Health impact assessment: estimating the health impacts of the BLMK ICS Green Plan (2022-25)

Emily Loud, ST3 public health registrar
Emily.loud@nhs.net
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Acronyms, abbreviations and technical terms

- Attributable fraction: proportion of cases in a particular risk group that can be attributed to (caused by) the risk factor which is present i.e. the proportion of cases in that group that would be avoided if the risk factor wasn't present.
- BLMK: Bedfordshire, Luton and Milton Keynes
- CO2e: carbon dioxide equivalent, which includes carbon dioxide and other greenhouse gas emissions suitably converted in order to be able to measure all gasses together.
- HIA: health impact assessment
- HR: hazard ratio, a measure of how often a particular event happens in one group compared to how often it happens in another group, over time. Can be interpreted as a risk ratio in some circumstances.
- ICB: Integrated Care Board, which is the commissioning organisation for the Integrated Care System, with a statutory responsibility covering NHS Trusts and primary care organisations in its geographical area, and a partnership relationship with local authorities within its area.
- ICS: Integrated Care System, which includes all the providers of health and care in a specific geographical area.
- PM2.5: particulate matter 2.5 microns (or less) in diameter, also known as fine particulate matter
- PM10: particulate matter 10 microns in diameter
- RR: risk ratio, also known as relative risk, the probability of a particular event/outcome in a group who have an exposure/ risk factor versus the probability in those who do not.
- WHO: World Health Organization

Key messages and executive summary

Key messages

Climate change and the carbon emitting activities that cause it **already drive disease and health inequalities in BLMK**, and will likely worsen without proactive action; Green Plans therefore present a significant and urgent opportunity to improve health.

This report is an initial attempt to **connect BLMK's carbon reduction commitments with local health outcomes**. This is a challenging process due to uncertainty and limited data but, by improving ICS Green Plan governance and data collection now, this connection – and the **ability to demonstrate impact** - will become clearer in future.

Although they lay a good foundation for future work, the current Green Plan commitments are not ambitious enough to take advantage of the opportunity to improve health and reduce inequalities. However, by following existing evidence and committing to **integrating climate and health related outcomes into existing ICS population health work**, BLMK will be able ensure that efforts in environmental sustainability has positive population health impacts and supports staff wellbeing in the short and longer term.

Executive summary

Context and aims

By April 2022, NHS Trusts and Integrated Care Boards had published their first round of Green Plans, adding to sustainability strategies already adopted in some local authorities. At the same time, the newly formed Integrated Care Systems have also taken on responsibility for population health management, supporting prevention and tackling inequalities. The link between these two areas of work has not yet been made formally or strategically at national or local levels. Bringing together relevant data on green policies and health should enable an approach to Green Plans that is evidence-informed and most likely to improve health locally. The aims of this project, supported by the regional East of England Greener NHS team, were therefore to:

- Identify the evidence base and data sources (and gaps) in relation to health and green policy areas.
- Enable the ICB and ICS organisations to better evaluate their plans and track their progress with environmental sustainability plans in relation to health impacts and co-benefits.
- Review scope and scale of current Green Plan commitments, and suggest opportunities to maximise population health while cutting carbon emissions.
- Inform a sharable health 'dashboard' that summarises available evidence and lays a foundation for future work in this area.

Key questions and methodology
After consulting local sustainability leads and ICB theme leads (those identified as leading on particular Green Plan ambitions), local data and reviews of the scientific literature were combined to answer the following key questions:

- What are the baseline emissions of current ICS activities and how likely are current Green Plan commitments to reduce them?
- What are the health impacts of existing emissions and how likely are current Green Plan commitments to reduce them?

Current carbon footprint of ICS – baseline data for commitments is limited
The high-level estimate from Greener NHS which estimated that BLMK ICS' 19/20 carbon footprint plus (including direct and indirect emissions) was 324,540 tonnes CO2e per year – the equivalent of driving 805.5 million miles in an average-sized petrol car. However, in relation to the baselines for each of the Green Plan's commitments, there is very limited locally collected activity data. This meant that estimating each commitment's likely contribution to carbon reduction was difficult, and in some cases not possible at all. In addition, when compared to the scientific literature, some commitments focussed on areas that would not provide maximum carbon reduction or health benefits.

Most information was available for estates, medicines (both based on Greener NHS dashboard data) and also for staff commuting (which could be estimated using workforce and national information). The least information was available for supply chain and adaptation theme areas, which was significant as supply chain and procurement was the largest part of the carbon footprint (192,980 tonnes CO2e), and adaptation planning has significant consequences for health in extreme weather scenarios.

Health impacts - current emissions and conditions are damaging health
Locally, key activities across the ICS that emit carbon currently are contributing to poor health and health inequalities among the communities we serve, and the staff we employ. Health issues related to four key areas were examined: air pollution, extreme weather, active travel and nutrition. The scientific evidence that climate change, carbon emissions and related activities are contributing to poorer health presently was strong. Air pollution was the area where the most significant damage to health was likely being done to staff and the wider community, with more than 460 deaths and 21% of all asthma cases in BLMK likely attributable to long term pollution. There is therefore a clear and urgent case for putting local health outcomes at the core of Green Plan work going forwards. There are global implications too; BLMK emissions from the single year 2019/20 are likely to cause between 73 and 325 excess deaths (depending on the model and scenario used) globally between 2020-2100.

Current ICS Green Plan commitments – not ambitious enough
The BLMK Green Plan outlines a number of high-level ambitions that provide a good foundation for future work. However, the evidence is that current commitments are neither specific nor ambitious enough to have significant local health improvements. This means that the local health and care sector risks continuing to contribute to damaging health and worsening health inequalities through carbon emissions and

related activities, particularly air pollution. However, there were some policy examples from the literature which evidenced or modelled significant improvements in health related to more ambitious policies, which mostly related to staff since this was where the best local data was available. These could be implemented as part of the Green Plan workstream to have a greater impact on health locally, and would intersect well with ICS organisations' roles as anchor institutions.

Areas of future focus – concentrate on win-wins, generate better evidence

Reducing private car use was a key evidence based policy for improving air quality and also facilitating health benefits to staff via active transport. Ensuring that canteen food complies with Eatwell guidance could improve health of staff and also cut carbon emissions from catering activities. For extreme weather, insulation and external passive cooling mechanisms were found to be helpful in reducing mortality during heatwaves, and so would need to be at the core of adaptation planning (which has not yet been done). However, it was worth noting that neither local data or policy implementation literature provided high quality evidence, so commitment to ongoing data collection, monitoring and evaluation to understand what works for BLMK is essential.

Recommendations for this and future Green Plan work

In order to maximise health impacts of commitments to reduce carbon emissions across the ICS, the following actions were recommended:

- Refine Green Plan goals to be more specific and evidence based in scale and scope, using an annual action plan, for example, to focus on policies (such as reducing car use, active travel, increasing fruit and vegetable consumption, passive cooling techniques) that are most likely to reduce emissions and improve health in a time-bound and measurable way.
- Fill key information gaps, including through a deeper exploration of data available to ICS partner organisations, to enable improved monitoring and evaluation, particularly in relation to key baseline activities for theme areas across the ICS, staff health and travel patterns, supply chain and adaptation planning.
- Improve ICS Green Plan monitoring, communication and governance to enable more comprehensive information collection, particularly with local authority, care sector and primary care partners, which are where the data available was either not publicly available or not readily aligned to the elements of the Green Plan. Further detailed work, with local authority and care sector partners in particular, should be considered to build on and refine the findings of the Health Impact Assessment
- Commit to evidence generation on policy measures, especially those where the policy translation into local setting is most complex e.g. air pollution.
- Clarify the ICB's role as a climate and health leader, bringing the system together towards cohesive, evidence-based policies to reduce carbon and improve health.
- Integrate climate and health outcomes into existing population health management work across the ICS, including health and wellbeing strategies and JSNA, to ensure their contribution to health and inequalities is formally recognised, and reduce possible duplication.

1. Context

Background and purpose of this project

Greener NHS East of England requested work to develop connections between Integrated Care System Green Plans and health outcomes on a regional level. The Bedfordshire, Luton and Milton Keynes Integrated Care System (BLMK ICS) volunteered to be the example setting for this work, which would then be shared and applied more widely.

This report aimed to:

- Identify the evidence base and data sources (and gaps) in relation to health and green policy areas.
- Enable the ICB and ICS organisations to better evaluate their plans and track their progress with environmental sustainability plans in relation to health and co-benefits.
- Review scope and scale of current Green Plan commitments, and suggest how efforts to maximise population health while cutting carbon emissions.
- Inform a sharable health 'dashboard' that summarises available evidence and lays a foundation for future work in this area.

The ultimate vision is to have a Green Plan that is evidence-based and actively improves local population health while reducing carbon emissions, and is well connected to ICS and provider activities that have similar goals.

Audiences for this report

This report and its accompanying materials are intended to support colleagues in both Integrated Care Boards and provider organisations across the East of England and beyond (including local authorities and non-NHS partners in the ICS), to assess likely health impacts of their green commitments. Although the NHS organisations and the Greener NHS Net Zero plan are featured heavily, local authority sustainability plans and data are also included where available, and these settings are recognised as crucial collaborators in reduction of carbon emissions and health outcomes.

NHS Green Plans

In 2022, NHS Trusts and Integrated Care Systems (ICSs) were mandated to submit their 'Green Plans' for the period of 2022 to 2025 in order to support the wider NHS ambition of achieving net zero carbon emissions by 2040[1]. However, given the current competing priorities and strain that the NHS is under – from care backlogs, to COVID recovery, to staff shortages, to inflation and stretched budgets[2] – there is a danger that environmental sustainability is not prioritised. While there is public support for NHS action to reduce its carbon footprint, it is not seen as a top priority by the public, nor is it well known about by NHS staff[3]. Connecting green policies with their potential health outcomes (and inequalities) may therefore be essential to achieving meaningful change at this time, because it could improve motivation for action on environmental sustainability among relevant staff and management.

Statutory duties of Integrated Care Boards and Systems

Integrated Care Systems (ICS), formed in 2022 to take the role of place-based commissioning for health and care, have also taken responsibility for population health management, which emphasises prevention and the role of the wider determinants of health in shaping a person's health outcomes[4]. The Integrated Care Board (ICB) is also tasked with collaborating with NHS provider organisations and local authorities across the ICS to form system year plans, informed by and working with local joint strategic needs assessments and health and wellbeing strategies[5]. The ICB therefore has both the opportunity and wider responsibility to lead the way in tackling environmental determinants of health to improve local wellbeing.

Health impact assessment process

This report followed the five typical steps to a health impact assessment[6], which are:

- Screening: would it be helpful, and how?
- Scoping: what data and health impacts should be considered? What methods should be used?
- Appraisal of evidence: what is the data telling us and where is the evidence strongest?
- Reporting and recommendations – what are our overall findings and how could health be maximised and harm minimised in the context of the ICS Green Plan?
- Monitoring and evaluation – how could these recommendations be supported and monitored going forward?

2. Screening

The screening process examines the question “could this proposal have an impact on, or implications for, people’s health and well-being or any factors which determine people’s health?” This question is answered below from a general standpoint of the issues at stake, and then applying this lens to the Green Plan in particular. This is meant to be high level, since detailed data appraisal follows if the health impact assessment is taken forward.

3.1. Climate change and health

Climate change is a public health issue globally, nationally and locally. The scientific consensus is that it is already affecting health in Europe and will continue to do so, through extreme weather events, changes to food and water systems, and shifting infectious disease landscapes[7]. There is also a serious risk that climate change will worsen existing health inequalities, with older and more deprived groups more like to suffer death and disability from extreme weather such as cold, heat and flooding[8].

Carbon reduction measures and health co-benefits

Reducing carbon has the overall effect of making extreme consequences of climate change less likely for all people, globally, in the medium to long term. However, local systems work on local population health needs as well as national priorities, so it is necessary to understand the possible mechanisms for health impacts locally on a shorter term. This makes it essential to identify co-benefits of carbon reduction measures – those that reduce carbon and also benefit health. The most well explored of these include reductions in air pollution (reducing respiratory and cardiac diseases), increase in active transport (improving obesity and cardiac diseases), and changes to diet (primarily through reductions in meat consumption)[9].

Adaptation and health co-benefits

The climate has already warmed by 1.1°C[10] compared to pre-industrial levels (1850-1900), and harms to health are already occurring and will continue to escalate whatever our future emissions trajectory[10]. This makes adaptation to extreme weather a key strategy for protecting health over the short, medium and longer term. One of the main adaptation areas with potentially significant co-benefits for health concerns the delivery of health and social care services in extreme weather, specifically high temperatures and flooding, and changes to NHS and care infrastructure to support healthy patients and undisrupted care[11].

The NHS and climate change

The NHS is estimated to emit 25 mega tonnes of CO2 equivalent per year[12] (carbon footprint ‘plus’), roughly equal to the emissions from the whole country of Sri Lanka[13]. This represents around 5% of the country’s emissions as a whole, and 40% of public sector emissions[14].

Health inequalities and vulnerable groups

The health impacts of climate change are also not being felt equally. In the UK, age, pre-existing medical conditions and social deprivation are key factors that can increase exposure to the effects of climate change and so generate inequalities in health impacts[15]. This must be addressed in the ways the NHS works to achieve net zero, and should form a part of action to reduce growing health inequalities, which is a core task of all Integrated Care Systems[16].

Limitations of connecting green policies and health benefits

While the health impacts of climate change are clear, the pathways and feedback loops between global warming and health outcomes are often complex and high level. Therefore, it can be difficult to evaluate strategies to improve health outcomes, and causal links between action and results can be difficult to draw[17]. Any reduction in carbon emissions should produce health benefits somewhere due to reduced global warming compared to not reducing emissions, and high level predictions estimating the global excess mortality associated with carbon dioxide equivalents (ranging from 1,000 tonnes[18] to around 4,000 tonnes[19] being sufficient to cause one premature death 2020-2100) can be helpful in conceptualising this. The challenge is that this type of health benefit is likely be separated in time and space from the people or organisation reducing their emissions, which is why drawing out local health impacts is important for catalysing change[20]. However, it is important to recognise that this view is limited; by focussing on observable local health outcomes we may miss wider impacts for which the data is weaker or is less applicable to our local context. Therefore, this health impact assessment can only provide part of the picture, not the full overview.

3.2. Possible impact of the BLMK Green Plan

What the plan says

Over the three years from 2022 to 2025, the BLMK ICS has committed to various actions around nine key themes[21]. Based on the general evidence discussed above, their impacts on health have been graded as high to low based on whether there is a clear pathway to health impact and whether there is a clear evidence base on the degree to which health would be affected.

Theme	BLMK ICS Green Plan commitments (2022-25)	Possible local health implications
Workforce and system leadership	• Embed staff training on sustainability into all induction processes • Have staff sustainability champions within each team • Include sustainability in job descriptions	Possible indirect and longer term support for the other commitments in the plan at team level, by promoting greater understanding of sustainability and health.
Sustainable models of care	• Reduce the distance to and frequency of appointments • Improve the efficiency of care delivered • Reduce length of stay in care facilities	Reducing patient and clinician transport emissions leading to improved air quality with impacts on respiratory and heart disease. Promoting active transport contributing to improved air quality, with additional individual benefits around obesity, heart disease and mental health.
Digital transformation	• Increase the use of online services for patients • Digitise paper-based operations • Integrate sustainability into digital plans	Fewer trips reducing emissions from transport, improving air quality with impacts on respiratory and heart disease.
Travel and transport	• Reduce the requirement to travel (reduce business miles by 10% each year by 2025) • Take measures to facilitate increased uptake of EVs • Encourage active travel through facilities for cycles (cycling infrastructure at 100% of feasible sites by 2025)	Possible improvement in air quality through reduced transport emissions, also direct physical benefits to staff through active transport.

Estates and facilities	• Improve energy efficiency and decarbonise energy inputs across all estates • Improve biodiversity and green estates where possible Reduce resource waste across all waste streams	Energy efficiency could improve temperature regulation of patients and staff in extreme weather, sources improved mental health and air quality through greening of estates, potentially improved air quality due to reduced incineration waste.
Medicines	• Engage patients and staff in discussions about medicines optimisation and develop an approach to reduce emissions generated by inhalers and anaesthetics where clinically appropriate • Tackle waste generated by medicines and promote training and awareness for staff on recycling and medicine disposal • Reduce emissions generated by the transport of medicines	Reduction in medicines transport emissions could improve air quality.
Supply chain and procurement	• Ensure suppliers are aligned with the NHS' green agenda • Switch to local suppliers where possible • Reduce the use of single-use plastic products	Possibility of indirect emissions reductions via local suppliers' alignment with Green Plan commitments and additional local employment.
Food and nutrition	• Reduce food waste across our sites and facilities • Phase out plastic packaging • Provide more sustainable food choices for our workforce	Possible reduction in processed food consumption for workforce and patient/client groups, with direct benefits for healthy weight, heart disease and long term illness.
Adaptation	• Develop risk assessment and progress monitoring mechanisms • Establish management and oversight practices • Increase risk mitigation efforts by developing the necessary emergency planning and preparedness strategies	Likely to reduce death and illness in extreme weather events (cold, hot, flood).

3.3. Local views and gaps in health information

Other green plans

Green Plans (or a close equivalent e.g. net zero or carbon reduction plan) for 10 of the 11 main provider organisations were also identified (a Green Plan was not identified for South Central Ambulance Service NHS Trust, but a previous Sustainable Development Management Plan was referenced instead – see below for complete list). The NHS provider organisations (6 of the 10) all followed similar commitment theme areas, however the local authority plans (4 of the 10) were more varied in both scope and detail, since there is no national guidance equivalent to Greener NHS for them to follow. All provider plans generally recognised the importance of emissions reductions for health, and 8/10 plans gave one or more specific example of this. However, none directly quantified any possible health benefits in their plans.

Views from local stakeholders

The ICS 'Green Operations Group', comprised of sustainability leads from BLMK was consulted on the possibility of a health impact assessment in June 2022 before work began on the screening section of the project in earnest. The prospect of an evidence base linking health outcomes with sustainable actions was positively received.

In addition, a survey was shared with ICS theme leads and sustainability leads from NHS provider trusts, and Healthwatch representatives to get more detail on what they thought of the health impact assessment, and how they might be able to use the results. Twelve people responded (2 from the ICB, 8 from provider organisations and 2 from Healthwatch). Some key findings included:

- 6/12 said it was difficult to connect ICS level green policies with health impacts, with 3/12 saying it was neither easy nor difficult, and 3/12 saying it was easy.
- The main barriers to Green Plan policies were system coordination, and lack of time, capacity and resources.
- 9/12 of respondents said it would be useful to have a dashboard or toolkit to connect policies with their health impacts. Two people said it would possibly be useful and another said it was unlikely to be useful. Interestingly, those who were less sure it would be useful came exclusively from the ICB. Quotes from individuals responding to this question are displayed below:

"Clearer evidence between health outcomes and local action would better support engagement with residents and connectivity between residents/patients and the Green Plan. Clinicians discussing medicine's optimisation with patients must have the evidence to clearly communicate that changes to prescribing is based on what is best for the patient and supports the environment. VSE bodies must be able to relate the evidence to bids for resources to grow green initiative projects." ***- voluntary sector context***

"This would be helpful. This would be great to share with the Council's Public Health team to show where the links lie and how the Council can assist in improving both health and reducing carbon emissions. It's not always easy for people to connect the two." – ***council context***

"Possibly [this could be useful]. I think what would be more useful would be a toolkit letting orgs know how they might implement elements." – ***ICB context***

- Of the ICB and provider responses, 3 people weren't tracking anything currently. The remaining 7 from this group were tracking a combination of process measures like meetings or progress on plan related actions, as well as utilities and energy use.
- For those who thought that having clearer evidence on health would be useful, the health topics they suggested they would like to see tackled included: respiratory issues and air pollution, staff well being, mental health, protection against extreme weather, active travel, and reduced health inequalities.
- There was no consensus on what level of geography or what timescale it would be most helpful to have health effects, with one respondent saying 1-2 years would be helpful for sharing with clinicians, and another citing longer term periods such as 8 years.

3.4. Conclusions

To conclude, a health impact assessment is required because the Green Plan represents a major policy instrument for the integrated care system, which is likely to have an impact on population health, and whose overall stakeholders support the strengthening of links between health impacts and sustainable actions. This was therefore be done as a concurrent health impact assessment (since the Green Plan has already been formulated and published). Methods combined desktop and comprehensive types of health impact assessment, which means that a small number of participants were be consulted for expertise, combined with longer term research drawing on scientific and grey literature.

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4. Scoping

4.1. Setting the scope of the health impact assessment

Geographical boundaries

This impact assessment only included impacts within the area of the integrated care system across the local authorities of Bedford Borough, Central Bedfordshire, Luton and Milton Keynes. The estimated population of around a million residents[22] has mixed ethnic groups and levels of deprivation, with a population that is growing faster than average[23].

Figure 1: Map of BLMK geography[24].

Governance and steering group

The HIA project group, which meets weekly, includes Tim Simmance (BLMK ICS Associate Director of Sustainability and Growth), and Stella Cockerill (Regional Net Zero Engagement and Sustainability Lead, NHS England - East of England). Activities were be reported back on an intermittent basis to Maria Wogan (Chief of System Assurance and Corporate Services).

The work was also regularly reported back to the BLMK ICS Green Operational Group whenever it meets, which includes sustainability representatives from organisations across the Integrated Care System. More widely, informal updates were shared with the East of England net zero leads group and the stakeholders who were surveyed at the start of the screening process. Once results were available, a summary of them was shared publicly across the ICS.

Key stakeholders

The ICS also covers a wide range of organisations providing health and care in the area, who are the key stakeholders for the ICS Green Plan and so also for this health impact assessment. Some of the main provider organisations in the ICS include:

- East London NHS Foundation Trust
- East of England Ambulance Service
- South Central Ambulance Service
- Milton Keynes University Hospital
- Bedfordshire Hospitals NHS Trust
- Central And North West London NHS Foundation Trust
- Cambridgeshire Community Services
- Luton Borough Council
- Bedford Borough Council
- Central Bedfordshire Council
- Milton Keynes Council

Other important parts of the ICS include:

- Healthwatch: Milton Keynes, Luton, Central Bedfordshire and Bedford Borough
- All local primary care networks and the 96 GP surgeries they cover[25]
- BLMK Integrated Care Board

Health issues

According to the overview of evidence and feedback gathered as part of the screening stage, the four main areas where health harms and benefits will be assessed are:

- Air pollution
- Physical activity
- Diet
- Extreme weather

Within each health issue, it will also be essential to discuss particularly vulnerable groups and health inequalities, wherever adequate information is available.

Emissions considered

Emissions will be considered based on availability of information, but are likely to focus on scope 1 and 2 level emissions:

- **Scope 1 emissions** are the emissions an organisation has direct control over. That is why they are also called direct emissions. They include emissions released due to energy use (apart from electricity), vehicle tail pipe emissions if the vehicle is owned by the business and, for the NHS, anaesthetic gases.
- **Scope 2 emissions** are indirect emissions associated with an organisation's electricity use which are released during the generation of electricity.

- **Scope 3 emissions** covers all other indirect emissions. They are a consequence of the activities of an organisation, but occur from sources not owned or controlled by the organisation, for example, emissions which are embedded in the supply chain. These emissions may occur upstream or downstream. For example, manufacturing products and well-to-tank emissions (WTT) are upstream scope 3 emissions. Whereas the use of sold products and disposal of waste are downstream emissions.

4.2. Scoping research questions and data sources

Overall research question: what health impacts could achieving targets in the ICS green plan have, and how could that progress be tracked?

To answer this question, evidence will be gathered and appraised in three stages:

1) **Measurement and monitoring**: what is existing best practice for measuring and linking carbon emissions and health outcomes in a health and care context?
   - *Local data*: targets articulated in the green plan and by theme leads, local context from other ICSs in the region.
   - *Academic and external data:* literature review of existing tools / dashboards/methodologies to support the connection of emissions and health related impacts to ensure these are combined in the most meaningful way.
2) **Current activities and emissions**: what are the baseline emissions of current ICS activities and how likely are current Green Plan commitments to reduce them?
   - *Focus:* use high level data to establish likely emissions from the ICS.
   - *Local data*: baseline activities from ICS theme leads and provider green plans, combined with standard carbon emissions datasets such as the BEIS emissions factors database[26] to estimate their current contribution by each theme area in the green plan. A hybrid approach to carbon footprinting (a combination of bottom up and top down, depending on what information is available) was used.
   - *Academic and external data:* if activity data is not available at a high level, then it will be estimated by reviewing the literature from comparable settings.
3) **Health effects**: what are the likely health impacts of existing emissions and how likely are current Green Plan commitments to reduce them?
   - *Focus*: connections between emissions and policies related to the most likely health issues covered in the green plan: air pollution, active travel, dietary change, and extreme weather in UK context.
   - *Local data*: input from the ICS on overall patients and staff involved in ICS activities each year; exposure and prevalence of relevant health conditions to be established via Fingertips, Defra and other public-facing government sources.
   - *Academic and external data:* review of systematic reviews and meta-analysis from Google Scholar and Pubmed for systematic reviews and meta-analysis literature providing a likely effect size on health for each issue of concern.

Full methodologies (including search terms) are detailed in the appendix. Once evidence for these three areas has been gathered and appraised, the following section will consider recommendations about how health impacts could be optimised and estimates could be improved in future.

In all cases, estimates on emissions and their health impacts will be computed using a combination of local data and information from scientific literature and relevant case studies if possible. However, it is likely that local information on emissions (from ICS theme leads and provider calculations, for example) will be limited since the ICS Green Plan was only published in 2022 and no formal carbon footprinting has yet been conducted. In this situation, high level estimates from the scientific literature, comparable settings, and reference emissions data will be computed so that more locally specific data can be calculated at a later date.

4.3. Appraisal of evidence

Conclusions for each section will be appraised along four main dimensions:

- **Current activities and emissions** – how much information is there on current activities and carbon emissions, and is it sufficient for us to estimate their current and future health effects?
- **Strength of scientific evidence** – how high is the quality of evidence for the link between the emissions reducing policy and health benefits / the emissions and damage to health in the wider literature? High quality evidence would be defined as:
    - A systematic review and meta-analysis in a high impact journal
    - Large scale observational studies from a UK context that clearly account for risks of bias in a high impact journal
- **Policy translation of evidence** – is there evidence of what kinds of policies can bring about these health improvements in real-life?
- **Impact of ICS commitments in light of evidence** – how well do ICS commitments match the scale or content of the evidence and policy findings?

The ratings will be marked on three levels:

- Strong – good quality evidence, sufficient data to make a judgement.
- Moderate – some evidence or data, but it may not be from local sources, a judgement can be made but it is quite uncertain.
- Weak – very little evidence or data, any judgement will be very uncertain.

4.4. Stakeholder engagement

Ongoing stakeholder engagement was key in order to shape the health impact assessment and its recommendations. It was also essential to establish current levels of knowledge around Green Plans and their equivalents, as well as to understand the levels of monitoring and data gathering was already happening.

This importance and interest matrix shapes how and how often different groups are involved in this process.

High interest	**Satisfy -** *Keep informed with what is happening and review their involvement regularly.* Sustainability leads from provider organisations ICS leads from East of England	**Manage closely -** *Key stakeholders who should be fully engaged and involved.* Tim Simmance – Sustainability Lead, ICS Stella Cockerill – NHS England, East of England Net Zero lead
Low interest	**Monitor -** *Keep informed* Healthwatch and the wider public, policy organisations and others around the country doing similar work, Greener NHS, ICS governance structures	**Keep informed -** *Review their engagement and involvement.* Maria Wogan / ICS governance and ICB theme leads
	Low influence / impact	**High influence / impact**

In terms of reporting to wider ICB leadership and committees, this work was reported back to relevant meetings, including all the stakeholders listed here. A full log of stakeholder engagement meetings (both scheduled and completed) can be found in the appendix.

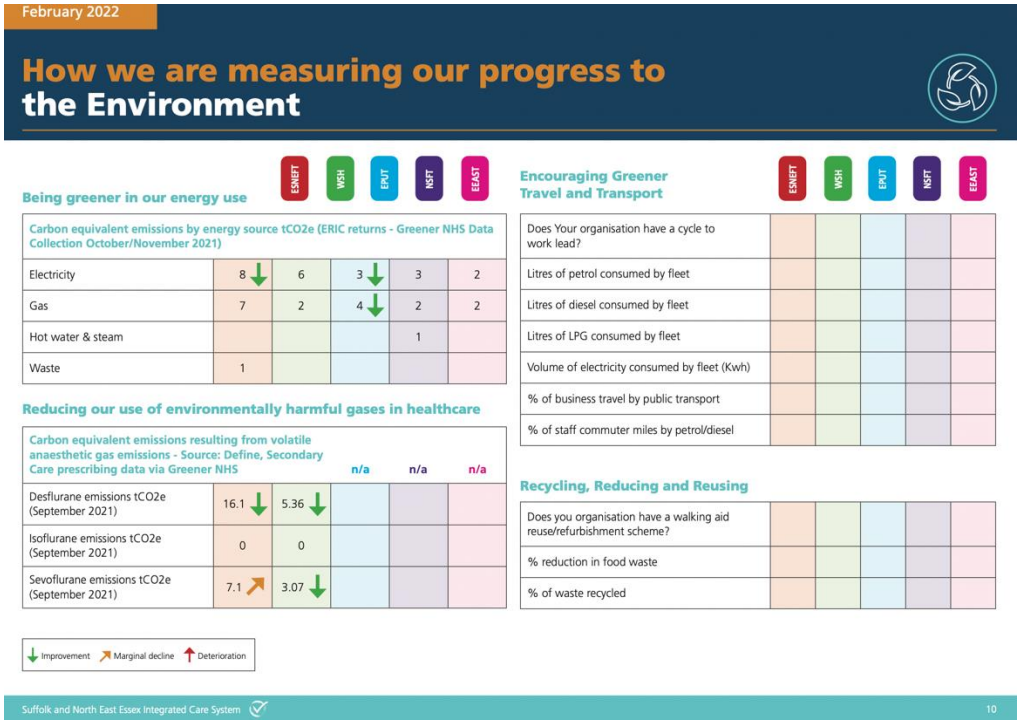
5. Appraisal of evidence and results

5.1. Measurement and monitoring

The aim of this section is to highlight existing approaches to measuring impact of green plans, specifically in relation to health, to ensure available tools are used, and the conclusions of HIA are up to date and not duplicating existing work.

5.1.1. Local approaches

In the East of England region, there is no directly similar tool or project currently underway. However, there is significant and potentially overlapping work ongoing on NHS trusts as 'anchor institutions', which are 'large, typically non-profit, public sector organisations whose long-term sustainability is tied to the wellbeing of the populations they serve'[27]. In particular the Suffolk & North East Essex Integrated Care System has been advancing its work on anchor institutions[28] by developing a dashboard that covers relevant social and environmental indicators. This includes some emissions and Green Plan related activity data, but is not currently complete; this presents an opportunity for tracking health outcomes of green policies in future.



February 2022

How we are measuring our progress to the Environment

Being greener in our energy use

Carbon equivalent emissions by energy source tCO2e (ERIC returns - Greener NHS Data Collection October/November 2021)	ESNEFT	WSH	EPUT	NSFT	EEAST
Electricity	8 ↓	6	3 ↓	3	2
Gas	7	2	4 ↓	2	2
Hot water & steam				1	
Waste	1				

Reducing our use of environmentally harmful gases in healthcare

Carbon equivalent emissions resulting from volatile anaesthetic gas emissions - Source: Define, Secondary Care prescribing data via Greener NHS			n/a	n/a	n/a
Desflurane emissions tCO2e (September 2021)	16.1 ↓	5.36 ↓			
Isoflurane emissions tCO2e (September 2021)	0	0			
Sevoflurane emissions tCO2e (September 2021)	7.1 ↗	3.07 ↓			

↓ Improvement ↗ Marginal decline ↑ Deterioration

Encouraging Greener Travel and Transport

	ESNEFT	WSH	EPUT	NSFT	EEAST
Does Your organisation have a cycle to work lead?					
Litres of petrol consumed by fleet					
Litres of diesel consumed by fleet					
Litres of LPG consumed by fleet					
Volume of electricity consumed by fleet (Kwh)					
% of business travel by public transport					
% of staff commuter miles by petrol/diesel					

Recycling, Reducing and Reusing

Does you organisation have a walking aid reuse/refurbishment scheme?					
% reduction in food waste					
% of waste recycled					

Suffolk and North East Essex Integrated Care System 10

In addition, previous work by students at the local Cranfield University modelled improvements in air quality against COVID-19 infection rates[29], which could have relevance in the context of Green Plan policies that could improve air quality.

It is also important to consider the work done in the ICSs, both in the East of England and across the UK. After enquiring with national NHS colleagues, they were not aware of other ICSs who were conducting work similar to this analysis. However, contact was made with Sussex ICS, who are in the early stages of a health and equalities impact assessment of their Green Plan.

5.1.2. National approaches and examples from literature

A key tool of note is the Greener NHS Dashboard (NHS Organisations), developed alongside the Green Plans, which monitors:

- Carbon equivalent emissions associated with NHS activity
- Policy and contractual levers which support a Net Zero NHS

This tracker is internally facing and takes measurements on a quarterly and annual basis. It tracks emissions by estates, anaesthetic gases, nitrous oxide and associated waste, and fleet. It is organised by NHS Trusts, not currently by ICS. Additionally, not all trusts have reported against each metric. There is another (unrelated) tool which helps GP surgeries calculate their carbon emissions – the GP carbon calculator[30]. None of these tools currently include health outcomes, but could be useful sources of activity and emissions data.

In addition, prior to the creation of Trust and ICS level Green Plans, Greener NHS provided ICS level estimates of carbon emissions. This was calculated using a mix of top down and bottom up information, and so was quoted alongside other calculations for context. More recent estimates were given where information was sufficient. However, it was not clear the extent to which local authority emissions were included.

An adaptation focussed tool from the University of Exeter looks at climate forecasts for a local area and how adaptation policies might affect it[31]. At the time of citation, this was only available for the Cornwall area, but there are plans for a national version in the near future.

Sustainable Development Assessment Tool (SDAT) was a self-assessment tool previously supported by the NHS' Sustainable Development Unit (now Greener NHS), and well used by Trusts in previous sustainability planning. It enabled trusts to mark their progress against various domains. It seems unlikely to have included health outcomes based on public facing examples of its use[32], but is no longer available online so it cannot be directly assessed. A similar tool for Green Plans specifically is apparently in progress, which would support this work directly going forward.

Additionally, the 'Health Outcomes of Travel' tool[33] was developed by the Sustainable Development Unit to model possible impacts of changes to travel methods in terms of Quality Adjusted Life Years (QALYs). Although it has not been updated since 2019, it contains helpful information that will be directly relevant to this exercise. A local authority air pollution and healthcare costs tool[34], and an older one for mortality[34] were also both previously developed by Public Health England (now UKHSA) to link air quality and health outcomes.

Future sources of information relevant to this exercise should also be considered, since they present the opportunity to update conclusions on health impacts as Green Plans progress. These include the new UKHSA Centre for Climate and Health[35], and the joint venture from the Office for National Statistics and the Wellcome Trust[36]. The ONS and Wellcome programme intends to gather and publish health data

related to climate change, which could include co-benefits of mitigation strategies, but this does not appear to be the initial focus. Meanwhile, the UKHSA centre intends to 'mobilise the evidence base to inform the design and implementation of climate change policies across local and national government and with international partners'[37], which certainly seems likely to cover this remit in future, although the timeline is uncertain. Overall, national work in this area is ongoing so the purpose of this HIA is to fill the gap and support local action on the Green Plan until such a time as improved tools and information is available.

5.2. Emissions levels and baseline activities

In order to support the development of the Green Plan, Greener NHS provided an estimate of BLMK ICS's carbon footprint for the year 2019/20. This is very high level, so it may be necessary to do some additional footprinting work to understand the possible effects of different policies, but this is also a helpful reference point for this health impact assessment exercise, particularly where newer information is available. This estimated that BLMK ICS's carbon footprint (emissions BLMK directly generate) was 57,280 tonnes CO2e per year, and our carbon footprint plus (emissions BLMK can influence) was 324,540 tonnes CO2e per year. Below, this estimate is broken down by Green Plan theme area.

Category	Tonnes CO2e
Medicines total	17,130
Anaesthetic gases	4,700
Metered dose inhalers	12,430
Estates total	30,510
Coal	0
Gas	14,870
Electricity	12,650
Heat and steam	0
Oil	130
Waste	2,370
Water	490
Travel and transport total	44,780
Business travel	8,370
NHS fleet	1,270
Patient travel	20,510
Visitor travel	5,990
Staff commuting	8,640
Supply chain total	192,980
Business services	32,570
Medicines and chemicals	66,670
Medical equipment	28,930
Construction and freight	24,510
Non-medical equipment	40,300
Food and nutrition total	24,200

Other total: commissioned health services outside NHS	14,930

5.2.1. Workforce and system leadership

Reminder of ICS Green Plan commitments in this area
The workforce and leadership commitments from the ICS green plan, and their required baseline activity levels, are:

- Embed staff training on sustainability into all induction processes (KPI: % of staff participation on sustainability e-learning modules)
- Have staff sustainability champions within each team (KPI: successful creation of cross-organisation working groups on sustainability, % of staff reached via communications channels on sustainability messaging)
- Include sustainability in job descriptions (KPI: none)

Available baseline information

Workforce and leadership activities are unlikely to have a direct contribution to reducing carbon emissions and having knock on health effects themselves, but should instead act as enablers to other types of action by increasing knowledge, engagement and willingness to act. This is because lack of knowledge is often cited as a barrier to action in a healthcare context[3]. However, the size and behaviours of the workforce also has a large influence on the carbon emissions of the ICS, so it is also important to understand this as a baseline measure.

Size of workforce

NHS Digital provides information on staff employed in the Trusts active across the ICS as of June 2022[38]. For the providers that also work outside of BLMK, employee numbers were scaled down in order to better represent numbers present within our area. These proportions were requested from each organisation, but where they were not confirmed or verified, estimates are followed by an asterisk (*).

In addition, in their Green Plans, Bedfordshire Hospitals NHS Foundation Trust specified they also had 500 volunteers, and East of England Ambulance Trust 1,500. For the GP workforce, NHS Digital also provides the number of employees in general practice across BLMK for August 2022[39]. Numbers for all local authority employees (including those in education) were obtained via the LG Inform platform[40], dated to quarter 2 (April-June) of 2022. Adult social care numbers were taken from a recent Skills for Care analysis[41]. This may be an underestimation, as it also doesn't include children's care workers.

Organisation	Headcount
Bedfordshire Hospitals NHS Foundation Trust - employees	7,844

Bedfordshire Hospitals NHS Foundation Trust – volunteers	500
East of England Ambulance Service NHS Trust – employees *(15% applied to overall number for BLMK estimate)**	836
East of England Ambulance Service NHS Trust – volunteers *(15% applied to overall number for BLMK estimate)**	225
Milton Keynes University Hospital NHS Foundation Trust	3,786
NHS Bedfordshire, Luton and Milton Keynes ICB	361
Cambridgeshire Community Services NHS Trust *(37% applied to overall number for BLMK estimate)*	1025
Central and North West London NHS Foundation Trust *(15% applied to overall number for BLMK estimate)**	1,157
East London NHS Foundation Trust *(27% applied to overall number for BLMK estimate)*	1,795
South Central Ambulance Service NHS Foundation Trust *(10% applied to overall number for BLMK estimate)**	447
All GPs	642
All GP nurses	379
All other patient facing staff at GP practices	349
All GP administrators	1,595
Bedford Borough Council	3,784
Central Bedfordshire Council	2,841
Luton Borough Council	5,680
Milton Keynes Council	4,063
Adult social care (independent sector)	18,000
Total employment footprint	**55,308**

If we take the average UK carbon footprint (4.85tCOe per person[42]) and apply it to the staff estimate above, the ICS Green Plan and plans of all the organisations with in it could be influential over 268 kilotonnes CO2e, excluding possible impact on the wider households of these employees. This is a significant number of people who could contribute personally and professionally to reducing carbon emissions, and benefit from policies to improve their health at the same time.

Other baseline activities

After meeting with theme leads for workforce and system leadership, it was evident that there was no further baseline information on sustainability champions, training or job descriptions across the system. Other helpful information for the calculation of co-benefits, in terms of sustainability awareness, employee travel patterns and occupational health data were not available, so would need to be based on national averages.

No evidence about whether including sustainability in job descriptions or having sustainability champions would decrease emissions was found. Although training is not a prerequisite for pro-environmental behaviour[43], weak evidence from the Carbon Literacy Project suggests that 5-15% of carbon emissions could be reduced with increased employee awareness (which includes pledges at the end of training), which are mostly via energy savings[44]. It is not clear whether this would be at work or at home. Applying the 5% level to the ICS carbon footprint plus of 324,540 tonnes CO2e per year, and assuming 25% of staff took this training and its effects did not wane, this could be a saving of around 4 thousand tonnes CO2e per year in a professional context. However, this evidence is vague and uncertain, so gains such as these cannot be guaranteed following training.

Appraisal of data and evidence on current activities and emissions

There was weak evidence on carbon footprint of current area.

There was weak evidence on how commitments might reduce emissions.

Further information required on current commitments:

- Ambition on proportion of the workforce that should undergo sustainability training (beyond induction), and the behavioural results expected from this.
- Understanding of what adding sustainability to job descriptions would look like and how this could influence behaviour and emissions.

Areas missing from commitments:

- What system leadership across the ICS for Green Plans and sustainability more broadly might involve or look like.

5.2.2. Sustainable models of care

Reminder of ICS Green Plan commitments in this area

- Reduce the distance to and frequency of appointments (KPI: average distance to receive care, % reduction year on year).
- Improve the efficiency of care delivered (KPIs: average number of avoidable visits / care episodes, referrals per 1000 population/specialty and PCN and follow-up appointments)
- Reduce length of stay in care facilities (KPI: average length of stay in hospital (by type of illness/treatment).

Available baseline information

After discussing with the digital lead, it was established that no local baseline information was available for average distance to care, frequency of appointments or length of stay in care locally. This means that national data and average were used in place of local baselines.

Distance to care and frequency of appointments
The few studies that do exist on mode of transport to care show that the majority of appointments are made by car, with one 2012 study from Yorkshire estimating that 75% of journeys were completed by car for GP appointments[45], and another randomised controlled trial conducted a travel survey as part of a health economics assessment also found 75% of people attended both GP and outpatient appointments by car[46].

Average car journey time (2019)[47] according to the Department for Transport is available for hospitals and GPs by local authority. Given the relatively short times on display, it would indicate that people often drive locally for their NHS care appointments. Taking an average of the Department for Transport's average road speeds[48] for motorways, A and B roads, local and minor streets, a driving speed of 39.9km/hr can help to provide a rough estimate of the equivalent distance travelled.

LA	Driving time to hospital (mins)	Estimated distance (km)	Return journey (km)	Driving time to GP (mins)	Estimated distance (km)	Return journey (km)
Bedford	16	10.6	21.2	9	6	12
Central Bedfordshire	23	15.3	30.6	9	6	12
Luton	17	11.3	22.6	7	4.7	9.4
Milton Keynes	14	9.3	18.6	8	5.3	10.6
Overall average BLMK	17.5	11.6	23.2	8.25	5.5	11

These average estimates can then be combined with data on the numbers of in person appointments in the year 21/22[49, 50] to understand overall activity and emissions levels:

Type	Number of attended, in person appointments 21/22 (BLMK)
General practice	3,709,496
Hospital outpatient	993,495

A limitation of this methodology is that it does not include community appointments or home visits. However, face to face remains the main method of appointment for GP and outpatient appointments, so this does capture the majority of activity. In addition, while this methodology overall does include various levels of assumptions, it is similar to one used by NHS Midlands and Lancashire Commissioning Support Unit to calculate the economic and environmental case for virtual appointments[51].

Combining the BLMK average distances calculated above with the number of in person appointments can provide estimates of emissions by appointment type. Assuming that 75% of journeys were made by car and 3% of those cars were electric[52], with the others using average emissions factors from BEIS (including well-to-tank):

- Hospital outpatient appointments: 3.7 kilotonnes CO2e per year, average 3.7kg per appointment
- GP appointments: 6.6 kilotonnes CO2e per year, average 1.8kg per appointment

It is unclear what an appropriate reduction in distance to and frequency of appointments would be, and the Green Plan does not set a specific reduction target. However, national targets are to reduce outpatient appointments by 25% against 2019/20 activity levels by 2023[53]. Although the composition of in-person and remote appointments has changed, the overall activity of attended outpatient appointments in BLMK is roughly the same in 2021/22 as it was in 2019/20[54]. If we assume that remote appointments remain the same proportion (19.4%, see below), this would represent a 20.4% reduction in face to face appointments and the associated travel emissions, saving around 2.2 kt CO2e per year.

Efficiency of care

There appears to be no generally accepted definition of an avoidable admission[55], and to come up with one that would be practical and clinically appropriate for BLMK is beyond the scope of this report. Therefore, there is more work required ICS-wide to define what specifically the commitments around efficiency would mean in practice.

Length of stay

For the BLMK area, the mean length of stay in hospital for 21/22 was 4 days, with a median of 1 day, for a total of 280,965 admissions and 696,555 bed days[56]. If the average emissions per day in hospital is 37.9kg CO2 e/bed day[57], then the carbon footprint for inpatient hospital stays for a year in BLMK is 26.4kt CO2e. Neither the ICS Green Plan, nor those from hospital providers have set any targets around

reduction in length of stay. However, the NHS Long Term Plan set an initial target of reducing the number of patients who experience a long stay (21+ days) by 25%, and then 40%[58]. One snapshot from 2022 put the proportion of beds occupied by those medically fit to leave at 13%[59], so a 40% reduction in this area could represent an overall reduction of 5.2%. This could bring bed days down to 660,334 per year and save 1.4kt CO2e.

Appraisal of data and evidence on current activities and emissions

Moderate evidence on carbon footprint of current area.

Moderate evidence on how commitments might reduce emissions.

Further information required on current commitments:

- Local information on patient commuting patterns and distances to appointments, for GPs, community appointments and acute care.
- Verification of realistic appointment volume targets.
- Local agreement on what an avoidable admission looks like and how we can measure them (and progress against them) locally.
- Clarification around practical targets for length of stay reductions and relevant local data to baseline and track this, particularly around those staying 21+ days.

Areas missing from commitments:

- Understanding of how sustainable models of care could apply to local authority services e.g. social care.

5.2.3. Digital transformation

Reminder of ICS Green Plan commitments in this area

- Increase use of online services for patients (KPIs: NHS and other organisations staff working remotely, % of outpatient activity delivered remotely, data on impact virtual wards have on; reducing emergency admissions, emergency readmissions and length of stay, and reduced travel through digital/remote working and delivery of care)
- Digitise paper-based operations (KPIs: % of devices recycled / reused, % of paper based operations digitised)
- Integrate sustainability into digital plans (KPI: annual reporting on improved digitisation and impact on carbon footprint)

Available baseline information

Use of online services for patients

In BLMK, 28.8% of GP appointments for April 21-22[49] were via telephone or video consultation. For BLMK outpatient appointments (those based in Bedford, Luton and Dunstable and Milton Keynes Hospitals), 19.4% of attended appointments were conducted remotely in 2021-22[50]. One recent UK-based study of epilepsy appointments found that, at its upper estimate (using a PC rather than laptop or phone, which are more energy efficient), a remote consultation would emit 148g CO2e per hour of consultation[60]. Given any consultation is unlikely to be longer than 30 mins, this could be reasonably halved to 74g for the highest emissions and longest likely duration of a hospital appointment, and 37g for a likely duration of a GP appointment. When paired with the per appointment emissions calculated in the sustainable models of care section above, this would make remote consultations 2.5% the travel emissions of a face-to-face appointment for a hospital, 2.6% of the emissions for a GP appointment.

In terms of possible savings from increased use of remote consultations, NHS England has set a target of 25% of outpatient appointments being delivered remotely[61]. Applying this relatively modest increase in remote consultations to activity levels for 21/22 this would reduce CO2e to 2.7 kt per year.

Paper based operations

Amanda Prichard shared in 2021 that 20% of NHS Trusts still “largely” paper based[62]. Both of the hospital Trusts in BLMK have some measure of electronic patient record in place[63, 64], with some evidence of East of England Ambulance Trust[65] and East London Foundation Trust[66] engaging in similar workstreams. Equivalent information was not uncovered for the other Trusts operating in BLMK. Overall, it is therefore difficult to estimate both the current status of paper-based operations and also the possible carbon savings associated with this policy commitment. While there are many benefits to digitisation, and it may save carbon emissions, this is not guaranteed and depends quite a lot on behaviour and recycling rates[67].

Digital plans

The Director of Digital Delivery at the ICB indicated that integration of sustainability into digital plans would happen at provider level via sustainability champions. However, given there is no baseline measure of sustainability champions, this makes this commitment equally difficult to baseline. In addition, there remains a missed opportunity to lead in this area with the ICB's digital strategy, which currently has no mention of sustainability or baseline for digital operations[68]. The digital plans commitment is therefore not sufficiently developed to analyse.

Appraisal of data and evidence on current activities and emissions

🟨 Moderate evidence on carbon footprint of current area.

🟨 Moderate evidence on how commitments might reduce emissions.

Further information required on current commitments:

- Current level of paper use across ICS organisations, and a reasonable estimate about whether or by how much electronic systems are likely to reduce emissions.
- Theory of change about how digital plans could reduce emissions and what good practice would look like in this area.

5.2.4. Travel and transport

Reminder of ICS Green Plan commitments in this area

- Take measures to facilitate increased uptake of electric vehicles (KPI: NHS staff switching to low carbon travel options including: electric vehicles, public transport, fleet transition to low carbon options)
- Reduce the requirement to travel (KPI: reduced travel through digital/remote working and delivery of care)
- Encourage active travel through facilities for cycles (KPI: NHS staff switching to low carbon travel options including: active travel)

Available baseline information

The 2019/20 Greener NHS estimate for BLMK travel and transport was 44,780 tonnes CO2e /year (including business travel, NHS fleet, patient travel, visitor travel, staff commuting). This roughly corresponds with the following high level estimate for 2020/21. NHS associated travel is estimated to account for 3.5% of all road travel in England, contributing around 14% of NHS' total emissions[69]. In 2021, there were 4.4 billion road miles driven in BLMK[70], which means 155 million miles per year are likely to have been associated with the NHS in our area. Using this high-level metric, and assuming 3% electric car use, this would equate to 41.3 kilotonnes CO2e per year.

This could be added to two of BLMK's councils, which already calculated their emissions footprint associated with travel and transport:

Organisation	Year	Emissions
Bedford Borough Council	2018/19	2,159 tonnes CO2e for owned transport (fleet and social care) 164 tonnes for business travel (scope 3 indirect, inc. air, rail)
Central Bedfordshire Council	2018/19	4,098 tonnes CO2e for transport

This would come to 52.6 kilotonnes of CO2e (both direct and well to tank emissions), not including estimates from Luton and Milton Keynes local authorities (which weren't available) or from social care.

Workforce travel – commuting and electric car use

The high level estimates above do not enable analysis by emissions component, which is required for estimating possible impacts of different policies. Instead, the burden of commuting can be calculated from the following information:

- The average commuting distance from National Travel Survey (2021) was 817 miles per person per year[71].
- 72% people used car as main mode of commuting according to a past NHS staff survey[72].
- Car ownership by fuel type is 3% electric, 32% diesel, 64% petrol according to the National Travel Survey[73], and average emissions per mile can be taken

from the Department for Business, Energy, and Industrial Strategy database[26].

With an estimated workforce of 55,225, these data points provide an estimated annual commuting emissions of 8.7 kilotonnes of CO2e per year. Although employers often don't control vehicle types for commuting, if electric car use rose to 10% from 3% and overall miles did not increase, there would be a reduction of around half a kilotonne (477 tonnes) CO2e per year. However, this is just an example, and the current ICS Green Plan does not specify the proportion of electric car use among staff it would be looking to support.

Workforce travel – fleet

Fleet information from provider Green Plans, the Greener NHS Dashboard and an FOI request[74]:

Organisation	**Fleet type**	**Number of vehicles**	**Fuel compositions**	**Emissions calculations** (if calculated)
EEAST	Rapid response vehicles and non-ambulance	1043	3% ZEV, LEV 85%	21.2 ktCO2e
CNWL	Lease vehicles	74	85% petrol	
CCS	Lease vehicles	160	Unknown	
BBC	Fleet (excluding tractors and related vehicles)	211	Unknown	2.2 ktCO2e
BHFT	Fleet (vans only, tug vehicles excluded)	9	10% ZEV, LEV 60%	
Total identified		1497		

As with previous calculations by Trust, this is complicated by the fact that Trusts such as EEAST are very large and work well beyond the boundaries of BLMK in addition to covering our area.

Using available information, the largest fleets with the biggest carbon emissions are the ambulance trusts such as EEAST. For example, if they were to swap the remaining 12% of their fleet (which presumably is petrol) with zero emissions vehicles, they could reduce emissions by 1.2 kilotonnes CO2e per year (once WTT and electricity emissions are also accounted for). However, for other organisations with small fleets like Bedfordshire Hospitals Foundation NHS Trust, the emissions from staff commuting are likely to be much larger than their fleet emissions. In this case, the BHFT fleet is 9 vehicles (70% of which are low emissions), compared to an estimated 1.6 kilotonnes CO2e per year for staff commuting.

Business miles

Business miles were not widely reported in provider Green Plans, except for SCAS, which reported 500,000 miles claimed per year. For an organisation with this level of

business miles, assuming the same fuel compositions of vehicles as used above, would result in 169.6 tonnes CO2e per year. Reducing business miles by 10% as SCAS has pledged to do (assuming this is equally spit across vehicles of all fuel types) would reduce emissions by 17 tonnes CO2e per year.

Active travel

Little local data on active travel is available, but in 2022, according to Bedfordshire Hospitals Foundation Trust's green action plan, 15-20% of the capacity at the Luton and Dunstable Hospital cycle hub is estimated to be used. According to a survey of NHS staff nationally in 2017, 2% reported cycling as their main mode of transport for commuting, and 4% reported walking or running[72]. Although we do not have comprehensive information in this area, we can still reasonably conclude that active travel among BLMK staff is starting from a low base.

Appraisal of data and evidence on current activities and emissions

Moderate evidence on carbon footprint of current area.

Weak evidence on how commitments might reduce emissions.

Further information required on current commitments:

- Current commuting modes and active travel habits of staff (rather than relying on old information which may not be representative), ideally by organisation.
- Annual business miles, by provider.
- Full fleet information (numbers and fuel types) for each organisation.
- An estimation of car miles associated with the local authority and care sectors, since we only have some information for BBC and CBC.

5.2.5. Estates and facilities

Reminder of ICS Green Plan commitments in this area

- Improve energy efficiency and decarbonise energy inputs across all estates (KPIs: emissions data published quarterly, annual and seasonal energy use, sources of energy, waste produced, water use)
- Improve biodiversity and green estates where possible (KPI: access to green space on site, for both employees and patients).
- Reduce resource waste across all waste systems

Available baseline information

Overall, estates and facilities make up about 15% of the NHS Carbon Footprint plus[69], due to energy use. The 2019/20 Greener NHS estimate for BLMK energy use and waste was: 30,510 tonnes CO2e per year. The calculations below give a more recent estimate from 2020/21.

Estates' energy use

	Gas (kt CO2e)	**Electricity (kt CO2e)**	**Totals** (or not disaggregated)
Bedfordshire Hospitals Trust*	10	6	16
Milton Keynes University Trust*	4	3	7
East of England Ambulance Trust^	1.7	1.8	3.5
CNWL*	3	1	4
ELFT*	2	2	4
Cambridgeshire Community Services**	-	-	0.9
Bedford Borough Council^	-	-	5
Central Bedfordshire Council^	-	-	15.8
	20.7	13.8	56

Sources: Greener NHS Dashboard (20/21) Green plan or equivalent^ - **estates footprints for key treatment buildings, but only one of these (Luton Treatment Centre) was within the BLMK area.*

No public information was found for estates emissions from SCAS, Luton Borough Council or Milton Keynes Council. Without this information, the known annual emissions estimate is 56.2 kt CO2e. For organisations where the breakdown was available, gas was a larger contributor to emissions than electricity. Ground source heat pump systems are an alternative to gas (and being considered by EEAST[75]), and at least one has been installed in an NHS hospital[76], with the organisation claiming that it would reduce the site's carbon footprint by 60%. Assuming this reduction applies only to the disaggregated estates and facilities gas footprint, and that it is transferrable to our contexts, similar actions across BLMK could reduce annual emissions by 12.4 kt CO2e. At provider level, some Green Plans included other initiatives to reduce energy use, such as:

- LED light replacement (estimated to reduce Bedfordshire Hospitals Trust[77] energy use by 576 tonnes/year).
- Solar panel installation was being considered by EEAST[75], although the carbon savings had not yet been identified.
- Energy efficient building standards, particularly BREEAM (Building Research Establishment Environmental Assessment Method), were identified by many providers, but again the energy savings associated with these were not quantified.

Biodiversity

One site in BLMK is recorded as being an NHS Forest site, but the only activity dates back to 2012 and the planting of a single tree[78], indicating that at one point there was local intention to do more on biodiversity, but this has not been meaningfully followed through. In addition, there is no evidence of biodiversity being considered in relation to key redevelopment of secondary care sites in BLMK[79]. It is therefore safe to assume that the baseline for biodiversity is that it currently is not contributing to the overall balance of carbon emissions for NHS organisations within the ICS. By contrast, tree planting is more advanced in local authority organisations, with Bedford Borough[80] planting thousands and Milton Keynes Council[81] hundreds of trees, and Central Bedfordshire[82] and Luton[83] offering tree planting to communities or residents. It could be important for NHS organisations to learn from them, given the biodiversity net gain targets coming into force in 2023[84].

Initiatives like NHS Forest do not advise using tree-planting directly to offset emissions since benefits may take a long time to emerge and absolute carbon reductions may be small[85]. However, the Greener NHS acknowledges that offsetting will be required[86], and meaningful action biodiversity, green estates action and nature based solutions are likely to be a key part of that[87, 88]. In order to calculate any benefits to carbon offsetting or health, specific targets will need to be articulated across organisations.

Waste

On the Greener NHS dashboard, the total ICS area has 1 kilotonne of CO2e listed as our 20/21 waste output. This compares to the Greener NHS estimate of 2.37 kilotonnes in 19/20. This could relate to a real terms decrease, but it could also be a methodological difference, since some waste streams are likely to have grown during COVID-19 due to increased procurement of single use plastic for personal protective equipment[89], for example. It is also estimated to be around 0.1% of the overall NHS carbon footprint[90], so likely to be a relatively small part of the picture.

Appraisal of data and evidence on current activities and emissions

🟨 Moderate evidence on carbon footprint of current area was provided by Greener NHS dashboard data.

🟥 Weak evidence on how commitments might reduce emissions, although more specific suggestions from provider organisations show possible ways forward.

Further information required on current commitments:

- Greener NHS Dashboard only contained secondary care estates emissions data, and evidence from the Green Plans was highly variable, leading to an incomplete picture of energy and waste.
- No data at all was available from SCAS, Luton Borough Council or Milton Keynes Council.

Areas missing from commitments:

- Reduction of energy use was not an explicitly stated goal in the ICS commitments.
- Link with adaptation and passive heating / cooling by using building technology and green estates, was not made.

5.2.6. Medicines

Reminder of ICS Green Plan commitments in this area

- Engage patients and staff in discussions about medicines optimisation and develop an approach to reduce emissions generated by inhalers and anaesthetics where clinically appropriate (KPI: patient feedback on medicines optimisation efforts, staff surveys to evaluate effectiveness of increased training)
- Tackle waste generated by medicines and promote training and awareness for staff on recycling and medicine disposal (KPI: obtain carbon footprint data from wholesalers for medicines, successful partnership-working across the system.)
- Reduce emissions generated by the transport of medicines (KPI: complete an audit of medicines transportation to identify opportunities to reduce travel)

Available baseline information

Medicines account for 25% of the NHS's emissions[69], and so have been a substantial focus nationally. The 2019/20 Greener NHS estimate for BLMK medicines (anaesthetics and inhalers) was 17,130 tonnes CO2e per year. A more up to date estimation is made below.

Inhalers and anaesthetics
Information from the Greener NHS dashboard provides the following information on current anaesthetic and inhaler emissions in BLMK:

Emissions source	**Total in secondary care**
Desflurane emissions (annual rolling average, Jul 22)	8tCO2e
Sevoflurane (annual rolling average, Jul 22)	11.8tCO2e
Nitrous oxide (annual emissions 21/22)	3,504 tCO_2e
Total	3523.8 tCO_2e

Inhaler type	**Number prescribed BLMK** (June 2022)	**Emissions BLMK** (June 2022)	**Annual equivalent** (estimated)
MDI	52,597 (77%)	1055 tCO2e	12,600 tCO2e
DPI/SMI	16,058 (33%)	11 tCO2e	132 tCO2e
Total	68,655	1066 tCO2e	12,732 tCO2e

This comes to annual estimated total of 16.3 kilotonnes CO2e per year from these two groups of high emissions medicines. The inhalers are by far the more emitting of the two groups, and if the target of 50% of prescribed inhalers being MDI that was set by the House of Commons Environment Audit Committee in 2018[91] were met (the current level in BLMK is 76.7%), our area could save 4.2 kilotonnes in carbon

emissions each year. Other improvements, such as increased prescription of salbutamol inhalers that have a lower footprint (e.g. BLMK's average salbutamol inhaler decreased from 25 kg CO2e in 2018 to 22 in 2022[92]) have been enacted, but the scale of change for this is much smaller than switching to DPI/SMI inhalers.

Medicines waste

The Greener NHS dashboard details that Bedfordshire Hospitals Foundation NHS Trust has set up a multi-disciplinary team to deal with nitrous oxide waste, but provides no detail on further progress. No further local information on medicines waste was available. Nationally, a 2015 report estimated that £300 million of prescribed medications are wasted each year[93]. Further, NICE guidance on medicines optimisation estimated that, if their guidelines on optimisation were followed then 202 tonnes CO2e per 100,000 population[94] could be saved per year.

Medicines transport

No local information on medicines transport was available. One example from Oxford was found to have reduced emissions from medicines by introducing cycle couriers, but this was only by 10 tonnes CO2e (a relatively small reduction) and the baselines were not provided for use by other areas[95].

Appraisal of data and evidence on current activities and emissions

🟨 Strong evidence on carbon footprint of current area was provided by Greener NHS dashboard data, but information on medicines transport and waste was very weak. Overall, level of data was therefore moderate.

🟥 Weak evidence on how commitments might reduce emissions, due to specific targets not being articulated.

Further information required on current commitments:

- Confirmation of whether the <50% MDI inhalers target is being worked towards locally.
- Benchmarks for medicines waste and transportation emissions.

Areas missing from commitments:

- Reduction and unnecessary prescribing could be added to medicines waste remit.

5.2.7. Supply chain and procurement

Reminder of ICS Green Plan commitments in this area

- Ensure suppliers are aligned with the NHS' green agenda (KPI: proportion of tenders with sustainability questions included, proportion of tenders which meet Government Buying Standards, number of suppliers with scope 1 and 2 emissions reduction plans in place)
- Switch to local suppliers where possible
- Reduce the use of single-use plastic products (KPI: number of ICS services with waste monitoring systems in place, data on waste redirected from landfill.)

Available baseline information

The 2019/20 Greener NHS estimate for BLMK's supply chain (including business services, medicines and chemicals, medical equipment, construction and freight, and non-medical equipment) was 192,980 tonnes CO2e.

Suppliers and the green agenda

Based on information for the ICS theme leads in this area, few 'green' questions were included historically in tenders. Those that were included previously were not given significant weighting as part of the decision-making process. It may therefore be safe to assume that no current tenders are fully compliant with the commitment that suppliers be aligned with the green agenda. However, they confirmed that since the NHS standard contract now includes green agenda questions[96], and the national procurement guidance PPN 06/20 and PPN 06/21 requires 10% net zero and social value weighting[97], this is what would be followed for all future tenders. Although the PPN 06/21 specifies that suppliers must commit to becoming net zero by 2050 at the latest, it only applies to contracts over the value of £5 million[98]. The success of this notice would depend on the correct application of the weighting, the implementation and timeline of these commitments, the location of the supplier, and the extent to which offsetting is used in place of emissions reduction, among many other unknown factors. Impact would also depend on ICS organisations applying the weighting correctly; a recent example of BLMK procurement put social value and net zero weighting at 4%, not 10%. It is therefore unclear how much the use of these PPN guidance notices[99] would support reduced carbon emissions in the short to medium term. In addition, the PPN notice only applies to NHS contracts and central government, and so does not currently cover local authority or care system suppliers and procurement.

Local suppliers

There was no universal definition for a local supplier, but it was informally felt to be a supplier from the same or neighbouring counties. However, more importantly, theme leads explained that under the current legal frameworks they are not able to prioritise locally based providers or suppliers, so instead must rely on the social value and net zero requirements, which could favour local suppliers due to shorter transportation distances. In addition, they noted that many local suppliers are small businesses, whose ability to meet a formal sustainability agenda may be limited.

Waste management and single use plastic

The status of current waste monitoring and levels of landfill waste and recycling was unknown at provider and ICS level. Instead, the NHS standard contract[96] would be relied upon going forward, which details:

"The Provider must have in place clear, detailed plans as to how it will contribute towards a 'Green NHS' with regard to Delivering a 'Net Zero' National Health Service commitments in relation to:

- 18.3.3 single use plastic products and waste, and specifically how it will take action:
- 18.3.3.1 to reduce waste and water usage through best practice efficiency standards and adoption of new innovations;
- 18.3.3.2 to reduce avoidable use of single use plastic products;
- 18.3.3.3 so far as clinically appropriate, to cease use at the Provider's Premises of single-use plastic cutlery, plates or single-use cups made of expanded polystyrene or oxo-degradable plastics;
- 18.3.3.4 to reduce the use at the Provider's Premises of single-use plastic food and beverage containers, cups, covers and lids; and
- 18.3.3.5 to make provision with a view to maximising the rate of return of walking aids for re-use or recycling, and must implement those plans diligently."

However, even if this is implemented in future, it would not cover the non-NHS providers within the ICS system.

Appraisal of data and evidence on current activities and emissions

🟥 Weak evidence on carbon footprint of current area from high level Greener NHS estimate.

🟥 Weak evidence on how commitments might reduce emissions, due to specific targets not being articulated and no specific baseline information being identified.

Further information required on current commitments:

- Understanding of how many suppliers are currently aligned with the green agenda. Estimate of how much carbon could be saved from the supply chain through PPN compliance
- Definition of a local supplier and understanding of how local suppliers could help reduce carbon footprint (e.g. transport of goods).
- ICS and provider level baselines for current single use plastic consumption, recycling and landfill rates.

Areas missing from commitments:

- Expanding the NHS "green agenda" to cover procurement by others in the ICS system, namely local authorities.
- Commitments related to reusable items and supporting a circular economy.

5.2.8. Food and nutrition

Reminder of ICS Green Plan commitments in this area

- Reduce food waste across our sites and facilities (KPIs: number of food waste recycling points and disposal facilities, amount of household waste reduction, % of food sourced locally)
- Phase out plastic packaging (KPI: amount of plastic packaging reduction)
- Provide more sustainable food choices for our workforce (KPI: annual reporting on workforce nutritional conditions)

Available baseline information

The Greener NHS 2019/20 estimate of the footprint for food and nutrition in BLMK was 24,200 tonnes CO2e. More recent estimates in this area are very high level, due to lack of current ICS theme lead and also some providers not including commitments on this as part of their Green Plans. Nationally, in 2018-19 £634 million was spent on hospital food, representing 140 million patient meals and approximately 6.7% of the total costs of running the NHS estate[100]. It also makes up around 6% of the NHS' carbon footprint plus[69].

Food waste
No local data was found on levels of food waste in organisations across the ICS. However, literature reviews have found that food waste in healthcare facilities can be up to 50%[101]. It is therefore very important to understand the local picture on food waste, since it could represent a significant part of the carbon emissions associated with this area.

Local procurement and plastic packaging
While procuring local food can be beneficial for social and economic reasons (and a Nottingham based Trust defined this as being within 30 miles[102]), only around 5.5% of food's emissions come from transportation, with a similar amount coming from packaging[103]. This means that choice of food is more impactful for emissions than where it comes from or its packaging. This doesn't mean there are no carbon savings to be found here, only that they are much smaller; for example, reducing plastic packaging by 10% (as promoted by the Plastics Pact[104]) could reduce overall emissions by 0.05%, which could be around 2 tonnes CO2e annually for BLMK's patient meals.

Sustainable food choices
A recent study found a possible 17% reduction in carbon emissions if meals were to comply with the Eatwell guide[105], compared to the average UK diet, which could equate to 4,114 tonnes CO2e per year for BLMK patient meals. This therefore could be the area of food and nutrition in which the greatest carbon reductions can be made.

Appraisal of data and evidence on current activities and emissions

🟥 Weak evidence on carbon footprint of current area

🟨 Moderate evidence on how commitments might reduce emissions, thanks to external estimates for two out of three commitments.

Further information required on current commitments:

- Baseline levels of food waste, local food procurement and food related plastic packaging were not found.

Areas missing from commitments:

- Measures such as composting food waste where appropriate were not included.

5.2.9. Adaptation

Reminder of ICS Green Plan commitments in this area

- Develop risk assessment and progress monitoring mechanisms (KPI: evaluation of risk assessment and progress monitoring efforts)
- Establish management and oversight practices (KPI: suitability of management and oversight approaches, level of engagement with local stakeholders)
- Increase risk mitigation efforts by developing the necessary emergency planning and preparedness strategies (KPI: progress made on the development of climate mitigation plans, and subsequent assessment of such plans).

Available baseline information

Information in this area is currently limited due to lack of current ICS theme lead, and no current adaptation plan at ICS level. In addition, at provider level, most commitments under adaptation were focussed on identifying risks.

However, national guidance about adaptation planning in relation to healthcare does exist.
Climate change is listed as a risk on BLMK ICB risk register as follows: “due to climate change, there is a risk of increased pressure on health and care services, and deteriorating population health outcomes”.

In addition, it also is featured in National Security Risk Assessment (NSRA) guidance used by Local Resilience Forums to plan for emergency situations. The NSRA is official sensitive, but its public facing counterpart the National Risk Register[106] covers flooding (responses include warnings, flood defences and construction resilience) and extreme weather (responses include providing alerts and advice).

According to national Greener NHS guidance, adaptation measures should look to the long term (not simply emergency response) and also not increase emissions[107], but there is no current way of assessing this without an official adaptation plan against which to benchmark.

The Local Health Resilience Partnership (which is made up of ICB and provider leads) is currently reflecting on longer term adaptation responses to heatwaves scenarios based on 2022 impacts, but primary responses being considered were expansion in air conditioning units. Compared to passive cooling strategies, this risks increasing energy use substantially[108] and therefore counteracting Green Plan goals.

Appraisal of data and evidence on current activities and emissions

🟥 Weak evidence on carbon footprint of current area.

🟥 Weak evidence on how commitments might reduce emissions, with the danger that adaptation measures could actually increase carbon footprint.

Further information required on current commitments:

- Baseline levels of food waste, local food procurement and food related plastic packaging were not found.

Areas missing from commitments:

- Clear commitment to long-term green adaptation, minimising additional carbon emissions wherever possible.

5.3. Health impacts

At a high level, using the range of mortality estimates associated with current carbon emissions, we can say that 324,540 tonnes of CO2 equivalent emitted in 2020 is likely to case 73-325 excess deaths before 2100[18, 19]. However, we cannot say these will be local deaths (in fact, this may be unlikely), so a closer look at more immediate impacts in time and geography is required.

5.3.1. Air pollution

Air pollution refers to gasses or particles that are generated by road traffic, manufacturing, agriculture and energy industries among others. They can form part of the air we breathe in different concentrations, and some have severe consequences for human health. The main pollutants of interest are typically nitrogen dioxide and particulate matter (PM) of various sizes. Key health conditions associated with air pollution primarily include asthma, respiratory disease, coronary heart disease, stroke, and lung cancer[34]. According to the World Health Organization, air pollution is carcinogenic, and recommended annual exposure limits should be 5 µg/m^3 for PM2.5, and 10 µg/m^3 for nitrogen dioxide[109].

Scientific literature – health factors

Issue and study authors	**Definition of air pollution**	**Health effects -** how much do cases increase or decrease in different pollution scenarios?
All-cause mortality meta-analysis from Chen and Hoek (2020)[110]	Per 10 µg/m^3 of $PM_{2.5}$	Risk Ratio (RR) for all-cause mortality was 1.08 (95%CI 1.06, 1.09)
Asthma meta-analysis from Khreis et al (2017)[111]	Black carbon (BC): Nitrogen dioxide (NO2), Nitrogen oxides (NOx): Particulate Matter < 2.5 µm in diameter (PM2.5): Particulate Matter < 10 µm in diameter (PM10):	Relative risk of developing childhood asthma with traffic pollution exposure: 1.08 (1.03, 1.14) per 0.5 × 10− 5 m− 1 1.05 (1.02, 1.07) per 4 µg/m3 1.48 (0.89, 2.45) per 30 µg/m3 1.03 (1.01, 1.05) per 1 µg/m3 1.05 (1.02, 1.08) per 2 µg/m3
Asthma and COPD meta-analysis based on London, Evangelopoulos et al (2022)[112]	PM 2.5 per 10 µg/m^3 increase NO2 per 10 µg/m^3 increase	3.2% (1.9-4.5%) increase in asthma hospital admissions in 0-14s 3.93% (1.06-6.89%) increase in asthma/COPD hospital admissions for 65+ 3.9% (1.5-6.4%) increase in asthma hospital admissions in 0-14s

		1.42% (1.07-1.76%) increase in asthma/COPD hospital admissions for 65+
COPD meta-analysis from Park et al (2021)[113]	10 µg/m^3 increase in $PM_{2.5}$	Increased incidence of COPD HR 1.18, (95% CI 1.13–1.23)
Coronary heart disease and stroke cohort study from Wolf et al (2021)[114]	10 µg/m^3 increase in NO_2 5 µg/m^3 increase PM2.5	Model 3 (fully adjusted models), hazard ratios Stroke incidence 1.08 (95% CI 1·04–1·12) Coronary heart disease incidence 1.04 (1.01–1.07) Stroke incidence 1.10 (1·01–1·21)
Stroke meta-analysis, Shah et al (2015)[115]	PM2.5 (per 10 µg/m3 increment) NO2 (per 10 ppb increment) PM10 (per 10 µg/m3 increment)	Relative risk of stroke: Incidence 1.011 (1.011 to 1.012) Hospital admission 1.011 (1.010 to 1.012) 85 Mortality 1.012 (1.011 to 1.012) Overall incidence 1.014 (1.009 to 1.019) Hospital admission 1.012 (1.005 to 1.018) Mortality 1.016 (1.007 to 1.023) Overall incidence 1.003 (1.002 to 1.004) Hospital admission 1.002 (1.000 to 1.003) Mortality 1.003 (1.002 to 1.004)
Lung cancer cohort study from Raaschou-Nielsen et al (2013)[116]	PM_{10} per 10 µg/m^3 For $PM_{2·5}$ per 5 µg/m^3	Lung cancer, statistically significant hazard ratio: 1·22 [95% CI 1·03–1·45] 1·18 [95% 0·96–1·46]
Compilation of meta-analyses on **preventable causes of cancer** Brown et al (2018)[117]	Air pollution – all types combined	Population attributable fraction for all cancers in England: 1% Population attributable fraction for cancer of lung, bronchus and trachea in England: 8.2%

Local data

Local exposure to unhealthy levels of air pollution and the burden of disease to which that contributes, according to the Fingertips tool from the Office for Health Improvement and Disparities[118]:

Local authority	Fine particulate matter (total concentrations of PM2.5) - 2020	Proportion of mortality (aged 30+) attributable to air pollution - 2020
England	7.5	5.6%
East of England	7.8	5.8%
Bedford	7.6	5.5%
Central Bedfordshire	7.6	5.7%
Luton	8.2	6.2%
Milton Keynes	8.2	6.1%

A 2014 Public Health England report estimating local burdens of disease from air pollution calculated that 354 deaths can be attributed to air pollution per year in the BLMK area[119]. Based on the attributable mortality from OHID above and the Office for National Statistics' mortality data[120], this was 465 deaths in 2020. In terms of the specific harms that are associated with air pollution, our local baselines are displayed in the table below. Using the relative risks provided by the literature review above and the Public Health England methods[119] and estimates from the research above, we can also calculate the attributable fractions for air pollution for each condition – the proportion of cases that would not occur if air pollution was not present.

	England	BLMK	BLMK attributable fraction % (cases)
COPD count (% prevalence)	1,170,437 (1.9%)	16,549 (1.6%)	PM2.5: 12.3% (2,028)
Asthma Prevalence – all Prevalence – under 19s**	3,629,071	60,739 (6.2%) 23,055 (9.1%)	PM2.5: 20.8% (12,649)* (4,801)
Coronary heart disease Count (%prevalence)	1,850,657 (3.0%)	27,120 (2.6%)	NO2: 7% (1,901)
Stroke (annual, 20/21) Prevalence Admissions Mortality	1,093,593 (1.8%)	14,511 (1.4%)	NO2: 13% (1,928) PM2.5: 14% (2,029)
Lung cancer incidence (annual 2020)	37,237	490	All air pollution: 8.2% (40)

**Childhood asthma population attributable fraction extrapolated to all asthma cases as lifetime risk ratios were not found. This is why childhood numbers were also included.*
***Local numbers for under 19s were unavailable, so figures from Asthma UK/NHS England were extrapolated to BLMK's 2021 under 19 census population.*

Exposure to air pollution for the ICS workforce and for patients seeking health care is also high. The SHAPE Atlas tool[121] overlays the UKHSA air pollution vulnerability indicator (UKHSA's pilot indicator to of population level vulnerability to air pollution at LSOA level) for PM2.5 and NO2 onto local maps, showing that all three of BLMK's highest volume sites (Luton and Dunstable Hospital, Bedford Hospital and Milton Keynes University Hospital) are in the highest scoring areas. This indicates high vulnerability to air pollution from the communities living around the hospital sites (see appendix 3 for the maps).

In addition, we know that average air pollution exposure at the hospital sites, and across BLMK counties more generally, is excessive. Two of the main hospital sites (Luton and Bedford) are also either in or bordering an Air Quality Management Area[122, 123]. More specifically, we can quantify exposure at BLMK's main hospital sites[124], and average roadside exposures[125] across the two main sources of air pollution harm:

Site	**PM2.5 exposure** (annual average)	**NO2 exposure** (annual average)
Bedford Hospital MK42 9DJ	11.53 µg /m3	18.40 µg /m3
Luton and Dunstable Hospital LU4 0DZ	10.80 µg /m3	17.86 µg /m3
Milton Keynes Hospital MK6 5LD	11.41 µg /m3	15.62 µg /m3
Bedford Borough – average roadside (2021)	7.6 µg /m3	17.6 µg /m3
Central Bedfordshire - average roadside (2021)	7.6 µg /m3	16.6 µg /m3
Luton – average roadside (2021)	8.2 µg /m3	21.4 µg /m3
Milton Keynes - average roadside (2021)	8.2 µg /m3	18.5 µg /m3

Examples of policies that have reduced exposure to air pollution

Mapping connections between policies and reduced exposure to harmful air pollutants is challenging because emissions are only one element of exposure; weather is also a powerful influence on how dispersed or concentrated pollutants might be. There are also several sources of PM (exhaust and non-exhaust e.g. tyres, brakes), and they and their effects may also overlap (COMEAP)[126]. In addition, road transport is not the only source of these pollutants; it is estimated to make up 13% of PM2.5 pollution and 68% of NO2 pollution[127, 128]. All of this means that policy

predictions are likely to be relatively uncertain initially, but can be improved with localised data collection. Below are some examples of research where reductions in exposure have been measured.

Policy description	How much were pollutants reduced?	Any health benefits associated?
Comparing NO2 and PM 2.5 exposure in London and asthma admissions in 2016 compared to 2019. During this time the T-charge (2017), which then became an ultra low emissions zone, (2019) was implemented. Source: Evangelopoulos et al (2022)[112]	Median population-weighted average concentrations reduced: -2.5 µg m-3 for PM2.5 -7.9 µg m-3 for NO2	20-30% reduction in asthma admissions attributable to air pollution
UK traffic volume and pollutants were compared between spring 2020 (during initial lockdown) and averages from 2017-19. Source: Jephcote et al (2021)[129]	Monthly-average daily traffic counts in April-2020 fell by 69% compared to April-2019. NO_2 and $PM_{2.5}$ concentrations fell respectively by 38.3% (8.8 µg/m^3) and 16.5% (2.2 µg/m^3).	None investigated
Modelled comparisons between 2016 levels of air pollution in London and two others, one based on ULEZ and London Environment Strategy (LES) scenarios for 2050. Source: Webber (2020)[130]	Unclear what the specific reductions being modelled are. Possible numbers offered by the ULEZ consultation are 13.6% reduction in PM2.5, 6.9% reduction in NOx from road transport[131].	ULEZ: 29% reduction in total new cases of disease attributable to air pollution in London LES: 35% reduction in total new cases of disease attributable to air pollution in London.
De-weathered and de-trended air pollution concentrations in Oxford 2016-19 compared to lockdowns 1 and 2 in 2020. Source: Singh et al (2022)[132]	Lockdown 1: 69% reduction in traffic volume, associated with -28.2% NO2 at roadside and -17% NO2 and -12% PM2.5 at urban background locations. Lockdown 2 : 38% reduction in traffic volume, no significant change in	
A modelled approach, looking at levels of PM2.5 in 2010 in Adelaide, Australia, and co-benefits	Shifting 40% of private car kilometres to alternative transport (10% cycling, 30% public	40% alternative transport scenario was modelled to prevent 542 deaths.

to shifting transport habits by 2030. Source: Xia et al (2014)	transport) over 20 years was modelled to reduce PM 2.5 by 26%. Alternatively, shifting 10% of private car kilometres to cycling would generate a reduction of 8.6% PM2.5.	10% cycling scenario prevent 326 deaths

Possible impacts of Green Plan policies on air pollution and health

Combining the population attributable fractions for air pollution, proportions of road traffic attributable to each air pollutant, and the high-level figure that NHS activity accounts for 3.5% of journeys in England[133], can give us an idea of the impact of local NHS transport emissions. Local NHS travel and transport (not capturing the impact of the care and local authority sectors) could therefore be responsible for:

- 2 deaths per year attributable to PM 2.5
- 58 cases of asthma due to PM 2.5, or 292 cases of asthma due to NO2
- 1 case of lung cancer
- 9 cases of COPD
- 46 strokes per year due to NO2, or 9 strokes due to PM2.5

If we take the average annual exposure at the three key hospital sites as an example, the reductions required to bring PM2.5 to WHO guidance levels of 5 µg /m3 and NO2 to 10 µg /m3 (displayed below) would be higher than any of the real or modelled reductions in the literature above.

Site	% PM2.5 reduction required to reach WHO standard	% NO2 reduction required to reach WHO standard
Bedford Hospital MK42 9DJ	-56.6%	-45.7%
Luton and Dunstable Hospital LU4 0DZ	-53.7%	-44%
Milton Keynes Hospital MK6 5LD	-56.2%	-36%
Bedford Borough – average roadside (2021)	-34.2%	-43%
Central Bedfordshire - average roadside (2021)	-34.2%	-40%
Luton – average roadside (2021)	-39%	-53%
Milton Keynes - average roadside (2021)	-39%	-46%

The scale of action required to see differences both at health and care sites, and across BLMK, depends on the extent to which we can attribute emissions at these sites to NHS activity. However, the largest modelled PM2.5 reduction (-26%) comes

from the Australian study, which requires a 40% swap from private car miles to active and public transport. It is therefore likely that at least this level of action would be required to see a meaningful difference.

The ICS Green Plan has set no specific target for reduction in private car use, and the only provider to set a specific aim for this is Milton Keynes University Hospital, which committed to a 10%-point decrease in the number of employees commuting alone and a 10%-point increase in the number of people car sharing, using public transport and active modes. While there are other commitments related to increasing share of electric vehicles among business, lease and commuter fleets, this is unlikely to have significant impacts on PM2.5 levels (although it would reduce NO2 and carbon emissions)[134]. This means that overall there is not likely to be sufficient action in this area to come close to reducing air pollution in a way that is likely to reduce air pollution and produce meaningful health benefits at present.

More specific, and much greater, commitments to get staff out of private cars wherever possible are therefore required in order to reduce the health impact of travel and transport associated with health and care. As for how to do this, suggestions from the literature include ensuring that public transport and active travel are the same price or cheaper than driving and parking for staff[135].

Inequalities and vulnerable groups

Overall, we know that patients, those who live nearby, and members of staff are currently exposed to high levels of pollution around key hospital sites in BLMK, and also that overall concentrations across our local authorities are at unhealthily high levels. These exposures are likely to be felt unequally, with research concluding that highest pollution exposures in the UK are experienced by the poorest 20% of households[136] and those with the highest numbers of young children[137], despite contributing least to emissions. Unequal exposure leads then to unequal outcomes, with air pollution compounding conditions already made more likely by deprivation[138, 139]. Therefore, not actively and ambitiously reducing the NHS' local contribution to air pollution would continue to contribute to ongoing health inequalities, contradicting work in other areas, especially as it relates to the poorest 20% of the population and those with chronic respiratory disease (which are both key targets for reducing inequalities in the CORE20PLUS5 framework[140]).

Appraising the evidence on health: air pollution

🟩 Strong evidence that generation of pollutants through ICS activity harms health locally currently (through travel-produced pollutants).
🟨 Moderate evidence of relevant policy interventions that could reduce this harm.
🟥 Weak evidence that ICS green policy commitments are aligned with scientific and policy evidence, and therefore likely to improve health locally.

5.3.2. Extreme weather

According to the Office for Health Improvement and Disparities, the main current and future risks of climate change and weather in the UK include heatwaves, flooding, wildfire, storms and drought[8]. A previous review of the impacts of extreme weather on the health and care system listed heatwaves, coldwaves and flooding as their primary areas of concern[141], so these are the issues highlighted by the literature below.

Scientific literature – health factors

Study type and authors	Definition of extreme weather	Health effects
Systematic review and meta-analysis, Cruz et al (2020)[142]	Flooding in the UK	Pooled prevalence of mental health conditions 12 months after experiencing a flood: Anxiety: 19.78% Depression: 21.35% PTSD: 30.36%
Systematic review and meta-analysis, Liu et al (2022)[143]	Heat exposure, per 1°C increase above the reference temperature (definition unclear, but Met Office threshold is 25-28°C [144])	Cardiovascular mortality in high income countries RR 1.020, 2.1% increase
Ecological study combining UK admissions and weather data, Rizmie et al (2022)[145]	Plotted effects from -5°C to 30+°C	Incidence risk ratio of emergency hospital admissions by disease area (significant ones listed only) for 30+°C compared to 10-15°C: Infectious diseases: 21.1% increase Metabolic diseases: 28% increase Respiratory diseases: 9.2% increase Injuries: 6.0% increase For -5°C compared to 10-15°C Respiratory diseases: 8.9% Injuries: 20.9%

Local information

Heatwave data for 2022 is not currently available on a regional level, but the ONS reports that there were 3,271 excess deaths across England and Wales from June to August 2022 over 5 heatwave periods[146]. For those over 65, excluding COVID-19, this amounted to 2,803 excess deaths, which is the highest since the heatwave plan was introduced in 2004[146]. If this was proportional to the over 65 population of BLMK, this would be equivalent to 40 deaths for this year alone. However, it is possible that our region experienced more excess deaths than this since the East of England (along with parts of the south) is one of the most vulnerable areas of the UK to adverse heat weather events[147]; a previous estimate for the annual mean deaths in the wider East of England region put the number at 78 per year[148]. Without

sufficient adaptation measures, this could grow to a mean of 110 and highs of 195 deaths per year in BLMK by 2050[149], depending on population growth levels. As part of their analysis of the 2022 heatwaves, the ONS also notes that deaths in care homes in particular were above average on heat period days[146], so these settings should receive specific consideration in future adaptation planning.

In addition, after attending the Local Health Resilience Partnership meeting, the leads for emergency preparedness and response across BLMK confirmed that the 2022 heatwaves period had interfered with delivery of care in several significant ways, including (but not limited to):

- Mortuary failure at two hospitals
- Air conditioning and air handling unit failures, leading to rising internal temperatures in staff and patient areas
- Medicines and devices becoming unusable due to very high temperatures in community staff vehicles.

Although the effects of climate change may mitigate the effects of cold, this type of adverse weather still contributes to mortality[150]. A recent study estimated that there were 6414 annual mean deaths due to cold in the East of England[148].

Nationally, 4,630 properties were also flooded in England in 2019/20[151]. Although there was significant regional flooding reported in BLMK (Bedford in 2022 and 2020[152], and Milton Keynes in 2021[153]) no local data about the number of people affected locally each year were found.

Local levels of the health-related conditions mentioned in relation to heat, cold and flood above (as extracted from Fingertips[154]) include:

Condition	BLMK	England
Depression – new diagnoses 20/21	7,815 (1.1%)	671,799 (1.4%)
Mortality from all cardiovascular disease (aged 65+) 2020	1,345	107,215
Emergency hospital admissions for respiratory disease (20/21)	7,120	407,719

Examples of policies to reduce effects of extreme weather on health

Study type and authors	Adaptation policies	Health effects
Literature review from Cheng et al (2013)[155]	Adaptation strategies that increase **social capital** (buddy systems, community outreach targeting vulnerable populations) Adaptation strategies that influence **urban design**	Decreased heat-related illnesses Improved overall health status due to increase capital, independent of other predictors of health Increased physical activity, decreased cardiovascular and

	(increasing green spaces, reducing concrete surfaces, building more bicycle and walking paths)	respiratory diseases, thermal comfort, improved mental health
Modelled analysis of heat island adaptation measures on health outcomes from Taylor et al (2018)[156]	**Energy efficiency** upgrades to housing stock: insulation of floors, roofs and walls, triple glazed windows. Installation of **external shutters or shading** on housing stock (used between 9am-6pm in summer).	External shutters could reduce heat attributable deaths by 30-60%. Shutter installation and energy efficiency retrofit together could reduce mortality by 52%
Narrative report from Jay et al (2021)[157]	**Landscape and urban scale**: water bodies, green space, shading, trees, urban ventilation, reducing vehicle density, active transport infrastructure, electric vehicles. **Building scale**: reflective coatings on walls, roofs and streets, insulation, glazing systems, external window shading **Individual scale**: fans, self-dousing, evaporative coolers, cold water ingestion, reducing activity, optimising clothing	Lower temperature and carbon emissions at the same time, can also have additional benefits related to physical activity and mental health. Reduce risks of indoor overheating and need for active cooling Can reduce body temperature, but only up to certain thresholds, and are also dependent on humidity.

Possible impacts of Green Plan policies on extreme weather and health

Given the current lack of long-term adaptation planning in the ICB and ICS provider organisations, it is difficult to assess what action might be taken on this topic and any impact it might have. There is also some significant overlap with biodiversity strand in the estates and facilities theme, since lack of green space is a key risk for urban heat islands[158], which is also starting from a baseline of no visible action. The other guidance documents which are followed in place of an adaptation plan – the National Risk Register[106] and Heatwave Plan for England[159] – focus on emergency response rather than longer term actions, which are the majority of recommended methods detailed in the literature above. Meanwhile, the National Adaptation Plan[160] focusses on delivery of health and social care services in adverse weather, rather than any longer term prevention strategies for health services. All this considered, it is unlikely

that any of the health effects of adverse weather will be reduced in any way without a plan that goes above and beyond existing adaptation guidance.

Inequalities and vulnerable groups

Older people are at much higher risk of heat related morbidity and mortality, due to reduced temperature control above around 26 degrees centigrade[161, 162]. This is also true for those with existing co-morbidities. Several studies also found that those who were more socio-economically deprived were at higher risk of harm from extreme weather brought on by climate change[15, 148], so ongoing inaction risks compounding existing health inequalities in BLMK.

Appraising the evidence on health: extreme weather

🟨 Moderate evidence from national estimates that current state of affairs, and ICS (in)activity in terms of adaptation harms health locally.
🟨 Moderate evidence of relevant policy interventions that could reduce this harm.
🟥 Weak evidence that ICS green policy commitments are aligned with scientific and policy evidence, and therefore likely to improve health locally.

5.3.3. Active travel

Active travel, defined as making journeys by physically active means (like walking or cycling)[163], is associated with many positive health benefits, including strong associations between reduced overall mortality, cardiovascular disease, lower rates of type 2 diabetes, reduced musculoskeletal issues, reduced cancer rates and improved mental health[164]. It is also crucial for cutting carbon and related emissions since it can replace private car journeys.

Scientific literature – health factors

Study type and authors	Definition and dose of active transport	Health effects
Systematic review from Jarrett et al (2012)[165]	2.5h per week of moderate physical activity	Type 2 diabetes: RR 0.81, 50% of effect achieved in 3.2 years Dementia: RR 0.89, 50% of effect achieved in 17 years Cerebrovascular disease (stroke): RR 0.77, 50% of effect achieved in 2 years Breast cancer: RR 0.87, 50% of effect achieved in 17 years Colorectal cancer: RR 0.92, 50% of effect achieved in 17 years Depression: RR 0.93, 50% of effect achieved in 2 years Ischaemic heart disease: RR 0.77, 50% of effect achieved in 2 years N.B. also increased incidence of injury
Prospective cohort study from Welsh et al (2020)[166]	1000 participants changing their commute to include cycling for 10 years (mixed or exclusive) from private car	15 fewer first cancer diagnoses (HR 0.89) 4 fewer cardiovascular events (HR 0.79) 3 fewer deaths (HR 0.88) 23 more injuries requiring hospital stay of <1 week 3 more injuries requiring hospital stay of >1 week
Retrospective cohort study from Patterson et al (2020)[167]	Usual commute by private motorised transport compared to public transport, walking and cycling from 1991-2016.	Analysis adjusted for age, sex, housing, marital status, ethnicity, education, car access, population density, socioeconomic classification, long term illness found: All cause mortality: bicycle HR 0.8 Cardiovascular mortality: bicycle HR 0.76 Cancer incidence: bicycle HR 0.89, walking HR 0.93 Cancer mortality: bicycle HR 0.84

Local data

Across BLMK, around two thirds of adults are classed as physically active[168], but very few use walking as their commute method and even fewer cycle to work. Common health consequences of insufficient physical activity range from overweight to heart disease, depression[169] and cancers, whose rates in BLMK are laid out below:

	England	East of England	BLMK*
% physically active adults	65.9%	65.7%	65.4%
% walking for travel 3+ days per week (19/20)	15.1%	13.8%	10.9%
% adults cycling for travel 3+ days per week	2.3%	2.4%	2.2%
Overweight or obese	63.5%	64%	66.7%
Obesity	25.3%	25%	28.5%
Coronary (ischaemic) heart disease	3%	3%	2.6%
Hypertension	13.9%	14.3%	13.2%
Diabetes 20/21 prevalence	7.1%	6.9%	7.2%
Depression (18+)	12.3%	11.3%	11.3%
Stroke prevalence 20/21	1.8%	1.8%	1.4%
Stroke hospital admissions (annual) 20/21	88,255	-	945
Cancer prevalence 20/21	3.2%	3.3%	2.7%

*population weighted average used where BLMK rate was not provided by Fingertips.

In addition, given there is a sickness absence rate of about 5% in NHS organisations across the East of England[170], and obesity is associated with higher rates of sickness absence[171], it is likely that staff activity levels have consequences for operational performance.

Examples of policies to improve active travel in healthcare staff

There was not a wealth of studies on successful active travel policies or interventions in healthcare or similar staff groups, or employees more generally. A review of the evidence from 2016 concluded that the evidence on effectiveness on reducing driving behaviour was not strong[172]. However, a more recent review looking at

population-level interventions concluded that those balancing incentives ("carrots") with disincentives ("sticks") were more likely to have an impact on transport behaviour[173].

Possible impacts of Green Plan policies on active travel and health

While it's possible that policies to encourage active travel could affect the wider BLMK population through infrastructure and the households of employees, the most direct avenues to impact would be through changing the commuting patterns of the health and care staff themselves.

However, language in the ICS Green Plan and in all but one of the provider plans is vague around encouraging active travel, with no specific targets outlined. The exception is Milton Keynes University Hospital, which commits to increasing the proportion of staff who commute by active means by 10%. If we take the 3.5% cycle commuting of the Milton Keynes area as typical, then this would represent 133 of their staff. Increasing cycle commuters by 10% would therefore be an increase of only 13 – far from the 1000 used as a benchmark in the Welsh et al study.

Instead, a more impactful ambition could be to aim to have 10% of those currently commuting by private car commuting by bicycle. Based on population rates of disease and scientific literature discussed above, this could have the following health benefits:

Condition	**Expected number of cases in BLMK workforce**	**Reduction in cases if 10% currently commuting by car cycled**	**Timeline over which health gains would occur**
Diabetes	3937 (7.2%)	75	50% in 3.2 years, all in 6.4 years – Jarrett et al
Ischaemic heart disease	1455 (2.6%)	33	50% of effect achieved in 2 years – Jarrett et al
Cerebrovascular disease (stroke)	773 (1.4%)	10	50% of effect achieved in 2 years – Jarrett et al
Depression	6240 (11%)	50	50% of effect achieved in 2 years– Jarrett et al
Any cancer	1491 (2.7%)	16	Over 15 years – Patterson et al.

Inequalities and vulnerable groups

Given that diabetes[174], heart disease[175], stroke[176], depression[177] and cancer[178] are all to some extent common among more deprived individuals, who are also less

likely to be physically active[179], any proactive policies that support greater active travel and generate improved health outcomes in these domains could have a greater impact on lower paid staff groups. However, any policies of this kind would also need to be inequalities sensitive to ensure that this is the case, by using "low-agency" rather than opt-in approaches, since these are more equitable[180].

Appraising the evidence on health: active travel

🟨 Moderate evidence from national data that baseline NHS activity (travel and transport patterns) is likely to be harming health of staff locally.
🟥 Weak evidence of relevant policy interventions that could reduce this harm.
🟥 Weak evidence that ICS green policy commitments are aligned with scientific and policy evidence, and therefore likely to improve health locally.

5.3.4. Nutrition

Diets high in salt, sugar, saturated fat and red and processed meat, but low in fish, fruit, vegetables and fibre increase the risk of high blood pressure, cardiovascular disease, type 2 diabetes and some cancers[181]. Food consumption is also something that we all do every day that can contribute to a lesser or greater extent to carbon emissions, so the scope for co-benefits is large.

Scientific literature – health factors

Study authors	**Definition of low carbon diet**	**Health benefit**
Jarmul et al. 2020 – systematic review	Vegan diet: 81% reduction in GHGs Flexitarian diet: 46.1% reduction in GHGs	Significant reductions found for: Nutrition related chronic diseases: -12% [-19.8 to -4.28] Diabetes: -19.3% [-36.1 to -2.54] Cardiovascular disease -15.1% [-26.1 to -3.93] Significant reduction in cardiovascular disease: -1.75% [-2.65 to -0.84]
Milner et al. 2015 – modelling study in UK population	Compliance with WHO recommendations, which would reduce GHGs by 17%	The switch would save almost 7 million years of life lost prematurely in the UK over the next 30 years and increase average life expectancy by over 8 months
Columbo et al. 2021	Fruit – 100g increase per day Vegetables – 100g increase per day Legumes – 50g increase Red meat – 100g decrease Processed meat – 50g decrease	Ischemic heart disease RR 0.86 (0.79-0.95) [over 10 years] Ischemic stroke RR 0.65 (0.55-0.79) [over 10 years] Tracheal, bronchus, and lung cancer RR 0.93 (0.89-0.97) [over 30 years] Oesophageal cancer RR 0.87 (0.78-0.0.97) [over 30 years] Type 2 diabetes RR 0.91 (0.84-0.98) [over 10 years] Ischemic heart disease RR 0.86 (0.78-0.94) [over 10 years] Ischemic stroke RR 0.87 (0.79-0.97) [over 10 years] Ischemic heart disease RR 0.76 (0.65-0.89) [over 10 years]

		Colorectal cancer RR 0.86 (0.76-0.97) [over 30 years] Type 2 diabetes RR 0.8 (0.68-0.97) [over 10 years] Ischemic heart disease RR 0.56 (0.39-0.97) [over 10 years] Colorectal cancer RR 0.85 (0.79-0.91) [over 30 years] Type 2 diabetes RR 0.58 (0.47-0.76) [over 10 years]

Local data

The local context for obesity, heart disease and stroke (displayed above in 5.3.3) is challenging. In addition, local estimates show that dietary quality is also poor, with data from Fingertips showing just over half of people getting five fruits and vegetables per day[182].

	England	East of England	BLMK*
% adults getting 5 a day (2019/20)	56.80%	56.70%	54.5%
Overweight or obese	63.50%	64%	66.7%
Obesity	25.30%	25%	28.5%
Coronary (ischaemic) heart disease	3%	3%	2.6%
Hypertension	13.90%	14.30%	13.2%
Diabetes 20/21 prevalence	7.10%	6.90%	7.1%

From calculations in the food and nutrition section (5.1.8) we know that BLMK is a provider of a significant volume of patient meals each year. What is less known, is the numbers of staff who also consume meals in their health and care workplaces. One general estimate (not from a UK setting) was that around 30% of employees eat at a work canteen[183], whereas another estimated that 44% of doctors ate in their hospital restaurant settings[184].

Another local unknown is the current nutritional quality of meals for patients, staff and visitors in the BLMK region where they are provided. Recent reviews of food from South-East England found that the majority of lunch meals in the canteen had "an unfavourable nutrient profile, and regular consumption of such meals may increase the risk of noncommunicable diseases"[185], and previous NHS staff surveys have revealed that 39% of staff think that catering prevision is poor[100].

Examples of policies to change nutrient consumption in health and care context

Very few examples of health or care based interventions to improve nutrition in a climate and health sensitive way were found. However, one systematic review of policies to improve consumption of healthy food by healthcare staff in high income countries concluded that the most effective interventions were around reducing availability of low quality food[186], not simply labelling, for example. Another review concluded that implementing existing guidelines was associated with an improved hospital food environment and decreased availability of unhealthy food[187]. However neither of these reviews reported quantitative health outcomes associated with these policies.

Possible impacts of Green Plan policies on nutrition and health

Existing commitments in the ICS Green Plan cover food waste, local providers and reducing packaging. In provider plans, where they exist on food and nutrition, they tend to focus on similar issues, although sometimes (in the ELFT plan, for example) plant based food is mentioned.

However, these will not have any tangible impacts on the health of staff, patients or visitors. The focus should be instead on meal composition, decreasing red and processed meats, increasing fruits and vegetable consumption in line with the Eatwell and WHO guidelines[188].

Using staff numbers from the BLMK hospital sites only (11630), and the lower 30% estimate of staff eating at the canteen (3489), we can calculate possible health effects of changing the composition of canteen food. Assuming that BLMK baseline levels of disease can be used for this staff group, and the changes could be achieved via one daily meal at the canteen, some of the possible health effects over 10 years for this hypothetical group of 3489 staff could be as follows:

Diet intervention (from Columbo et al.)	**Health effects on 3489 staff over 10 years**
Fruit +100g per day	13 fewer cases of ischaemic heart disease 22 fewer cases of diabetes
Vegetables +100g per day	13 fewer cases of ischaemic heart disease
Legumes +50g per day	22 fewer cases of ischaemic heart disease
Red meat -100g per day	49 fewer cases of diabetes
Processed meat -50g per day	40 fewer cases of ischaemic heart disease 104 fewer cases of diabetes

From this review of possible shorter term health impacts of canteen changes, the impactful intervention would be to reduce (or remove) consumption of processed meat. It is also possible that combining the interventions could enable individuals to reach their '5 a day' target, as the average UK diet in the Columbo et al. study was estimated to contain 140g of vegetables and 88g of fruit per day, a total of 228g of the 400g minimum advised by both WHO and the NHS[189].

Inequalities and vulnerable groups

Similarly to the considerations around active travel, healthy eating is much less affordable or common for those on lower incomes[190], leading to obesity becoming more prevalent at lower income levels[179]. This is likely to be exacerbated by the ongoing cost of living crisis. Therefore, subsidising healthier and more sustainable food on offer to staff and patients could make policies around food and nutrition more equitable, with greater health benefits felt by those on lower incomes. However, this would only be effective if those on lower incomes are using organisational catering services, and we do not have good data on this locally for BLMK at present.

Appraising the evidence on health: nutrition

🟨 Moderate evidence from national sources that baseline activity (food provision) is likely to be harming health (particularly of staff) locally.
🟥 Weak evidence of relevant policy interventions that could reduce this harm.
🟥 Weak evidence that ICS green policy commitments are aligned with scientific and policy evidence, and therefore likely to improve health locally.

6. Recommendations and reporting

6.1. Reporting: assessing emissions and health impacts

Available information for baselining of carbon reduction commitments was poor, and carbon reduction potential therefore was uncertain
In many of the ICS' Green Plan commitment areas, information on the current baseline level of activities and carbon emissions was not available to the degree that would enable a reliable forecast of how much emissions would be reduced as result of the commitment being fulfilled. Commitments were often also not specific, well-defined, or time-bound, which added to this difficulty. Although estimates using scientific literature were offered as part of this report, they were limited by a lack of local data. Therefore, the extent to which current Green Plan commitments will meaningfully cut carbon emissions is uncertain.

Current commitments were not plausibly sufficient to improve health
Current ICS level Green Plan commitments are not specific or ambitious enough to realistically improve health for BLMK communities or staff. Often the types of actions outlined within commitments were in the right area, but lack of specific targets made it impossible to say that they would live up to any health improving potential.

Climate change, carbon emissions and related activities are contributing to poor health and health inequalities in BLMK now
Air pollution
In BLMK in 2020, more than 460 deaths could be attributed to air pollution and 21% of asthma cases may be attributable to long term exposure. NHS associated activity could be responsible for 16 deaths and 443 asthma cases annually. The poorest communities are most likely to be exposed to high air pollution and suffer the consequences. Levels of PM2.5 and NO2 are also well above WHO recommended limits for key BLMK hospital sites and roadsides across all counties.

Extreme weather
Around 48 deaths for individuals over 65 years old in BLMK were attributable to the 2022 heatwaves. It is not known how many of these occurred in health and care settings. This weather also contributed to mortuary failures and high temperatures in health facilities and cars of health workers; the damage to care has not yet been quantified, but it is likely to have impacted quality of care and outcomes.

Active travel
The small amount of available evidence indicates that the health and care workforce are not likely to be involved in active travel, and many of them will not be meeting recommended levels of physical activity. This has consequences for obesity, heart disease and sickness absence.

Nutrition
If their health corresponds to that of BLMK as a whole, almost half of health and care staff are not getting 5 fruits and vegetables per day, and two thirds are overweight or obese. Although local data was lacking, evidence from elsewhere indicated that many staff in settings such as hospitals where there is a canteen are likely to eat in

it, and the quality of the food available there is likely to have an unfavourable nutrient profile.

Updated Green Plan policies could increase likelihood of improving health
Based on the data available now, updated commitments could improve the likelihood of maximising health gains and cutting carbon by focussing on the following types of actions.

Air pollution
Reducing private car use was likely to be the most effective method for improving air quality in relation to PM2.5 and NO2. In relation to travel and transport, reducing private vehicle use from commuting was also the most effective way of reducing carbon emissions for many organisations (except ambulance trusts), although this may change if fleet data is improved in future.

Extreme weather
BLMK ICS currently has no long term plan about how to adapt to high temperatures, minimise morbidity and mortality during heatwaves, and do this while reducing energy use and carbon emissions (e.g. not simply relying on air conditioning). Energy efficiency (insulation and triple glazing) paired with external shutters and shading for organisational and housing stock could reduce deaths 30-60%, whilst also lowering energy use in non-heatwave periods. Outside shading with trees could also lower the external temperatures and reduce the risk of urban heat island effects around key health and care facilities.

Active travel
Reducing private car use was also the most impactful option for improving health via active travel routes. However, health benefits for staff could be shown at lower levels of reduction than required for improving air quality. Across all BLMK staff, 10% staff swapping their private car commute for a bicycle could avert 75 cases of diabetes, 33 of heart disease, 10 strokes and 50 cases of depression, with effects seen within 2-3 years.

Nutrition
Changing the profile of available food was the intervention most likely to produce health outcomes. Reduction or elimination of certain meats had the greatest health effects; when modelled for a group of around 3500 staff over 10 years, 100g less red meat per day resulted in 49 fewer cases of diabetes, and 50g less processed meat per day resulted in 40 fewer cases of ischaemic heart disease and 104 fewer cases of diabetes. There were similar but smaller health gains for increasing consumption of fruit, vegetables and legumes. Providing a healthier diet in line with Eatwell guidance was also the most impactful choice from a carbon reduction perspective, and could save around 4 thousand tonnes of carbon dioxide equivalent per year compared to BLMK's 19/20 baseline.

6.2. Recommendations: monitoring and evaluation of health impacts moving forwards

In order to implement the measures detailed above and improve the ICS's ability to demonstrate health impact via Green Plan measures in future, the following changes were recommended:

Refine Green Plan goals to be more evidence based in scale and scope
Use the information gathered in this report to refine the ICS Green Plan commitments into SMART goals, including targets based on maximising health co-benefits. This could be done as an annual action plan, which is a tool that has been used in other ICSs and Trusts to improve pace and detail of Green Plan reporting.

Fill key information gaps to enable improved monitoring and evaluation
Working with ICS partners, the ICB should support direct information gathering on the health impacts of climate change in order to better capture current and future damage and co-benefits. This should include firstly basic activity data such as:

- Staff travel and commuting patterns
- Staff occupational health data
- Annual business miles by Trust
- Staff canteen use and meal quality/contents
- Patient and care home statistics and meal quality/contents
- Information on challenges faced by care homes, local authority and primary care in the recent heatwave.

Areas of the Green Plan missing most baseline information:

- Granular supply chain information e.g. levels of local procurement, in order to be able to establish how net zero guidance might shape outcomes via suppliers within BLMK.
- An adaptation plan with commitments, against which progress can be measured.

This could also extend to directly collecting health impact related information such as:

- Pollution levels at major health and care sites as measured by an air pollution monitor so peaks and troughs can be recorded rather than modelled.
- Temperature monitors from major health and care sites to profile vulnerability to extreme weather via indoor air temperature.
- Patterns of admissions and service demands during the 2022 heatwave (and previous similar events) to help forecast future challenges and inform adaptation planning.

Improve ICS communication, assurance and governance to enable better information collection
In order to build momentum around the Green Plan, improve its impact and ensure better data is collected in future, governance should be strengthened, including measures such as:

- Board level commitment to regular (e.g. quarterly) review of commitments, data and progress related to the ICS Green Plan.
- Board level commitment to identifying theme leads for each area in the Green Plan, and resourcing them if relevant teams do not have sufficient capacity.
- Reconvening of the ICS wide sustainability leads group in order to facilitate peer governance, networking and standardisation of approaches where possible.
- Consider using project management resources and setting up performance dashboard so that progress can be easily monitored and that there are adequate resources to drive Green Plan work forwards. This is what Norfolk and Waveney ICS have done[191].
- Engage primary care and adult social care more formally to understand what their plans are in this area.
- Further engage local authorities (including linking in with active travel, planning and public health teams where possible) to ensure they are aware of NHS Green Plan processes, can share their expertise in making progress in this area where they are more advanced than NHS Trusts (BBC, CBC) and support others to catch up (MK Luton), working towards eventually having data that is broadly comparable and aggregable from local authorities and NHS organisations.

Commit to evidence generation on policy measures
Although the evidence on connections between climate change, carbon emissions generation, and health impacts is strong across the board, there was not a wealth of evidence around policies in health and care settings to reduce these impacts. This means that evidence generation about what works in our context is crucial for success in this area going forward. This is particularly necessary if we are to move beyond estimating health impacts on staff, and have more reliable estimates for the wider BLMK communities. Academic partners could be approached for support in this domain.

Clarify the ICB's role as a climate and health leader
In order to clarify leadership and scope of the ICS Green Plan, further work should be done to specify how provider plans and ICS plans overlap, and ensure that responsibility for each area is clear so that no areas are neglected. In areas where the ICB does not have authority or direct influence, a theory of change should be developed as to how it will support providers throughout the ICS to take action. A helpful vision of ICS leadership in this area could be borrowed from the Norfolk and Waveney ICB, which defines itself as "driving consistency and ensuring best practice is shared and adopted"[191], and specifically lists different tasks in this area that ICB is responsible for and what the provider organisations should do, to promote clarity in this area.

Integrate climate and health outcomes with existing population health work
Ultimately, the ICS is responsible for improving population health, and the Green Plan provides a clear opportunity to do so, both for our own staff and the communities we serve. Therefore, climate and health indicators as explored in this report should be included in future versions of the BLMK PHM strategy[192]. Work should go forward to develop population health datasets across the ICS, to ensure they are embedded in this significant workstream moving forwards and not seen as

fringe because they are linked to environmental sustainability. It would also make sense to ensure that these indicators are embedded within other major health strategy work across the ICS, such as the Joint Strategic Needs Assessment and the local Health and Wellbeing strategy. This would be a coherent approach, since the health impacts of climate change and carbon emissions are currently contributing to health inequalities, and reducing carbon emissions in a health conscious way is also a prime opportunity to increase workforce wellbeing.

6.3. Next steps

6.3.1. Dissemination and feedback

This report and its findings will be shared with key stakeholders for feedback and input, specifically around the recommendations and the practicality of implementing them. As of December 2022, this has involved sharing and presentation to the following groups:

- ICS Green Operational Group (which involves net zero leads from all provider organisations)
- ICB executives group
- East of England net zero leads group

Further dissemination to contacts outside of the East of England will also be considered for early 2023, in order to gain feedback, share learning and support similar assessments elsewhere.

6.3.2. Toolkit

In order to ensure this work is a first step towards improved policies to maximise health benefits and reduce carbon emissions, a spreadsheet containing all the evidence and calculations made in this report has been produced in order to share it with provider organisations. This will enable them to better understand why better information collection is required and could build an appetite for them to appraise the health impacts of their own plans as well.

6.3.3. ICB actions

Once dissemination has been completed and feedback collated, the ICB should take the following next steps to begin implementation of recommendations (provided no serious objections are raised during dissemination):

- Start drafting a Green Plan action plan specifying key actions and deliverables for 2023.
- Draft a proposal around resource implications of recommendations, particularly governance, monitoring and data collection.
- Discuss recommendations with the population health management collaborative at ICS level.

Appendix 1 – record of engagement

Log of engagement meetings:

September 2022	Survey shared with 35 key stakeholders across the system.
October 2022	4 October – discussed with Helen Haumann, ICB Digital Lead 13 October – presented plan and progress to ICS net zero lead group 17 October – discussed with Luke McGeogh, Health Foundation 28 October – discussed James Bate Regional NHS England South
November 2022	1 November – discussed with supply chain and procurement ICB leads, and workforce ICB team (separately) 4 November – presented overview to Greener NHS National Leads 14 November – discussed with Paul Lomax, ELFT sustainability lead, separately with Helen Codd Sussex ICB Green Plan Lead 17 November – participated in adaptation discussion at Local Health Resilience Partnership meeting
December 2022	15 December - East of England Green Operational Group meeting 21 December – ICB executives meeting

Appendix 2 – methodological notes

5.1. Search for tools and monitoring approaches

Methodology:

- Sharing information locally, meeting with ICS partners and asking about related projects
- Literature review (“health outcomes” “green policies”, pubmed [0 results] and Google scholar [189 results], Google [“health outcomes” “green policies” tool uk nhs] [857 results, first 5 pages]). Post 2010
- Snowballing

5.3.1 Air pollution

- Literature review (impacts of air pollution on health meta-analysis uk, Google Scholar and pubmed[40])
- asthma air pollution meta analysis [pubmed 143]
- COPD air pollution meta analysis[pubmed 41]
- Stroke air pollution meta analysis [pubmed 33]
- coronary heart disease air pollution meta analysis [pubmed 15]
- lung cancer air pollution meta analysis [pubmed 80]

- Inclusion criteria: meta-analysis, most recent
- Exclusion criteria: doesn't provide a health effect tied to a specific increase in air pollution e.g. 1mg/m3
- Of chosen studies, only significant findings reported

5.3.2. Extreme weather

- green adaptation climate change health
- green adaptation climate change health uk
- green adaptation climate change health nhs uk
- health impacts extreme weather climate change [pubmed 8]
- health impacts heat climate change uk [pubmed 2]
- health impacts flooding uk climate change [pubmed 45]

5.3.3. Active travel

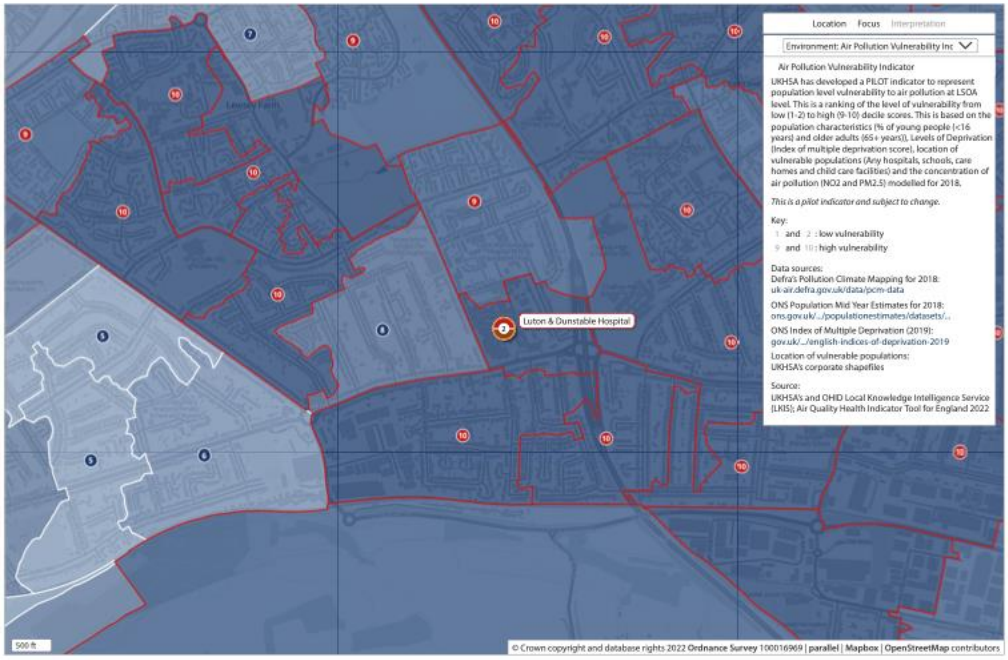
- active travel health benefits meta-analysis uk [pubmed 15]
- active travel health benefits meta-analysis uk [google scholar 4,310]
- active travel nhs staff interventions uk [google scholar]

5.3.4 Diet

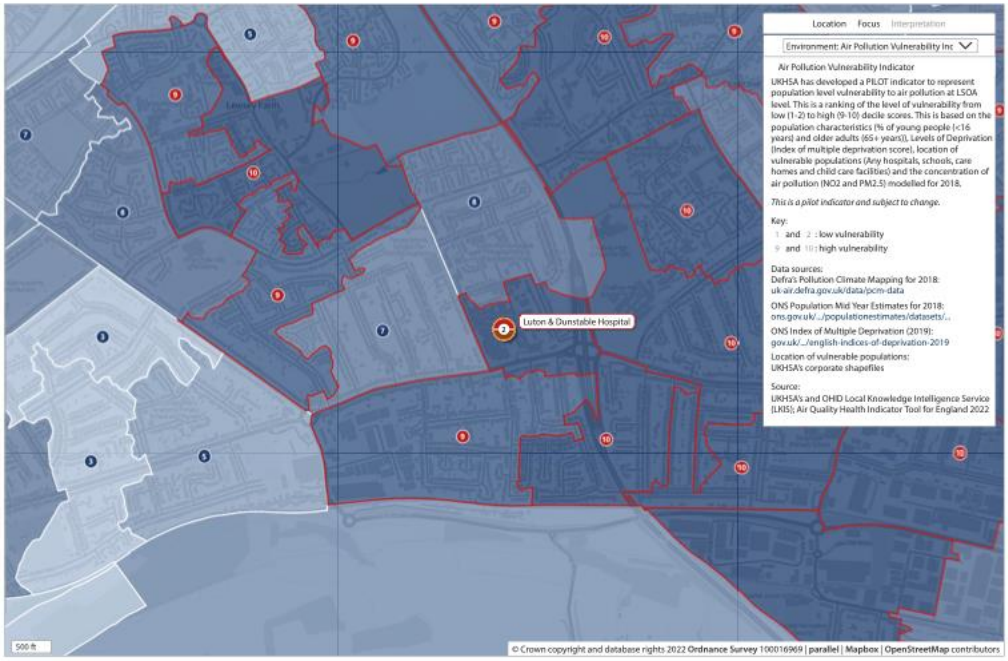
- diet "climate change" carbon emissions meta analysis health outcomes
- climate change diet health outcomes meta analysis uk
- Low carbon diet health outcomes – 7 results pubmed
- climate change diet health outcomes meta analysis uk – 2 results pubmed
- policies to improve health patient and staff meals nutrition nhs – Google Scholar

Appendix 3 – air quality maps around BLMK hospital sites
Source: ATLAS Shape Tool: https://app.shapeatlas.net

Luton and Dunstable Hospital – PM2.5 vulnerability indicator

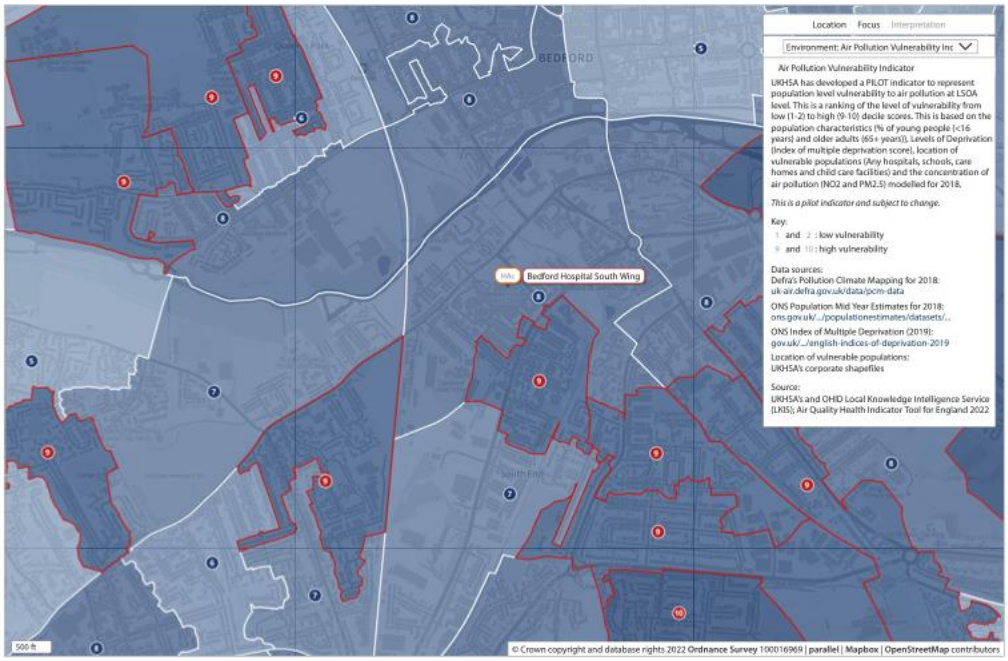


Luton and Dunstable hospital – NO2 vulnerability indicator

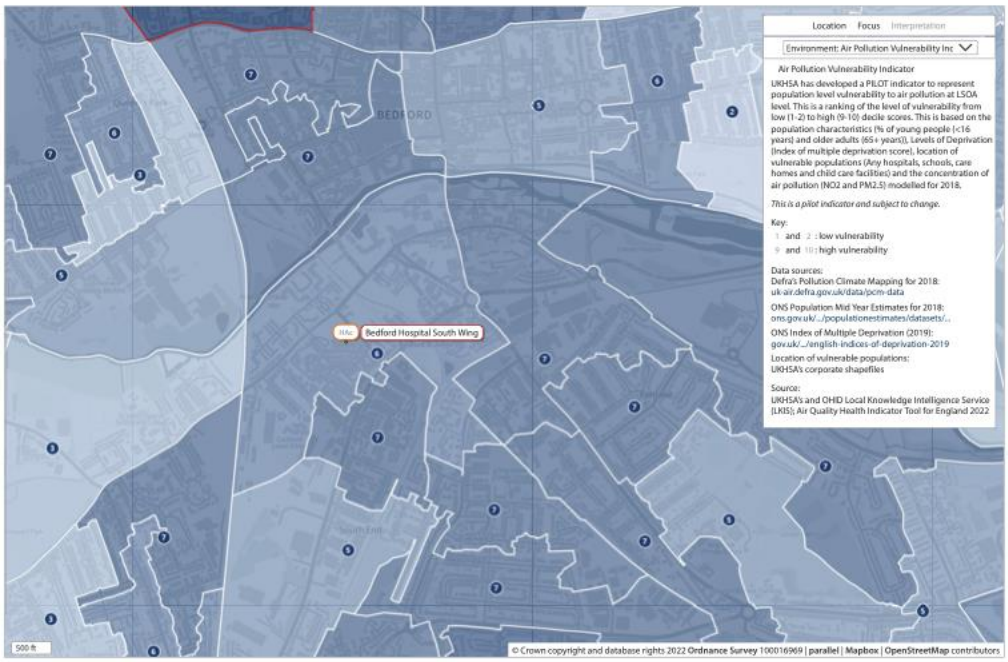


Luton – Air Quality Management Area 2

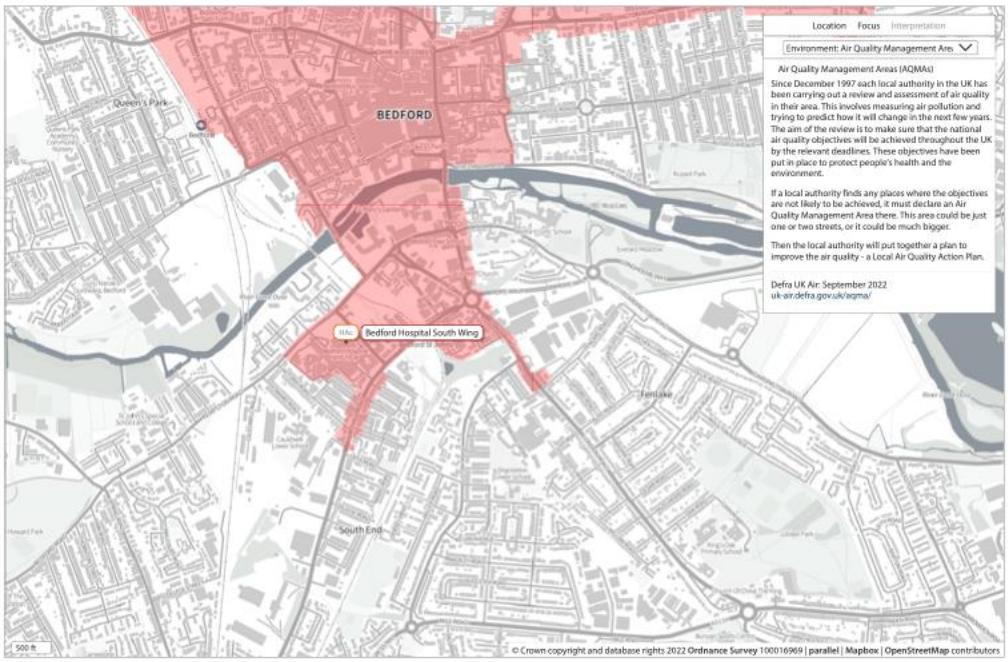
Bedford Hospital – PM2.5 vulnerability indicator



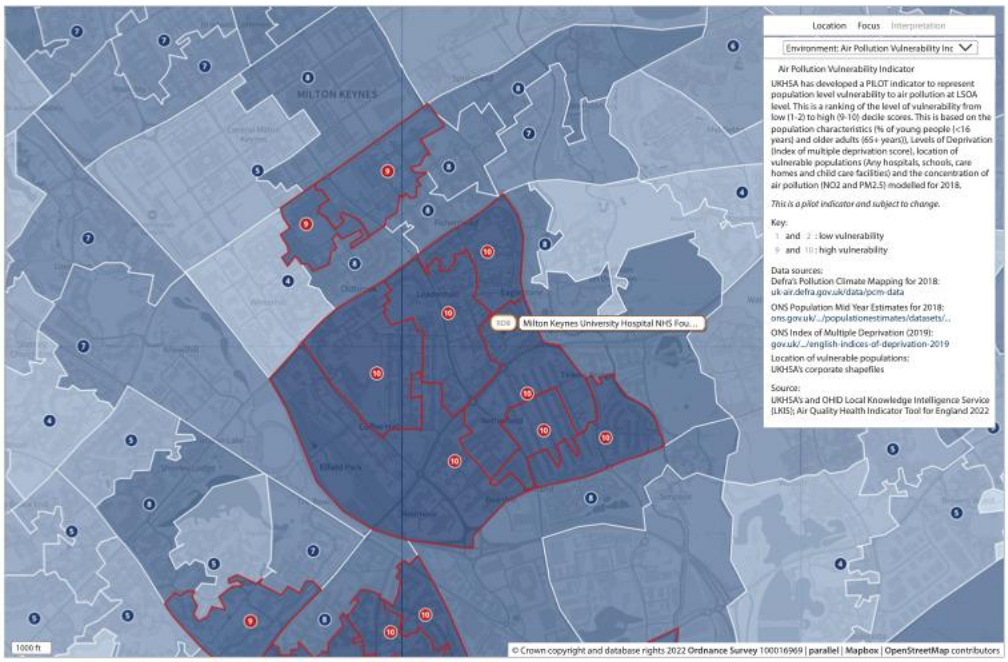
Bedford Hospital – NO2 vulnerability indicator



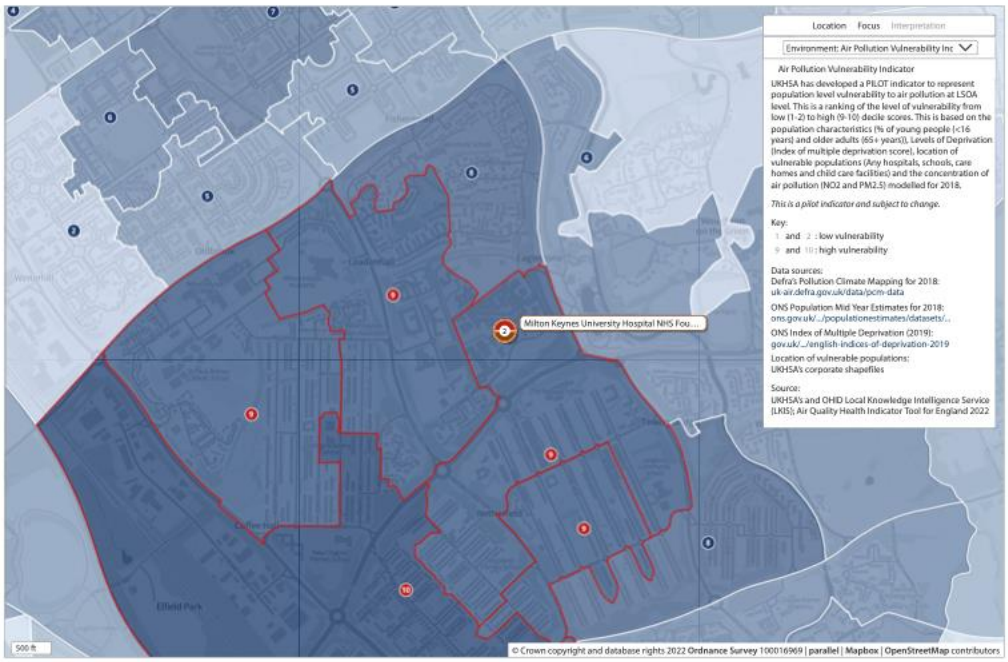
Bedford – Air Quality Management Area



Milton Keynes – PM2.5 vulnerability indicator



Milton Keynes – NO2 vulnerability indicator



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