion: how strong is the evidence for co-benefits?

There are strong conceptual connections between environmental sustainability and other policy objectives in health and social care. The

critical question is how far these potential co-benefits can be realised in practice. In the case of financial co-benefits, there are a growing number of case studies which demonstrate real savings being made as a consequence of adopting more sustainable practices. There are also measures which, if implemented successfully, could improve public health and quality of care alongside environmental sustainability, but as yet limited empirical research assessing these co-benefits in practice. More evidence will be needed in order to help people working in health and social care implement changes which can achieve multiple objectives. The next section of this report gives an overview of some of the changes which our review suggests might be necessary.

5 Improving the environmental sustainability of health and social care - what needs to change?

Our review suggests that changes at a number of levels will be required to develop more environmentally sustainable health and social care. In analysing the changes we applied a framework adapted from the NHS Sustainable Development Unit's Routemap for Sustainable Health (6). The framework distinguished between actions at three levels:

- **Innovation** – changes to models of care, and to health and social care technologies (including technologies used directly in frontline care, and those associated with the supporting infrastructure e.g. in facilities)
- **Behaviours, attitudes and cultures** – changes to organisational cultures, professional behaviours and attitudes within services, and public behaviours and attitudes in society at large
- **System governance and policies** – changes to the way the health and social care system is governed, and the policy levers used for this

Actions at each of these three levels are closely interdependent. The successful implementation of innovative approaches will be contingent on supportive behaviours and attitudes among professionals and the public, and these in turn will be influenced by the overarching policy framework within which health and social care organisations operate.

Through the course of our analysis, we found it helpful to make a further distinction between 'direct' and 'indirect' actions:

- **Direct** – actions which are explicitly intended to improve the environmental sustainability of services
- **Indirect** – broader actions which may improve environmental sustainability without that necessarily being the primary rationale for the action

This distinction was drawn in recognition of the observation – already made in section 4 – that sustainability is highly congruent with existing policy objectives, and that much of what may be needed to develop a more environmentally sustainable approach towards health and social care need not be done on grounds of environmental sustainability alone.

Table 3 uses this framework to summarise some of the main changes that may be required, as identified through our literature review and expert interviews. The remainder of this section elaborates on these changes. The aim here is not to give a comprehensive account, but rather an overview of some of the areas where action may be needed, and some of the relevant evidence from published research.

	Innovation	Behaviours & attitudes	Systems & policies
Direct	• Less resource-intensive buildings &equipment • Low carbon care pathways • Reducing 'care miles' through telecare, care closer to home etc. • 'Green' drug manufacturing • Improved waste management • System preparedness for environmental change	In services: • Engaging professionals & developing leadership for sustainability • Sustainable procurement & commissioning practices In society: • Engaging public & patients in sustainable service delivery • Building community resilience to health impacts of environmental change	• Developing metrics for sustainability • Identifying levers at national level (e.g. financial incentives, regulation, targets, NICE guidelines) • Wider policies e.g. CRC Energy Efficiency Scheme • Data systems for environmental accounting
Indirect	• Prevention, shifting care upstream • Efficient, effective care • Well-coordinated, integrated care • Effective medicines management • Patient empowerment, self-care, enablement • New delivery models e.g. time-banking	In services: • 'Learning organisations' that encourage experimentation • Devolving managerial powers to clinical teams • Clinical behaviours (e.g. addressing variations) In society: • Promoting healthy behaviours	• Incentives/drivers for prevention, care closer to home, integrated care • A policy framework that permits a long-term focus in organisations • Enabling hospital reconfiguration

Table 3. Changes that may be needed in delivering more sustainable health and social care, identified through literature review and expert interviews

5.1 Innovative models of care, facilities and technologies

5.1.1 Pharmaceuticals & care technologies

Pharmaceuticals account for around 22% of the overall NHS carbon footprint and 13% of its costs (72). On both financial and environmental grounds, there is a pressing need to gain control over inflationary pressures in the drugs budget.

There is some scope for the NHS to use its monopsony powers to lever changes in manufacturing processes (see section 5.2.1). However, a consistent message from our interviewees was that in order to do this with credibility, health services will also need to reduce the large volumes of medicines wasted due to inadequate stock management or inappropriate prescribing, as well as the high proportion of drugs not taken as prescribed. Marginal improvements in medicines management could have a major impact in aggregate because of the high volumes involved. Shared decision-making tools may help by supporting patients in making informed choices about medication (73;74).

The extent of polypharmacy in older age and the large volumes of medications wasted as a result of over-medication or inappropriate prescribing in care homes (75) indicates that there may also be a role for social care professionals in improving the efficient use of pharmaceuticals. Intensive pharmaceutical use in the final months of life highlights the impact of attitudes towards end of life care on the environmental sustainability of the health and social care system.

Innovations in medical equipment and care technologies could also have a significant impact. For example, there has been some research on water conservation in renal dialysis indicating that new designs could generate carbon and cost savings (76). A sustainable approach to health and social care will involve making the most of new technologies as they are developed, and rapidly diffusing innovation throughout the system. There was a consensus among our interviewees that this is not well done at present, a finding consistent with previous research on the uptake of new technologies within the NHS (77).

> *"Healthcare today is definitely not patient-centred, definitely not resource efficient, and definitely doesn't take advantage of the best technologies"*
>
> Director of health care charity

5.1.2 Sustainable facilities

The environmental sustainability of health and social care facilities could be improved considerably. Several interviewees stressed that there are major problems with existing estates, in terms of both resource efficiency and resilience to change. In the NHS, direct energy use in hospitals and other buildings accounts for 19% of the total carbon footprint (55). In social care, the main focus for attention here will be care homes, which have a substantial impact on account of operating 24 hours and typically being highly heated. A number of innovations may help reduce impacts associated with buildings, including using narrow-plan buildings (see glossary), exploiting opportunities for natural heating, lighting and ventilation, and installing combined heat and power systems. More fundamentally, there are opportunities to reduce our reliance on buildings-based services by providing more care in people's own homes.

A number of studies have examined ways of improving the disposal of hospital waste materials. There may be scope to reduce environmental impacts associated with this, through more effective segregation of waste streams, and increased recycling and re-use where appropriate. It is well-established that a high proportion of low risk, non-infectious clinical waste is disposed of as high-risk waste and sent for unnecessarily energy-intensive high-temperature incineration (12;41;57). Experience in Cornwall NHS Trust suggests that the combination of improved segregation and recycling could reduce clinical waste production by 30% (78). Greater reductions could be achieved by minimising the volume of waste generated in the first place (16;57). There may be similar opportunities to improve waste management in care homes and other social care institutions, but we found no literature on this.

There are also opportunities to reduce running costs and CO_2 emissions through lower water use. We found limited published evidence assessing these opportunities. However, one study found that installing leg-operated taps for surgical scrubbing cut water use in theatres by over 50%, which would translate into carbon savings of 1,400 tonnes of CO_2 if extrapolated across the NHS (79).

A significant barrier to using resources more efficiently in health and social care facilities is the dearth of detailed data within organisations on their resource use. For example, many hospitals do not have sufficient sub-metering to allow clinical departments or teams to be provided with

information on their use of electricity. Similarly, while all local authorities have information on their overall use of resources and carbon emissions, it is often not possible to know how much of this is attributable to social care, or to care homes specifically.

It will also be important to ensure that buildings are resilient to environmental change. This will involve assessing potential risks, putting in place plans for responding to extreme weather conditions and where necessary investing in more adaptable facilities. Our interviewees highlighted, for example, that many facilities house patient records and IT infrastructure in basement floors - a high-risk approach for those sited in flood plains.

There is some risk of measures taken for the purposes of mitigating climate change to be in tension with climate change adaptation - for example, designing facilities to maximise natural heating or 'solar gain' may reduce heating costs in winter but at the expense of creating rooms which are difficult to keep cool in summer. Given that most of the excess deaths recorded during the 2003 European heat wave were of older people, it is important that the design of hospitals and care homes does not contribute to this.

The aim in planning sustainable facilities should be to reduce reliance on buildings-based services over time, and where appropriate to shift care out of hospitals and other energy-intensive environments. In one analysis, it was predicted that a proposed shift to a system of satellite clinics for breast care appointments would reduce total emissions by 14%, despite marginally higher emissions from staff travel (80). However, this logic only holds if capacity can be taken out of the hospital sector.

5.1.3 Minimising 'care miles'

Patient and staff travel accounts for 16% of the NHS carbon footprint, and may account for a greater proportion of the environmental impact of social care, given the peripatetic nature of much social care work. Interviewees saw delivering care closer to home as an important way of reducing this impact, but the published evidence highlights that some approaches to this may be more successful than others. For example, mobile breast screening in Norfolk saved 75 tonnes of CO_2 per year - a two thirds reduction (14) - but in the case of kidney dialysis, home dialysis using currently available technology can have a larger environmental impact (despite reductions in travel) when this means patients need to dialyse more frequently and for longer (23). This demonstrates the need for a comprehensive approach to environmental impact assessment which takes into account the multiple different routes through which care can affect the environment.

There is some evidence that telehealth and telecare interventions can be used to reduce emissions (81), but again, more research is needed to indicate how these can be used to greatest effect. In one study, a telehealth intervention focusing on doctor-to-doctor interactions had only a relatively small impact on emissions. The study concluded that greater effects could be achieved by focusing on patient travel - using telecare to reduce the need for outpatient appointments (82). Some services have used videoconferencing to reduce business travel - for example, a cancer network reported savings in terms of both emissions and costs from this (83).

Travel associated with home visits can be minimised through careful planning of rosters. Where travel is necessary, some services have explored lower impact options. For example, the 'Go Low' sustainable travel project in Avon and Wiltshire Mental Health Partnership NHS Trust has reduced business mileage claims and CO_2 emissions using car pools, smart cars and electric bikes.

Hospital reconfiguration decisions can have a major impact on travel-related emissions. In one study, concentrating care for heart attack in tertiary centres was estimated to have tripled travel-related emissions (84). However, this needs to be set against the potential environmental benefits of removing over-capacity and matching supply of hospital care more closely to demand.

5.1.4 Prevention & self-management

A strong message from our review was that prevention must be at the core of sustainable health and social care. Interviewees stressed that the most sustainable approach to health and social care - with the smallest environmental impact - will be one which minimises care needs by preventing ill-health, encouraging health-promoting behaviours in the population, and supporting those who do develop health problems to manage their own condition as effectively as they can. Prevention is therefore an area where there is an important intersection between sustainability and other policy objectives.

"The best thing that could be done for the environment, for quality of life and for the long-term viability of the NHS is to keep people healthy, stop people becoming patients in need of treatment. And you can do that in ways that are very environmentally-friendly, by encouraging healthier lifestyles"

Social policy expert and analyst

Prevention is relevant to sustainability to the extent that preventative approaches can reduce subsequent resource demands and lifetime service use. From a sustainability perspective, the focus of preventative activity should be on preventing avoidable consumption of health and social care resources. In part, this will involve preventing the initial onset of illness. But it will also need to include tertiary prevention - preventing those who develop illnesses (particularly long-term conditions) from requiring highly resource-intensive care.

There is a growing evidence base that a range of primary, secondary and tertiary preventative approaches can successfully reduce subsequent demand and in doing so can deliver a financial return on investment (48;85;86). For example:

- A recent report commissioned by the Department of Health demonstrates the economic case for prevention in mental health (87)
- It has been estimated that half of all cancers in the UK are preventable (88)
- Evidence from the Department's Partnerships for Older People Projects suggests that local authority-led preventative approaches in older age can help to reduce demand on secondary services (75).

The relevance of these findings to environmental sustainability is that reduced demand can be taken as a proxy for avoided environmental

damage - although this must be set against any environmental costs associated with preventative measures themselves.

Self-management and re-ablement approaches can also play a part if they are successful in reducing demand for formal care. The Department of Health suggests that around 70-80% of people with a long-term condition can manage their own condition if provided with appropriate education and support (89). Self-management programmes can improve outcomes, coping skills and self-confidence, and in some cases have succeeded in reducing unplanned hospital admissions (90-93). From a sustainability perspective, more evidence is needed to test whether improved self-management can reduce overall resource use in the health and social care sector.

5.1.5 Evidence-based, personalised care

A crucial component of environmentally sustainable health and social care will be continuing the drive for evidence-based care at all levels. Those forms of treatment or support which offer maximum value to service users for a given investment of resources (financial or natural) can be seen as being intrinsically the most sustainable because they reduce wasteful use of these resources.

"Evidence-based interventions by their nature should be greener – because they actually work"

Director of health care charity

The challenge here is two-fold. Firstly there is a need for further development of the evidence base on what forms of care are the most cost-effective. Secondly, and equally importantly, there is a need for much more systematic implementation of evidence that already exists. This will involve identifying unwarranted variations in practice, reducing use of low-value interventions, and exploring the issue of supply-induced demand.

In assessing what is of "maximum value" it is important that this is understood from the perspective of individual patients or service users - hence care should be personalised as well as evidence-based. Shared decision-making tools can be used to identify what outcomes individuals value most highly, and in doing so can contribute towards creating a system focused on value and efficiency (73;74). In some cases shared decision-

making can result in people opting for less intensive forms of care, for example with a greater emphasis placed on psychosocial interventions.

While the promotion of cost-effective treatment, as conventionally defined, can be expected to contribute towards improvements in environmental sustainability, there may also be a need to redefine the concept of cost-effectiveness to include environmental costs which are currently externalised. Valuing these costs appropriately will be an ethical question as much as an economic one. A discussion paper published by the Social Care Institute for Excellence examined ethical frameworks that could be applied to sustainable health and social care, and concluded that more work was needed in this area (94).

If the concept of cost-effectiveness is to be expanded to include environmental costs, this will require a much more detailed understanding of the comparative environmental impacts of different forms of care. In some service areas, health and social care professionals are already leading the way. For example, considerable research and development work has been conducted as part of the Centre for Sustainable Healthcare's Green Nephrology programme, which includes a network bringing together clinicians, patients, renal technicians and industry partners (22;23). Similar work will be needed in other service areas to build the evidence base.

5.1.6 Well co-ordinated, integrated care

Just as the effectiveness and efficiency of individual interventions has a bearing on the environmental impacts of care, so too does the efficiency of the overarching framework within which these interventions are delivered. Interview participants stressed the inefficiencies and waste created by poor communication and information-sharing between organisations and different parts of the health and social care system. They suggested that more integrated models providing better co-ordinated care could be more sustainable in environmental as well as financial terms.

> *"More integrated care is surely the holy grail of a sustainable health care system"*
>
> Sustainability adviser (Delphi participant)

"There is an enormous amount of waste in terms of the way things are organised that results in external expenditure"

Oncologist

Improving this would require better information-sharing between teams, more shared or collaborative care arrangements (e.g. with specialists providing support to primary care), and better integration between health and social care.

Alongside integration at the clinical and service level, close relationships between organisations can support strategic planning for sustainability. Evaluations of the corporate citizenship approach in health and social care have identified effective joint-working between health organisations, local authorities, and other local partners as a key enabler supporting the development of environmentally sustainable approaches, including through joint appointments (95;96).

Coordinated planning across a range of agencies is necessary to create a system which is able to adapt to environmental change. Systems to support inter-sectoral planning on adaptation at the local level will be needed, with clear responsibilities allocated to specific organisations for taking a lead on defined activities. Our interviewees highlighted that in many areas processes are not in place to allow agencies to exercise collective responsibility for climate change adaptation, and for facilitating the necessary conversations.

5.1.7 New models of service delivery

The expert interviews and literature review identified several innovative service delivery models which may be able to play a role in reducing the environmental impacts of health and social care. These included time banking and co-production approaches which rest on harnessing and strengthening community resources, with a reduced reliance on professionally-provided care (see box 3). Interviewees also stressed the value in looking beyond the UK for international examples of care which deploy professional skills in a more efficient way, including from low- and middle-income countries. If these alternative models translate into reduced resource use in the formal care sector they could contribute towards reducing associated environmental impacts.

Box 3: Time Together, Swansea

Social care services in Swansea have been remodelled using a co-production approach in which a key role of professionals is to identify and harness the strengths and capabilities of local people and communities. The aim is to move away from a model based on professional 'givers' and client 'recipients' of care, towards one in which older people themselves are seen as an asset. One mechanism through which this approach has been put into practice is time banking. In this, the contributions that community members make to mutual care and support are recognised and rewarded.

Source: (48)

5.1.8 Preparedness for environmental change

Limited attention has been given in the health and social care sector to adaptation and preparedness for environmental change, including both climate change and also the increased scarcity of natural resources such as fossil fuels and water. There are however some signs that this is beginning to change. For example, the 2011 update to the Department of Health's Heatwave Plan for England gives more attention than previous versions to climate change and the projected increase in incidence of heatwaves (97).

More work will be needed on system preparedness at the levels of policy, strategy and research. There is limited evidence on how organisations can adapt to a changing climate. A report published by the Faculty for Public Health suggests that as a minimum, organisations will need to identify vulnerable groups in the local population, review plans for responding to floods, heatwaves and other extreme weather events, and establish contingency plans to deal with disruption to supplies of energy, food and water (98). Facilities will need to be suitable for changing weather conditions (see section 5.1.2), and beyond this, organisations will need to ensure that the supply chains, workforce and public infrastructure on which services depend are all sufficiently resilient.

The evidence base on adaptation to environmental change within health and social care comes largely from countries outside the UK, notably Australia. Key characteristics of a well-adapted system identified by this research include: (50-52)

- Flexibility in terms of who provides services, and what bases these are provided from
- Allocation of resources in relation to vulnerability to the health impacts of environmental change
- Robust procedures for coping with "surge capacity" demands
- Close inter-sectoral collaboration in conducting long-term planning
- Strong monitoring and surveillance systems
- High levels of community awareness of climate-related health risks

5.2 Behaviours, attitudes and cultures

By itself, developing innovative approaches to health and social care will achieve little unless the right behaviours, attitudes and cultures are present to support implementation - both within the health and social care sector, and in wider society.

"Sustainability is a cultural journey. It isn't sticking wood-fired pellet boilers onto your hospitals or turning down the heating system by two degrees… it's much more than that"

Sustainability consultant

5.2.1 Sustainable procurement and commissioning practices

Procurement may be the area where the biggest improvements could be made. Almost two thirds of the NHS carbon footprint is associated not with what is done directly within health services, but with goods and services procured. It is not clear whether the same is true in social care, but there are likely to be substantial opportunities here too.

Health and social care organisations have some power to influence organisations in their supply chain to operate in an environmentally sustainable way. Indeed, third sector organisations report that public clients are increasingly doing so, for example by including environmental requirements in procurement processes (99). However, this often appears to be a tokenistic exercise at present, with little active management of these requirements once the procurement is completed. The National Audit Office found that public sector procurement teams often fail to operationalise a strategic commitment to environmental sustainability due to a number of barriers, including cost and a lack of training or guidance (46).

Sustainability consultants interviewed for our review suggested that suppliers to the health and social care sector are often supportive, in principle, of developing more sustainable goods and services. Several pharmaceutical companies are beginning to consider new business models, for example, to fit a more preventative model of health care. However, progress can be held back by a number of factors:

- Suppliers are not always clear what clients in the health and social care sector want in terms of sustainable products (15)
- Health and social care organisations do not always have detailed, disaggregated data on exactly what products they procure, or sufficient understanding of the supply chain, e.g. what different suppliers can offer (15)
- Suppliers do not always know the environmental impacts of their products

Given these barriers, there is a clear need for cooperation between the health and social care sector and suppliers to develop a better mutual understanding of what is needed and what can realistically be provided. Suppliers will be more able to improve the sustainability of goods and services if their clients take a consistent approach. Organisations may need to act as part of a sustainable procurement community in order to influence suppliers effectively. This could include working with other public sector purchasers within the UK, or with the international health and social care community.

A related issue is the commissioning of health and social care services. By influencing the design and development of care pathways and by including sustainability requirements within service contracts, commissioners could play an important role in driving many of the sustainable approaches described elsewhere in this report. For example, the London Borough of

Camden has developed an outcomes-orientated approach to commissioning which includes outcome measures for environmental, financial and social sustainability (48). By holding providers to account for sustainability outcomes, commissioners could drive more integrated, preventative models of care and create incentives for innovation.

An important over-arching issue identified in our expert interviews is that public sector commissioning and procurement processes often tend to focus on price rather than long-term value. For example, it is known that the initial capital costs of new buildings compose a minor part of lifetime costs (100). However, procurement and commissioning processes are often conducted with a view to minimising initial costs rather than maximising long-term value. In part, this can be a consequence of having capital and revenue costs sitting in different budgets. A shift to whole life-cycle costing would be more sustainable from both a financial and an environmental point of view. Some organisations report that these methods are increasingly gaining currency, particularly in local authorities (99).

5.2.2 Staff engagement

There is a significant evidence-base, albeit largely from outside the health and social care sector, on how organisations can successfully adopt environmentally sustainable approaches. One of the most consistent findings from this is that staff engagement at all levels is critical for success (15;47-49;61;96;101;102). Limited staff awareness or buy-in is a commonly cited barrier impeding attempts to improve environmental sustainability. A study of psychological factors limiting engagement with sustainability in health care settings identified a number of barriers, including value conflicts, 'groupthink' and diffusion of responsibility for resource use (103). Other reasons for poor engagement may include:

- A sense of not having sufficient power or the right knowledge or skills to be able to change existing practices
- Ingrained habits and/or resistance to change amongst frontline staff (48;102)
- Staff are often unable to see the environmental costs attached to their work practices (102)
- Peripatetic staff or those working across a number of facilities and institutions may feel less responsibility towards the environmental impacts associated with any particular workplace (43).

It is important to acknowledge that some aspects of sustainability challenge existing practice and cultures. One of our interviewees argued that sustainable practice will require a cultural change in attitudes to wastefulness and inefficiency equivalent to that seen in relation to hygiene and hand-washing in NHS hospitals over last 10 years. Above all, sustainability asks those working in health and social care to accept a responsibility towards the needs of *future* service users. Our expert interviews identified the risk of a psychological "moral offset" - the notion that working in the interests of people today can absolve professionals of a sense of responsibility towards the future.

The literature stresses the importance of senior leadership, for example in Boards and Executive teams (15;61;96;101;102). In Bristol, high-level commitment to environmental sustainability across the public sector and among local politicians was identified as a crucial condition for the progress made within adult social care (48). Employees take their cue about how seriously to take sustainability from the level of priority given to it by leaders. Research in other sectors recommends embedding sustainability in senior leadership and creating rewards for success (101). Creating working groups to act as champions within individual service areas was also found to be helpful in one study (96).

A major barrier is that responsibility for resource use and environmental impacts is currently highly diffuse. Departments and teams often have limited information on their use of resources, and less still on environmental impacts associated with this (102). A combination of more disaggregated data collection processes (e.g. through electricity sub-metering in individual facilities and departments) and changes to managerial practices (e.g. through service line management arrangements) could be used to devolve responsibility for sustainability throughout organisations.

More will need to be known about how to engage staff successfully. There is a limited evidence-base on educational interventions for promotion of sustainable practice. For example, an educational intervention in Australia succeeded in reducing energy and water consumption and improving waste disposal practices in primary care, but this was a small-scale study (104). An approach suggested within the literature and by our interviewees is to focus on the opportunities and co-benefits, highlighting the synergies between environmental sustainability and people's existing values and objectives (43;47). A consistent message from the research was that many of those working in health and social care have a strong sympathy with

environmental protection, and would engage with the notion of sustainable health and social care if they felt empowered to do so.

"There is a latent pool of people who could be mobilised on this agenda within the NHS, if only they were given the right forms of support"

Senior health services manager and consultant

5.2.3 Developing a learning culture within organisations

There has been some research (again, largely outside of health and social care) examining what organisational characteristics are associated with successful adoption of sustainable approaches. Two recent reviews concluded that while a number of enabling conditions exist (e.g. strong leadership, suitable governance structures and IT systems) the critical factor is creating an organisational culture which encourages experimentation and innovation, and putting in place feedback loops to learn from this (47;49). This evidence suggests that the most successful organisations devolve responsibility for sustainability to individual employees and teams, allow improvisation and experimentation, and create conditions that foster learning in every-day practice, specifically:

- Decentralisation of responsibility
- Connectedness between staff in different parts of the organisation
- Opportunities for feedback and communication between stakeholders

Part of the rationale for this devolved, adaptive approach is that our collective knowledge base on environmental sustainability is not sufficiently developed for organisations to be able to develop a highly-specified, top-down blueprint for strategic change. On this logic, experimentation - and by extension, failure - need to be permitted and used to create opportunities for learning. The concept of the 'learning organisation' has been developed to describe organisations which do this successfully. A consistent message from our expert interviews was that these enabling conditions are not present in many health and social care organisations, where the prevailing ethos is one of caution and conformity. This was seen as a significant barrier to the adoption of more environmentally sustainable approaches.

5.2.4 Individuals and communities

Professionals may find it difficult to develop more sustainable approaches to health and social care without engaging local communities. The environmental sustainability of the system is dependent on the behaviours and attitudes not only of those working within it, but also across the general population it serves. There are three senses in which social and behavioural changes may be needed among patients and the public.

Firstly, individual lifestyles and wider social factors profoundly influence health and wellbeing, and in doing so determine service activity levels and associated financial and environmental costs. The sustainability of the health and social care system therefore hinges on the effectiveness of public health measures, the adoption of healthy behaviours and creation of health-promoting communities.

Secondly, patients and the public will need to be engaged in and supportive of efforts to improve the environmental sustainability of health and social care. This will be particularly important in the context of increased patient choice, the growth of any qualified provider markets and personalisation in social care (48). In a system where resource flows are increasingly dependent on individuals' decisions, service users will need to be encouraged and supported to make choices which minimise avoidable environmental harm.

Thirdly, there may be a role for health and social care services in building individual and community-level resilience to the health effects of environmental change, and in ensuring that vulnerable groups are protected from the combined effects of climate change and rising prices for fuel, food and water. There is some evidence, for example, that communities with higher levels of social cohesiveness and stronger social capital may be more able to withstand the effects of natural disasters and extreme weather events (105). This may be partly because local residents often play an important role in filling the gaps in statutory responses to emergencies (106).

The work of the Local Government Information Unit's sustainable social care learning network suggests there could be a particular role here for social care professionals, and for local authorities more generally in their community leadership and place-shaping function (107). New models of

service delivery such as the co-production approaches described in section 5.1.7 could help build social capital and resilience in communities. As more health and social care is delivered outside of institutional settings the issue of how well adapted private homes are to a changing environment could become of increasing relevance. Social care professionals could support older people to live independently for longer by helping them to improve their homes, for example by identifying funding support for improved insulation – which could have dual environmental and health benefits. The increasing importance of this is demonstrated by the finding that many of the those who died during the 2003 European heat wave were older people stranded in their own poorly-adapted homes (108).

An evaluation of the Sustainable Development Commission's good corporate citizenship model for health care organisations found that while many trusts were taking a range of actions to reduce CO_2 emissions, few were engaging communities in these efforts, and concluded that the importance of this may be under-appreciated (96).

5.3 Systems & policies

5.3.1 A supportive policy framework

Financial, regulatory, performance management and other signals will need to be aligned to support the innovations and behaviours described above. Without a supportive policy framework, action is unlikely to spread beyond the enthusiastic minority.

Interviewees discussed a range of policy levers that could be used to encourage sustainable approaches. In general, the use of financial incentives was seen as being necessary but probably not sufficient to drive the necessary changes. For example, including incentives for environmental sustainability within the payment by results tariff would be unlikely to create a sufficiently strong signal for service providers to detect or respond to. Regulatory approaches could be used to add some weight to financial and contractual levers. One interviewee argued that innovative, sustainable approaches are more likely to be developed by new providers than incumbents, and that an important characteristic of a sustainable system is therefore that it enables market entry and innovation.

As well as encouraging action which explicitly aims to improve environmental sustainability, it is important that the policy framework for health and social care supports changes which it is believed may have an indirect but critical impact – for example, promoting a shift towards a more preventative model of care, integrating health and social care, delivering care closer to home, or enabling hospital reconfiguration where necessary.

A strong message from our expert interviews was that the existing financial reimbursement systems for health and social care providers often acts as a significant impediment in developing more environmentally sustainable approaches. In the health sector, there was widespread concern that the hospital reimbursement tariff system - Payment by Results (PbR) - creates an incentive for increased activity and for (at times unnecessary) face-to-face contact. Providers are in effect financially penalised for adopting innovative methods such as telephone-based consultation or preventative approaches which could be more sustainable. While PbR was originally developed in part precisely to introduce incentives to increase activity (in part to deal with long waiting times), the continuation of this incentive is increasingly seen as counter-productive from the point of view of environmental sustainability.

Payment systems need to reward providers for delivering lean, efficient care. To an extent this may be achieved through the efficiency factor in the payment by results tariff or through the move towards best practice tariffs. However, more sophisticated ways of paying for care may be needed in future, for example, based on payment for outcomes rather than activity, or through capitated budgets and more sophisticated contracting on the part of commissioners.

Another consistent message was that certain fundamental characteristics of the health and social care system encourage a short-term focus and make it difficult for managers and other professionals to prioritise longer-term sustainability. As a consequence, decisions are sometimes taken which do not make sense in the longer-term, either financially or environmentally – for example, closing a service may increase costs in the long-run by increasing needs in other parts of the system.

"Even if the NHS wanted to be long-termist, it hasn't got the terms of reference to be able to do that"

Health services management consultant

Several factors may contribute to this short-termism. Firstly, health and social care organisations operate in a highly politicised environment – which, as one of our interviews described, "is usually a recipe for dancing to a political tune rather than a sustainable agenda". In health care, this largely relates to the role of central government, whereas in social care our interviewees reported that local political agendas can make it difficult to take a longer-term perspective.

"Some of our European counterparts set 15 to 20 year plans for population health which are not subject to change every 4 or 5 years depending on who thinks they're going to get the vote. And until we move to that sort of agenda we're going to still have problems with the sustainability of health care provision"

NHS Foundation Trust Medical Director

The need to balance budgets on an annual basis may further contribute towards this short-term focus, as may the fact that Foundation Trusts are not always permitted to hold onto budgetary surpluses for future investment.

Finally, some interviewees argued that a significant barrier to taking a longer-term perspective is the tension between local financial costing and broader economic costing. One NHS consultant characterised the health and social care system as being composed of numerous organisations all seeking to maximise short-term revenue and improve efficiency from their own local perspective, which does not always coincide with the perspective of the taxpayer or society as a whole.

"Efficiency always depends on the perspective you look at it from… What the NHS is, is lots of little local units balancing their budgets but carrying on with gross inefficiencies because changing something seems expensive from their perspective"

Oncologist

The major changes introduced by the Health and Social Care Bill mean that it will be important to identify levers for sustainability in the reformed system. Whether the reforms will support environmental sustainability remains to be seen, but alongside the risks there are a number of possible opportunities:

- Health and wellbeing boards could play an important role by including a sustainability perspective within health and wellbeing strategies for local communities.
- The creation of the independent NHS Commissioning Board could potentially support longer-term planning with less political influence. The Board's annual mandate from the Secretary of State could be used to hold the system to account for sustainability outcomes.
- The outcomes frameworks for the NHS, social care and public health could also help if these succeed in creating a more outcomes-orientated system with greater incentives for upstream approaches to care, particularly if these include metrics on environmental sustainability.

The uptake of sustainable approaches in health and social care will also be influenced by environmental policies that are not sector-specific. It is not clear whether the incentives created by policy tools such as the CRC Energy Efficiency Scheme are currently large enough to drive significant changes, but the size and scope of such schemes can be expected to grow over time.

5.3.2 Metrics and methods

Interviewees stressed the critical importance of developing measures and metrics that can be used by health and social care organisations, regulators, policy makers and members of the public to evaluate the environmental sustainability of different interventions, pathways, technologies and approaches. Development of appropriate metrics has also been identified as a key enabler by research on the impact of corporate social responsibility programmes in other sectors (66). Without being able to readily quantify environmental impacts, it will not be possible to embed sustainability within routine management targets, objectives and indicators:

"We have to understand the metrics. Until we can measure these things it's just going to be hot air. Until we can face decision-makers with true costs, or costs that are being deferred to a subsequent generation, then it's all just nonsense"

Oncologist

Measuring environmental sustainability is complex since it has multiple components which must be weighed against each other. Environmental impact tools exist but there is no widely accepted gold-standard in the UK. The most commonly used single metric - CO_2 emissions - provides an important but incomplete measure, as it focuses exclusively on the issue of climate change. Some of our expert interviewees felt that sustainability within the health and social care sector is currently overly focused on carbon reduction. A number of composite measures (e.g. 'ecological footprinting') have been developed which attempt to provide a unified measure of environmental impact, but these risk losing helpful detail. The trend within the sustainability sector recently has been towards using a basket of selected measures rather than a single composite. Identifying a standard set of measures for use within health and social care could help support comparisons between different service models, interventions or organisations.

There are also a number of practical challenges relating to the use of carbon footprinting within health and social care. Footprinting methodologies developed in other sectors have not yet been adapted for health and social care. In particular, standardised 'emissions factors' (see glossary) for different units of care have yet to be established, meaning that to conduct a sufficiently robust footprinting exercise in health and social care sector can be restrictively time-consuming.

New methodologies may need to be developed within health economics. The sustainability agenda is about taking a broader view on costs. In the context of this review, the central issue is expanding from a focus on short-term financial costs to include a consideration of longer-term financial and environmental costs. This presents several challenges. Firstly, it requires currently external costs to be quantified and internalised. Increased budgetary integration – for example between health and social care – could help here by internalising some of the costs which were previously external and falling on other parts of the system. Secondly, it raises questions about appropriate discount rates to use in valuing future costs (and benefits) in the context of environmental effects. Work is needed to resolve these and other methodological challenges, as concluded by a recent review of economic evidence on health and climate change (109):

> *"There is an urgent need for climate change-specific health economic guidelines to ensure robust methods are used, giving comparable results"*

5.4 Conclusion: what needs to change?

Substantial changes are needed to develop an environmentally sustainable approach to health and social care. The changes needed include changes at the level of care pathways, processes and technologies; behavioural and cultural changes; and changes at the level of policy and system governance.

Some progress can be made by improving the efficiency of existing processes, technologies and facilities and minimising unnecessary resource use at the day-to-day operational level. Though necessary, this alone is unlikely to be sufficient. The scale of the environmental challenge demands a more fundamental transformation in the way we provide health and social care.

To a large extent, the transformation needed is the same as that called for on financial and quality grounds - the common problem being that existing delivery models often fail to provide effective, efficient support for people with chronic conditions. Services need to be redesigned to shift care upstream (where this makes sense in cost-effectiveness terms) and place greater emphasis on primary care, prevention and self-management. A more integrated system which provides well-coordinated support for people's multiple needs could be more sustainable from both an environmental and financial perspective. In this sense, environmental sustainability provides a new lens through which to view existing problems in the health and social care system, and a new way of assessing existing policy solutions:

> *"The carbon challenge is so demanding that it begs questions of the health service that make you go into a more open, questioning frame of mind where the innovation has to be transformational. And in trying to solve the carbon problem, you are then tantalisingly offered the potential to clear up ill health while you're at it"*
>
> Sustainability consultant

It is important not to overstate the overlap with other policy agendas, however. There are some things that need doing specifically for the purposes of promoting environmental sustainability, and it cannot always be

assumed that these will bring wider benefits. Nonetheless, the best approach to implementing such changes may often be to identify changes which are happening already – to services, buildings or people – rather than asking for new changes specifically on the grounds of sustainability.

Research will be needed to bring greater clarity on what changes are needed and how these can be implemented most effectively. It is to these research needs that this report now turns.

6 Research needs

The previous section described the wide-ranging changes needed to improve the environmental sustainability of health and social care. An implication of this breadth is that developing a research agenda to support these changes will not be straight-forward. It is beyond the scope of this review to systematically identify research gaps in all of the areas covered. The approach taken here is to use the framework described in the previous section (table 3) to give an overview of areas where research may be needed.

Table 4 describes the main areas in which research is needed. As before, we distinguish between research which is directly about environmental sustainability, versus research aiming to support the introduction of changes which could have an important but indirect impact (although in practice some research areas straddle this divide). In addition to the three areas taken from the framework used in the previous section, we add a fourth area covering research on future needs and pressures. This was necessary to capture research which is not about the nature of the changes needed, but rather the underlying challenges prompting these changes.

The remainder of this section describes what research may be needed in each of the areas given in table 4, taking into account the strength of the existing evidence base. Where possible we include specific suggestions for research identified during the literature review and expert interviews, but in general breadth has been prioritised over depth of detail. We also present the results of our Delphi exercise, which give some indication as to where particular effort needs to be invested. The results presented here are from the second, final stage of the Delphi exercise (results from stage one are provided in appendix 5). Research areas are given in the order of priority given to them by participants in the Delphi exercise, with the highest scoring first.

While this section provides an overview of the areas where research may be needed, the following section, chapter 7, indicates how research funders can use these findings to construct a programme of research to support environmental sustainability in health and social care, and discusses what the funding priorities should be.

	Research on innovative approaches to health and social care	Research on behaviours, attitudes and cultures	Systems-level and policy research	Research on future needs and pressures
Direct	• Co-benefits of sustainable approaches • Measuring environmental costs	• Barriers to change in organisations • Procurement & commissioning • Engaging professionals & the public • Building resilient communities	• Embedding sustainability in existing policies • Identifying policy levers to promote sustainability • Developing & evaluating metrics & methods	• Modelling risks to the system • Health impacts of environmental change
Indirect	• Prevention • Prescribing & medicines management • Cost-effectiveness research • Self-management	• Individual and community-level behaviour change • Creating 'learning organisations'	• Supporting preventative approaches • Encouraging a longer-term focus • Supporting integrated care	• Forecasts & scenarios for the future

Table 4. Framework summarising research needs for sustainable health and social care

6.1 Research on innovative approaches to health and social care

Participants in the Delphi exercise were asked what research on innovative approaches to health and social care should be funded first. Figure 4 shows the total scores received by each research area in this category. The highest scoring areas were research on prevention, co-benefits and measurement of environmental costs associated with health and social care.

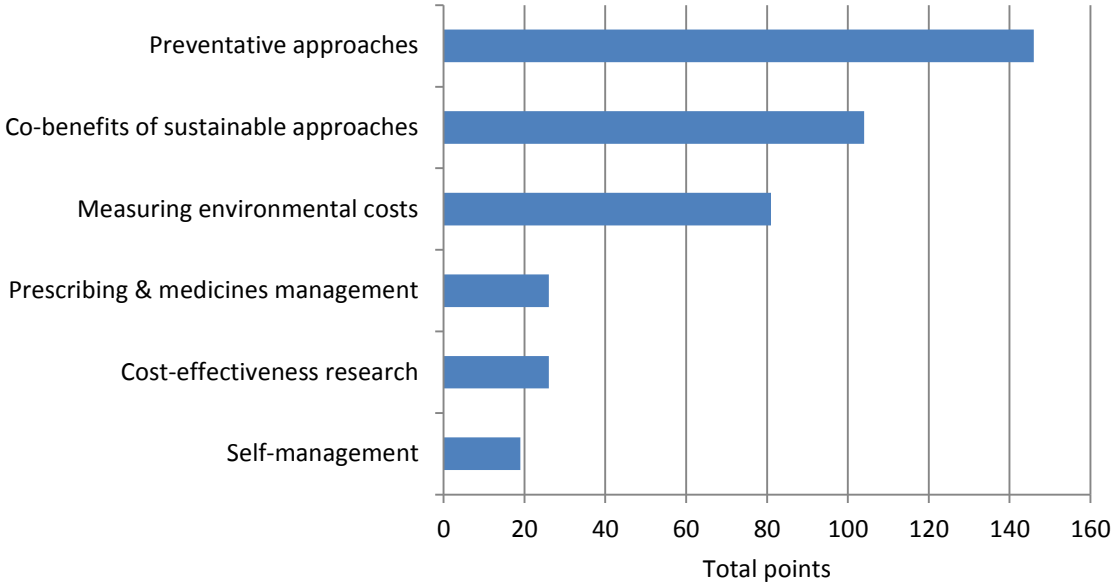

Figure 4. Priorities for research on innovative approaches to health and social care (Delphi exercise, stage two)

6.1.1 Prevention

Measuring the long-term cost-effectiveness of different preventative approaches that could reduce demand for health and social care - particularly in relation to long-term conditions

Research on prevention emerged as a clear priority in the Delphi exercise, and was also a major theme in the expert interviews. While there is an existing evidence base demonstrating the effectiveness of a range of preventative approaches in health and social care, the major scaling-up of preventative activities that is central to the concept of environmentally sustainable care would require considerable expansion of this evidence base. Given that long-term conditions are the driver for most activity in health and social care, evaluating means of preventing the onset and escalation of these should be the priority. As stressed in the previous section, from a sustainability perspective, the focus of preventative research should be on preventing avoidable consumption of health and social care resources.

Where possible research on prevention should measure success in terms of avoided environmental costs as well as financial cost savings, to establish whether successful preventative approaches actually translate into lower environmental impacts in practice. Particular research areas could include:

- The cost-effectiveness and return on investment delivered by preventative interventions
- Disparities in uptake of preventative interventions between different groups
- The role of mental health and social factors in generating and exacerbating physical illness – and the effectiveness of interventions to prevent this

6.1.2 Co-benefits of sustainable approaches

Measuring the win-wins or 'co-benefits' that may be gained through adopting more sustainable approaches (e.g. in terms of reduced service costs or improved public health or quality of care)

Section 4 made the case that while there are clear conceptual connections between environmental sustainability and other objectives in health and social care, the existing evidence-base is not always sufficient to indicate where and how these can be achieved in practice. Interviewees argued that further research in this area will be vital in giving decision-makers at all levels the evidence they need to justify and guide action on sustainability. The area was also rated highly by Delphi participants. More robust evidence will be needed on:

- Cost savings that can be achieved through adopting different sustainable approaches, to identify the 'low-hanging fruit' as well as longer-term opportunities. Our expert interviewees stressed that in order to give people the confidence to act, this would need to include real-life evaluations to demonstrate savings can be made in practice not just in theory. It will also need to include economic evaluation of adaptation measures.
- Health co-benefits of mitigation and adaptation strategies in health and social care. Including the health co-benefits related to active travel, dietary change and other sustainable approaches.
- Organisational co-benefits such as improved recruitment and staff retention by making organisations more attractive to existing and potential employees.

There are a number of interventions and approaches which could represent an improvement in terms of quality of care, cost and environmental sustainability, but where the evidence is not yet definitive - for example,

various forms of telecare or care closer to home. Further research is needed to test these hypotheses. Rather than funding studies to examine the environmental impacts in isolation, it may be more useful to fund comprehensive evaluations which include environmental impacts among measures of quality, costs and outcomes. For example, a study on the impact of telephone or email-based follow-up for chronic disease could assess impacts on patient empowerment, adherence to medication, quality of life and carbon emissions.

Our review found a number of specific areas where uncertainties remain in relation to the environmental, financial, and health co-benefits:

- Care closer to home / telecare - More evidence is needed to establish where these might deliver environmental and other benefits, and where they might be counter-productive
- Building design and technologies - Are environmentally sustainable buildings more or less expensive over their lifetime?
- Adaptation measures - It is important that the co-benefits of these are included in research, as there is very little evidence to date. Empirical data is needed to indicate which investments in terms of climate change adaptation would deliver the greatest returns.

There is some evidence from other sectors linking sustainability with financial performance (see section 4.2). Further research would be needed to explore the nature of this relationship and test whether it applies in health and social care.

Research may also be needed to explore the limits of co-benefits - to shed light on those areas where there may be tensions and conflicts between environmental sustainability and clinical best practice.

6.1.3 Measuring environmental costs

Measuring the environmental impact of particular care pathways, technologies, drugs & facilities, for example using carbon footprinting

Although evidence exists on the overall environmental impact of care, there is a need for finer-grained information on the impacts associated with specific care pathways, technologies, drugs and facilities. For example,

nephrology is the only clinical area where comprehensive carbon footprinting studies have been conducted to date, and our literature review found that very few health and social care organisations have calculated their carbon footprint using 'bottom-up' methods (see glossary).

Identifying the pathways which currently have the greatest environmental costs would allow for prioritisation of subsequent research and action. There may need to be further unpacking of the impacts associated with sources identified as key issues by the existing evidence - for example:

- A more detailed understanding of the impacts associated with specific pharmaceutical products to indicate where the biggest opportunities might lie
- Breaking down travel-related emissions according to particular types of care, e.g. GP visits versus outpatients
- Understanding the contribution of IT systems to direct energy use in buildings and whether this reduces the potential benefits to be made from investment in e-health

There is a particular dearth of evidence on environmental costs within social care. A carbon mapping exercise similar to that conducted for the NHS, distinguishing between emissions related to buildings, travel and procurement, would be a helpful first step. Developing a clearer understanding of the environmental impact associated with care homes and other social care facilities should be a particular priority.

A strategic approach will be needed to build up the evidence base on environmental costs – it will not be possible, for example, to conduct a full carbon footprinting exercise for every different care pathway. Instead, the aim should be to calculate the environmental costs of a comprehensive set of discrete modules of care. This could be done either in term of service units (e.g. a night in hospital, a blood test, one hour in theatre) or disease states (e.g. stable diabetes). The NHS Sustainable Development Unit has begun work in this area, calculating average carbon emissions associated with an inpatient admission or an outpatient appointment, but much more needs to be known (21). These modules could then be used to quickly build models for different pathways to inform real-life service development decisions.

There may be value in comparing how different types of provider compare in terms of their typical environmental footprint - for example, social care organisations versus health; independent sector providers versus public; mental health trusts versus acute trusts and so on. This could give

organisations a more tailored picture of where their key opportunities for improvement might lie.

In evaluating the sustainability implications of new interventions or service changes, research will need to take a comprehensive approach towards assessing environmental costs. For example, an alternative care pathway may reduce travel-related emissions, but have greater environmental costs overall if reduced travel is offset by greater use of medications or poorer clinical outcomes.

Research in this area will need to go beyond carbon emissions and also measure other forms of environmental impacts. For example, there may need to be further research to clarify the pathway through which chemicals from pharmaceutical products enter the natural environment.

6.1.4 Prescribing practices and medicines management

Evaluating innovative approaches towards improving prescribing practices and medicines management, to increase patient adherence and reduce wastage of pharmaceuticals

Large volumes of medicines are currently wasted as a result of inadequate stock management or inappropriate prescribing, and a high proportion of drugs are not taken as prescribed. There is some evidence that clinical support systems and shared decision making techniques could improve prescribing practices in the UK (110). However, most of the evidence is US-based. Implementation and evaluation of clinical support systems and shared decision making in the UK could help to reduce the considerable environmental impacts associated with inefficient use of pharmaceuticals. Other research that may help reduce these costs could include:

- Evaluating the carbon and cost saving of a different approach to prescribing in a complex disease
- Evaluating systems for alerting prescribers to the environmental footprints of different drugs, for example, a colour coding system - would this make any difference to prescribing patterns?
- Assessing whether returned medicines can be safely re-used, and whether 'use by' dates and rules are overly restrictive

There may be a need for collaboration between the health sector and the pharmaceutical industry, for example, to build a shared database of information on environmental impacts associated with different processes and products.

6.1.5 Cost-effectiveness research

Cost-effectiveness research to identify which services and interventions in health and social care are of highest value to patients, to help prioritise spending

Our understanding of what services and interventions in health and social care are most cost-effective is far from complete. Generic cost-effectiveness research which helps to prioritise spending and reduce low-value, wasteful activity can be seen as contributing towards improving environmental sustainability, on the grounds that wasted financial expenditure can - to an extent - be taken as a proxy for avoidable environmental damage.

To avoid the need to use financial cost as a proxy for environmental costs, in future cost-effectiveness studies should increasingly be based on full costs, including currently externalised environmental costs. This calls for a redefinition of the concept of cost-effectiveness, moving away from a narrow conception of cost-effectiveness based on immediate financial costs. Ideally, measures of environmental cost would be included in generic cost-effectiveness research, rather than being funded separately.

Research is needed not only to identify which interventions are the most cost-effective, but also to elucidate the processes that determine whether or not these interventions are made available in practice. Research on clinical and practice variations needs to be a part of this, as this can serve as a useful means of identifying sub-optimal practice where the most cost-effective approaches are not being adhered to (111).

6.1.6 Self-management

Evaluating self-management tools and programmes that reduce demand for formal care

Further research is needed to establish how self-management approaches can be best used to reduce demand for formal care, and whether this translates into reductions in environmental impacts. A recent review of the evidence on self-management concluded that it "has the potential to alleviate the pressure on health and social services" but that "implementing one off interventions is unlikely to make a significant impact on the overall health of the population or on the sustainability of health and social care systems" (92). Research may therefore need to move from a focus on individual self-management tools to one which examines self-management as part of wider and ongoing transformation of the relationship between caregivers and service users into a more collaborative partnership. Research may also be needed to answer the following questions:

- What attitudes do professionals and service users have towards self-management, for example regarding the acceptability of less formal approaches to care?
- What training or support do professionals need in order to be able to enable people to look after their own conditions effectively?
- What works in supporting older people to have healthier, more independent lives?

Ability to self-manage can be severely impaired by the presence of co-morbid mental health and psychological problems, which are highly common among people with long-term conditions (112). There is a need for more research on how people with co-morbidities and complex needs can be supported to manage their own condition successfully.

6.2 Research on behaviours, attitudes and cultures

Participants in the Delphi exercise were asked what research on behaviours, attitudes and cultures should be funded first. Figure 5 shows the total scores received by each research area in this category. The highest scoring areas included research on barriers to change, and the use of procurement and commissioning processes to drive sustainability.

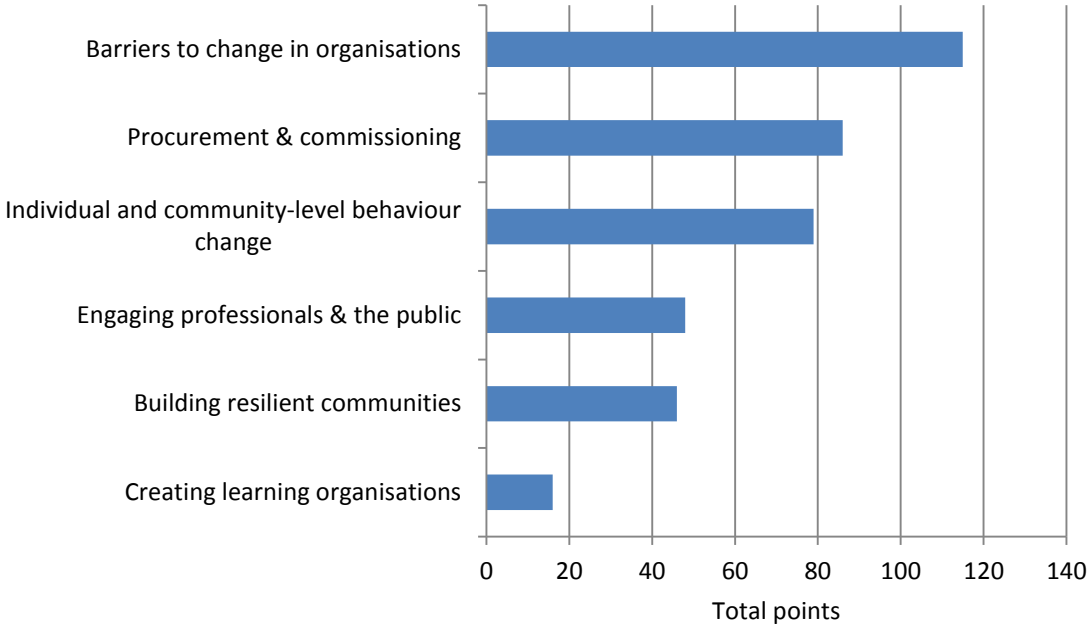

Figure 5. Priorities for research on behaviours, attitudes and cultures (Delphi exercise, stage two)

6.2.1 Barriers to change in organisations

Understanding the political, financial and cultural barriers and interests that shape how health and social care organisations (and their suppliers) respond to the sustainability agenda

A strong message from interviewees was that while there is already good evidence indicating that certain approaches could be more sustainable, there is poorer understanding of what *prevents* these approaches from being implemented in practice. Research aiming to understand the barriers within organisations was given a high level of priority by Delphi participants.

Research in this area would aim to strengthen our understanding of how the structures and processes within health and social care organisations lead to staff adopting (un)sustainable behaviours - the dynamics of how different types of organisations respond to the sustainability agenda. For example, one study found that a number of political, social and functional pressures in local authorities affected the uptake of sustainable practices (113). Further research in this area, drawing out lessons from leading

organisations, including those from other sectors and businesses, could help in devising strategies for overcoming the barriers.

6.2.2 Procurement and commissioning

Understanding how health and social care organisations can use procurement and commissioning processes to drive improvements in their supply chain and service providers

Little research has been conducted to understand how health and social care organisations can use procurement and commissioning processes to drive improved environmental performance in their supply chain and service providers. The high level of importance given to this by Delphi respondents reflects the significant contribution made by procured goods to the environmental impact of the health and social care sector, as well as the importance placed on commissioning as a driver of change by current policy. There are a number of questions that it may be useful to explore, including:

- Is outcome-orientated commissioning effective in driving more sustainable practices?Do suppliers know what the health and social care sector wants in terms of environmental sustainability? What would they need from clients in order to develop more sustainable products and services?
- What barriers do suppliers face in developing more sustainable products?
- How does the structure of the supplier market affect capacity to respond to signals from commissioners/procurers - for example, do small suppliers find it more or less difficult to adopt sustainable practices?
- Can commissioners successfully use social impact bonds to reward providers for long-term improvement on environmental outcomes?
- What are the sustainability implications of centralised versus localised procurement of different goods and services?

A number of tools have been developed to support procurement or commissioning, for example, the NHS Sustainable Development Unit's Procuring for Carbon Reduction tool. Evaluation of these tools could be a useful research objective.

6.2.3 Individual and community-level behaviour change

Measuring the effectiveness of behaviour change strategies at the individual and community level to promote healthier behaviours in the population

There has been a significant amount of research conducted on behaviour-change strategies to promote healthy behaviours, but gaps in the evidence-base remain (114). Crucially, research is needed to assess whether improved health-related behaviours translate into lower lifetime use of health and social care, and thereby lead to reductions in the environmental impacts of care.

In the context of environmental sustainability, it may be particularly useful to evaluate the effectiveness of interventions to encourage behaviours which could in themselves have a dual health and environmental benefit, such as walking/cycling rather than using motorised transport.

Research could also assess the effectiveness of behaviour change strategies at the community level, for example, examining whether it is possible to build health-promoting communities through strengthening social networks and cohesion, and the role of social care in this.

6.2.4 Engaging professionals and members of the public

Understanding how to engage professionals and members of the public with the issue of environmental sustainability in health and social care, and what skills they would need to become involved

A World Health Organisation review of global research priorities on health and climate change identified developing a better understanding of how to engage decision-makers and the general public in climate change issues as a key priority (115). Existing research suggests that communications around climate change typically tend towards alarmism and/or defeatism, which may not be the most effective way of engaging the public (116).

In organisations, research highlights the importance of engaging senior leadership as well as staff at all levels, but does not provide clear evidence on how this can be done most effectively within health and social care. A better understanding of what motivates and empowers professionals to engage and take leadership roles in relation to sustainability is needed. Particular questions which may benefit from further research include:

- What are the existing attitudes of staff towards environmental externalities and the concept of sustainable care - including staff in independent sector providers?
- What incentive structures would promote engagement?
- How can we engage professionals with adaptation – how can it be made to resonate with them?
- What are the training needs for staff to give them the necessary skills?

There is also a need for greater understanding of how service users and members of the public can be engaged with the sorts of changes required to develop a more sustainable approach to health and social care. This is particularly important where they will be acting as service commissioners themselves under direct payment systems. A review of sustainable social care concluded that a key priority for research should be to examine how to engage service users with the notion that their purchasing decisions impact on the sustainability of the services they use (48). A better understanding will be needed of what informs service users' choices under direct payment systems, and what would encourage them to include environmental sustainability in that decision-making process.

To support efforts at engaging the general public in sustainable health and social care, research may be needed to explore public perceptions of the health risks of climate change, and the acceptability of adaptive responses in the health and social care system (117).

6.2.5 Building resilient communities

Understanding how to build resilient communities which are more able to withstand the health impacts of environmental change, for example through strengthening social networks and cohesion

Research could explore what approaches can be used to strengthen the resilience of communities to the health and social effects of environmental change, for example, the social and mental health effects of flooding. This could include action research with communities. The role of social care and

third sector organisations in building capacity and resilience could be a particularly useful issue to explore.

There are a number of social movements, such as the 'Transition Towns' initiative, which aim to build community resilience to environmental change. Research could be conducted to evaluate the impact of these on levels of health and social care needs. A related question is whether people in such communities are more engaged in efforts to improve the sustainability of health and social care services in their local area.

6.2.6 Creating learning organisations

Understanding how to develop a learning culture within health and social care organisations which encourages experimentation and sees responsibility for innovation and resource use being devolved closer to the frontline

There is some research which suggests that organisations with decentralised decision-making processes, strong internal connectedness and communication, and a culture of permitting and learning from experimentation and innovation are more likely to successfully adopt environmentally sustainable approaches to their business. Further research would be needed to:

- Confirm whether this is true in the health and social care sector
- Assess the extent to which these enabling conditions are currently present in health and social care organisations
- Understand how health and social care organisations can implement this way of working
- Examine whether specific tools such as service line management can be used to devolve responsibility for resource use and make staff more resource conscious - and importantly, whether this would lead to behaviour change with respect to sustainability.

6.3 Systems-level and policy research

Participants in the Delphi exercise were asked what systems-level and policy research should be funded first. Figure 6 shows the total scores received by each research area in this category. The highest scoring areas included research aiming to understand how existing policy objectives can be delivered in a sustainable way, and what policy levers can be used to promote the adoption of more environmentally sustainable approaches.

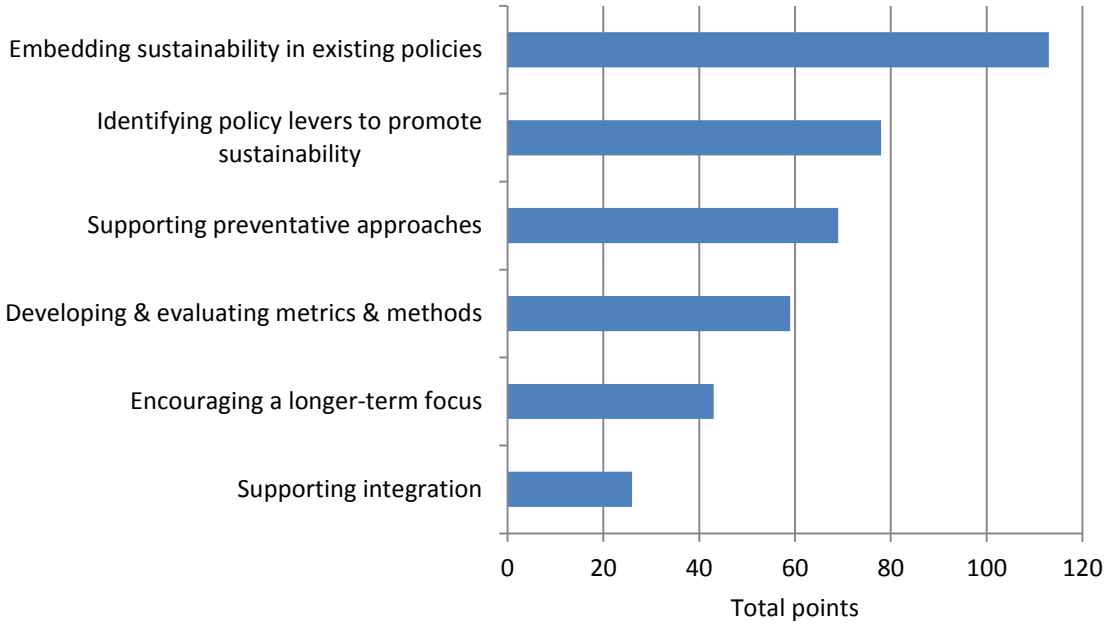

Figure 6. Priorities for systems-level and policy research (Delphi exercise, stage two)

6.3.1 Embedding sustainability within existing policies

Understanding how existing policies can be delivered in a sustainable way, such as personalisation and enablement in social care; integration of health and social care; or delivering care closer to home

A clear message from our review was that while there are multiple potential points of congruence between environmental sustainability and other policy objectives, in practice existing policies could have a positive or negative

impact on sustainability, depending on how they are designed and implemented. There will inevitably be tensions and areas where environmental sustainability and other policy objectives come into conflict. The results of the Delphi exercise indicate that there may be particular value in conducting research which assesses the sustainability implications of existing policies (e.g. personalisation), and which indicates how wider policy goals can be achieved in the most sustainable way.

An important aspect of this would be developing a clearer understanding of the drivers for sustainability in the reformed health and social care system - something frequently discussed by interview participants. There is a need for further examination of the risks and opportunities associated with the reforms with respect to environmental sustainability. Key uncertainties include:

- Will shifting the commissioning function to clinical commissioning groups encourage the development of more environmentally sustainable care pathways?
- Can health and wellbeing boards use sustainability as a guiding principle in putting together their health and wellbeing strategies and holding local commissioners to account?
- Will devolving financial control to more local units make it harder for commissioners to take a more global view of efficiency? How can they be encouraged and incentivised to take a broader economic view?
- How can the new outcomes frameworks be used to drive sustainable models of care?

6.3.2 Policy levers to encourage sustainable approaches

Understanding what policy levers and changes at the national level would help drive sustainable approaches across the system e.g. the role of financial incentives, regulatory approaches, targets, or lower barriers to new entrants

In creating a national policy framework that supports the adoption of sustainable approaches, more needs to be known about how the various policy levers available could be used to maximum effect. Policy research could address a number of questions, including:

- What form of financial incentives would be most effective? For example, would it be better to internalise environmental costs within PbR tariffs, or to construct a separate charging mechanism (e.g. an NHS carbon trading system)? How large would the incentive have to be for organisations to respond to it?

- Could alternative payment mechanisms e.g. capitated budgets create more effective incentives for sustainability?
- What role could regulatory approaches, NICE guidelines and/or targets play?
- Could transparent public reporting of environmental performance be used as a driver for improvement?
- How are incentives and regulations created at the macro level interpreted and made real in practice?
- What new financing vehicles could be used to make investment in green technologies deliver more feasible?
- How else can the uptake of green technologies be encouraged e.g. by innovation hubs?

There may also be a need for research on the impact that wider environmental policy levers - for example the CRC Energy Efficiency Scheme - are having on organisations in the health and social care sector.

6.3.3 Supporting preventative approaches

Understanding what system-level changes would support the implementation of a more upstream, preventative approach to health and social care

Although there has been a significant evidence base on certain forms of prevention for some time, limited progress has been made in shifting to a more upstream, preventative model of care. This raises the question of why greater progress has not been made, and what systemic changes are needed to allow prevention to be implemented more consistently. Interviewees suggested that answering this question could involve research of various forms, such as a political economy analysis exploring what ideas drive existing patterns of behaviour and whose interests are challenged by a shift to a more preventative system.

6.3.4 Metrics and methods

Developing and evaluating metrics and methods for use in research, audit and governance, for example, carbon footprinting tools or innovative health economic methods

An early priority should be the development of measures and metrics for environmental sustainability, since these will need to underpin other research activities. Although this was not among the highest scoring areas in the Delphi exercise, our analysis of the published literature and expert interviews made it clear that work on this is vital and will need to precede several of the other areas of research described.

There are currently a range of metrics available for environmental impact, with significant discrepancies between calculations based on different methods. A greater consensus is needed on which are most suitable for the health and social care sector. Tools developed in other sectors need adapting and refining so that they can be applied easily within health and social care without compromising on accuracy, for example through calculating emissions factors for units of care (see section 5.3.2).

There is a role for research in developing and evaluating these tools and metrics. Greater academic assessment of the range of approaches available could be valuable. It would be useful to know whether the differences between them are large enough to lead to different actions being prioritised if they were applied in practice.

Methods of assessing comprehensive environmental impact are needed - rather than evaluating the impact of service changes on travel, medication use and so on separately. There is also a need for development of new health economic methods which can internalise environmental costs within economic analyses, and for exploration of ways of embedding these methods and tools within standard managerial and regulatory processes. For example, there is ongoing work funded by NICE to develop methodologies to enable carbon emissions to be included in NICE guidelines.

There is little existing work on metrics for adaptation. Further development of these will be needed in order to quantify and monetise returns from investment in adaptation measures.

6.3.5 Encouraging a longer-term focus

Understanding what system-level changes would support health and social care organisations in taking a longer-term focus in planning and decision-making

Several interview participants argued that a powerful barrier to environmental sustainability is that fundamental system characteristics make it difficult for health and social care organisations to operate with a view to achieving long-term goals rather than meeting short-term imperatives. However, there was not a clear consensus on exactly which characteristics create this situation. Hypotheses included a politicised operating environment for health and social care organisations, a lack of coordination between different parts of the system, and constraints imposed by budgetary processes (see section 5.3.1).

There may be a role for research in clarifying what system-level changes would support health and social care organisations in taking a longer-term focus. Some participants identified the creation of the independent NHS Commissioning Board as something which could potentially support longer-term planning with less political influence. Research could aim to explore the extent to which the NHS Commissioning Board is able to operate in this way, and what would support it in doing so.

6.3.6 Supporting integration

Understanding what system-level changes would support the development of more integrated care with closer working between different parts of the system e.g. health and social care

Developing more integrated models of care was seen by several expert interviewees as being a central component of a more environmentally sustainable system. Some Delphi respondents suggested that the relatively low score given to this in the Delphi exercise may reflect uncertainty as to whether integration is an issue that requires further research, or if it is more an issue of developing the right set of policy levers to drive it.

However, others suggested that research may be needed to examine whether integrated models of care could be more environmentally

sustainable, and what systemic changes are needed to allow integration to be implemented more consistently. A recent review highlighted a number of policy barriers including a lack of sophistication in policy on competition and choice, the focus within foundation trusts on expanding acute activity, and perverse incentives associated with the PbR payment system (118). IT infrastructures can be another significant barrier where further research may be beneficial.

The interface between health and local government was identified in our review as a priority for research and an area where significant opportunities could exist, particularly in the context of the shift of the public health function to local authorities. Research here could examine how improvements in this interface could affect environmental outcomes.

6.4 Research on future needs and pressures

Participants in the Delphi exercise were asked what research on future needs and pressures should be funded first. Figure 7 shows the total scores received by each research area in this category.

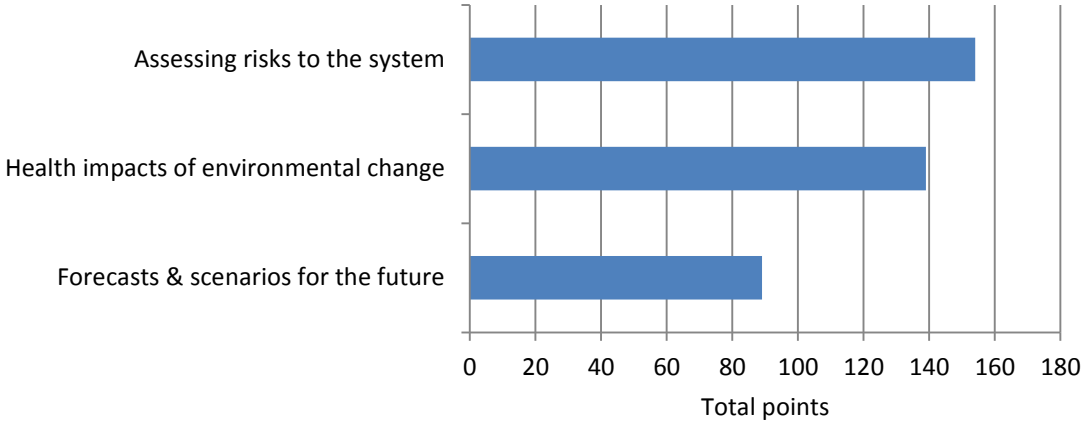

Figure 7. Priorities for research on future needs and pressures (Delphi exercise, stage two)

6.4.1 Assessing the risks facing the system

Assessing the risks to the health and social care system posed by environmental change e.g. in terms of the resilience of facilities, systems, supply chains and the workforce to floods, droughts and heat-waves

Environmental change presents a number of risks to health and social care services, in terms of system resilience to climatic changes and adverse weather events, increased scarcity of natural resources, and associated increases in prices (e.g. for energy – see section 3.3). Some efforts have been made to examine the risks involved, for example:

- The London Climate Change Partnership has assessed what proportion of facilities in London are vulnerable to river flooding and other risks (34).
- As part of an ongoing series of climate change risk assessments, the Department for Environment, Food and Rural Affairs has commissioned a study on adaptation in the public sector, which includes a small sample of NHS organisations.

In addition to these, the *Adaptation and Resilience to a Changing Climate* programme funded by the Engineering and Physical Sciences Research Council includes two projects focusing on the resilience of health and social care:

- The *Design and Delivery of Robust Hospital Environments in a Changing Climate (DeDeRHECC)* project at Cambridge University is examining how NHS estate can be made more resilient while meeting agreed emissions targets.
- The *Built Infrastructure for Older People's Care in Conditions of Climate Change (BIOPICCC)* project at Durham and Heriot-Watt universities focuses on the resilience of wider infrastructure and systems supporting care for older people.

While some research in this area is underway, more comprehensive assessment of the risks to the health and social care sector may be needed in order to establish how resilient current facilities, systems, infrastructures and care processes are, and how these can be made more resilient. There is a particular lack of research conducted on the potential consequences on service delivery of raised prices for energy and natural resources.

6.4.2 Health impacts of environmental change

Establishing how health and social care needs will be affected by environmental change, and which population groups will be most vulnerable

The Department of Health has already commissioned reviews of the evidence on the possible health impacts of climate change in the UK (5) and other studies have taken a global perspective on this (27). However, many uncertainties remain and further epidemiologic research will be needed to elucidate the pathways through which environmental change may affect health, and to develop more precise estimates of the magnitude of health impacts predicted under various climate and socioeconomic scenarios. At the international level, the World Health Organisation is coordinating ongoing research examining the predicted impacts in a number of countries.

The potential for environmental change to exacerbate health inequalities will need further assessment. There are unanswered questions regarding which population groups, geographic areas or service types will be most vulnerable to health impacts of environmental change. A better understanding of the social processes that shape vulnerability, and how these interact with geographies and infrastructure, will be needed (29).

There will also be a need for research on system responses to these impacts. For example, it is not clear how effective heat wave early warning systems are, or whether they correctly identify the most vulnerable people. The optimal level of adaptation depends on societal risk thresholds – i.e. how much we are willing to invest in order to develop health-sector responses to events which will occur with a certain level of probability. These risk thresholds could be measured using discrete choice experiments. Research could also explore ways of engaging the public in decision-making around these issues.

Societal responses to environmental change may themselves have health impacts. The World Health Organisation review of global research priorities on the health impacts of climate change concluded that a major priority for further research should be conducting health impact assessments of mitigation and adaptation measures, such as carbon capture and sequestration, or increased use of biofuels (115) - something which several of our interview participants agreed with. Some have suggested that a shift to lower carbon lifestyles could be healthier and lead to reduced need for

health and social care. Research to test this hypothesis could be highly valuable in understanding future needs.

6.4.3 Forecasts and scenarios for the future

Developing forecasts and scenarios for what sorts of needs and preferences patients in future decades might have, what society might look like, and how health and social care systems might need to respond to these changes

Most of the possible research areas discussed above are rooted in a perspective in which we take the current system and examine how it needs to be transformed. An alternative approach would be to start by articulating a vision of what health and social care might need to look like in the future – for example, a carbon neutral health and social care system in the year 2050 – and to work backwards to establish what changes are needed. If this approach were taken, research could take the form of forecasts and scenarios which attempt to characterise the patient of the future, and the needs and preferences they will hold.

Research in this area will need to consider the interaction between environmental and demographic change. Environmental change will take place against the backdrop of an aging population, and this context is likely to have a number of implications for sustainable service delivery. Models of care will need to be sustainable with regard to both of these sets of changes.

One possibility suggested by an interview participant would be to articulate radically different models for health and social care in 2050 and then to implement these approaches in different local areas and evaluate their effects. A Delphi participant suggested that research in this area would best be commissioned and conducted as part of a wider exercise not specific to the health and social care sector.

7 Key messages for research funders

The sustainability agenda is increasing in importance in the health and social care sector, and the research community needs to be able to respond to this. A growing number of managers and professionals are introducing changes to the way health and social care services are provided, and there is a need for rigorous evaluation of this innovative activity to guide further developments. Investing research money will itself provide a form of leadership that sends a signal that environmental sustainability is something the health and social care sector should be taking seriously.

Building the evidence base will require a dual approach which includes commissioning research explicitly focused on environmental sustainability, while also exploiting opportunities for existing research programmes to create relevant knowledge. There are close conceptual connections between sustainability and other system goals, notably productivity, prevention and integration, and if the right approach is taken to funding and conducting research there are opportunities to serve multiple objectives simultaneously.

A co-ordinated research strategy is needed which brings together research at a number of levels:

- Service and delivery research
- Public health and epidemiological research
- Health technology assessment
- Clinical research
- Policy research

Table 2 in section 6 provides a framework which can be used to map out the research needs in different areas. The aim should be to conduct research at these different levels which is mutually supportive and which enables a system-wide response to the sustainability challenge.

Research on some subjects will require collaboration between health, environmental and meteorological researchers, and with co-ordinating bodies such as the UK Climate Impacts Programme at the University of Oxford.

7.1 What are the priorities?

It should be stressed that research in all of the areas described in section 6 could help support the development of a more environmentally sustainable approach to health and social care. However, given the breadth of the areas covered there is a need to indicate which of these should be given particular priority as part of a programme of research on environmentally sustainable health and social care.

The following assessment draws in part on the results of the Delphi exercise presented in section 6, but is also informed by the other stages of the review. For example, where interviewees stressed the importance of a particular research issue, we have taken this into account. This high-level overview of the research priorities should be read in conjunction with the relevant sub-sections of chapter 6, which provide more detailed and specific proposals:

- **Developing a more detailed understanding of the scale of the problem should be a major priority**. This will include measuring the environmental costs associated with health and social care (section 6.1.3), and assessing the impact of environmental change on future care needs and services (section 6.4.2). A cost-effective approach towards the former would be to calculate the environmental costs of a comprehensive set of discrete modules of care, which could then be used to quickly build models for different pathways. In order to support this research **there is an immediate need for development and evaluation of metrics and methods** for assessing environmental costs in health and social care (section 6.3.4).

- A strong message from our review is that research should be focused on implementation and made of practical relevance to service delivery and policy issues. **Research on the co-benefits of sustainable approaches is likely to have the largest impact in terms of supporting professionals** to implement change (section 6.1.2). Robust measurement of the financial returns on investments in sustainable approaches will be a key part in this. Also important in supporting implementation will be research on the individual, organisational and systemic barriers to change (section 6.2.1), and research aiming to assess the environmental impact of other policies and to identify how existing policy goals can be delivered in the most sustainable way (section 6.3.1).

- The research that is needed will not always be research about environmental sustainability per se. There are a number of important areas where reduced environmental impact can be considered a secondary benefit. Key among these is **research on prevention**, which emerged as a major priority throughout all stages of our review (sections 6.1.1 and 6.3.3). From a sustainability perspective, the key task for research is to assess whether preventative approaches can reduce demand for

formal care, and thereby lessen associated environmental impacts. Work in this area could include research on behaviour change (section 6.2.3) and on self-management as a form of tertiary prevention (section 6.1.6).

- There is a need for a greater understanding of **how procurement and commissioning processes can be used to drive sustainable practices** in supply chains and service providers (section 6.2.2).

- Research on **medicines management and prescribing practices** aiming to reduce inefficient or wasteful use of pharmaceuticals should be a priority, given the significant environmental impact of these

- In addition to funding specific research projects, **sustainability should be treated as a dimension of quality akin to access or equity** in wider research. In particular, assessments of the cost-effectiveness of new technologies, interventions or care pathways should increasingly aim to quantify environmental costs and include these within the analysis (see section 6.1.5). Similarly, evaluation of demand management tools could include environmental costs as an outcome measure.

Although more selective than the full breadth of research areas described in section 6, this list still contains a wide range of possible areas for enquiry. To help focus these further we have mapped out what we consider to be the most important specific questions for research to answer over the short-, medium- and long-term (see table 5). This table is intended to support the translation of the above list into a more coherent programme of research, indicating how this might be sequenced over time.

Although table 5 distinguishes between short-, medium- and long-term priorities, we would suggest that in practice this distinction should be treated with a degree of caution. There will be inter-dependencies between several research areas, and in some cases a parallel approach will be needed. The table should not be interpreted as implying that questions for the longer-term can be deferred significantly, and is meant as an indicative planning tool rather than as a definitive solution.

Table 5. A timeline for research on sustainable health and social care, indicting the key questions for research to answer in the short-, medium- and long-term.

	Research on innovative approaches to health and social care	Research on behaviours, attitudes & cultures	Systems-level & policy research	Future needs & pressures
Short-term – developing the methods & establishing baseline information	• What are the environmental costs and benefits associated with individual units of care and/or disease states? • Which care pathways, drugs, technologies etc. have the greatest environmental impacts? • What is the overall environmental impact of social care?	• What are existing attitudes towards environmental sustainability in health & social care among staff, patients and the public, and other stakeholder groups?	• What are the most appropriate metrics for environmental sustainability in health & social care ? • How can economic methods incorporate longer term costs and benefits most appropriately?	
Medium-term – comprehensive assessment of the challenge and potential solutions - including the health and healthcare system co-benefits	• Which interventions can deliver a rapid financial return-on-investment while reducing environmental impacts? • What are the health and quality co-benefits of sustainable approaches? • Can preventative approaches reduce lifetime demand for care and associated environmental impacts? • How can wasteful/ineffective use of pharmaceuticals be reduced?	• How can procurement & commissioning processes be used to drive sustainable practices? • What factors within organisations facilitate good environmental performance? • How can staff and other stakeholders be engaged in the environmental sustainability of care, and what skills would they need to do so?	• How can existing policy goals be delivered in a sustainable way? • What are the policy enablers & barriers to environmental sustainability in the health & social care system? • Can more consistent & transparent reporting help promote sustainable practices?	• How will the health impacts of climate change fall across the population - will it exacerbate health inequalities, and how will it interact with demographic change? • How will environmental changes impact on service delivery at the operational level? • How will higher prices for fossil fuels and other natural resources affect health needs and service delivery models?
Long-term – looking ahead & mainstreaming sustainability within standard research	• How can environmental costs & benefits be included as an outcome measure as a matter of course in evaluation of health and social care interventions & technologies	• What role can the health and social care sector play in strengthening community resilience to the health effects of environmental change		• What might the health impacts of societal responses to climate change (e.g. mitigation and adaptation measures) be? • Could a radically lower-carbon society be healthier?

7.2 What approach should be taken towards funding research on sustainable health and social care?

The line of argument developed above suggests that the research funding community needs to see sustainable health and social care not as an 'environmental' issue, but as being core to many research areas. Funders of all kinds need a clear understanding of what sustainable development is and how it impacts on their research programmes.

On the basis of our review, we would recommend that research funders within health and social care:

- Actively exploit the synergies between environmental sustainability and other objectives. For example, if commissioning research on behaviour change, encourage applicants to consider behaviours which may have environmental as well as health benefits, and to include an assessment of these multiple benefits.

- Take a rounded approach to sustainability, including adaptation as well as mitigation, and recognising the intimate connections between the financial, environmental and social aspects of sustainability. Although undoubtedly important, climate change mitigation should not be the sole objective of research in this area.

- Collaborate with research funders in other countries and other sectors of the economy. Sustainability is an international and pan-sectoral challenge, and solutions developed elsewhere and in other industries may be transferable. International comparative work may shed light on the range of approaches taken, for example by providing examples of more preventative, integrated or localised systems.

- Fund research using a range of methodologies and encourage an inter-disciplinary approach. There is a need for further thinking about how complex interventions and systems-level changes can be evaluated.

- Encourage researchers to conduct research in a way that is itself environmentally sustainable. The National Institute for Health Research Carbon Reduction Guidelines provide advice on how this can be done.

Health and social care are 'high churn' environments, and much can be achieved by working with the natural cycle of change and renewal, rather than adding to it. One useful approach towards building an evidence base around sustainable health and social care may therefore be to focus on changes which are happening already – for example, to services, buildings or people – and explore the sustainability implications and opportunities arising from these.

It is worth noting that while research can go some way in developing solutions to the sustainability challenge, in practice it is unlikely to deliver all the answers. Part of the role of research will not be about developing the solutions so much as generating knowledge that enables others working in the system to experiment and develop solutions.

7.3 Health versus social care - do the research needs differ?

To a large extent the research needed in social care will be similar to that needed in health. We asked participants in our Delphi exercise to suggest how the research needs might differ between the two, but responses to this question more often highlighted the value in taking an integrated approach:

"I think that as they are so closely linked, it would be better to look for research synergies between social and healthcare."

Postdoctoral research fellow

Care pathways frequently straddle health and social care, with an increasing blurring of role boundaries. Research needs to reflect this, for example by assessing environmental costs across integrated care pathways. Similarly, research on prevention needs to assess prevention of health and social care needs together.

There may, however, be differences in emphasis. Findings from the Local Government Information Unit's sustainable social care learning network indicate that particular priority areas for research within social care might include: engaging service users in environmental sustainability; adaptation to environmental change; environmental measures in care homes and other facilities; and commissioning sustainable services (107). The results of our review broadly confirm the importance of these areas. The role of social care professionals in protecting the vulnerable suggests there could be a particular affinity with the issue of adaptation to environmental changes, and with research examining how vulnerable communities can be protected from the health and social effects of these changes.

The increasing shift of care provision away from institutional settings indicates that attempts to develop a more sustainable health and social care

system will need to happen in tandem with efforts to build more sustainable communities. Research on how to do this successfully - how to engage individuals and communities in the kinds of change required to develop a more sustainable approach towards health and social care - will be of particular pertinence to the social care sector, and to local authorities more broadly.

There is a general need for a better understanding of the sources of environmental impacts associated with social care. Travel-related impacts might be proportionately higher than in health care given the peripatetic nature of much social care work. Conversely, procurement might account for less of the total environmental costs, as much of the procurement-related carbon footprint in the NHS is driven by the use of pharmaceuticals. However, social care professionals can support more efficient use of pharmaceuticals in the health sector through the care and self-management advice they provide to clients, illustrating that the attribution of emissions to either the health or social care sector may not be helpful.

Existing policy objectives within social care could have important implications for environmental sustainability. There is a risk that personalisation could make it more difficult to build in sustainability criteria when procuring services. Alternatively it could mean that the focus of our attention in attempting to improve sustainability simply needs to shift from organisations to individuals. Existing studies have stressed the importance of conducting further research on this (48).

There may also be differences in emphasis in terms of what specific projects might need to be funded within each research area. For example, from a social care perspective it could be particularly useful to focus on older people when researching behaviour change and community development, as well as on the evolving needs and expectations of the next generation of older people.

An important difference alluded to above is that the evidence base on environmental sustainability in social care is generally less well developed than within health care. We found a limited amount of published research evidence relating to the environmental impacts of social care, or the impact of environmental change on social care needs. Building up this evidence base should therefore be a priority.

Despite these differences in emphasis our overall message is that a collaborative approach is needed. The benefits of investment in research will not always accrue to a single sector. In the main, these are inter-disciplinary research issues – and need to be funded accordingly.

8 Conclusions

This study has reviewed the existing evidence regarding environmental sustainability in health and social care, and explored what further research is needed. On the basis of the review, several high-level conclusions can be drawn:

- The health and social care system has a considerable impact on the natural environment
- Predicted environmental changes, including the multiple effects of climate change and depletion of natural resources such as fossil fuels and water, are likely to affect health and social care needs in the UK, and will also have direct operational consequences for service provision
- Reducing the environmental impact of health and social care in line with wider policy aspirations regarding climate change mitigation will require substantial changes at a number of levels, including innovation in terms of how and where care is delivered; behavioural changes among staff, patients, and the public; and changes at the level of policy and systems governance
- Changes may also be needed to ensure the system is resilient to anticipated environmental changes
- There are close conceptual connections between environmental sustainability and other policy objectives in health and social care, and emerging evidence that some of the changes recommended on sustainability grounds could also help to improve public health, quality of care and/or productivity.

An increasing volume of research has been published, particularly in the last five years, which adds detail to these high-level statements. However, much remains unknown or unproven. For example, while there appears to be a number of opportunities to improve environmental sustainability while also achieving other system goals, the size and scope of these co-benefits requires further exploration, as do the potential tensions that can be expected to arise when competing goals cannot be mutually satisfied.

This review has described how a coordinated programme of research could be developed to address these gaps in the knowledge base. Such a programme could play a critical role in supporting the development of more environmentally sustainable approaches to health and social care.

8.1 Limitations of the review

The scoping review was conducted as a relatively rapid exercise aiming to provide a starting point for future research in this area, by mapping the existing evidence base and capturing stakeholder views on what further research is needed. The review of the literature followed a systematic process but cannot claim to be exhaustive in its coverage. In particular, we are aware that there may be ongoing, as-yet-unpublished pieces of research not described here.

The stakeholder interviews included a wide range of professions and perspectives, but neither these nor the Delphi exercise were intended to provide a definitive view on what the priorities for future research and development should be. Nonetheless, the high degree of concurrence between participants on the importance of certain issues indicates that it is possible to outline the main components of what a programme of research on environmental sustainability in health and social care would need to include.

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Appendix 1 - Overview of literature

Authors	Year	Title	Article type	Country	Main focus of article	Aspect of sustainability
Achour; Price	2010	Resilience strategies of healthcare facilities: present and future	Review	International	Facilities design	Adaptation & resilience
ATKearney	2009	'Green' Winners: The Performance of Sustainability-Focused Companies during the Financial Crisis	Empirical	USA	Relationship between environmental and financial performance	Multiple
Ball A	2005	Environmental accounting and change in UK local government	Empirical	UK	Social care/local government	Multiple
Barrett J;Jenkin N;	2004	Material health : a mass balance and ecological footprint analysis of the NHS in England and Wales	Empirical	UK	Measuring environmental impacts	Multiple
Blashki G, Armstrong G, Berry HL et al.	2011	Preparing health services for climate change in Australia.	Review	Australia	Impact on health and social care needs	Adaptation & resilience
Bond	2009	Tackling climate change close to home : mobile breast screening as a model	Empirical	UK	Clinical service design	Carbon emissions
Bradshaw, Sillett, Walker	2010	Independence, community and environment: final report of the Sustainable Social Care Learning Network	Empirical	UK	Social care/local government	Multiple
Brockway P	2009	Carbon measurement in the NHS. Calculating the first consumption-based total carbon footprint of an NHS Trust.	Empirical	UK	Measuring environmental impacts	Carbon emissions
Brockway P;	2010	NHS at forefront of carbon modelling	Empirical	UK	Measuring environmental impacts	Carbon emissions
Cannaby S	2010	Delivering the climate change agenda: is the NHS ready?	Report	UK	Behavioural & systems change	Carbon emissions
Claude V;	2000	Towards the development of a policy of recycling assistive technology for people living with a disability	Empirical	Canada	Behavioural & systems change	Waste / recycling
Connor A;Lillywhite R;Cooke MW;	2011	The carbon footprints of home and in-center maintenance hemodialysis in the United Kingdom	Empirical	UK	Measuring environmental impacts	Carbon emissions

Connor A;Lillywhite R;Cooke MW;	2010	The carbon footprint of a renal service in the United Kingdom	Empirical	UK	Measuring environmental impacts	Carbon emissions
Cox G, Max C.	2011	Sustainable health and social care: towards an ethical framework for decision-making. Discussion paper: findings and principles.	Report	UK	Ethics of sustainable health and social care	Multiple
Dangelico R;Pujari D;	2010	Mainstreaming Green Product Innovation: Why and How Companies Integrate Environmental Sustainability	Empirical	Internatio nal	Relationship between environmental and financial performance	Multiple
Dooris M;	2006	The challenge of developing corporate citizenship for sustainable public health : an exploration of the issues, with reference to the experience of North West England	Empirical	UK	Organisational strategy	Multiple
Duputie S;Farrington N;	2002	The road to a greener hospital	Empirical	Ireland	Measuring environmental impacts	Multiple
Eames M; Bedowale M;	2002	Sustainable development and social inclusion: towards an integrated approach to research	Report	UK	Research needs	Multiple
Evans S, Hills S, Orme J.	2011	Doing More for Less? Developing Sustainable Systems of Social Care in the Context of Climate Change and Public Spending Cuts.	Empirical	UK	Social care/local government	Multiple
Evans S;Hills S;Grimshaw L;	2010	Sustainable systems of social care	Empirical	UK	Social care/local government	Multiple
Fenwick	2007	Developing organizational practices of ecological sustainability: A learning perspective	Review	Internatio nal	Organisational culture	Multiple
Fogarty A;Blashki G;Morrell E;Horton G;	2008	The GreenClinic pilot--educational intervention for environmentally sustainable general practice	Empirical	Australia	Behavioural change	Multiple
Frumkin	2008	Climate Change and Public Health: Thinking, Communicating, Acting	Review	Internatio nal	Multiple	Carbon emissions
Gatenby PA;	2011	Modelling the carbon footprint of reflux control	Empirical	UK	Clinical service design	Carbon emissions
Griffiths J;Stewart L;	2008	Sustaining a healthy future: taking action on climate change	Report	UK	Multiple	Carbon emissions

Haines A, Wilkinson P, Tonne C, Roberts I	2009	Aligning climate change and public health policies.	Review	International	Impact on health and social care needs	Adaptation & resilience
Hanna EG, Spickett JT.	2011	Climate Change and Human Health: Building Australia's Adaptation Capacity.	Review	Australia	Impact on health and social care needs	Adaptation & resilience
Haq G, Whitelegg J, Kohler M.	2008	Growing Old in a Changing Climate. Meeting the challenges of an ageing population and climate change.	Report	UK	Older people	Adaptation & resilience
Harris N;Pisa L;Talioaga S;Vezeau T;	2009	Hospitals going green: a holistic view of the issue and the critical role of the nurse leader	Review	USA	Behavioural & systems change	Waste / recycling
Heslin PA;Ochoa JD;	2008	Understanding and developing strategic corporate social responsibility	Review	International	Relationship between environmental and financial performance	Multiple
Houghton A;Vittori G;Guenther R;	2009	Demystifying first-cost green building premiums in healthcare	Empirical	USA	Facilities design	Carbon emissions
Huang C, Vaneckova P, Wang X, et al	2011	Constraints and Barriers to Public Health. Adaptation to Climate Change. A Review of the Literature	Review	International	Multiple	Adaptation & resilience
Hutchins; White	2009	Coming round to recycling	Review	UK	Waste management	Waste / recycling
Hutton G	2011	The economics of health and climate change: key evidence for decision making.	Review	International	Economic evidence	Adaptation & resilience
James R;	2010	Incineration: why this may be the most environmentally sound method of renal healthcare waste disposal	Empirical	UK	Waste management technologies	Waste / recycling
Jochelson K;	2005	Sustainable food and the NHS	Empirical	UK	Procurement	Multiple
King M, Church C, Evison S.	2009	The Sustainability Challenge: Implementing Change that Doesn't Cost the Earth.	Report	UK	Third sector organisations	Multiple
Kjellstrom T, Butler AJ, Lucas RM, Bonita R.	2010	Public health impact of global heating due to climate change: potential effects on chronic non-communicable diseases	Review	International	Impact on health and social care needs	Carbon emissions
Kreisberg J;	2007	Green healthcare in America: just what are we doing?	Review	USA	Multiple	Multiple
Lewis D;Axford AT;Tranter G;	2009	Use of videoconferencing in Wales to reduce carbon dioxide emissions, travel costs and time	Empirical	UK	Telemedicine	Carbon emissions

Lindgreen A;Antioco M;Harness D;Sloot R;	2009	Purchasing and Marketing of Social and Environmental Sustainability for High-Tech Medical Equipment	Empirical	Netherlands	Procurement	Multiple
London Climate Change Partnership	2011	London's changing climate. In sickness and in health. London's changing climate. In sickness and in health.	Report	UK	Multiple	Adaptation & resilience
Mackridge AJ;Marriott JF;	2007	Returned medicines: waste or a wasted opportunity?	Empirical	UK	Pharmaceuticals	Waste / recycling
Masino C;Rubinstein E;Lem L; et al	2010	The impact of telemedicine on greenhouse gas emissions at an academic health science center in Canada	Empirical	Canada	Telemedicine	Carbon emissions
Mathbor GM;	2007	Enhancement of community preparedness for natural disasters: the role of social work in building social capital for sustainable disaster relief and management	Review	International	Social care/local government	Adaptation & resilience
Max C, Prescott M, Cave B, Geofutures.	2010	London Climate Change Partnership Health and Social Care Risk Assessment and Action Plan	Report	UK	Multiple	Adaptation & resilience
McConnell CR;	2009	Energy management: another growing concern for the department manager	Review	USA	Energy management	Carbon emissions
Mittal RK;Sinha N;Singh A;	2008	An analysis of linkage between economic value added and corporate social responsibility	Empirical	India	Relationship between environmental and financial performance	Multiple
Nichols; Maynard; Goodman; Richardson	2010	Health, Climate Change and Sustainability: A systematic Review and Thematic Analysis of the Literature	Review	International	Multiple	Carbon emissions
Nichols; Richardson	2010	Climate change, health and sustainability: A brief survey of Primary Care Trusts in the South West of England	Empirical	UK	Organisational strategy	Carbon emissions
Nidumolu R, Prahalad CK, Rangaswami MR.	2009	Why Sustainability Is Now the Key Driver of Innovation.	Review	USA	Relationship between environmental and financial performance	Multiple
Oglethorpe; Heron	2010	Sensible operational choices for the climate change agenda	Empirical	International	Procurement	Carbon emissions

Ostry A, Ogborn M, Bassil KL, et al	2010	Climate Change and Health in British Columbia: Projected Impacts and a Proposed Agenda for Adaptation Research and Policy	Empirical	Canada	Impact on health and social care needs	Adaptation & resilience
Oven KJ, Curtis SE, Reaney S et al	2011	Climate change and health and social care: Defining future hazard, vulnerability and risk for infrastructure systems supporting older people's health care in England	Review	UK	Impact on health and social care needs	Adaptation & resilience
Pflueger D	2010	The high-performance link	Review	UK	Relationship between environmental and financial performance	Multiple
Richardson J;Kagawa F;Nichols A;	2009	Health, energy vulnerability and climate change: a retrospective thematic analysis of primary care trust policies and practices	Empirical	UK	Organisational strategy	Carbon emissions & adaptation/ resilience
Royal College of Nursing	2011	Freedom of Information report on waste management	Empirical	UK	Multiple	Waste / recycling
Scott	2010	New times, new connections. Civil society action on climate change	Report	UK	Third sector organisations	Carbon emissions
Smith; Sharicz	2011	The shift needed for sustainability	Empirical	Internatio nal	Organisational strategy	Multiple
Social Care Institute for Excellence	2010	Sustainable social care: climate change	Report	UK	Social care/local government	Carbon emissions
Somner, Cavanagh DJ, Wong KKY, et al	2008	Surgical scrubbing: can we clean up our carbon footprints by washing our hands?	Empirical	UK	Medical technologies	Water conservatio n
Sprinkle GB;Maines LA;	2010	The benefits and costs of corporate social responsibility	Review	Internatio nal	Relationship between environmental and financial performance	Multiple
Sulbaek Andersen MP, Sander SP, Nielsen OJ, et al	2010	Inhalation anaesthetics and climate change	Empirical	Internatio nal	Pharmaceuticals	Carbon emissions
Sustainable Development Commission	2008	Sustainable development: The key to tackling health inequalities	Report	UK	Health inequalities	Multiple
Tarrass F, Benjelloun M, Benjelloun O, et al	2010	Water Conservation: An Emerging but Vital Issue in Hemodialysis Therapy	Review	Internatio nal	Medical technologies	Water conservatio n

Tennison I.	2010	Indicative carbon emissions per unit of healthcare activity.	Empirical	UK	Measuring environmental impacts	Carbon emissions
The Environment Council	2008	An independent evaluation of the Sustainable Development Commission's Good Corporate Citizenship Assessment Model	Report	UK	Organisational strategy	Multiple
Topf M;	2005	Psychological explanations and interventions for indifference to greening hospitals	Review	USA	Behavioural change	Multiple
Tudor TL, Noonan CL, Jenkin LE	2005	Healthcare waste 24 management: a case study from the National Health Service in Cornwall	Empirical	UK	Multiple	Waste / recycling
Tudor TL;Woolridge AC;Bates MP; et al	2008	Utilizing a 'systems' approach to improve the management of waste from healthcare facilities: best practice case studies from England and Wales	Empirical	UK	Waste management	Waste / recycling
Weaver HJ;Blashki GA;Capon AG;McMichael AJ;	2010	Climate change and Australia's healthcare system - risks, research and responses	Review	Australia	Research needs	Adaptation & resilience
Whittle R, Medd W, Deeming H et al	2010	After the Rain - learning the lessons from flood recovery in Hull. Final project report for 'Flood, Vulnerability and Urban Resilience: a real-time study of local recovery following the floods of June 2007 in Hull'.	Empirical	UK	Behavioural & systems change	Adaptation & resilience
Wootton R;Tait A;Croft A;	2010	Environmental aspects of health care in the Grampian NHS region and the place of telehealth	Empirical	UK	Telemedicine	Carbon emissions
World Health Organisation	2009	Protecting health from climate change: Global research priorities	Report	Internatio nal	Multiple	Adaptation & resilience
Zander A;Niggebrugge A;Pencheon D;Lyratzopoulos G;	2010	Changes in travel-related carbon emissions associated with modernization of services for patients with acute myocardial infarction: a case study	Empirical	UK	Clinical service design	Carbon emissions

Appendix 2 - Interview schedule

Developing more sustainable approaches

1. Do you think environmental sustainability is something the health and social care sector should be thinking about? If so, why?

2. If we want to improve the environmental impact of health and social care, what needs to change about the services we provide and the way we deliver them?
   - Present graphic and use to prompt for changes in different areas

3. If there is environmental change in future, how might we need to adapt the way we provide health and social care to make sure services are resilient to that?
   - Prompt using main elements of predicted environmental change

4. Will becoming sustainable require a radical change in the way we deliver health and social care services in the UK or can we build on what we have now? If the former, what models should we move towards?

5. Of all the changes mentioned, which are the most important?

Barriers/facilitators

6. What barriers might stand in the way of these changes?
   - Prompt for barriers at different levels - individual, organisational, systems-level

7. What might help in achieving them?

8. Do we need a regional/national approach or can individual organisations lead this?
   - Should there be new statutory requirements or financial incentives?

9. What effect might the government's proposed reforms to health and social care have?

Research needs

10. What research needs to be done to enable the sorts of changes you've been talking about?
    - Prompt about social care specifically

11. Are there any areas that have been particularly under-researched so far?
    - Prompt for particular gaps emerging from lit review / other interviews

12. Are there areas where the evidence-base is already strong?

13. What would your priorities be if you had a limited amount of money to spend on research in this area?

Productivity

14. Is it feasible to develop more environmentally sustainable health and social care services at a time when the sector is facing a huge financial challenge?

15. Do you think action on sustainability could contribute towards addressing the productivity challenge, or is there a tension between the two? If so, how?

16. Is more research needed to identify actions which could promote both sustainability and productivity?

Main messages

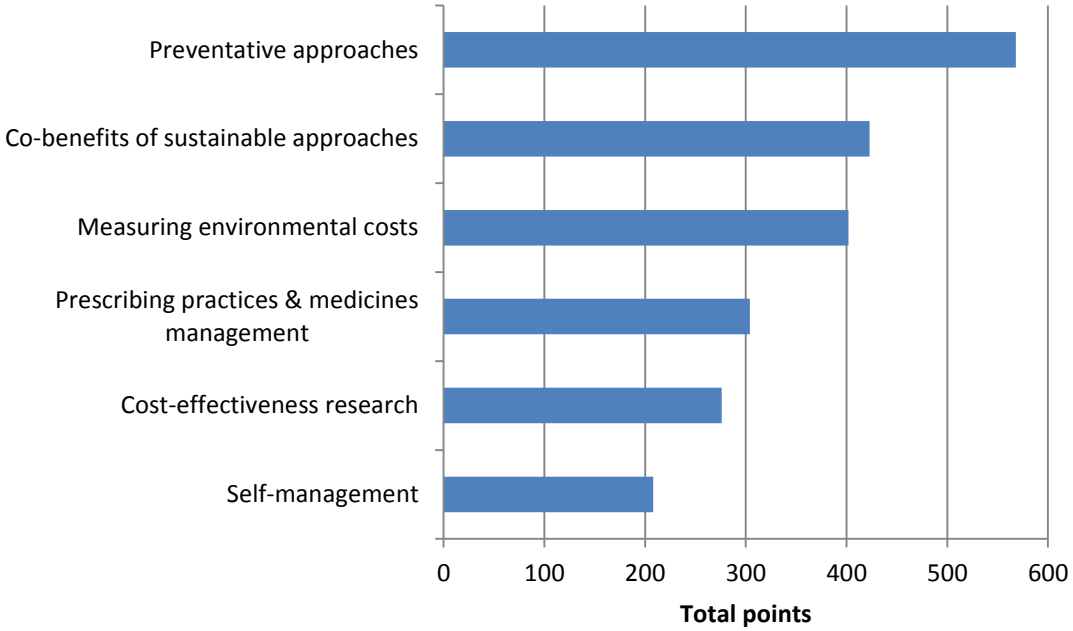
17. Overall, what do you think are the most important messages we should communicate to research funders about funding research in this area?

18. What are the most important messages we should communicate to health and social care managers and professionals?

Appendix 3 - Stage one Delphi results

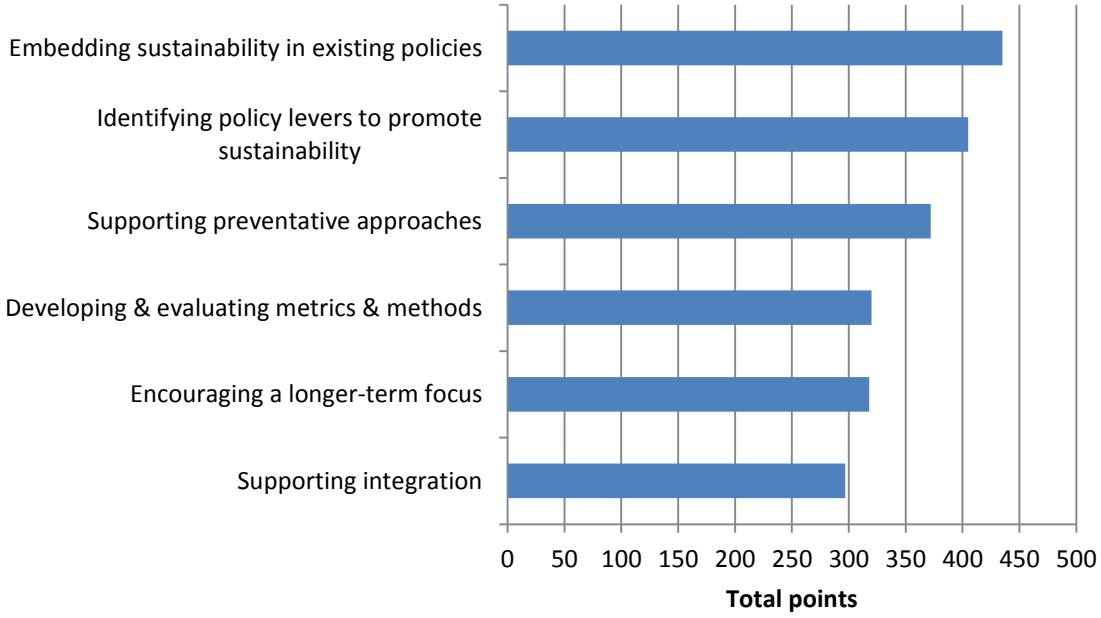
The following figures illustrate the scores from stage one of the Delphi exercise, as presented to participants in the second stage. The results of the two stages were highly consistent - there were no changes in the rank order of the research areas, and the priority given to the highest scoring areas became more pronounced in the second stage. Scores from stage two are presented in the main body of the report (section 6).

Priorities for research on innovative approaches to health and social care (Delphi exercise, stage one)

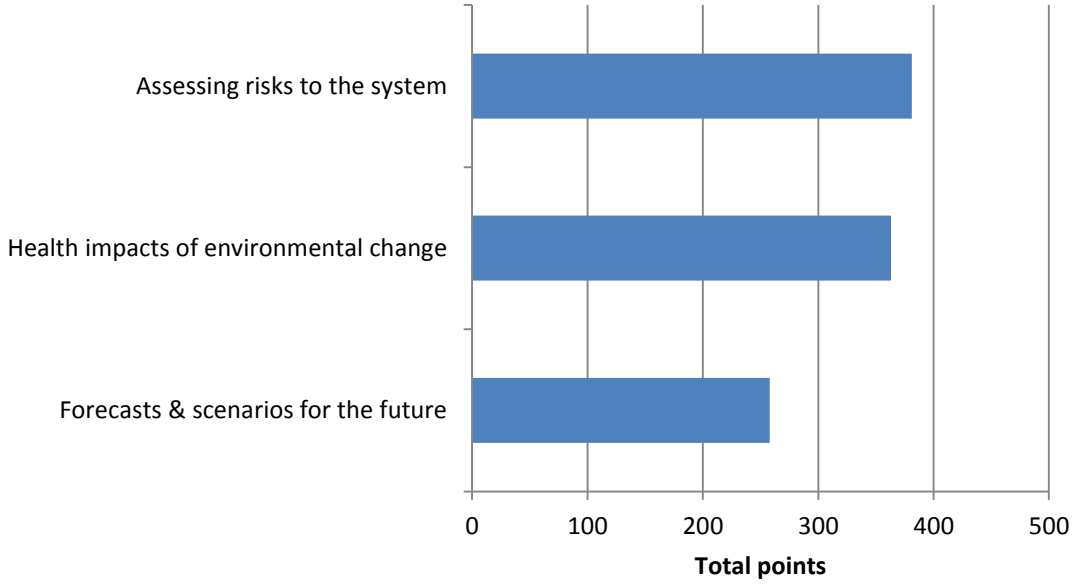


Priorities for research on behaviours, attitudes and cultures (Delphi exercise, stage one)

Priorities for systems-level and policy research (Delphi exercise, stage one)



Priorities for research on future needs and pressures (Delphi exercise, stage one)



Addendum:

This project team was originally commissioned and funded by the NIHR SDO programme to complete a scoping review of environmentally sustainable health services. The project team received additional funding from the Social Care Institute for Excellence (SCIE) to complete a parallel scoping review of environmentally sustainable social services. The final report resulting from this project was reviewed and published by NETSCC. From January 2012, the NIHR SDO programme merged with the NIHR Health Services Research programme to establish the new NIHR Health Services and Delivery Research (NIHR HS&DR) programme.