Air Quality Framework

Contents

Cheshire and Merseyside Integrated Care Board Air Quality Framework

1.   Introduction

Air pollution impacts on the health of people throughout their lifetimes, contributing to a range of conditions from before conception to the end of life that require NHS care. These impacts are not equally felt and some groups suffer more than the general population, both because they are more exposed to air pollution and because they are more vulnerable to its effects due to underlying causes.

Air pollution costs the NHS through attendances, admissions and treatment, as well as through staff absence and lower productivity for associated conditions. By 2025, this is estimated to have cost the NHS and social care in England £5.56 billion since 2017 (Public Health England, 2018).

Action on air pollution will help to improve population health outcomes, tackle inequalities and support broader social and economic development, as Integrated Care Systems (ICSs) were designed to do (NHS England, no date).

2.   Context

Work on air pollution links into NHS Cheshire and Merseyside's *Green Plan* areas of adaptation, green spaces and biodiversity, and travel and transport. It is also mandated in the Service Conditions of *NHS Standard Contract 2024/25* (see Box 1).

When the coroner's prevention of future deaths report was published for Ella Adoo-Kissi-Debrah (who was the first person in the UK to have air pollution listed on their death certificate as a cause of death), the coroner noted that the negative impacts of air pollution on health were not being adequately communicated to patients by healthcare professionals and called for this to be rectified (Courts and Tribunals Judiciary, 2021).

The *Chief Medical Officer's Annual Report 2022* focused on air pollution and contains many recommendations to improve this, including around active travel, reducing pollution near healthcare facilities and schools, as well as acknowledging the importance of indoor air quality (although there is less evidence around what works in this space).

Did you know?

UK air quality targets are up to 4 times weaker than recommended by the World Health Organization.

The *NHS Net Zero Travel and Transport Strategy* requires ICSs to produce a Sustainable Travel Strategy as part of their Green Plan by 2026 and highlights the importance of strategic partnerships within ICSs, particularly around transport planning (NHS England, 2023).

The report from Sir Michael Marmot's Institute of Health Equity for Cheshire and Merseyside, *All Together Fairer*, proposes cycling and walking as a Marmot Beacon Indicator and contains a number of recommendations related to this, as well as highlighting the key importance of housing to health (including around indoor air quality) (Marmot et al., 2022).

Action on air pollution across the system in Cheshire and Merseyside would not only improve quality of life, particularly for our most vulnerable communities, but reduce costs on our health and social care system and reduce our emissions. As part of the partnerships required to work at ICS system level, this is also an opportunity to develop relationships across organisations to reach net zero goals. Work has been explored with local authorities and Liverpool City Region Combined Authority to explore how air pollution could be tackled in conjunction with NHS partners.

18.3 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:

> 18.3.1 air pollution, and specifically how it will take action:
>
> > 18.3.1.1 to reduce air pollution from fleet vehicles, to offer and promote more sustainable travel options for Service Users, Staff and visitors and to increase use of such options, in accordance with the NHS Net Zero Travel and Transport Strategy; and
> >
> > 18.3.1.2 to phase out fossil fuels for primary heating and replace them with less polluting alternatives.

Source: NHS England, 2024.

3.   Health and healthcare impacts

As recognised by NHS Cheshire and Merseyside's *Green Plan,* air pollution is the single biggest environmental risk factor for health and operates on a socio-economic scale, so does not affect all equally. It is estimated that outdoor air pollution causes between 26,000 and 38,000 deaths per year; note that this figure excludes indoor pollution (Chief Medical Officer, 2022). It also causes illness and exacerbates illness in people with underlying conditions, directly impacting upon the healthcare system through increased attendances and admissions. Pregnant people, children and older adults are the most vulnerable to the effects of air pollution and poorer communities are more impacted due to where they live (which also intersects with other equalities characteristics such as ethnicity). Those with existing cardiovascular and respiratory conditions are particularly at risk of the effects of air pollution.

Figure 1 below summarises the health impact of air pollution through the life course.

Figure 1: Conditions across the life course with associations with air pollution
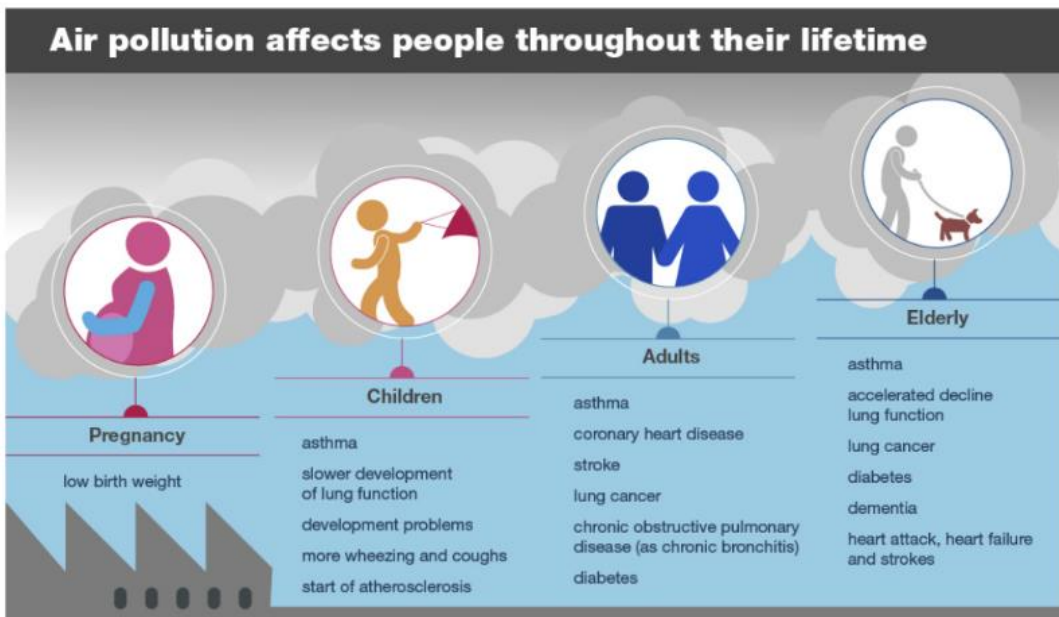
Source: Public Health England, 2022.

The aforementioned *Chief Medical Officer's Annual Report 2022* reported that a reduction of one µg/m3 of particulate matter 2.5 ($PM_{2.5}$) in 2017 in England could prevent the following by 2035:

- 50,900 cases of coronary heart disease
- 16,500 strokes
- 4,200 lung cancers
- 9,300 cases of asthma in adults

Research published in 2018 found that between 2017 and 2025, air pollution (PM2.5 and nitrogen dioxide) cost the NHS and social care approximately £1.60 billion where only strong evidence of association with specific diseases was included (Public Health England, 2018). This figure rose to £5.56 billion when other diseases with weaker evidence of association were included. Low birth weight and dementia were not included in the model as at the time this evidence was less certain, so this is likely to be an underestimate of costs.

4.   Sources of poor air quality

Outdoor air quality is affected by pollution from a range of sources, and there are a number of reports which have explored this in detail, including: *Chief Medical Officer's Annual Report 2022*; *Air Pollutant Inventories for England, Scotland, Wales, and Northern Ireland: 2005-2021* (National Atmospheric Emissions Inventory, 2023); and *Emissions of air pollutants in the UK – Summary* (Department for Environment, Food and Rural Affairs, 2024).

Figure 2 below categorises the main sources of the various air pollutants nationally, and notes that nitrogen dioxide (NO2) and PM are particular problems in urban areas (both because they may be higher than in other areas and also because they have more of an effect on human health in more densely populated areas).

Figure 2: Sources of air pollution in England
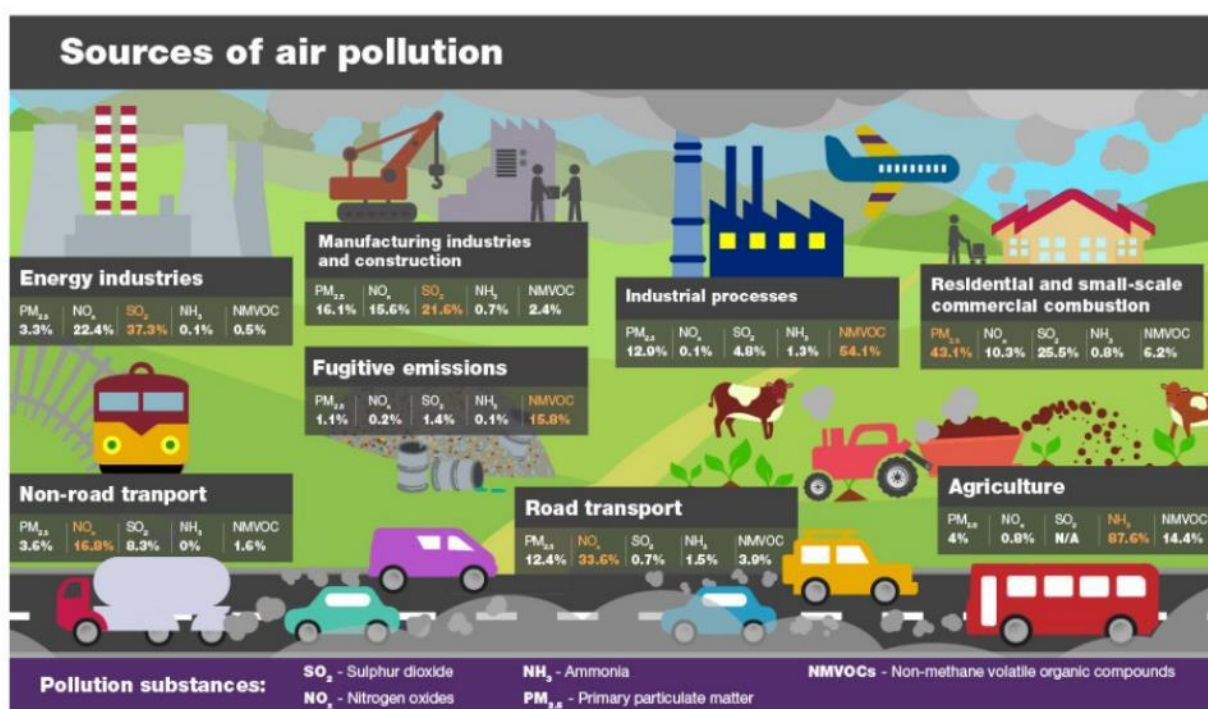
Source: Public Health England, 2022.

Box 2: Glossary of pollutants[1]

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[1] All quotes are from National Atmospheric Emissions Inventory (2022) – see references for full citation.

PM$_{2.5}$ – Particulate matter less than 2.5 micrometres: "Historically, interest in particulate matter focused mainly on smoke which can cause health problems especially in combination with other pollutants. However, recent epidemiological evidence has also linked concentrations of particles in the atmosphere with human health effects".

NH$_3$ – Ammonia: "plays an important role in a number of different environmental issues including acidification, nitrification, and eutrophication. It also acts as a precursor to secondary particulate matter, therefore contributing to the related health impacts […] NH$_3$ emissions can impact on a highly localised level, as well as contributing to effects from long-range pollutant transport".

NMVOCs – Non-methane volatile organic compounds: "are emitted to air as combustion products, as vapour arising from petrol and solvent use and from numerous other sources. NMVOCs are involved in the photochemical production of ozone and secondary organic aerosols in the atmosphere over a large spatial scale. Different individual NMVOCs have a different reactivity in the atmosphere and therefore a different propensity to forming ozone and organic aerosols. Some NMVOCs also have a direct impact on human health. For example, benzene and 1,3-butadiene are both carcinogens".

NO$_x$ – Nitrogen oxides: "Studies have shown that oxides of nitrogen (NO$_x$) can cause lung irritation as well as lowering people's resistance to pneumonia and bronchitis and other respiratory infections. In the presence of sunlight, NO$_x$ can react to produce a photochemical smog. If hydrocarbons are also present, ozone can be produced, which has a similar health effect to NO$_x$. Although higher concentrations of NO$_x$ are found in city areas, resulting ozone concentrations tend to be higher in rural areas."

SO$_2$ – Sulphur dioxide: "has long been recognized as a pollutant because of its role, along with particulate matter, in forming winter-time smog. Studies indicate that SO$_2$ causes nerve stimulation in the lining of the nose and throat. This can cause irritation, coughing and a feeling of chest tightness, which may cause the airways to narrow. People suffering from asthma are considered to be particularly sensitive to SO$_2$ concentrations".

Source: National Atmospheric Emissions Inventory, 2022.

The Department for Environment, Food and Rural Affairs (Defra) (2024) notes some changes in trends around sources over the last decade. Those most relevant to the healthcare system are:

- Cleaner energy is driving a reduction in sulphur dioxide and nitrogen oxides.
- Stricter standards for emissions of petrol and diesel vehicles is driving down NO$_x$ and NMVOC emissions. However, transport is still a major source of NO$_x$ and NMVOCs have a range of sources including cleaning products (which contribute towards indoor air pollution) and emissions from the food and beverages industry.
- The pattern of sources of emission of PM has changed; emissions from road transport and energy industries have decreased whilst domestic burning, industrial combustion of biomass based fuels and construction emissions have increased. PM emissions from road wear, brake wear and tyre wear (non-exhaust sources) are making up an increasing proportion of road transport emissions.

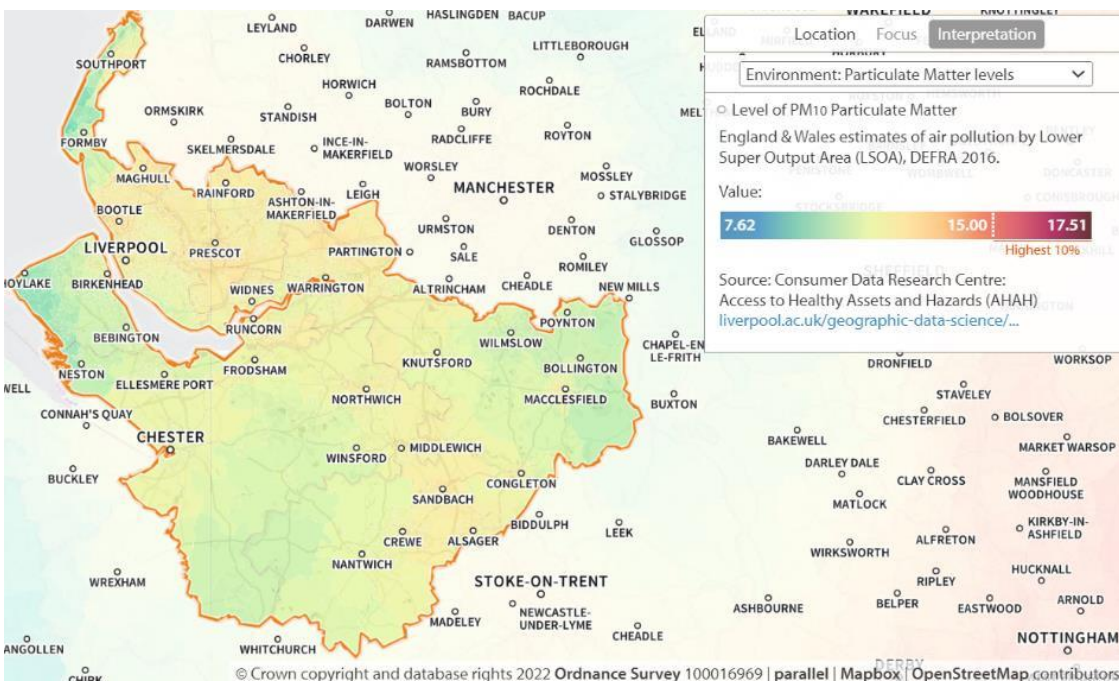# 5.   Measurement of poor air quality

There are a range of measurements of poor air quality in Cheshire and Merseyside.

Defra provides a range of ways to measure air pollution including:

- Defra managed monitors for different pollutants are available for sites in Cheshire East, Halton, Liverpool, Sefton, St Helen's, Warrington and Wirral via https://uk-air.defra.gov.uk/interactive-map The data can be visualised to show trends over time.
- Locally managed monitors (which don't come with Defra's quality assurance) for different pollutants are available in a number of areas in Cheshire East, Cheshire West and Chester, Halton, Liverpool, St Helen's, Warrington, Wirral via https://www.ukairquality.net/ The data can be visualised to show trends over time.
- Defra's interactive tool allows the user to explore ambient air quality concentration data (for different pollutants) from their national Pollution Climate Mapping modelling (this includes small area level detail): https://uk-air.defra.gov.uk/data/gis-mapping/ Data from previous years is available.

The SHAPE Place tool has a number of layers relating to air pollution that can be accessed (such as NO, PM and more), and health facilities can also be layered onto the map to allow planning for adaptation and mitigation measures[2]. Figures 3 to 6 and their keys show some of this data for Cheshire and Merseyside. Figures 5 and 6 show an index measure which combines air pollution with vulnerability to air pollution (based on deprivation) to allow for targeted action.

Figure 3: PM$_{10}$ levels in Cheshire and Merseyside

© Crown copyright and database rights 2022 Ordnance Survey 100016969 | parallel | Mapbox | OpenStreetMap contributors

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[2] https://shapeatlas.net/

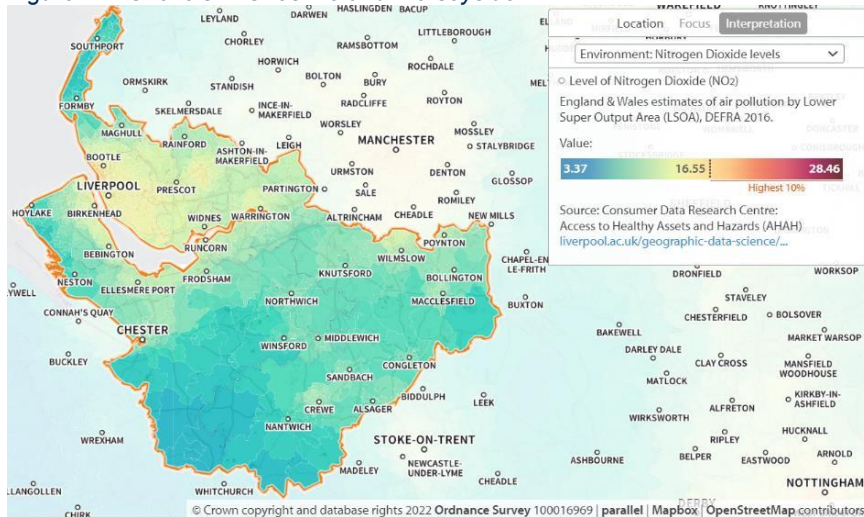*Figure 4: NO levels in Cheshire and Merseyside*

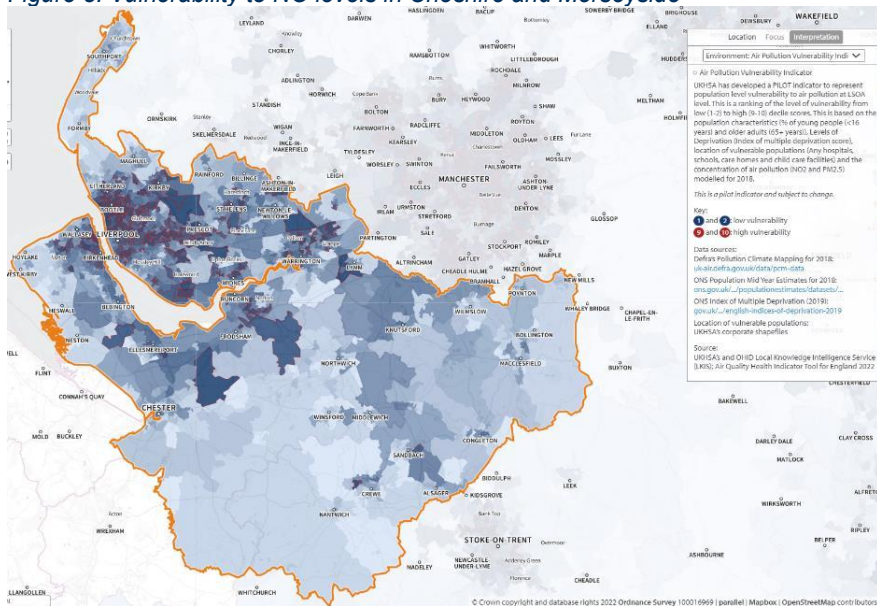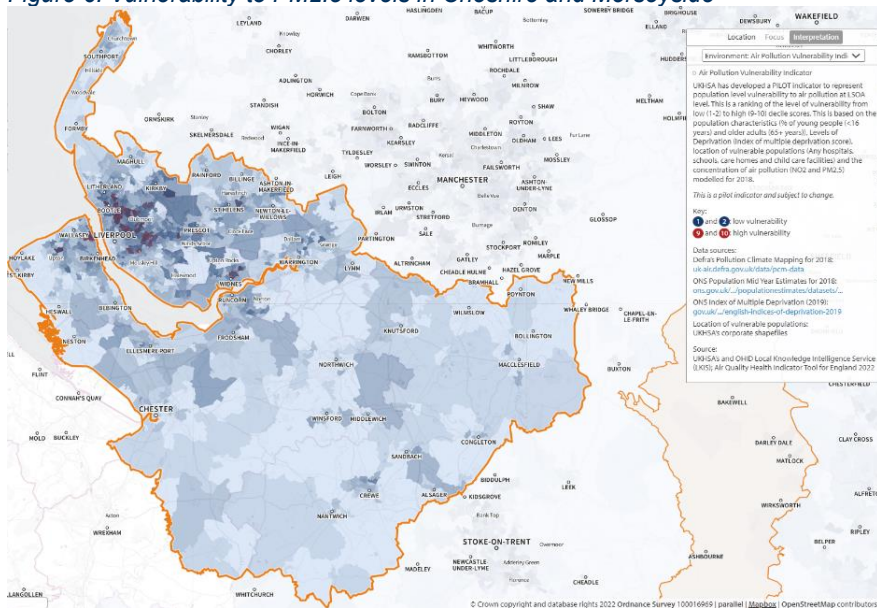*Figure 5: Vulnerability to NO levels in Cheshire and Merseyside*

Figure 6: Vulnerability to PM2.5 levels in Cheshire and Merseyside

Liverpool John Moores University (LJMU) have some air quality monitors, including at the Royal Liverpool, where they have been monitoring indoor and outdoor air quality and using the information to improve services. LJMU also have air quality monitors across the city region and there is the potential to link up datasets the university has (e.g. pollutants, weather) and health data from Trusts to influence things like patient scheduling on poor air quality days (looking at days and times where air quality is worse), and mapping addresses of those with respiratory conditions and air quality to improve quality of care. As well as outdoor air quality they also measure indoor air quality at some sites too. LJMU are also doing some work around behaviour change in terms of active travel such as routes to avoid polluted roads.

University of Liverpool also have a network of 55 monitors across Liverpool which are mapped and provide live updates every 30 minutes to one hour. Work has been undertaken with Alder Hey to look at associations between poor air quality and attendance at hospital for respiratory conditions. A publication exploring this in further detail is forthcoming but some key emerging findings are a particular association with under 5s, deprivation and seasonal variation (with October and November seeing the strongest association).

6.   Existing frameworks

Global Action Plan have produced frameworks for clean air at both a hospital (2019) and ICS level (2022). These contain a number of useful recommendations, some of which have been incorporated into this document. Figure 7 provides a useful visualisation of what an ideal clean air hospital would look like.

Figure 7: Elements of a clean air hospital

Source: Global Action Plan, 2019.

7. Consultation

Individual meetings with NHS Trust Sustainability Managers were conducted to ascertain work already being undertaken to combat poor air quality. The following summarises the comments:

- There are lots of initiatives going on already and enthusiasm to do more
- Some Trusts are working together to share learning and are keen to expand on this
- There will be different solutions for different Trusts (e.g. rural versus urban/specialist versus general)
- Some Trusts are already linked with local authority air quality teams, but this could be more consistent
- Air quality monitoring and action is happening in some Trusts
- Linking with transport authorities is also happening in some Trusts
- Active travel as part of green social prescribing was mentioned as a key opportunity
- The ultimate goal in order to advance this and other net zero work is to have sustainability integrated as part of decision making

Throughout consultation for this piece of work, barriers to effective work on air pollution have been noted:

- Difficulties in making the financial argument because any savings are likely to be long term and potentially dispersed (not necessarily to the organisation who funded the work)
- Commitments required under the *NHS Standard Contract* and also the requirement to produce a Green Plan do not apply to primary care, meaning work with this group is on a voluntary basis
- Funding for expansion of university projects is limited

8. Integrated Care Board (ICB) action

The ICB has a Sustainability Board which meets quarterly to discuss NHS progress against Green Plan priorities. It also has a number of sub-groups to advance action in relevant areas (Boxes 3 and 4).

Box 3: Air quality (AQ) sub-group priorities to be advanced

- Agreeing a local NHS position statement on AQ and health to use our trusted voice as health professionals to influence wider action
- Chapters on AQ as part of Green Plans
- Engaging our board level leads on AQ
- Joining up campaigns on indoor and outdoor air pollution including around clinical, managerial and patient engagement
- Sharing experiences, best practice and value of AQ monitoring, both at sites and more widely by the local authority, Defra etc.
- Exploring how to improve indoor air pollution
- Joining together to explore sources of funding

Box 4: Travel and transport sub-group priorities to be advanced

- Sustainable travel prioritised on websites
- Calendar of Dr Bike/guided ride events
- Travel and transport plan tracker to have oversight of system progress
- Linking into travel and transport engagement fora and building our partnerships with Active Cheshire and Merseyside Sports Partnership
- Sharing details of car lease/bike schemes – i.e. what does the 'C&M offer' look like and is it consistent

• Concessions and staff incentives • Policy reviews – i.e. are we consistent • Sharing best practice	

9.   Recommendations

Recommendations are based on consultation locally and best practice, including sub-group priorities. They are designed to work at different levels, from influencing system change to employee behaviour.

9.1   Prioritisation

Action	Enablers

Ensure air quality is a key consideration at strategic level in NHS organisations.	• Air quality sub-group priorities on
	    o "Chapters on AQ as part of Green Plans"
	    o "Engaging our board level leads on AQ".
	• Air quality chapter as part of the refreshed ICB *Green Plan*.

9.2   Monitoring and data

Action	Enablers
Contact local authority/city region as applicable to discuss what monitoring is already occurring and how this could be used by NHS Trusts in their work. Proxy data might be adequate to determine which areas might be most affected by poor air quality.	• Air quality sub-group priority on "Sharing experiences, best practice and value of AQ monitoring, both at sites and more widely by the local authority, Defra etc." • Air quality technical group includes AQ officers from all LAs in region • University links have already been developed through individual Trusts and the ICB.
Explore the possibilities of how to use data from the University of Liverpool and LJMU on air quality both to link to health data that Trusts/ICB/primary care have to explore associations, and to target interventions in the NHS e.g. provide route planning advice to patients to reduce their exposure to particulate matter. There could be an opportunity to expand the current work being done with LUHFT with other Trusts and explore the impact of different pollutants on patients and then developing measures to mitigate these.	
Where monitoring is undertaken, use this in campaigns for staff and local community to ensure it is linked into education to reduce air pollution.	

Case study: Linking of air pollution data to patient records

9.3   Travel and transport

Action	Enablers
NHS organisations to input into travel and transport policies and strategies produced by local authority/city region (as applicable) to highlight health impacts, effect on staff and patient travel.	• Travel and transport sub-group priority on "Linking into travel and transport engagement fora". • Air quality sub-group priority on "Local NHS position statement AQ and health" – can be used as a template for engagement.

NHS organisations to influence their own staff and visitor travel using the sustainable travel hierarchy (shown in Figure 2 of the document) to encourage more active travel (walking, cycling, wheeling) and public transport use, as well as promoting electric vehicles and car-sharing where car use is required.	• Travel and transport sub-group priorities on:
	  o "Sustainable travel prioritised on websites"
	  o "Calendar of Dr Bike/guided ride events"
	  o "Sharing details of car lease/bike schemes"
	  o "Concessions and staff incentives".

9.4   Primary care

Action	Enablers
Encourage primary care organisations to take manageable actions on air quality.	Influence Cheshire and Merseyside Greener Practice £20k funding and link to 10-Point Green Plan for Primary Care.

Case studies: • Mobilising Primary Care on Air Pollution • Top 5 things GPs can do to tackle air pollution

9.5   Green spaces

Action	Enablers
Consider enhancement or potential for green spaces in areas with poorer air quality.	• NHS Forest can assess and provide ecological advice to NHS Trusts for free as part of the Trees Call to Action Programme. • Mersey Forest can also provide a range of services, including the "Natural Health Service" and woodland advice and grants for landowners. • Biodiversity sub-group of ICB Sustainability Board. • Centre for Sustainable Healthcare have been commissioned to do biodiversity mapping.

9.6   Indoor air quality

Action	Enablers
Consider funding for projects on indoor air quality, as the evidence base for this area is less robust than for outdoor air quality.	• Housing and health is a key priority of the ICB's approach. • Cheshire and Merseyside has already pioneered work in this area (see case study on Torus project below).
Take learning from Wirral Defra funded communications campaigns on indoor air quality and the Global Action Clean Air Night materials and potentially replicate across the region (see case study below).	

Case studies: • Torus Foundation - Air Quality Key Findings – the project utilised existing community initiatives to deliver indoor air quality projects more successfully and it focuses both on smaller changes individuals can make as well as legitimising tenant requests for housing improvements from the landlord through being able to provide specific readings. • Global Action Clean Air Night materials

9.7   Training and campaigns

Action	Enablers
Ensure healthcare staff are aware of the impact of air pollution on health, and how they can help patients to reduce their exposure, particularly those in vulnerable groups.	Air quality sub-group priority on "Joining up campaigns on indoor and outdoor air pollution including around clinical, managerial and patient engagement".
Ensure local and national campaigns (such as those mentioned on indoor air pollution above) are shared across Cheshire and Merseyside.	

Case studies: • All Our Health: Air Pollution – NHS England have produced mini-training as part of their All Our Health series that is hosted on the e-Learning for Health website. This has 4 modules: why this matters; what can I do to help; knowledge check, and where can I find more information. It contains simple key messages and is a good, quick overview. • Air pollution and health: an introduction for health workers – Training from the World Health Organization that is detailed and comprehensive but somewhat focused on low and middle income countries so may be of less relevance for a UK context. This may be better for clinicians with a particular interest in this area looking to expand their knowledge.

9.8   Advocacy

Action	Enablers
• Encourage healthcare staff to use their trusted voice to advocate for clean air.	• Air quality sub-group priority on "Local NHS position statement on AQ and health". • Royal Colleges campaigns. • Local council or neighbourhood campaigns. • National campaigns.

Case studies:

- Alder Hey's Clean Air Clinic – a great local example of clinicians who are advocating for action on housing for patients affected by mould.
- Royal College of Paediatrics and Child Health – has information including a tool for advocacy on climate change (including air pollution) and child health inequalities.
- Royal College of Physicians - provides advice to members about action they can take on clean air.

Did you know?

1,737 schools across England are located in areas where nitrogen dioxide or PM2.5 levels, or both, are double the WHO guidelines.

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APPENDIX A –Air Quality Information

Local Authorities

Local Authority	Information	Link
Cheshire East Council	• Air quality monitoring data • Air quality action plan • Air quality strategy • Low emission strategy	https://www.cheshireeast.gov.uk/business/environmental_health/local_air_quality/local_air_quality.aspx
Cheshire West and Chester Council	• Air quality monitoring • Air quality review / assessment • Low emission strategy • Air quality and health	https://www.cheshirewestandchester.gov.uk/residents/pests-pollution-food-safety/pollution-and-air-quality/air-quality-review-and-assessment
Halton Council	• Co-ordinating with Liverpool City Region on air quality matters	https://www.liverpoolcityregion-ca.gov.uk/improving-our-air-quality
Knowsley	• Air quality strategy • Reports	https://www.knowsley.gov.uk/environment/environmental-health/air-pollution-and-air-quality/air-quality
Liverpool	• Clean air plan • About air pollution • Air quality in Liverpool	https://letscleartheairliverpool.co.uk/
Liverpool City Region	• "Improving our air quality"	https://www.liverpoolcityregion-ca.gov.uk/improving-our-air-quality
Sefton	• Air quality status report • Clean air zone feasibility study • Domestic solid fuel project	https://www.sefton.gov.uk/environment/air-quality/
St Helens	• Air quality monitoring • Annual status reports • Air quality action plan	https://sthelens.gov.uk/AirQualityMonitoring
Warrington	• Air quality management areas • Health and air pollution • Reports and action plan • How to improve air quality	https://www.warrington.gov.uk/airquality
Wirral	• Air quality strategy • Annual status reports • Air quality monitoring locations • Air quality information • How to improve air quality	https://www.wirral.gov.uk/environmental-problems/pollution-control/air-quality

APPENDIX B –Air Quality Framework

Air Quality Framework Recommendations Infographic