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Ultra Low Emission Zone Integrated Impact Assessment

Health Impact Assessment

October 2014

In association with:

Ben Cave Associates and Ricardo-AEA

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Contents

1 Introduction

1.1 Overview

1.1.1 Transport for London (TfL) commissioned Jacobs to undertake an Integrated Impact Assessment (IIA) of the proposed Ultra Low Emission Zone (ULEZ).

1.1.2 The ULEZ is a proposal to reduce emissions specifically from road transport. The following objectives for ULEZ were proposed in line with the Mayor's Transport Strategy 2010 (MTS):

- *reduce air pollutant emissions from road transport, particularly those with greatest health impacts, to support Mayoral strategies and contribute to achieving compliance with European Union (EU) limit values (LV);*
- *reduce carbon dioxide (CO_2) emissions from road transport, to support Mayoral strategies and contribute to a London-wide reduction; and*
- promote sustainable travel and stimulate the low emission vehicle (LEV) economy by increasing the proportion of LEVs in London.

1.1.3 The IIA considers and documents the findings of the following individual assessments in relation to ULEZ, to provide a streamlined and integrated overview of the anticipated impacts of the ULEZ:

- *Environmental Assessment (EA);*
- *Health Impact Assessment (HIA);*
- *Equality Impact Assessment (EqIA); and*
- *Economic and Business Impact Assessment (EBIA).*

1.1.4 This report is the HIA and should be read in conjunction with its sister documents and the overarching IIA report. The HIA has been undertaken in association with Ben Cave Associates and Ricardo-AEA.

1.2 Purpose of this report

1.2.1 This report presents the findings of the HIA undertaken to identify and determine the potential health effects relating to the implementation of the ULEZ. The report will be incorporated into the IIA. The IIA will be used to inform consultation and dialogue with stakeholders.

1.2.2 The report also presents measures which could be used to help manage, mitigate or enhance identified health effects.

1.3 Scope of the HIA

1.3.1 The MTS IIA objectives and criteria were used to develop IIA topics and objectives for assessing the impacts of the proposed ULEZ. All IIA topics and corresponding objectives are identified in Table 1-A.

1.3.2 The health impacts assessed relate to one IIA objective highlighted (in light grey) in Table 1-A which is 'to contribute to enhanced health and wellbeing for all within London'. This report assesses the extent to which the ULEZ would achieve this objective.

1.3.3 This HIA used the NHS Healthy Urban Development Unit's (HUDU) Rapid HIA matrix to assist with scoping.

IIA topic	IIA objective
Air quality	To contribute to a reduction in air pollutant emissions and compliance with EU LVs (from Scoping Report).
Noise	To reduce disturbance from general traffic noise (from Scoping Report).
Climate change	To reduce CO_2 emissions and contribute to the mitigation of climate change
Biodiversity including flora and fauna	To protect and enhance the natural environment, including biodiversity, flora and fauna
Cultural heritage	To protect and enhance the historic, archaeological and socio-cultural environment
Water	To protect and enhance riverscapes and waterways through planning and operation
Material resources and waste	To promote more sustainable resource use and waste management
Landscape, townscape and urban realm	To protect and enhance the built environment and streetscape
Health and well being	**To contribute to enhanced health and wellbeing for all within London**
Population and equality	To enhance equality and social inclusion
London's economic competitiveness	Provide an environment that will help to attract and retain internationally mobile businesses
Small and Medium Sized Enterprises (SMEs)	Support the growth and creation of SMEs

Table 1-A ULEZ IIA Objectives

1.4 Structure of this report

1.4.1 The report is structured as follows:

- *Chapter 2 provides background information on the proposed ULEZ;*
- *Chapter 3 provides details of the proposed ULEZ including a description of the ULEZ study area;*
- *Chapter 4 provides a description of the relevant legislative and policy applicable to the HIA;*
- *Chapter 5 provides an overview of the methodology used in completion of the HIA;*
- *Chapter 6 outlines the baseline information used in the assessment of health impacts;*
- *Chapters 7 -12 provides the assessment of the health impacts resulting from the ULEZ; and*
- *Chapter 13 summarises the key findings from the HIA and how the proposed ULEZ meets the IIA health objective (see Table 1-A).*

2 Background

2.1.1 Whilst the London Low Emission Zone (LEZ), introduced in 2008, and other Mayoral policies have improved air quality in Greater London, the challenge remains to meet the specified air quality limits set by the European Union (EU). Air pollution affects the quality of life of a large number of Londoners, especially those with respiratory and cardiovascular conditions. In 2008, an equivalent of 4,300 deaths in the Capital were attributed to long-term exposure to fine particulate matter ($PM_{2.5}$) and a permanent reduction of 1µg/m^3 would increase life expectancy across the population, with the expected gains differing by age (Miller, B. G., 2010).

2.1.2 A number of strategies published by the Greater London Authority (GLA) including the Mayor's Air Quality Strategy 2010 (MAQS), the Climate Change Mitigation and Energy Strategy 2011 (CCMES) and the MTS aim to reduce emissions to mitigate climate change and improve London's air quality. Since the publication of the MTS, TfL has delivered a greener bus fleet, encouraged the use of electric cars and increased public transport patronage, alongside cycling and walking.

2.1.3 TfL's Transport Emissions Roadmap 2014 (TERM) builds on this by focussing on reducing emissions from ground-based transport in London. The TERM introduces a range of proposed measures to be considered by various parties to help meet the challenge of reducing carbon dioxide (CO_2) emissions and air pollutants, particularly oxides of nitrogen (NO_x), nitrogen dioxide (NO_2) and particulate matter (PM_{10}), in London. Implementation of the ULEZ in central London is one of the measures identified.

3 Details of the Proposed ULEZ

3.1 Overview

3.1.1 The ULEZ would require all vehicles driving in central London to meet new exhaust emission standards (ULEZ standards). The ULEZ would take effect from 7 September 2020 and apply 24 hours a day, seven days a week. A vehicle that does not meet the ULEZ standards could still be driven in central London but a daily charge would have to be paid to do so.

3.1.2 The ULEZ would include additional requirements for TfL buses, taxis (black cabs) and PHVs:

- *a requirement that all taxis and new PHVs presented for licensing from 2018 would need to be zero emission capable;*
- *a reduction in the age limit for all non zero emission capable taxis from 2020 from 15 to 10 years (irrespective of date of licensing); and*
- *investment in the TfL bus fleet so that all double deck buses operating in central London would be hybrid and all single deck buses would be zero emission (at source) by 2020.*

3.1.3 Details of the ULEZ option selection and feasibility work which TfL undertook can be found in the ULEZ Supplementary Information (TfL, 2014).

3.1.4 The proposed ULEZ requirement by vehicle type can be found in Table 3-A and a breakdown of the ULEZ emission standard for each type of vehicle is provided in Table 3-B.

Category	Vehicle	Proposed ULEZ requirement
TfL buses entering ULEZ	TfL double-decker buses	• Euro VI hybrid
	TfL single-decker buses	• Zero emission at source
Revised licensing London wide	Taxis	• 10 year taxi age limit for all non-zero emission capable taxis • All newly licensed taxis to be zero emissions capable from 2018
	PHVs	• All newly manufactured/ newly licensed PHVs to be zero emissions capable from 2018 • All newly licensed second hand PHVs must meet the ULEZ standards • Existing licensed PHVs that do not meet the ULEZ standards must pay the charge when driving in the ULEZ.
Emission-based vehicle charging in ULEZ	Heavy goods vehicles (HGVs)	• Euro VI engine (or pay charge when driving in the ULEZ)
	Non-TfL buses and coaches	
	Light goods vehicles (LGVs)	• Euro 4 engine (petrol) or Euro 6 engine (diesel) (or pay charge when driving in the ULEZ)
	Cars and PHVs	
	Motorcycles and power two-wheelers	• Euro 3 engine (or pay charge when driving in the ULEZ)

Table 3-A ULEZ proposals by vehicle type

Vehicle type	Proposed emissions standard[1]	Date from when manufacturers must sell new vehicles meeting the emissions standards	Maximum age of vehicle by 2020[2]	Charge if vehicle is not compliant with the ULEZ standard[3]
Motorcycle, moped etc.	Euro 3	From 1 July 2007	13 years	£12.50
Car and small van	Euro 4 (petrol)	From 1 January 2006	14 years	£12.50
	Euro 6 (diesel)	From 1 September 2015	5 years	
Large van and minibus	Euro 4 (petrol)	From 1 January 2007	13 years	£12.50
	Euro 6 (diesel)	From 1 September 2016	4 years	
HGV	Euro VI	From 1 January 2014	6 years	£100
Bus/coach	Euro VI	From 1 January 2014	6 years	£100

[1]Euro standards for heavy-duty diesel engines use Roman numerals and Arabic numerals for light-duty vehicle standards.
[2]Vehicles this age or younger in 2020 will comply with the ULEZ standard and not incur a charge.
[3]This is payable in addition to any applicable LEZ or CCZ charges and is the charge per day (i.e. 00:00 – 23:59).

Table 3-B ULEZ standard for each type of vehicle

3.2 ULEZ study area

3.2.1 The study area for the ULEZ falls within the Greater London Administrative Area (GLAA). For some assessments, areas beyond the GLAA were considered, as changes to vehicle trip patterns on London's road network brought about by implementation of the ULEZ are likely to extend beyond this boundary.

3.2.2 The study area is divided into five zones as described in Table 3-C, which correspond to those employed in the atmospheric emissions modelling that informed the development of the ULEZ.

Zone	Extent
Congestion Charging Zone (CCZ)	Based on the existing boundary which has been in operation since 2003 (and the boundary for the proposed ULEZ)
Inner Ring Road (IRR)	A 12 mile (19km) route formed from a number of major roads that encircle the CCZ
Inner Zone	Extends outwards from the CCZ to cover a number of London boroughs including Haringey to the north, Newham to the east, Lambeth to the south and Hammersmith and Fulham to the west
Outer Zone	Extending from the boundary of the Inner Zone to the boundary of the GLAA. Includes London boroughs such as Enfield to the north, Havering to the east, Croydon to the south and Hillingdon to the west
Non-GLAA	Covers the area outside the GLAA boundary

Table 3-C Description of the five zones making up the ULEZ study area

3.2.3 The same study area, where applicable, was adopted across all assessment reports (the EA, HIA, EqIA and EBIA).

3.2.4 With the exception of the IRR (which defines the boundary of ULEZ), the four zones are consistent with the London Atmospheric Emissions Inventory (LAEI) 2010.

4 Regulatory Context

4.1 Introduction

4.1.1 The importance of health has been reinforced by a number of recent legislation and policy changes and the key ones of relevance to the implementation of the ULEZ are outlined in the following sections.

4.2 The National Planning Policy Framework (NPPF)

4.2.1 The National Planning Policy Framework 2012 (NPPF) sets out the Government’s planning policies for England and also provides a framework within which local people and their accountable councils can produce their own distinctive local and neighbourhood plans, which reflect the needs and priorities of their communities. The NPPF supports the role of planning to create healthy, inclusive communities by supporting local strategies to improve health, social and cultural wellbeing for all and by working with public health leads and health organisations to understand and take account of the health status and needs of the local population.

4.3 The London Plan

4.3.1 The London Plan includes a policy on improving health and addressing health inequalities through the use of health impact assessments.

4.4 The Mayor’s Transport Strategy (MTS)

4.4.1 The MTS provides the statutory policy basis for the ULEZ. Policy 15 as set out in the MTS aligns with the ULEZ as it seeks to reduce emissions of air pollutants from transport.

4.5 The Mayor’s Air Quality Strategy (MAQS)

4.5.1 The MAQS provides a framework for improving London’s air quality and measures aimed at reducing emissions from transport, homes, offices and new development, as well as raising awareness of air quality issues.

4.6 Mayor’s London Health Inequalities Strategy

4.6.1 The Mayor’s London Health Inequalities Strategy sets out the Mayor’s vision for tackling health inequalities in London and calls partners to action – from the NHS, businesses and boroughs to communities and academics.

4.7 Other strategies and policies relevant to health and wellbeing

4.7.1 *Healthy Lives, Healthy People: Our Strategy for Public Health in England* (2010) sets out the Government’s long-term vision for the future of public health in England. It aims to create a “wellness” service (Public Health England) and to strengthen both national and local leadership. It adopts the Marmot Review’s life course framework for tackling the social determinants, and aims to support healthy communities (The Marmot Review, 2010).

4.7.2 The *Health and Social Care Act 2012* (subsequently referred to as the '2012 Act') creates a duty on the Secretary of State, NHS England and Directors of Public Health (DsPH) to secure continuous improvement in the quality of services provided to individuals for or in connection with — 'protection or improvement of public health'. The Act sets out the statutory responsibilities which local authorities have for public health services. From 1st April 2013 local authorities have had a new duty to take such steps as they consider appropriate for improving the health of the people in their areas. DsPH are local authority officers and air quality is a responsibility of the local authority. The DsPH are responsible for the local authority's contribution to health protection matters, including the local authority's roles in planning for, and responding to, incidents that present a threat to the public's health.

4.7.3 *Improving the health of Londoners, Health Action Plan* (TfL, 2014), commits to undertaking actions to ensure that by 2017 TfL more explicitly recognises and demonstrate its role in improving the health of Londoners.

4.7.4 In October 2011, the Mayor published the final *Delivering London's Energy Future: The Mayor's CCMES*. It sets out the strategic approach to limiting further climate change and securing a low carbon energy supply for London. To limit further climate change the Mayor has set a target to reduce London's CO_2 emissions by 60 per cent of 1990 levels by 2025. The strategy focuses on energy savings to building and energy supply and also details activities underway to reduce CO_2 emissions from transport savings as detailed in the London Plan and MTS.

4.7.5 The recently published report, *Better Health for London* (London Health Commission, 2014), prioritises addressing air quality to improve public health in London. The report not only advocates the ULEZ, but also calls for more ambitious proposals, including expansion of the zone and offering stronger financial incentives and disincentives.

4.7.6 Taken together, this legislative and policy context sends a strong signal that all major policies and plans need to incorporate consideration of health, and of inequalities in health, to improve health outcomes in new and existing communities.

5 Method

5.1 Introduction

5.1.1 The introduction of the ULEZ in London has the potential to change human health through:

- *changes to the emissions standard of vehicles on the road;*
- *changes in levels of road traffic; and*
- *changes to emissions to air (as an outcome of the first two bullet points).*

5.1.2 Other indirect health impacts which may result from the ULEZ include:

- *increased levels of physical activity within a community; or*
- *changes to the volume and speed of traffic along residential streets (having positive implications for road safety or subsequent changes to social networks).*

5.1.3 The objective of the ULEZ in relation to health is 'to contribute to enhanced health and wellbeing for all within London'. In order to assess whether the ULEZ would achieve this objective, the HIA:

- *defines health and wellbeing;*
- *identifies information related to health issues associated with the implementation of the ULEZ;*
- *identifies and addresses health impacts arising from the ULEZ and factors which negatively impact upon health and wellbeing; and*
- *recommends actions to mitigate against possible negative health impacts and maximise positive health impacts.*

5.2 Defining health and wellbeing

5.2.1 The World Health Organization (WHO) define health as '...*a state of complete physical, mental and social wellbeing and not merely the absence of disease or infirmity*'. Health encompasses physical and mental health and incorporates the broader concept of wellbeing.

5.2.2 Health and wellbeing are positive aspects to which governments, statutory agencies, voluntary organisations, businesses, communities and individuals can all contribute.

5.2.3 Many factors in the social, economic and physical environment can influence (positively, negatively or neutrally) the health of communities and the health of individuals within communities. Air quality is a major factor of the physical environment. Figure 5-A summarises some of the main determinants of health and their spheres of influence, starting with those at an individual level and moving through to those at a societal level. Factors in the outer rings influence actions in the more inner rings. Some factors that influence health are outside an individual's control. Individuals have more control over factors such as lifestyle including physical activity and smoking. Health and wellbeing are not distributed equally throughout a population. Reducing inequalities in health is an important consideration for public policy.

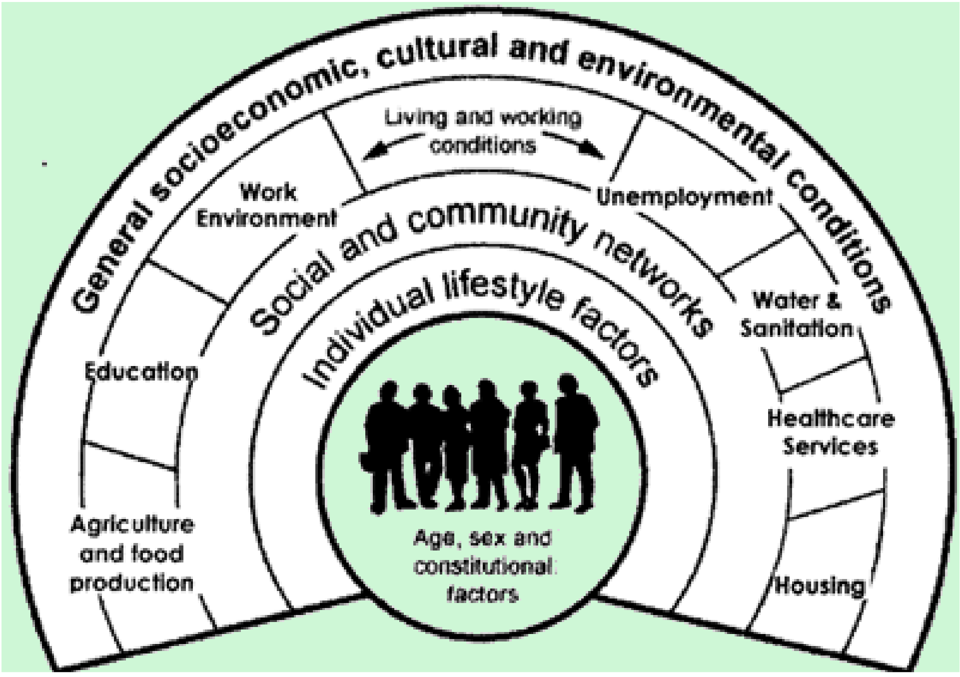

Figure 5-A Socio-Economic Model of Health
(Source: adapted from Dahlgren and Whitehead, 1991)

5.3 Defining HIA

5.3.1 Undertaking a HIA enables decision makers to make choices about alternatives and improvements to prevent adverse impacts to health and to actively promote health and wellbeing and reduce inequalities in health.

5.3.2 The International Association for Impact Assessment and the World Health Organization (2006) define HIA as '*a combination of procedures, methods and tools that systematically judges the potential, and sometimes unintended, effects of a policy, plan, programme or project on both the health of a population and the distribution of those effects within the population. HIA identifies appropriate actions to manage those effects'.*

5.4 Approach

5.4.1 The aim in undertaking this HIA has been to identify whether the ULEZ meets the IIA objective for health and provide all interested parties with an overview of the impacts for health that may result from implementation of the ULEZ. It uses publicly available literature on the relationships between transport and health, feedback from stakeholder workshops, and outputs from air quality modelling undertaken by King's College London (KCL) and interpreted from a public health perspective by Ricardo-AEA.

5.4.2 The different stages involved in undertaking the HIA are summarised in Table 5-A.

Stage	Description
Screening	Identification of whether the proposed ULEZ should be subjected to a HIA. The nature of the anticipated emissions reductions from the proposed ULEZ means this stage was omitted as impact on health was highly likely and it was assumed that a HIA was required.
Scoping	Setting the boundaries of the HIA i.e. the geographical scope, the population groups whose health is considered, and the timescale over which to predict impacts.
Assessing impacts	Assessment of identified health impacts to inform recommendations to mitigate and enhance such impacts. Air quality specialists from Ricardo-AEA and KCL Environmental Research Group fed into the assessment process and representatives from TfL have been closely involved with preparation of the IIA to ensure information presented is correct.
Making recommendations	Recommendations for TfL to maximise positive impacts of the ULEZ and minimise any negative ones.
Monitoring & evaluation	Suggestions for monitoring the impacts of the ULEZ on health and wellbeing.

Table 5-A Stages in completing the HIA

5.4.3 A stakeholder workshop was held on the 11 July 2014 and was attended by representatives from the following organisations:

- *Changing Perspectives;*
- *Public Health England; and*
- *GLA.*

5.4.4 The workshop discussed the proposed approach to the HIA and attendees were invited to comment and aid the development of the methodology and assessment framework, and to suggest any omissions and amendments to the scope of the assessment. The issues identified at the stakeholder consultation workshop are summarised in the overarching IIA and addressed by this report.

5.5 Scoping methodology

5.5.1 The scoping stage identified the issues that the HIA would cover and those that would be excluded from the assessment.

5.5.2 The HUDU Rapid HIA self-completion form (NHS Healthy Urban Development Unit, 2013), which is TfL's standard methodology, was used to scope and complete the assessment. The form poses questions about the ways in which a proposal might affect health and wellbeing. It provides a structure for working through the determinants of health and identifying topics that should be included in an assessment.

5.5.3 Whilst scoping the HIA it was assumed that all changes implemented as part of the ULEZ would be permanent i.e. no assumptions were made regarding more stringent regulations or vehicle changes in the future. The following were also considered:

- *whether the impact is likely to be positive or negative; and*
- *impact on neighbouring populations:*
    - *high = sensitive, permanent neighbouring populations;*
    - *medium = permanent neighbouring populations; and*
    - *low = temporary neighbouring populations.*

5.5.4 The assessment has been coordinated with the EqIA to ensure identification of any sensitive population areas. This means that factors such as access to healthcare services and other social infrastructure have not been considered in the HIA.

5.5.5 The scoping assessment was discussed and refined with TfL, as well as being discussed at the stakeholder consultation workshop. The scoping assessment was also revisited a number of times as details of the scenarios and plans underway were agreed. Table 5-A and Table 5-B provide rationale for the topics scoped into and out of the ULEZ HIA.

Included in assessment	Rationale
Air quality	The ULEZ explicitly seeks to reduce emissions to air. This will have a direct effect on exposure to pollutants and health and wellbeing.
Noise and neighbourhood amenity	Noise affects health. The ULEZ will levy a charge on older vehicles which tend to emit more noise, encourage zero emission capable taxis, and eliminate the use of conventional engine buses in central London. Alterations to the vehicle fleet composition across London’s roads may result in effects on noise levels.
Active travel	The way in which people are able to move about the city and to access goods and services is important for health & wellbeing. Population-level efforts to increase non-leisure physical activity, particularly active transport, are important means of promoting and maintaining active lifestyles. Walking to and from public transport stops can help physically inactive populations attain the recommended level of daily physical activity. The implementation of the ULEZ may have an impact on the mode of transport chosen for travel within the ULEZ and may influence the level of active transport.
Safety	Road safety, specifically vehicle safety, involves many factors such as driver behaviour and education, law enforcement, roadway engineering, traffic patterns and environmental attributes all working in unison to affect the overall health of the public. This HIA considers the potential effects of the ULEZ of changes in traffic volume and driver behaviour. Being a victim of crime has an immediate physical and psychological impact. It can also have indirect long-term health consequences including disability, victimisation and isolation because of fear.
Climate change	The environmental and societal effects that are predicted to result from a changing climate would have impacts on health. The implementation of the ULEZ is likely to result in a degree of transition towards the use of low and zero emission vehicles in central London which may impact the level of greenhouse gas emissions.

Table 5-B Topics scoped into the HIA

Not included in assessment	Rationale
Employment and effects on employers	The additional charges that would be levied on non-compliant vehicles entering the ULEZ could affect some employers' costs regarding operations within the ULEZ. This applies to some employers providing goods and services within the ULEZ. This potential effect is considered in the EBIA.
Access to healthcare services and other social infrastructure	The additional charges that would be levied on non-compliant vehicles entering the ULEZ would affect people's willingness/ability to drive into the ULEZ. This will be an important consideration for people who would otherwise have driven into the ULEZ to access, for example, healthcare services. Any changes in access to healthcare services and other social infrastructure could result in impacts on health. This issue is covered in the EqIA, which considers the impact of the ULEZ based on equality target groups including age, disability, sex/gender, religion/faith, pregnancy and maternity, race and socio-economically deprived people.
Housing quality & design	The ULEZ would have no effect on the quality and design of housing. This is not considered relevant for the HIA of the ULEZ.
Social cohesion and lifetime neighbourhoods	The ULEZ would have no effect on social cohesion and lifetime neighbourhoods. This is not considered relevant for the HIA of the ULEZ.
Access to open space and nature	The ULEZ would have no direct effect on access to open space and nature. Any changes to this factor are expected to be as a result of reducing private motorised traffic and improving active travel. People who currently drive to open spaces within the ULEZ (potentially those with disabilities) and who drive a non-compliant vehicle will face an additional charge. Access to open space and nature is not considered relevant for the HIA of the ULEZ.
Access to healthy food	The ULEZ would have no direct effect on access to healthy food. This topic is not relevant for the HIA of the ULEZ.
Access to work and training	The additional charges that would be levied on non-compliant vehicles entering the ULEZ may affect people's willingness/ability to drive into the ULEZ. This will be an important consideration for people who have no choice but to drive into the ULEZ to access work, training and education opportunities such as those with disabilities. Any changes in access to work and training could result in health and other effects. This issue is covered in the EqIA.
Minimising the use of resources	This topic is not relevant for the HIA of the ULEZ.

Table 5-C Topics scoped out of the HIA

5.6 London Low Emission Zone (LEZ) HIA

5.6.1 The LEZ was introduced by TfL in February 2008 to reduce the tailpipe emission of PM from diesel powered commercial vehicles within the Greater London area. Vehicles that enter the LEZ are required to pay a daily charge. The findings of the HIA of the LEZ were considered as a part of this HIA, to compare the scoping results.

5.6.2 The following determinants of health which were considered in the HIA of the LEZ have been addressed in this HIA.

- *improvements to air quality;*
- *perceptions of environmental improvement;*
- *reduction in noise; and*
- *improved road safety (AEA Energy and Environment, 2006).*

5.6.3 Other determinants of health, which were considered by the HIA of the LEZ but are not considered in this HIA, include access to services and employment status. These issues are dealt with in the EqIA and EBIA respectively. Refer to Table 5-B and Table 5-C for rationale on the HUDU topics covered in this HIA.

6 Baseline Data and Local Health Conditions

6.1 Introduction

6.1.1 A Community Profile Report (CPR) was developed as part of the IIA of the ULEZ and is included as Appendix 1. It includes information sourced from the Office for National Statistics, the London Datastore, Department of Communities and Local Government, Transport in London Report 6 (TfL, 2013), and Health Profiles Indicators for all London Boroughs 2014 and has been used to assist with undertaking this HIA.

6.1.2 The CPR provides a baseline of the health and socio-demographic context of the zone covered by the proposed ULEZ and the wider London area where potential health impacts from the ULEZ may be experienced.

6.1.3 A summary of the CPR taking into account health issues is provided in the following sections.

6.2 Population

6.2.1 The total population for all areas (Greater London, inner London, outer London, and the CCZ) are expected to increase between 2011 and 2025, as shown in Figure 6-A. The population increase for the CCZ is shown in Figure 6-B (because of the issue of representing the data at a much smaller scale to the other zones).

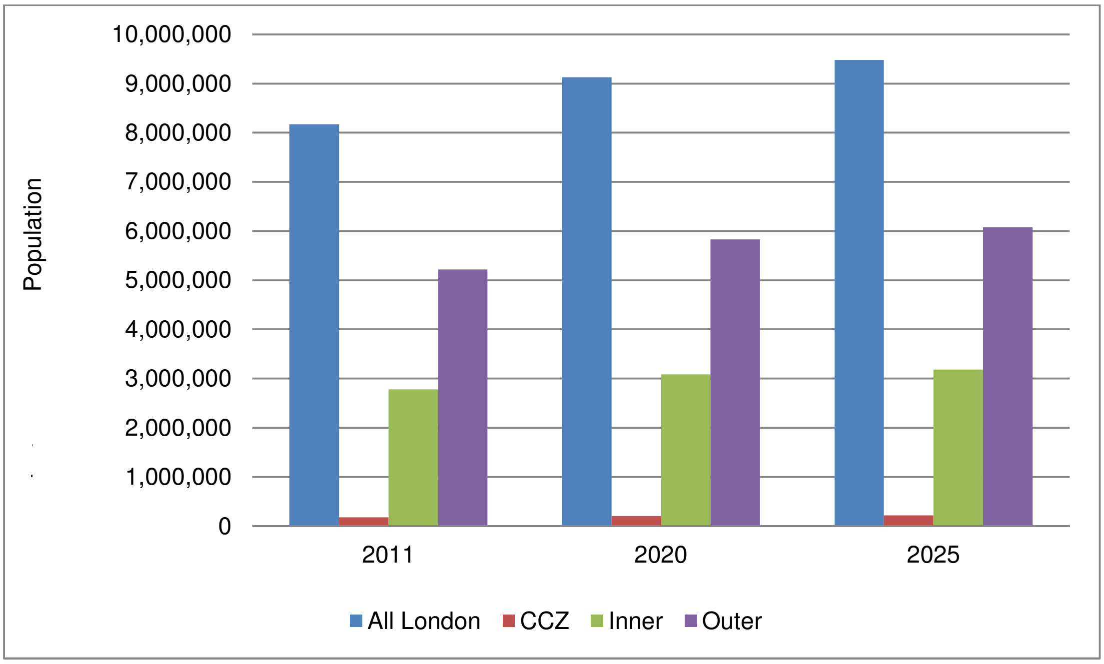

Figure 6-A Total sum of population for 2011, 2020 and 2025 within Greater London
(Source: the Office for National Statistics, 2011)

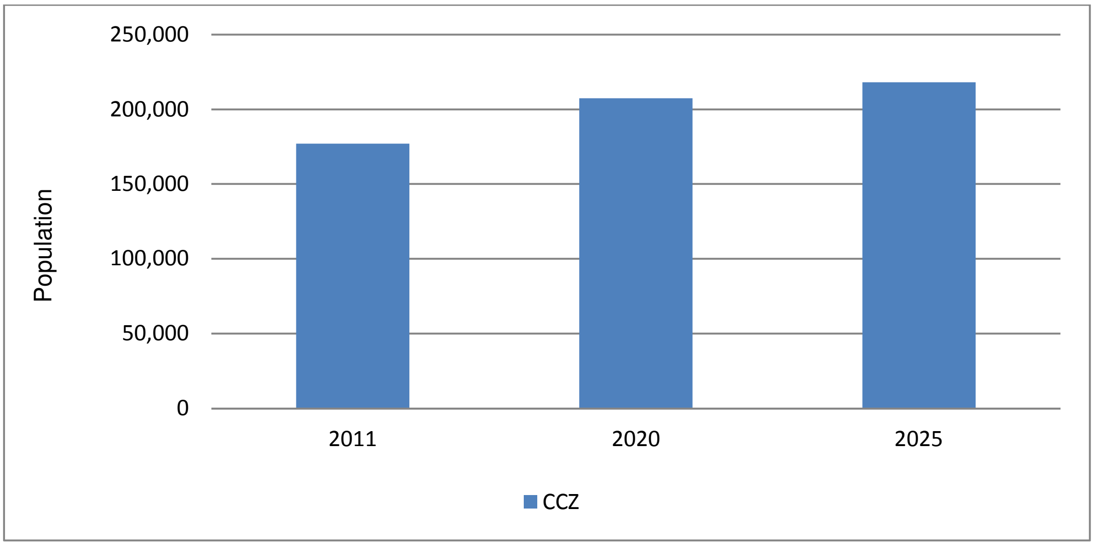

Figure 6-B Total sum of population projection for CCZ for 2011, 2020 and 2025
(Source: the Office for National Statistics, 2011)

6.2.2 The population density for Greater London is 8,243 people per square kilometre (km). The CCZ and inner London have a higher population density at 11,613 and 12,708 people per square km. Outer London has a lower population density of 5,755 people per square km.

6.3 Age profile

6.3.1 The age structure of a population indicates both the current and strategic (future) requirements of an area. A younger population, for example, may require additional access to schools, safe recreation play facilities and the development of future employments opportunities, while aging populations are likely to require a greater focus on health care, living support, accessibility and social networks. Age is also a factor in vulnerability to health effects of air pollutants.

6.3.2 Figure 6-C shows the distribution of the population within Greater London who are between the ages of 0 and 14 years and 65 and 80+ years. The young and the elderly are generally the most susceptible to health impacts from poor air quality. The population is set to increase for all age ranges between 2011 and 2025, apart from between 2020 and 2025 it is expected that the population of people aged 0-4 will drop slightly.

6.3.3 Further information, including a breakdown of age profiles for the CCZ and inner and outer London zones, can be found in the information contained in Appendix 1.

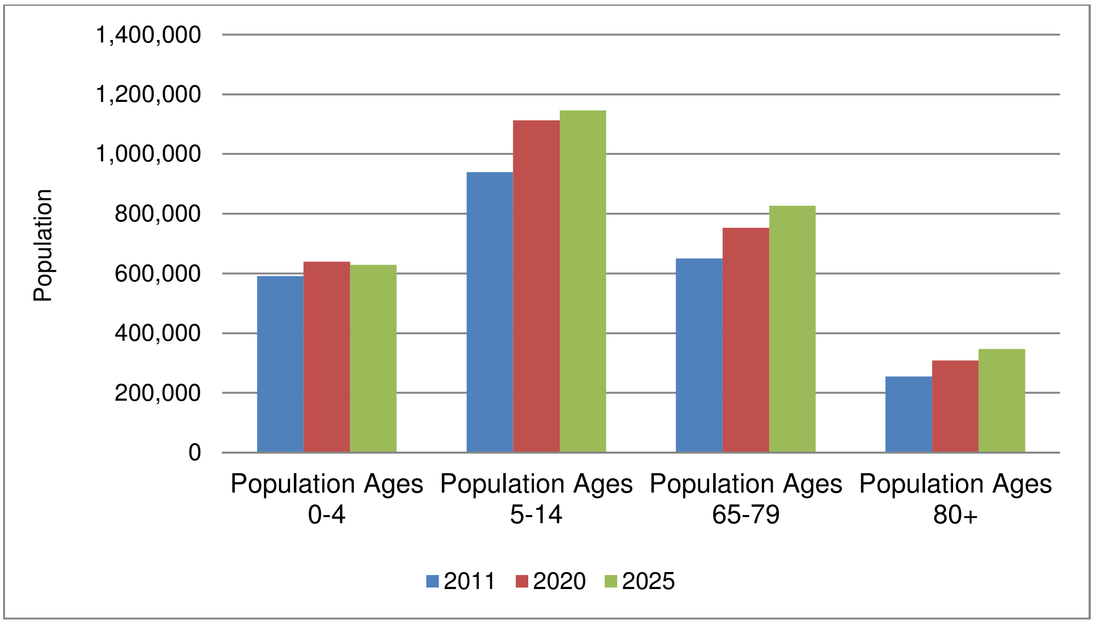

Figure 6-C   Population ages for 2011, 2020 and 2025 within Greater London
(Source: the Office for National Statistics, 2011)

6.4 Employment

6.4.1 The average employment rate for 16-74 year olds in 2011 for Greater London was 65.5 per cent. Inner London and outer London have a similar rate at 65.2 per cent and 65.7 per cent respectively. The CCZ has a lower employment rate of 62.7 per cent.

6.5 Transport

6.5.1 Data from TfL's Transport in London Report 6 shows that in 2012 33 per cent of journeys were made by private transport (i.e. car), whilst 44 per cent were made by public transport. Walking made up 21 per cent of journeys made and cycling was used for 2 per cent of journeys. This reflects a net shift away from private transport in recent years within London.

6.5.2 Motor cycle was the least used mode of transport for daily journeys within Greater London (0.6 per cent).

6.5.3 Cycle hires within the Barclays Cycle Hire Scheme increased between 2010 and 2012 but decreased between 2012 and 2013. The number of walk trips have increased for both short journeys (under 5 minutes) and longer trips (over 5 minutes) between 2005/6 and 2012/2013.

6.5.4 The CCZ has the lowest average number of cars per household at 0.36, compared to Greater London having on average 0.84 cars per household. Inner London averages 0.54 cars per household and outer London average 1.02 cars per household.

6.5.5 In 2012, the total number of fatal road collisions within Greater London was 134. This was 25 less fatal collisions than in 2011 and 77 less than the average figure for 2005-2009. Each category of road user experienced a reduction in fatal collisions.

6.5.6 In 2012, the number of fatal and serious road collisions within Greater London was 3018. This was 213 more fatal and serious collisions than in 2011. The 2012 figure is 607 less than the average figure for 2005-2009. Pedestrians and pedal cyclists experienced an increase in fatal and serious collisions when compared to 2011. When compared to the 2005-2009 average the number of fatal and serious collisions for pedestrians in 2012 fell (by 8 per cent). The number of fatal and serious collisions for cyclists in 2012 rose by 60 per cent over the 2005-2009 average. TfL note that this increase must be seen in the context of a considerable increase in cycling in London.

6.5.7 TfL's *Travel in London* Report 6, 2013 looks at road user group and risk. It notes that in 2012, vulnerable road users (those walking, cycling and riding a motorcycle) accounted for the majority (80 per cent) of Killed or Seriously Injured (KSI) casualties, with car occupants accounting for most of the remainder (a further 15 per cent of all KSI casualties). While this indicates which road user groups are experiencing greatest levels of injury, raw casualty numbers do not account for the exposure to risk in terms of the numbers or lengths of journeys undertaken by each road user group, or the time spent travelling.

6.5.8 Looking at KSI casualties associated with walking, cycling and riding a motorcycle alongside the number of journeys by each of these modes shows that vulnerable road users are over-represented in the casualty figures.

- *walking accounted for 21 per cent of daily journeys, but 37 per cent of KSI casualties in London in 2012;*
- *pedal cycles accounted for two per cent of daily journeys, but 22 per cent of KSI casualties in London in 2012; and*
- *motorcycles accounted for one per cent of daily journeys, but 21 per cent of KSI casualties in London in 2012.*

6.6 Crime

6.6.1 The crime rate per million passenger journeys on various forms of London public transport has decreased between 2004/2005 and 2012/2013 for all transport type (bus, London Underground (LU)/Docklands Light Rail (DLR), Tramlink and London Overground) (TfL, 2013).

6.7 General health of the community

6.7.1 Figure 6-D shows the general health of residents within Greater London per data from the Office of National Statistics. The highest number of the population would describe their health as good or very good.

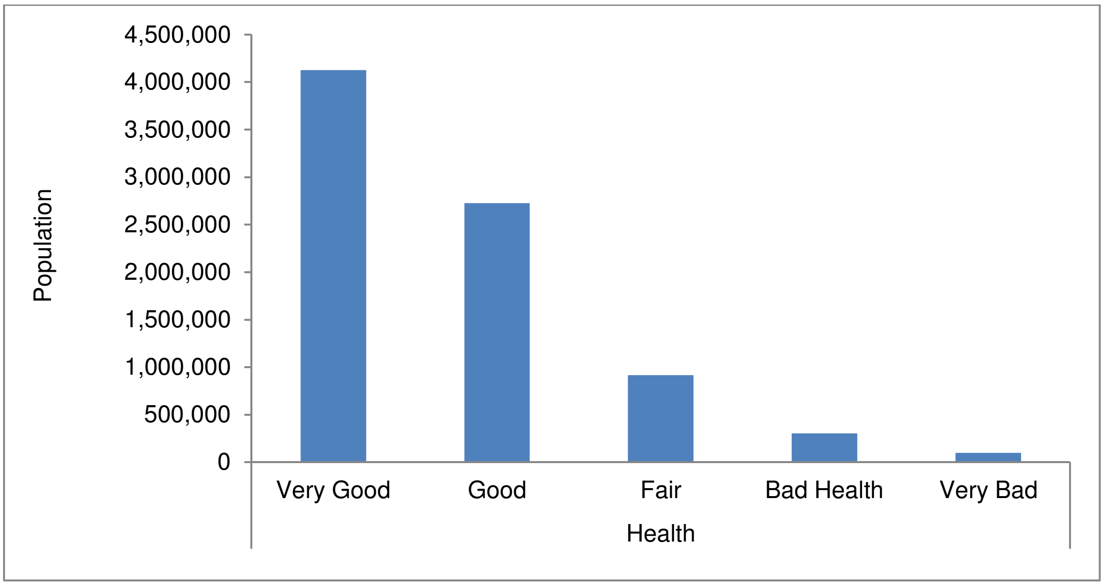

Figure 6-D Self-rated health of residents within Greater London
(Source: Office for National Statistics, 2011)

6.7.2 Male and female life expectancy in Greater London is better than the average for England (for a breakdown of life expectancy by gender at borough level refer to Appendix 1). However, within London there are significant inequalities in life expectancy and healthy life expectancy and these have grown since 2007. Between the highest and lowest performing boroughs there is a five year difference in life expectancy, but between neighbourhoods within individual boroughs there are between seven and twenty year differences in life expectancies.

6.7.3 The percentage of the population experiencing social deprivation[1] in Greater London is higher than England as a whole. The three most deprived local authorities in England are Newham, Hackney and Tower Hamlets.

6.7.4 Baker, Fitzpatrick & Jacobson (2012) identified health issues where the great majority of London boroughs were doing worse than the England average and the Health Profiles 2012 confirm those findings. These include new cases of tuberculosis, for which the latest profiles show that 26 boroughs are now doing worse than average, with Newham and Brent having the highest rates in England. Childhood obesity is a further challenge across London, with 22 boroughs doing worse than the England average, while Southwark has the highest percentage of obese 10-11 year olds in England (26.5 per cent).

6.7.5 Smoking is still the top cause of avoidable deaths in the city, with around 8,500 smoking related deaths in London each year.

[1]Social deprivation of population in the ULEZ area was categorised by where they appear in the scale of deprivation across the whole of the UK, namely: <5 per cent, 5-10 per cent, 10-20 per cent and >50 per cent, where the lower the percentage the more deprived the area (Ricardo-AEA, p. 1).

7 Assessment of Impacts

7.1 Introduction

7.1.1 In order to address the IIA Objective for health and wellbeing which is ‘to contribute to enhanced health and welling for all within London’ this HIA considers impacts in relation to the following topics:

- *air quality;*
- *noise and neighbourhood amenity;*
- *active travel;*
- *crime reduction and community safety;*
- *social cohesion and lifetime neighbourhoods; and*
- *climate change.*

7.1.2 For each topic, the assessment looks at impacts from the ULEZ in relation to health pathways and receptors.

7.1.3 A health pathway can be described as the way in which an activity influences a known determinant of health. As an example of how the health pathway concept is applied: construction activities influence environmental determinants of health including air, noise and traffic.

7.1.4 Receptors comprise those population groups whose health may be affected by the impacts resulting from the ULEZ.

7.1.5 The analysis of impacts, other than those arising from changes in air quality, has been descriptive and qualitative. It is anticipated that the ULEZ would result in small benefits for the determinants of health other than air quality, where larger benefits are expected.

8 Assessment of Impacts: Air Quality

8.1 Introduction

8.1.1 The information used for the assessment of air quality impacts are identified in Table 8-A.

Topic	Assessment type	Information considered
Air quality	Quantitative	• KCL, Atmospheric Emissions Modelling, 2014 • TfL ULEZ Air Quality Health Impact Assessment, Ricardo-AEA, October 2014 (included in Appendix 2) • Census 2011 • TfL Travel in London Report 6

Table 8-A HIA for air quality

8.1.2 An analysis of air quality modelling and associated improvement to health as a result of ULEZ has been undertaken by Ricardo-AEA. The results are summarised in this chapter, with further detail provided in Appendix 2.

8.1.3 Ricardo-AEA used modelled concentrations of pollutants for a base case (‘without ULEZ’) and a ‘with ULEZ’ scenario provided by KCL. These were used to calculate the impact of the ULEZ on exceedances of the European LV[2] for the protection of human health and to quantify health impacts.

8.1.4 Ricardo-AEA captured a range of positive health impacts directly associated with changes in concentrations of air pollutants including:

- *the impact of chronic exposure to particulate concentrations on mortality;*
- *the impact of acute exposure to particulate concentrations on respiratory hospital admissions and cardio-vascular hospital admissions; and*
- *in the extended set of sensitivity analysis, the assessment also includes the impact of chronic exposure to NO_2 concentrations on mortality and the impact of acute exposure to NO_2 concentrations on respiratory hospital admissions.*

8.1.5 The air quality assessment for the HIA was completed using population data at a finer level of detail (smaller Output Areas) than that set-out in Appendix 1.

8.2 Health pathway

8.2.1 Studies of air pollution have shown that high levels of ambient air pollution are associated with strong increases in adverse health effects. Due to the health concerns associated with many pollutants, UK and European legislation has been introduced to improve air quality. The ULEZ is seen as an important mechanism for helping London respond to this legislation.

[2]The European limit values for the protection of human health are set out in Table D1 in Ricardo-AEA’s report – refer to Appendix 2.

8.2.2 The specific health pathway assessed to identify impacts on health from air quality as a result of ULEZ was a reduction in the inhalation and ingestion of airborne pollutants due to road traffic emissions.

8.3 Receptors

8.3.1 Key receptors include all people exposed to local air pollution ((e.g. residents, road users, pedestrians, the elderly/ children). As such, the following buildings and places are considered as receptors: residential properties, schools, hospitals, care homes, open spaces, public rights of way and nature conservation sites.

8.4 Impact assessment

(a) Limit Value (LV) exceedances

8.4.2 The annual mean concentration for NO_2 is, set at 40µg/m^3. This was due to be met by January 2010 (EU Air Quality Directive). However, this is regularly exceeded in 16 zones across the UK, including Greater London (European Commission, 2014). Ricardo-AEA analysed reductions in NO_2 levels for all the London boroughs. The results indicate that those with the highest levels of social deprivation (based on the Index of Multiple Deprivation 2010) will experience higher annual mean NO_2 concentration in both 2020 and 2025. The average exposure to NO_2 across the population would be reduced with ULEZ compared to the base-case in both years. However, ULEZ would have (on average) a greater impact on air quality in locations where the residential population has higher levels of social deprivation.

8.4.3 Specifically, the ULEZ would result in reductions in the number of people living in areas above the NO_2 annual LV in 2020 and 2025. Specifically in 2020 ULEZ would result in the following reductions of people living in areas about the NO_2 annual LV:

- *Central Zone – reduction of 74 per cent;*
- *Inner Zone – reduction of 51 per cent; and*
- *Outer Zone – reduction of 43 per cent.*

8.4.4 For PM_{10}, the annual mean LV of 40µg/m^3, which was due to be achieved by January 2005, has been met throughout London when Defra last reported on compliance in 2013. The daily PM_{10} LV of no more than 35 days with daily mean concentration greater than 50µg/m^3 is somewhat more challenging to achieve, but central government are currently reporting compliance with this EU LV across the UK. Defra report annual compliance assessments on this to the European Commission (see: http://uk-air.defra.gov.uk/ for more details).

8.4.5 The annual mean $PM_{2.5}$ LV of 25µg/m^3 (to be achieved by January 2015) is also met through London. The impact of the ULEZ on PM_{10} and $PM_{2.5}$ would be much smaller than the impact on NO_2 and there is no distinct difference between the impacts on areas with experiencing lower or higher levels of multiple deprivation.

(b) Hospital admissions and life years lost

8.4.6 The estimated health impacts are presented in the following tables. These tables show for each study year, the health 'burden' associated with the absolute levels of pollutant concentrations under the base-case and 'with ULEZ' scenarios, and the impact of the ULEZ relative to the base-case (i.e. the health benefit associated with the ULEZ, calculated as the difference between the base-case and ULEZ burdens). Hospital admissions (HA) show the burden or relative change in burden in the study year (2020 or 2025) associated with the pollutant change in that year. Chronic mortality values reflect the total burden or change in burden in life years lost (LYL) over a 100-year assessment period associated with the change in pollution in the initial assessment year (2020 or 2025).

Scenario	Region	Chronic mortality $PM_{2.5}$ (LYL)	Chronic mortality NO_2 (LYL)	Respiratory HA PM_{10} (HA)	Respiratory HA NO_2 (HA)	CVD HA PM_{10} (HA)	Total chronic mortality All (LYL)	Total Respiratory HA (HA)
Base-case	Central	1,436	*1,363*	35	*38*	28	*2,799*	*74*
	Inner	22,899	*15,733*	563	*542*	445	*38,632*	*1,106*
	Outer	36,347	*14,880*	850	*714*	672	*51,227*	*1,563*
	London-wide*	60,731	*32,206*	1,448	*1,294*	1,145	*92,937*	*2,742*
ULEZ	Central	1,420	*1,033*	35	*33*	28	*2,454*	*68*
	Inner	22,830	*13,778*	562	*514*	444	*36,608*	*1,076*
	Outer	36,310	*13,203*	849	*690*	671	*49,513*	*1,539*
	London-wide*	60,608	*28,206*	1,446	*1,237*	1,143	*88,815*	*2,683*
ULEZ - change in burden	Central	15	*330*	0	*5*	0	*345*	*5*
	Inner	69	*1,955*	1	*29*	1	*2,024*	*30*
	Outer	36	*1,677*	1	*23*	1	*1,714*	*24*
	London-wide*	123	*4,000*	2	*57*	2	*4,123*	*59*

Those numbers in italics are NO_2 impacts included in the extended sensitivity tests.
(*Totals may differ from individual sub-values due to rounding)

Table 8-B Results of air quality health impacts analysis for the base-case and ULEZ scenario in 2020

(Source: Ricardo-AEA, 2014)

Scenario	Region	Chronic mortality $PM_{2.5}$ (LYL)	Chronic mortality NO_2 (LYL)	Respiratory HA PM_{10} (HA)	Respiratory HA NO_2 (HA)	CVD HA PM_{10} (HA)	Total chronic mortality All (LYL)	Total Respiratory HA (HA)
Base-case	Central	1,448	*1,052*	36	*34*	28	*2,500*	*69*
	Inner	23,302	*11,797*	576	*492*	455	*35,100*	*1,067*
	Outer	37,113	*9,691*	876	*660*	692	*46,804*	*1,535*
	London-wide*	61,908	*22,720*	1,487	*1,185*	1,176	*84,628*	*2,672*
ULEZ	Central	1,443	*880*	36	*31*	28	*2,323*	*67*
	Inner	23,288	*10,999*	575	*480*	455	*34,287*	*1,056*
	Outer	37,106	*9,154*	876	*652*	692	*46,260*	*1,528*
	London-wide*	61,882	*21,195*	1,487	*1,164*	1,176	*83,078*	*2,650*
ULEZ - change in burden	Central	4	*172*	0	*2*	0	*176*	*3*
	Inner	15	*798*	0	*11*	0	*813*	*12*
	Outer	7	*537*	0	*8*	0	*543*	*8*
	London-wide*	26	*1,524*	0	*21*	0	*1,550*	*22*

Those numbers in italics are NO_2 impacts included in the extended sensitivity tests.
(*Totals may differ from individual sub-values due to rounding)

Table 8-C Results of air quality health impacts analysis for the base-case and ULEZ scenario in 2025

(Source: Ricardo-AEA, 2014)

8.4.7 The results of the core air quality health impacts analysis undertaken by Ricardo-AEA suggest that the ULEZ would deliver positive health benefits relative to the base-case in both modelled years of the study. The size of the benefit is seen to reduce between 2020 and 2025 corresponding to the decrease in the pollutant reduction impact, over and above the baseline, between the two study years.

8.4.8 The reduction in LYL associated with pollution (NO_2, PM_{10} and $PM_{2.5}$) reductions across Greater London in 2020 would total 4,123. However, not all the mortality benefits would fall in the first year of implementation (2020): this health impact is associated with reductions in chronic exposure and these impacts are modelled to accrue over a 100-year period. The size of the benefit would reduce between 2020 and 2025 amounting to 1550 life years lost in the latter. This corresponds to the decrease in the pollutant reduction impact between the two study years. The benefits associated with reductions in NO_2 concentrations are significantly larger than those delivered through reductions in particulate matter due predominantly to the greater reductions in NO_2 which would be achieved by the ULEZ. The equivalent savings in LYL for 2020 and 2025 attributable to PM_{10} and $PM_{2.5}$ only amounts to 123 LYL and 26 LYL respectively.

(c) Impacts on different age groups

8.4.9 Ricardo-AEA undertook an analysis to assess the proportion of different age groups exposed to different levels of NO_2 concentrations across London. The population in areas above the LVs split by age was calculated from the average concentration by output area data. Figure 8-A shows the proportion of people exposed to concentrations of NO_2 above the annual LV within three age categories: the young (aged 0-19), the elderly (65+) and the adult population (20-64).

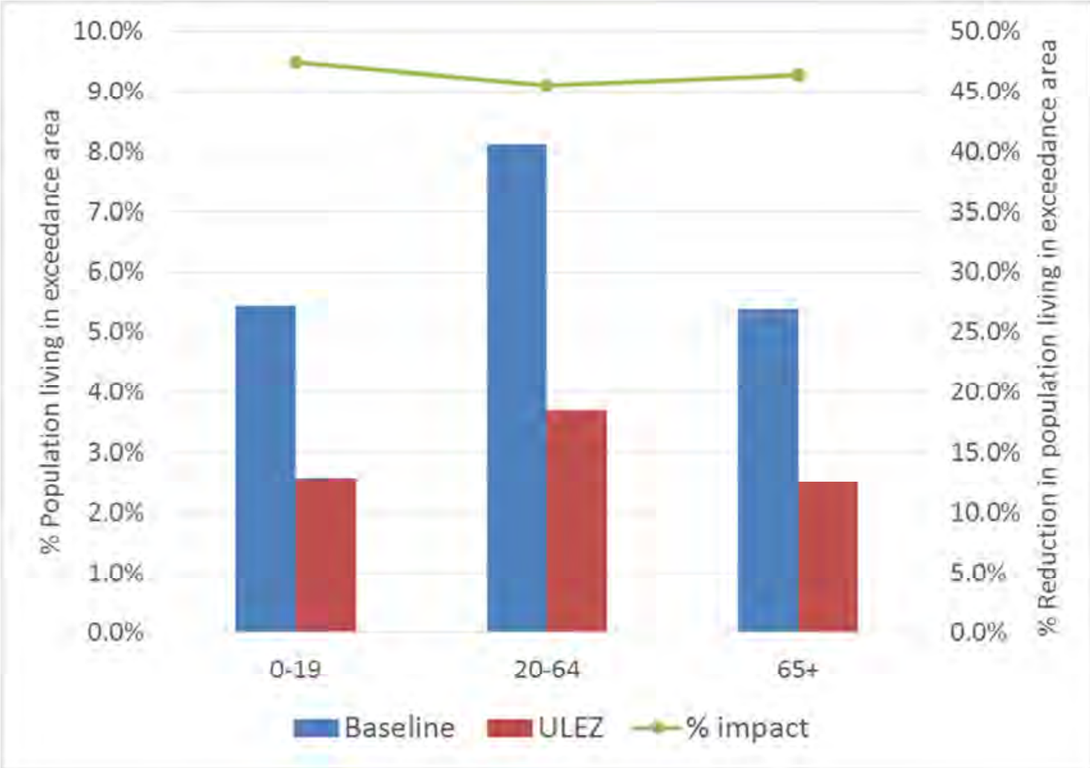

Figure 8-A The population in areas exceeding NO_2 LV in 2020 split by age group
(Source: Ricardo-AEA, 2014)

8.4.10 The figure shows that the age groups potentially most vulnerable to health impacts associated with air quality, namely children and the elderly, have lower proportions of their population in areas where NO_2 concentrations exceed the annual LV relative to the average and adult populations. An assessment of the impact of the ULEZ shows that the proportion of the population living in areas exceeding the NO_2 annual LV decreases by at least 45 per cent for all age categories, and the impact is slightly greater for children and the elderly.

(d) Hospital, care homes and schools

8.4.11 Ricardo-AEA further analysed the impact of the proposed ULEZ on the concentration of pollutants at schools, hospitals and care homes, as these are buildings which are disproportionately used by young people and older people and therefore classified as sensitive receptors. The findings are presented in Appendix 2 and the EqIA. In summary the ULEZ would result in a large reduction in the number of care homes, hospitals and schools in areas of NO_2 exceedances. The fall is greatest in central London and is as follows:

- *care homes – decreases from 1 (without ULEZ) to 0 (with ULEZ);*
- *hospitals – decreases from 29 (without ULEZ) to 10 (with ULEZ); and*
- *schools – decreases from 27 (without ULEZ) to 4 (with ULEZ).*

(e) Monetary value of health benefits

8.4.12 The health benefits associated with the ULEZ can be valued (i.e. presented in monetary terms) to show the economic benefit associated with reductions in air pollution. The valuation of health improvements captures a number of economic effects, including the direct impact on the utility of the affected individual (commonly captured by the 'willingness-to-pay' of the individual to avoid the detrimental health outcome), reduction in medical costs and increase in productivity. Monetising the health impacts in this way is a common approach which allows the economic benefits of improved health outcomes to be compared to the costs of delivering the ULEZ in cost-benefit analysis.

8.4.13 Ricardo-AEA has employed the Defra Impact Pathway Approach Guidance to estimate the monetary values attributable to the impacts on health. The improved health outcomes arising from the reduction in Nox, PM_{10} and $PM_{2.5}$ under the ULEZ for the GLA area are estimated to have a total monetised benefit of £101m to in 2020 and £32m in 2025.

8.5 Conclusion

8.5.1 The assessment found that the ULEZ would result in a reduction in the inhalation and ingestion of airborne pollutants due to road traffic emissions (the health pathway).

8.5.2 Ricardo-AEA conclude that the ULEZ would bring about important reductions in the health impacts associated with air pollution, and would therefore be an important part of London's overall strategy for improving air quality and limiting the associated health impacts. This is evidenced from: the analysis of the number of people who would no longer be in exceedance areas for NO_2 after the introduction of the ULEZ; analysis of the mean exposure to NO_2 and PM and from the quantification of actual health benefits.

8.5.3 The size of the benefit is seen to reduce between 2020 and 2025 corresponding to the decrease in the impact of the ULEZ on pollutant reductions between the two study years.

8.5.4 The majority of health benefit and associated economic impacts realised from avoided mortality would be associated with reductions in NO_2. This highlights the importance of the impact of ULEZ on NO_2 concentrations.

8.5.5 The improvements in health outcomes under the ULEZ are estimated to have a total London-wide economic benefit valued around £101m in 2020 and £32m in 2025 for the London-wide area (all impacts are in 2014 prices and discounted to 2014). Please note: these figures are based on economic valuation specific to of health considerations.

8.5.6 There are significant differences in the distribution of these benefits. Central London boroughs are forecast to experience the highest level of benefit due to the fact that this is where the ULEZ would be located and air quality problems are the most severe. It is the most deprived communities that on average would experience the largest reductions. Although the relative reductions are not forecast to be significantly greater than those experienced in less deprived areas, this is still important given that such communities are thought to be more vulnerable to air quality impacts on health. In areas of exceedance other vulnerable groups, determined on the basis of age, are not expected to experience very different levels of beneficial impact of the ULEZ, compared with the population as a whole.

8.6 Recommendations

8.6.1 As anticipated impacts upon air quality from the ULEZ are positive and therefore no mitigation is required.

8.6.2 Over time the cost of producing low and zero emission vehicles is likely to reduce. This may make it more economically feasible for a greater proportion of London's buses and other vehicle types to utilise these technologies. TfL should, where possible, continue to support the development of the low and zero emission vehicle market and facilitate their use through additional policies and proposals.

8.6.3 Further improvements in air quality could be enhanced through encouraging increased usage of hybrid, electric and hydrogen buses. Initially the greatest proportion of routes running these buses will be in central London. This could be extended into the Inner Zone and Outer Zone.

9 Assessment of Impacts: Noise & Neighbourhood Amenity

9.1 Introduction

9.1.1 The information used for the assessment of noise impacts are identified in Table 9-A.

Topic	Assessment type	Information considered
Noise and neighbourhood amenity	Quantitative and qualitative	• Census 2011 • TfL Travel in London Report 6 • TfL's Perception of the Travel Environment Survey

Table 9-A HIA for noise and neighbourhood amenity

9.1.2 Noise nuisance and vibration caused by traffic and commercial activity can have a detrimental impact on health resulting in sleep disturbance, cardiovascular and pyscho-physiological effects. The quality of the local environment can have a significant impact on physical and mental health.

9.2 Health pathway

9.2.1 Noise pollution and noise exposure are health pathways for assessing the health impacts of the ULEZ on noise and neighbourhood amenity. Noise pollution is a health pathway as it can have a detrimental impact on health resulting in sleep disturbance, cardiovascular and psycho-physiological effects. Noise exposure is a health pathway as it can increase levels of stress, induces hearing impairment, increase risk of hypertension and cardiovascular disease, and contribute to sleep disturbance and decreased school performance.

9.3 Receptors

9.3.1 Key receptors include residential properties, schools, hospitals, the elderly / children, care homes, open spaces, public rights of way and nature conservation sites.

9.4 Impact assessment

9.4.1 According to the results of traffic modelling outlined in the EA, London would experience an overall reduction in traffic across the CCZ, IRR and Inner Zone as a result of the ULEZ.

9.4.2 This reduction would be greater in the year the ULEZ is implemented in 2020 and would gradually decrease over time as fewer vehicles are non-compliant due to natural turn-over.

9.4.3 Using these zonal traffic forecasts, in addition to the results of stated preference surveys and behavioural modelling, results indicate that at a zonal level there would be overall reductions in road traffic volume across London in both 2020 and 2025, as a result of the ULEZ. This is largely accounted for by results of the behavioural modelling which suggest a proportion of travellers would either change mode or no longer travel.

9.4.4 In line with Design Manual for Roads and Bridges (DMRB) assessment methodology, this indicates that there are no 'affected routes' (i.e. no more than +20 per cent to -25 per cent change in daily traffic flows). Thus no significant effects on noise levels relating to changes in traffic flows and volumes are anticipated.

9.4.5 Alterations to the vehicle fleet composition across London's roads may also have the potential to result in effects on noise levels.

9.4.6 The most significant effect on noise likely to result from implementation of the ULEZ relates to the increased usage of low and zero emission vehicles, particularly the introduction of zero emission singled-decked electric and hydrogen buses and low emission hybrid double-decked buses.

9.4.7 The EA notes that the use of hybrid buses can offer a reduction in noise levels of around 3db(A) or 30 per cent compared to conventional, diesel based engines (TfL, 2014; Emmes et Al, 2009). Fully electric buses are likely to offer even greater reductions in noise and vibration (TfL, 2014).

9.4.8 This means that along route corridors where this new fleet of low and zero emission buses are in operation, the ULEZ may result in reductions of noise upon nearby receptors.

9.4.9 Additional noise reductions are likely to be achieved through phasing out older taxis, with the ULEZ setting the age limit at 10 years. In addition, all newly licensed taxis and PHVs are proposed to be zero emissions capable by 2018.

9.4.10 Overall road traffic noise is not anticipated to result in a significant level of increased/decreased community annoyance, or disruption. The level of change is not high enough to quantify any adverse/beneficial health outcome.

9.4.11 TfL's Perception of the Travel Environment Survey, undertaken in summer 2011, found that satisfaction with transport-related noise in London was fairly good. It is not expected that the proposed ULEZ would have any significant impact on transport-related noise. However, any shift towards electric vehicles in the longer term could be expected to have a positive impact on transport-related noise as these vehicles are considerably quieter than conventional internal combustion engines (TfL, 2012).

9.4.12 It is anticipated that the ULEZ would lead to only marginal reductions in noise levels, due to the introduction of newer vehicles (which tend to be quieter) into the vehicle stock in London, therefore, it is stated that health benefits are likely but that they would be small. They have not been quantified in this assessment.

9.5 Recommendations

9.5.1 As anticipated impacts upon noise from the ULEZ are likely to be positive, no mitigation is required.

9.5.2 Reductions in noise levels could be enhanced through encouraging increased usage of hybrid, electric and hydrogen buses. Initially the greatest proportion of routes running these buses would be in central London. It would be recommended that TfL extend this roll out of hybrid, electric and hydrogen buses throughout the Greater London Area to maximise the benefits.

9.5.3 Over time the cost of producing low and zero emission vehicles is likely to reduce. This may make it more economically feasible for a greater proportion of London's buses to utilise these technologies.

9.5.4 An effective programme of vehicle maintenance would need to be adopted to ensure that positive effects on noise levels are maintained over time.

10 Assessment of Impacts: Active Travel

10.1 Introduction

10.1.1 Active travel includes walking, cycling and use of public transport.

10.1.2 The information used for the assessment of air quality impacts are identified in Table 10-A.

Topic	Assessment type	Information considered
Active travel	Qualitative	• Census 2011 • TfL Travel in London Report 6 • National Travel Surveys 2012 • Access to services is considered within the Equalities Impact Assessment • Impact on low income groups who have to drive into the ULEZ are considered in the Equalities Impact Assessment and in the Economic and Business Impact Assessment.

Table 10-A HIA for active travel

10.1.3 Population-level efforts to increase non-leisure physical activity, particularly active transport, are important means of promoting and maintaining active lifestyles. Walking to and from public transport stops can help physically inactive populations attain the recommended level of daily physical activity (Davis, 2009).

10.1.4 Discouraging car use and providing opportunities for walking and cycling can increase physical activity and help prevent chronic diseases, reduce risk of premature death and improve mental health.

10.1.5 Convenient access to a range of services and facilities minimises the need to travel and provides greater opportunities for social interaction. Buildings and spaces that are easily accessible and safe also encourage all groups, including older people and people with a disability, to use them.

10.2 Health pathway

10.2.1 Physical activity such as bicycling and walking influences health by providing many positive benefits (World Health Organisation, 2008) such as:

- *a 50 per cent reduction in the risk of developing coronary heart disease, non-insulin dependent diabetes and obesity;*
- *a 30 per cent reduction in the risk of developing hypertension due to increased blood perfusion and improved vascular integrity;*
- *a decline in blood pressure among hypertensive people;*
- *physical exercise forces reuptake of calcium by the bones, thus helping to maintain bone mass and protecting against osteoporosis;*
- *improving balance, coordination, mobility, strength and endurance; and*
- *increasing self-esteem, improved memory and concentration, and improved psychological wellbeing.*

10.2.2 Therefore, the health pathway for this assessment looks at how ULEZ would result in increased physical activity.

10.3 Receptors

10.3.1 Key receptors include local residents, tourists, visitors and the commuting workforce.

10.4 Impact assessment

10.4.1 Choosing active forms of travel can bring about immediate health benefits for individuals primarily through increasing their levels of physical activity. The implementation of ULEZ would levy a charge on private vehicular traffic that does not meet the required ULEZ standard whilst travelling in the zone.

10.4.2 As per the EA, which covers the assessment of traffic changes, it is anticipated that there would be an overall reduction in road traffic volume, at a zonal level, across London as a result of the ULEZ in both 2020 and 2025. This is largely accounted for by results of the behavioural modelling which suggest a proportion of travellers would either change their travel mode or no longer travel. TfL will continue to encourage the use of electric cars, ultra-low or zero emission vehicles, increased public transport patronage and increased cycling and walking.

10.4.3 This type of change in travel mode has been observed after the introduction of central London motor vehicular charging schemes such as the London Congestion Charge and LEZ.

10.4.4 The HIA team considered using the Health Economic Assessment Tool (HEAT)[3] for cycling and walking to demonstrate the potential effect. The modal shift to walking and cycling has not been modelled. It was thus not possible to use HEAT. While it is not currently possible to quantify the health benefits of the ULEZ, arising from a modal shift to walking and cycling, it is estimated that they are likely to occur but that they would be modest.

10.4.5 According to the National Travel Surveys 2012, 41 per cent of trips under five miles by English residents in London were made by walking or cycling, the highest proportion in the country. Encouraging people to walk and cycle more in London has become increasingly important as an alternative to using cars for travelling short distances, increasing health benefits and reducing pollution.

10.4.6 With regard to walking and cycling, people are primarily concerned about safety and the condition of roads and pavements. A London Councils poll of residents to understand their attitudes towards walking in London and what measures would encourage them to walk more revealed the following priorities to encourage more walking and cycling:

- *better road safety;*
- *better condition of pavements;*
- *a safe urban environment;*
- *a less polluted environment;*

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[3] The Health Economic Assessment Tool (HEAT) for cycling and walking was developed by the World Health Organization. It enables the user to determine the monetary value of gains in health that result from changes to walking or cycling as a result of a particular policy intervention.

- *a quieter urban environment;*
- *better information and way finding; and*
- *more information on health benefits.*

10.4.7 With regard to air quality, the ULEZ would help to achieve a less polluted urban environment. These improvements combined with TfL's existing campaigns and investment to encourage walking and cycling would be anticipated to result in a positive health benefit as more people engage in active travel.

10.4.8 The EqIA report addresses the potential impacts on accessibility as a result of the ULEZ.

10.5 Recommendations

10.5.1 As there are no negative predicted impacts on active travel, there are no recommendations. In terms of enhancements, TfL should continue its efforts to promote and invest in active travel in the London area.

11 Assessment of Impacts: Crime Reduction and Community Safety

11.1 Introduction

11.1.1 This section considers road safety and crime reduction and community safety.

11.1.2 The information used for the assessment of air quality impacts are identified in Table 11-A.

Topic	Assessment type	Information considered
Crime reduction and community safety	Qualitative	• Census 2011 • TfL Travel in London Report 6 • Home Office Research Study 292, Assessing the impact of Closed-circuit Television (CCTV)

Table 11-A HIA for crime reduction and community safety

11.1.3 Road safety, specifically vehicle safety, involves many different, but interacting factors at varying degrees such as driver behaviour and education, law enforcement, roadway engineering, traffic patterns and environmental attributes all working in unison to affect the overall health of the public.

11.1.4 In relation to community safety, being a victim of crime has an immediate physical and psychological impact. It can also have indirect long-term health consequences including disability, victimisation and isolation because of fear. Thoughtful planning and urban wellbeing of residents. design that promotes natural surveillance and social interaction can help to reduce crime and the 'fear of crime', both of which impacts on the mental..

11.2 Health pathway

11.2.1 Improvements to road safety and community safety are the health pathway assessed in this chapter. Both road safety and community safety can influence health and crime reduction.

11.3 Receptors

11.3.1 Key receptors include local residents and the commuting workforce.

11.4 Impact assessment

(a) Road safety

11.4.2 As per the EA, it is anticipated that there would be an overall reduction in road traffic volume, at a zonal level, across London as a result of the ULEZ in both 2020 and 2025.

11.4.3 A reduction in private motorised transport would be a beneficial health effect was assuming it is associated with a reduction in collisions, injuries and deaths. This reduction would need to be balanced against danger that the remaining traffic moves faster and thus increase risk for cyclists and pedestrians.

11.4.4 An increase in average speed is directly related both to the likelihood of a collision occurring and to the severity of the collision related to mortality, injury and property damage (World Health Organisation, 2013). A five per cent increase in average speed leads to an approximately 10 per cent increase in collisions that cause injuries, and a 20 per cent increase in a fatal crash.

11.4.5 In line with the findings from the HIA of the LEZ (AEA Energy & Environment, 2006) it is possible that any benefits in reducing collisions might have a potentially greater benefit for children (and particularly for deprived children) in that these groups have a higher average risk of involvement in road traffic incidents, though in practice, it would seem most likely that the largest benefits would be in reducing risk to vehicle drivers.

11.4.6 The ULEZ would result in the introduction of fuel-efficient, environmentally sustainable and safer vehicle transport. The average age of the vehicle fleet is an indirect indication of the environmental performance of road transport. An increase in newer vehicles, especially newer HGVs, resulting from the proposed ULEZ could lead to some small improvements in road safety, and a resulting small benefit to health.

(b) Crime reduction and community safety

11.4.7 Under the CCZ, a comprehensive camera network and concept is already established, with embedded travel behaviour and enforcement. The CCZ Automatic Number Plate Recognition (ANPR) cameras network will detect the number plates of vehicles driving within the ULEZ zone using fixed and mobile cameras. The ULEZ enforcement infrastructure would primarily be made up of the existing CCZ cameras.

11.4.8 CCTV does not have a large effect on reducing the fear of crime. CCTV has been found to reduce property and vehicle crime but provide little deterrent for street crime in open areas (Gill and Spriggs, 2005). The surveillance of the ULEZ does not increase the amount of surveillance that is currently in place and therefore it is not considered likely that there would be any additional deterrence of illegal driving and other antisocial behaviour.

11.4.9 The *Protection of Freedoms Act 2012* requires the Secretary of State to prepare a code of practice for surveillance camera systems. This is not binding – authorities need only have ‘regard’ to the code and breaching it will not mean they automatically face legal sanction[4]. There is little binding regulation about how this technology is to be used, who can be targeted using it, how long images are to be stored for and for what purpose.

11.4.10 These are valid concerns but the ULEZ would not change the way in which data is collected, and as such no negative impacts are anticipated. The importance of this debate is noted for security, social cohesion and trust all of which are relevant to health and wellbeing.

[4] See *CCTV and ANPR*. Available at https://www.liberty-human-rights.org.uk/human-rights/privacy/cctv-and-anpr

11.5 Recommendations

11.5.1 As there are no negative predicted impacts on safety, there are no specific recommendations.

11.5.2 The MTS provides proposals to improve safety and security including for improving public transport safety and road safety and reducing crime, fear of crime and antisocial behaviour.

11.5.3 Additionally the Mayor has the Safe Streets for London - the Road Safety Action Plan for London 2010 and TfL continues to do a lot of work to encourage newer and safer lorries with, for example, cyclist safety features like side guards.

12 Assessment of Impacts: Climate Change

12.1 Introduction

12.1.1 The information used for the assessment of air quality impacts are identified in Table 12-A.

Topic	Assessment type	Information considered
Climate change	Qualitative and quantitative	• Intergovernmental Panel on Climate Change. Human health: impacts, adaptation and co-benefits. Fifth Assessment Report. Climate Change 2014: Impacts, Adaptation, and Vulnerability • Environment Agency (2011). Strategic Environmental Assessment and Climate Change: Guidance for Practitioners • TfL ULEZ Air Quality Health Impact Assessment, Ricardo-AEA, October 2014 (included in Appendix 2)

Table 12-A HIA for climate change

12.1.2 The environmental and societal impacts that are predicted to result from a changing climate will have impacts on health. This will affect people in London as well as nationally and globally. The report Fair Society Healthy Lives (the Marmot Review, 2010) is clear that local areas should prioritise policies and interventions that 'reduce both health inequalities and mitigate climate change' because of the likelihood that people with the poorest health would be hit hardest by the impacts of climate change.

12.1.3 Planning is at the forefront of both trying to reduce carbon emissions and to adapt urban environments to cope with higher temperatures, more uncertain rainfall, and more extreme weather events and their impacts such as flooding. Poorly designed homes can lead to fuel poverty in winter and overheating in summer contributing to excess winter and summer deaths. Developments that take advantage of sunlight, tree planting and accessible green/brown roofs also have the potential to contribute towards the mental wellbeing of residents.

12.2 Health pathway

12.2.1 In recent decades, climate change has contributed to levels of ill-health though the present world-wide burden of ill-health from climate change is relatively small compared with other stressors on health and is not well quantified (Intergovernmental Panel on climate change, 2014). If climate change continues as projected the major increases of ill-health compared to no climate change will occur through a wide range of factors including heat waves; food and waterborne disease and lost-work capacity.

12.2.2 Climate change affects health through three basic pathways:

- *direct impacts, primarily changes in the frequency of extreme weather including heat, drought and heavy rain;*
- *effects mediated through natural systems, e.g. disease vectors, water-borne diseases and air pollution; and*
- *effects heavily mediated by human systems, for example, occupational impacts, under nutrition and mental stress.*

12.2.3 The ULEZ would contribute to reducing emissions of CO_2 and will therefore have indirect benefits for climate change and for health.

12.2.4 There are co-benefits from actions to mitigate climate change. Reducing levels of use of private, motorised transport and supporting active travel will decrease emissions and increase levels of physical activity.

12.3 Receptors

12.3.1 Key receptors include local, regional, national and global populations.

12.4 Impact assessment

12.4.1 CO_2 is London's principal Greenhouse Gas (GHG) emission. Alongside wider national initiatives, the Mayor has committed to reducing emissions of CO_2 in London by 60 per cent overall, relative to 1990 levels and across all sectors, by 2025.

12.4.2 UK Government guidance on undertaking an SEA with regards to climate change suggests that a proposal or plan's impact on climate change cannot be assessed directly (Environment Agency, 2011). This is due to there being many other factors involved, including inherent natural variability and the global scale of consequences. However, a proposal or plan's impact on energy use and greenhouse gas emissions can often be determined, providing an indicator for impacts on climate change.

12.4.3 Most of these impacts will not be direct, but will arise through a chain of actions. For example, the implementation of the ULEZ would likely result in a degree of transition towards the use of low and zero emission vehicles in central London, particularly via the ULEZ bus policy and increased public awareness of vehicle impacts.

12.4.4 As identified in the EA, whilst low and zero emission vehicles offer reduced emissions during use, during the manufacturing process GHGs are often released. The ULEZ may therefore directly and indirectly contribute to changes in emission levels and climate change.

12.4.5 The direct effects on CO_2 emissions that may arise from implementation of the ULEZ, emissions modelling undertaken by TfL and KCL has produced forecast emissions for without ULEZ and with ULEZ for the years 2020 and 2025.

12.4.6 Full details of the emissions modelling can be found in the EA. The results from the atmospheric emissions modelling suggest that the implementation of the ULEZ would bring about substantial reductions in CO_2 emissions in central London. These impacts are likely to be experienced predominantly within the existing CCZ and to a lesser extent in the IRR and Inner Zone. Anticipated effects of the ULEZ on CO_2 emissions in outer London and outside the GLA are relatively minor.

12.4.7 Reductions in CO_2 emissions resulting from the ULEZ would predominantly be achieved through increased uptake of low and zero emission vehicles and greater compliance with more stringent Euro fuel standards. There may also be indirect reductions through the increased use of other transport modes such as public transport and active travel.

12.4.8 A move away from fossil fuel related transport to active travel will improve people's physical health. The health benefits associated with greater physical activity by active travel are addressed above.

12.5 Recommendations

12.5.1 As the anticipated impacts of the ULEZ on CO_2 emissions are positive, no mitigation is required.

12.5.2 Further reductions in CO_2 emissions could be enhanced through encouraging increased usage of hybrid, electric and hydrogen buses. Initially the greatest proportion of routes running these buses will be in central London. This could be extended into the Inner Zone and Outer Zone.

13 Conclusions

13.1 Assessment conclusions

13.1.1 This HIA assessed health and wellbeing impacts of the ULEZ against the IIA Objective 'to contribute to enhanced health and wellbeing for all within London' whilst having regard to the following six topics:

- *air quality;*
- *noise and neighbourhood amenity;*
- *active travel;*
- *crime reduction and community safety;*
- *social cohesion and lifetime neighbourhoods; and*
- *climate change.*

13.1.2 The health benefits resulting from air quality improvements from the ULEZ are the most notable in contributing to enhanced health and wellbeing for all within London. ULEZ would also result in improvements to noise and neighbourhood safety, active travel and climate change. Impacts on crime reduction and community safety as well as social cohesion and lifetime neighbourhoods are less notable.

13.1.3 Benefits from improved air quality are summarised in Table 13-A.

Positive impact	Duration of impact	Scale of impact
ULEZ would result in increased personal health and well-being as a result of improvements to air quality as people switch to less polluting vehicles and other modes of transport e.g. public transport, walking and cycling.	Positive long term	Major
ULEZ would result in reductions in the number of people living in areas above the NO_2 annual LV in 2020 and 2025. Specifically in 2020 ULEZ would result in the following reductions of people living in areas above the NO_2 annual LV: • Central Zone – reduction of 74%. • Inner Zone – reduction of 50%. • Outer Zone – reduction of 42%. Additionally, the proportion of population (by age group) living in areas exceeding the NO_2 annual LV decreases by at least 45% for all age categories and the impact is slightly greater for children and elderly.	Positive long term	Major
In 2020 ULEZ would, as a result of positive health benefits (from the reduction in NO_X, PM_{10} and $PM_{2.5}$ under the ULEZ for the GLA area), result in reductions of 4,123 life-years lost across Greater London. However this reduces in 2025. This improved health outcome is estimated to have a a total monetised benefit of between £100.9m to £101.3m in 2020 and £31.9m to £32.1m in 2025.	Positive long term	Moderate

Table 13-A Summary of health benefits from the ULEZ from improved air quality

13.1.4 In addition to positive benefits from air quality small positive impacts on health in relation to noise would result from the ULEZ. Specifically, a reduction in noise and vibration annoyance and disruption for some receptors and communities (where overall road traffic noise along some roads decreases as a result of increased usage of low and zero emission vehicles, initially in central London).

13.1.5 ULEZ would also contribute towards the promotion of active travel by providing a less polluted urban environment. For those entering the ULEZ who do not have a compliant vehicle, the ULEZ may also deter them from entering the zone or result in a modal shift to greener transport modes such as buses, tubes, trains or cycling. Small improvements in road safety as a result of increased newer vehicles on the road may also help to promote active travel.

13.2 Key enhancement suggestions

13.2.1 Health benefits from reductions in air pollution and noise as a result of the proposed ULEZ can be enhanced by encouraging the use of public transport, cycling and walking. The MTS promotes walking and cycling which is supported by investments in public transport and walking and cycling infrastructure.

13.2.2 To maximise the potential health benefits of the ULEZ, the ULEZ could be enhanced through encouraging increased usage of hybrid, electric and hydrogen buses. Initially the greatest proportion of routes running these buses would be in central London. This could be extended into the Inner Zone and Outer Zone.

13.2.3 Further, the geographical scale of the ULEZ limits the health benefits that the ULEZ may achieve. Greater health benefits from a reduction in air pollution, an increase in active travel and greater neighbourhood cohesion could be encouraged through the expansion of the ULEZ in the future to a wider geographical area.

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15 Acronyms

ANPR	Automatic Number Plate Recognition
CCMES	Climate Change Mitigation and Energy Strategy
CCTV	Closed-circuit Television
CCZ	Congestion Charging Zone
CO_2	Carbon dioxide
CPR	Community Profile Report
DLR	Docklands Light Railway
DMRB	Design Manual for Roads and Bridges
DsPH	Directors of Public Health
EA	Environmental Assessment
EBIA	Economic and Business Impact Assessment
EqIA	Equality Impact Assessment
EU	European Union
GHG	Greenhouse Gas
GLAA	Greater London Administrative Area
GLA	Greater London Authority
HA	Hospital Admissions
HEAT	Health Economic Assessment Tool
HGV	Heavy Goods Vehicle
HIA	Health Impact Assessment
HUDU	Healthy Urban Development Unit
IIA	Integrated Impact Assessment
IMD	Index of Multiple Derivation
IRR	Inner Ring Road
KCL	King's College London
KSI	Killed or Seriously Injured
LAEI	London Atmospheric Emissions Inventory
LEV	Low Emission Vehicle
LEZ	Low Emission Zone
LGV	Light Goods Vehicle
LU	London Underground
LV	Limit Value
LYL	Life Years Lost
NPPF	National Planning Policy Framework
MAQS	Mayor's Air Quality Strategy

MTS	Mayor's Transport Strategy
NHS	National Health Service
NO_2	Nitrogen dioxide
NO_X	Oxides of nitrogen
PHE	Public Health England
PHV	Private Hire Vehicle
PM	Particulate Matter
TERM	Transport Emissions Roadmap
TfL	Transport for London
UK	United Kingdom
ULEZ	Ultra Low Emission Zone
WHO	World Health Organisation

Appendix 1 Community Profile Report

Ultra Low Emission Zone Integrated Impact Assessment

Health Impact Assessment

Appendix 1 Community Profile Report

October 2014

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Contents

Appendix A Figures

1 Introduction

The geographical scope of the Emission Zone (ULEZ) will be enforced within the limits of the Congestion Charging Zone (CCZ), which covers some or all of the City of London and the City of Westminster, and the London Boroughs of Camden, Lambeth, Southwark, Hackney, Islington and Tower Hamlets. The CCZ provides an existing boundary for central London, shaped by the inner ring road. Not only is this zone a defined area, Transport for London (TfL) also already operates an extensive camera enforcement network, which is planned to be utilised to manage compliance with the ULEZ, helping to reduce the capital investment required for implementation.

The Integrated Impact Assessment (IIA) will primarily cover anticipated effects within the CCZ, although in the case of some assessments it may be decided that a wider boundary (within the Greater London Boundary) is considered to recognise and emphasise the extended secondary and indirect effects, both positive and negative, of the ULEZ.

The aim of the Community Profile Report (CPR) is to provide a baseline of the health and socio-demographic context of the area covered by the ULEZ proposals and the Greater London Area where the potential health and equality impacts of the scheme may be experienced. The IIA study area is broken down into three zones, the CCZ, inner London and outer London, as shown by Figure 1 in Appendix A. A fourth and fifth zone, the Inner Ring Road and non-Greater London Administrative Area (GLAA) has also been considered in some cases (please refer to the IIA report for more information).

The CPR has been produced to cover issues of importance to the Health Impact Assessment (HIA) through desk-top collection of Greater London health and socio-demographic data at Lower Super Output Area (LSOA) and ward or borough spatial scales. In wards or LSOA boundaries that cross between two of the zones, the ward or LSOA is designated to the assessment zone in which the majority (over 50%) of the land area falls.

The air quality assessment for the HIA has been completed using population data at a finer level of detail (smaller Output Areas) than that set-out by the CPR.

The data for the CPR is collected from the following five sources:

(i) The Office for National Statistics (Census 2011)

The Office for National Statistics neighbourhood statistics website provides a comprehensive range of Census 2011 statistics for local populations. Table 1-A presents the tables that contain the data, the section in the report where the table is contained and spatial level of the data.

Table	Section	Data Spatial Level
2-D	Population	LSOA
2-E	Population	LSOA
4-G	Transport	Ward
4-I	Transport	Borough
7-A	Health	Borough
7-B	Health	Borough

Table 1-A Census 2011 data used in the CPR

(ii) The London Datastore – Ward Profiles and Atlas (2014)

This data source provided a range of demographic and related data for each ward in the GLAA. They are designed to provide an overview of the population in these small areas by presenting a range of data on the population, diversity, households, life expectancy, housing, crime, benefits, land use, deprivation, and employment. Table 1-B below presents the tables that contain the data, the section in the report where the table is contained and spatial level of the data.

Table	Section	Data Spatial Level
2-A	Population	Ward
2-B	Population	Ward
2-C	Population	Ward
3-A	Employment and Income	Ward
4-I	Transport	Borough
Figure	**Section**	**Data Spatial Level**
2-A	Population	Ward
2-B	Population	Ward

Table 1-B Ward Profiles and Atlas data used in the CPR

(iii) Department of Communities and Local Government, Index of Multiple Deprivation 2010

The English Indices of Multiple Deprivation 2010 (IMD2010) results were used to indicate the relative deprivation of each LSOA found within each borough of London (Department of Communities and Local Government, 2010a). The IMD2010 provides a relative measure of deprivation at small area levels in England (LSOA). Areas are ranked from least deprived (100%) to most deprived (<5%). The English Indices of Deprivation 2010 are collated over a range of socio-economic domains into the following 7 overarching domains of deprivation:

- *income deprivation;*
- *employment deprivation;*
- *health deprivation and disability;*
- *education, skills and training deprivation;*
- *barriers to housing and Services;*
- *living environment deprivation; and*
- *crime.*

In addition to these seven domains, there are two additional add-on indices; the Income Deprivation Affecting Children Index (IDACI) and the Income Deprivation Affecting Older People Index (IDAOPI). Each of the domains is collated over a range of socio-economic indicators and represents a specific form of deprivation experienced by people within an individual LSOA. Table 1-C below presents the tables/figure that contains the data, the section in the report where the table is contained and spatial level of the data.

Table	Section	Data Spatial Level
5-A	Housing	LSOA
7-C	Health of the Community	LSOA
8-A	Indices of Multiple Deprivation	LSOA
Figure	**Section**	**Data Spatial Level**
2	Appendix A	LSOA
3	Appendix A	LSOA

Table 1-C IMD 2010 data used in the CPR

(iv) Transport in London Report 6 (2013)

The data from the Transport in London Report 6 was used in the Transport and Crime sections of the CPR. Table 1-D below presents the tables that contain the data, the section in the report where the table is contained and spatial level of the data.

Table	Section	Data Spatial Level
4-A	Transport	Borough
4-B	Transport	Borough
4-C	Transport	Borough
4-D	Transport	Borough
4-E	Transport	Borough
4-F	Transport	Borough
4-G	Transport	Borough
4-H	Transport	Borough
6-A	Crime	Borough
6-B	Crime	Borough

Table 1-D Transport in London Report 6 data used in the CPR

(v) Health Profiles Indicators for all London Boroughs 2014

The data from the Health Profiles Indicators for all London Boroughs 2014 was used in the Public Health England (PHE): 2014 Health Profiles for London section of the CPR. PHE's Health Profiles use a range of health indicators collected at ward level to rank the overall health of the community against other communities nationwide.

Figure	Section	Data Spatial Level
9-A	Public Health England: 2014 Health Profiles for London	Summary information

Table 1-E below presents the tables that contain the data, the section in the report where the table is contained and spatial level of the data.

Table	Section	Data Spatial Level
9-A	Public Health England: 2014 Health Profiles for London	Ward
Figure	**Section**	**Data Spatial Level**
9-A	Public Health England: 2014 Health Profiles for London	Summary information

Table 1-E Public Health England: Health Profiles for London 2014 used in the CPR

2 Population

2.1 Size and age distribution

Table 2-A provides the 2011 population and projections for 2020 and 2025, for children and the elderly within Greater London.

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Areas	Sum of Total Population			Population Ages 0-4			Population Ages 5-14			Population Ages 65-79			Population Ages 80+		
	2011	2020	2025	2011	2020	2025	2011	2020	2025	2011	2020	2025	2011	2020	2025
All London	**8173941**	**9127648**	**9480377**	**591495**	**639813**	**628415**	**939674**	**1112320**	**1145591**	**649889**	**752696**	**826630**	**254860**	**308420**	**346715**
CCZ	**177066**	**207350**	**218045**	**7934**	**9010**	**9241**	**11970**	**13772**	**14517**	**12184**	**14018**	**15255**	**4292**	**5317**	**6047**
Camden	35758	39845	40859	1436	1322	1323	2574	2394	2323	2373	2736	2870	798	967	1094
City of London	7375	8363	8592	236	223	217	351	409	412	772	1013	1077	263	363	434
Islington	26129	33288	34188	1307	1596	1610	1903	2438	2660	1425	1610	1804	670	713	775
Lambeth	23937	28988	31935	1270	1629	1719	2049	2479	2753	1661	1878	2130	509	694	770
Southwark	30119	36374	40142	1405	1722	1871	2226	2499	2747	1395	1611	1921	513	641	749
Westminster	53748	60492	62329	2280	2518	2501	2867	3553	3622	4558	5170	5453	1539	1939	2225
Inner	**2778950**	**3087403**	**3183958**	**195970**	**212435**	**209094**	**293486**	**333300**	**342376**	**173609**	**196477**	**216148**	**61359**	**73704**	**81870**
Camden	184580	203790	208948	11732	11614	11442	17918	18678	18694	15006	16777	17519	5800	6777	7732
Hackney	246270	281555	294154	19149	20771	20555	29238	33182	34242	13103	15565	17773	4292	5486	6192
Hammersmith & Fulham	182493	185918	187556	11900	11355	11000	16180	18865	18576	12137	13189	13605	4276	5041	5645
Haringey	254926	282645	292053	18112	19504	19430	31009	31087	31698	17081	19329	21479	5288	6955	7612
Islington	179996	203972	211545	10982	12563	12482	16798	19935	20847	11938	12858	13828	4003	4632	5068
Kensington & Chelsea	158649	155697	155908	9189	7766	7392	14056	14434	13404	14190	16833	17308	4925	6322	7690
Lambeth	279149	307412	313908	19431	20395	19980	29081	32745	33333	15394	17443	19957	5623	6559	7130
Newham	307984	365331	386091	25384	31308	31249	40421	45924	49028	15516	18600	21959	5077	6450	7060
Southwark	258164	285016	291483	19334	21011	20535	27433	32389	33232	14855	17136	19818	5566	6022	6485
Tower Hamlets	254096	309060	325910	18750	22979	22722	28733	35129	37739	11373	12714	14717	4197	4792	4977
Wandsworth	306995	328389	334342	21670	23173	22585	27095	34122	34937	19581	21184	22304	7330	8529	9450
Westminster	165648	178618	182060	10337	9996	9722	15524	16810	16646	13435	14849	15881	4982	6139	6829
Outer	**5217925**	**5832895**	**6078374**	**387591**	**418368**	**410080**	**634218**	**765248**	**788698**	**464096**	**542201**	**595227**	**189209**	**229399**	**258798**
Barking & Dagenham	185911	223387	239004	18676	20430	20409	27088	35736	37241	13055	14730	16796	6266	6341	6680
Barnet	356386	406979	427021	26239	28285	27695	43645	53167	55019	32757	39796	43588	14675	17774	20806
Bexley	231997	248997	256420	15182	16163	15916	29033	31807	32576	26176	28591	30774	11036	13154	14420
Brent	311215	348207	363348	22446	25160	24433	36590	43257	44901	24628	28856	33045	8048	12033	13824
Bromley	309392	334724	345374	20095	20955	20788	36673	42266	42820	35994	40940	43306	16043	18365	20622
Croydon	363378	398276	412239	27972	28542	27574	46226	54513	55334	32075	38389	42724	12300	15688	17874
Ealing	338449	368059	380097	25426	26564	25684	39428	47098	48050	26687	31532	34562	9540	12922	14698
Enfield	312466	352534	369382	24513	25455	25133	41235	47887	48739	28012	32276	35627	10821	13661	15710
Greenwich	254557	282409	293410	20945	21359	20795	31309	37838	38153	18614	22313	24965	7502	8737	9894
Harrow	239056	263972	274035	15916	17880	17407	29011	33279	34630	24146	28050	30701	9521	12395	14013
Havering	237232	259432	270844	13661	16019	16001	27595	31869	33895	29280	32659	34864	12997	15093	16629
Hillingdon	273936	315848	330694	19704	23148	22805	33792	41521	43679	25307	28811	31642	9871	12273	13646

Areas	Sum of Total Population			Population Ages 0-4			Population Ages 5-14			Population Ages 65-79			Population Ages 80+		
	2011	2020	2025	2011	2020	2025	2011	2020	2025	2011	2020	2025	2011	2020	2025
Hounslow	253957	290799	303787	19725	21999	21450	28844	37317	38747	19889	24135	26721	6970	9162	10507
Kingston upon Thames	160060	178463	184361	10964	11348	11040	17507	21778	22177	13994	17255	18494	6364	6982	7930
Lewisham	275885	309505	321558	22004	23648	23508	31933	38058	38986	18754	20506	23425	7381	7878	8317
Merton	199693	221309	229479	14830	15951	15425	21881	28388	28980	16404	19380	21136	6718	8116	9213
Redbridge	278970	321639	340002	21666	25276	25018	37503	46026	49183	23266	27679	30506	10119	11547	12927
Richmond upon Thames	186990	202522	207976	14038	13370	13020	20934	26305	26119	17548	21889	23198	7748	8862	10369
Sutton	190146	211674	220352	12750	13918	13585	22768	27720	28584	19130	22606	24398	8103	9605	10897
Waltham Forest	258249	294160	308991	20839	22898	22394	31223	39418	40885	18380	21808	24755	7186	8811	9822

Table 2-A Public Health England: Health Profiles for London 2014 used in the CPR

(Source: The London Datastore, 2014)

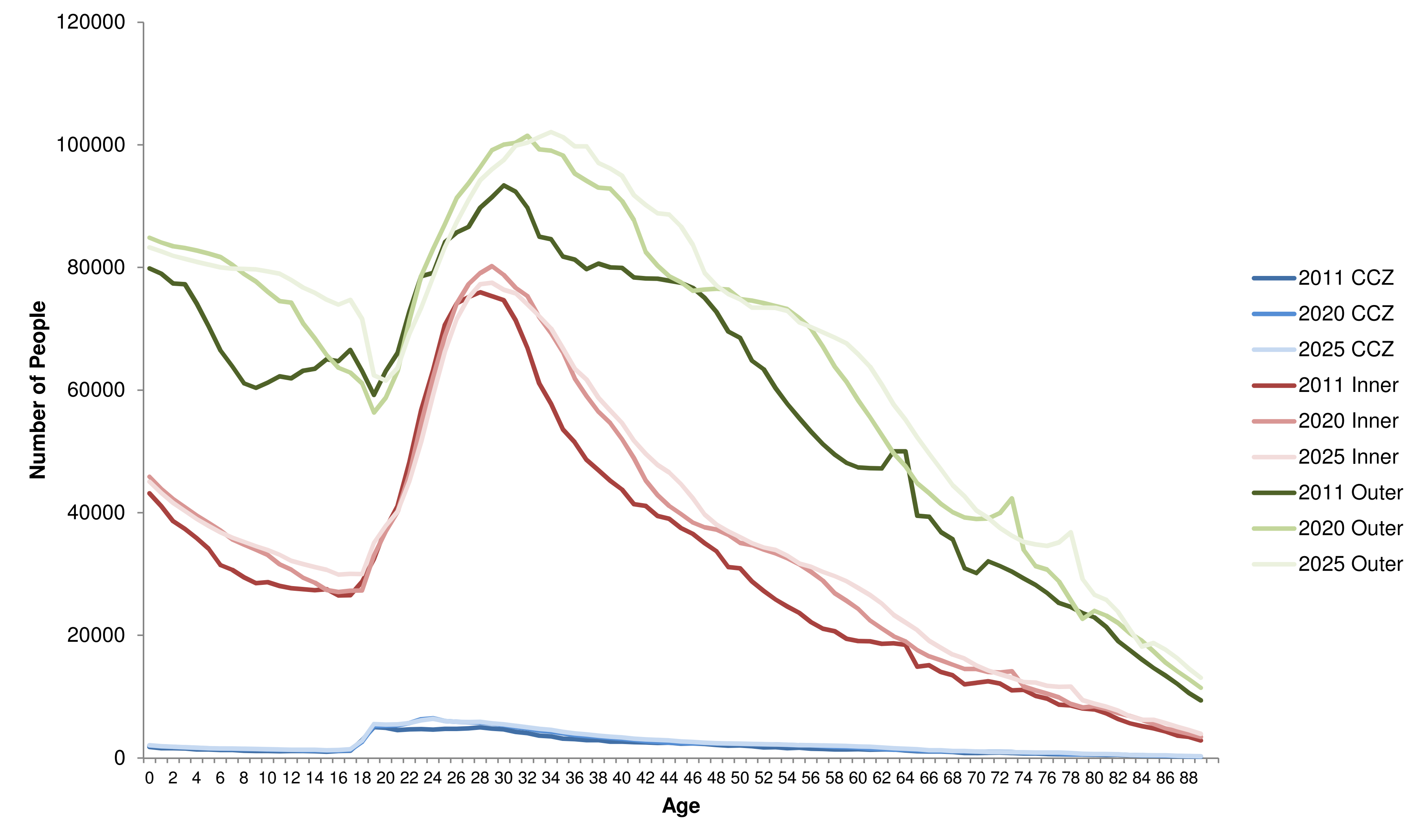

Figure 2-A Population data at ward level for 2011, 2020 and 2025 within Greater London

(Source: The London Datastore, 2014)

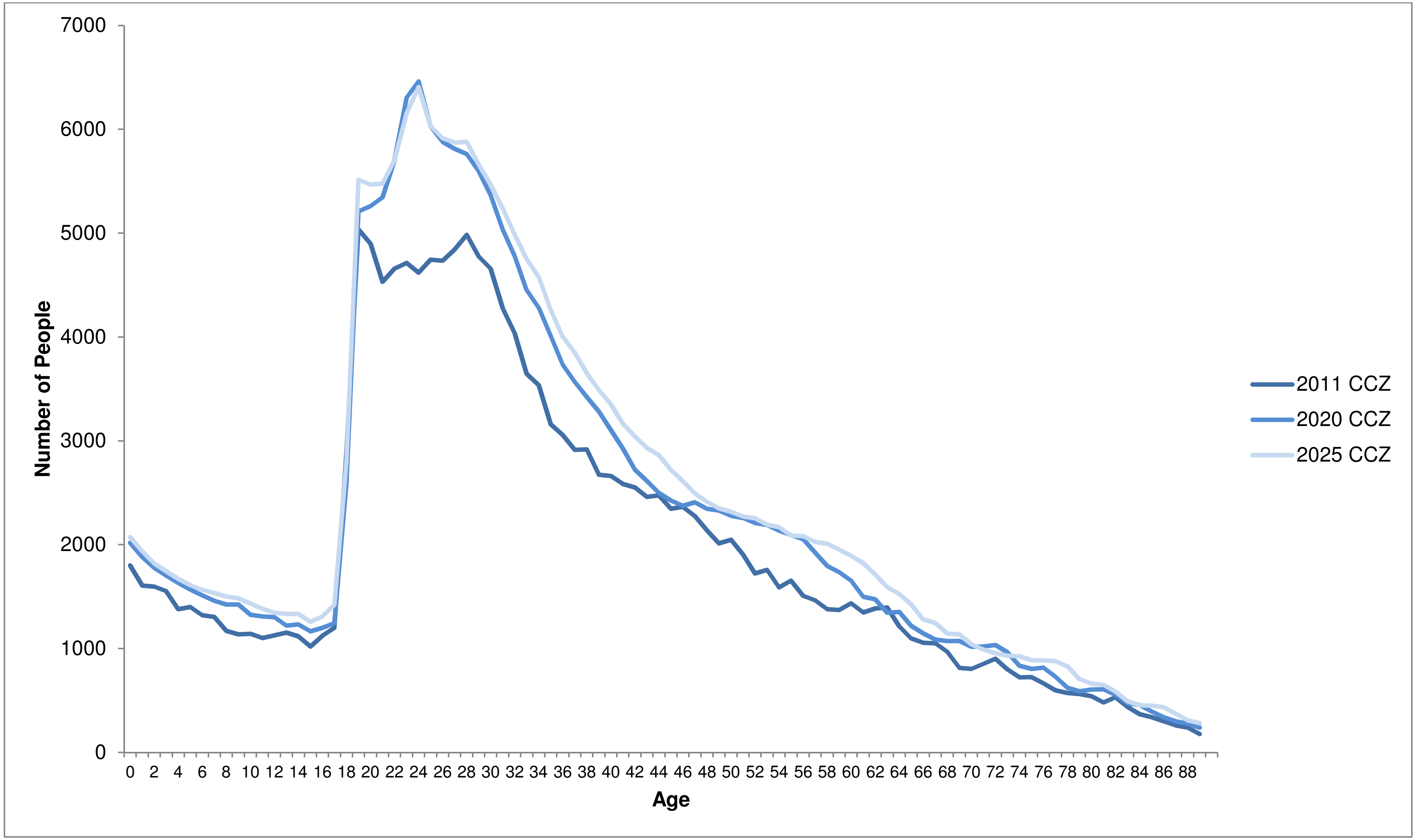

Figure 2-B   Population data at ward level for 2011, 2020 and 2025 within the CCZ
(Source: The London Datastore, 2014)

Areas	Sum of population	Male	Female
All London	**8173941**	**49.3%**	**50.7%**
CCZ	**177066**	**52.4%**	**47.6%**
Camden	35758	51.8%	48.2%
City of London	7375	55.5%	44.5%
Islington	26129	51.3%	48.7%
Lambeth	23937	51.8%	48.2%
Southwark	30119	51.1%	48.9%
Westminster	53748	54.0%	46.0%
Inner	**2778950**	**49.7%**	**50.3%**
Camden	184580	48.4%	51.6%
Hackney	246270	49.6%	50.4%
Hammersmith & Fulham	182493	48.7%	51.3%
Haringey	254926	49.5%	50.5%
Islington	179996	48.9%	51.1%
Kensington & Chelsea	158649	49.3%	50.7%
Lambeth	279149	49.6%	50.4%
Newham	307984	52.1%	47.9%
Southwark	258164	49.3%	50.7%
Tower Hamlets	254096	51.5%	48.5%
Wandsworth	306995	48.4%	51.6%
Westminster	165648	49.8%	50.2%
Outer	**5217925**	**49.1%**	**50.9%**
Barking & Dagenham	185911	48.5%	51.5%
Barnet	356386	48.5%	51.5%
Bexley	231997	48.1%	51.9%
Brent	311215	50.3%	49.7%
Bromley	309392	48.0%	52.0%
Croydon	363378	48.5%	51.5%
Ealing	338449	50.0%	50.0%
Enfield	312466	48.2%	51.8%
Greenwich	254557	49.6%	50.4%
Harrow	239056	49.4%	50.6%
Havering	237232	48.1%	51.9%
Hillingdon	273936	49.6%	50.4%
Hounslow	253957	50.2%	49.8%
Kingston upon Thames	160060	48.8%	51.2%
Lewisham	275885	48.9%	51.1%
Merton	199693	49.3%	50.7%
Redbridge	278970	49.5%	50.5%
Richmond upon Thames	186990	48.7%	51.3%
Sutton	190146	48.6%	51.4%
Waltham Forest	258249	49.9%	50.1%

Table 2-B Population data at ward level by gender within Greater London

(Source: The London Datastore, 2014)

Areas	Average population density (persons per sq. km) (2013)
All London	**8243**
CCZ	**11613**
Camden	14578
City of London	2406
Islington	13949
Lambeth	9763
Southwark	14389
Westminster	10371
Inner	**12708**
Camden	12094
Hackney	14311
Hammersmith & Fulham	13049
Haringey	9596
Islington	14992
Kensington & Chelsea	13522
Lambeth	12256
Newham	11755
Southwark	11405
Tower Hamlets	14007
Wandsworth	10204
Westminster	17125
Outer	**5755**
Barking & Dagenham	6717
Barnet	5200
Bexley	4423
Brent	8559
Bromley	3252
Croydon	5745
Ealing	6917
Enfield	5435
Greenwich	5562
Harrow	6034
Havering	3166
Hillingdon	3671
Hounslow	5287
Kingston upon Thames	5559
Lewisham	8356
Merton	6621
Redbridge	6719
Richmond upon Thames	4163
Sutton	5490
Waltham Forest	8309

Table 2-C Population data at ward level by gender within Greater London

(Source: The London Datastore, 2014)

2.2 Ethnicity and religion

Minority ethnic groups often experience lower socio-economic status and physical health problems; this may be a result of discrimination, levels of education, or even language barriers (Smaje, 1995). The concept of a minority group can also be applied to religions, as with ethnicity.

JACOBS

Areas	Average White: English /Welsh/ Scottish/ Northern Irish/ British %	Average of White: Irish %	Average White: Gypsy or Irish Traveller %	Average White: Other White %	Average Mixed/ multiple ethnic group: White and Black Caribbean %	Average Mixed/ multiple ethnic group: White and Black African %	Average Mixed/ multiple ethnic group: White and Asian %	Average Mixed/ multiple ethnic group: Other Mixed %	Average of Asian/ Asian British: Indian %	Average of Asian/ Asian British: Pakistani %	Average of Asian/ Asian British: Bangladeshi %	Average of Asian/ Asian British: Chinese %	Average of Asian/ Asian British: Other Asian %	Average of Black/ African/ Caribbean/ Black British: African %	Average of Black/ African/ Caribbean/ Black British: Caribbean %	Average of Black/ African/ Caribbean/ Black British: Other Black %	Average of Other ethnic group: Arab %	Average of Other ethnic group: Any other ethnic group %
London Average	**45.9%**	**2.2%**	**0.1%**	**12.6%**	**1.4%**	**0.8%**	**1.2%**	**1.4%**	**6.4%**	**2.6%**	**2.6%**	**1.5%**	**4.8%**	**6.9%**	**4.2%**	**2.0%**	**1.3%**	**2.1%**
CCZ	**40.6%**	**2.5%**	**0.1%**	**19.7%**	**1.2%**	**0.9%**	**1.5%**	**1.8%**	**3.2%**	**0.8%**	**4.0%**	**4.7%**	**3.9%**	**6.7%**	**2.3%**	**1.9%**	**2.1%**	**2.2%**
Camden	36.2%	2.4%	0.1%	18.1%	0.8%	0.8%	1.7%	1.9%	3.5%	0.9%	9.8%	7.1%	4.9%	4.9%	1.4%	1.8%	1.6%	2.0%
City of London	55.8%	2.5%	0.0%	19.0%	0.6%	0.5%	1.5%	1.4%	2.9%	0.2%	3.9%	3.6%	2.9%	1.5%	0.7%	0.7%	1.0%	1.2%
Hackney	44.3%	2.4%	0.1%	28.6%	1.6%	0.9%	2.6%	3.5%	1.5%	0.4%	0.1%	3.1%	3.4%	2.6%	1.4%	0.6%	0.9%	1.9%
Islington	46.1%	2.9%	0.1%	18.7%	1.5%	0.6%	1.3%	1.8%	2.8%	0.9%	1.7%	4.1%	3.5%	6.1%	2.3%	2.2%	1.0%	2.4%
Lambeth	38.9%	2.4%	0.1%	14.9%	2.1%	1.3%	1.2%	2.1%	2.0%	0.6%	1.1%	5.3%	3.7%	11.6%	6.0%	3.5%	1.2%	2.0%
Southwark	39.1%	2.7%	0.1%	14.5%	1.6%	1.1%	1.3%	1.9%	3.9%	0.8%	3.1%	3.9%	3.6%	12.6%	3.3%	3.0%	1.3%	2.2%
Tower Hamlets	27.8%	1.8%	0.0%	23.8%	0.6%	0.4%	1.1%	1.0%	2.5%	1.5%	28.2%	3.0%	2.5%	1.9%	1.0%	0.7%	0.8%	1.4%
Westminster	40.3%	2.1%	0.0%	27.3%	0.6%	0.7%	1.6%	1.7%	3.4%	0.8%	1.6%	3.9%	4.1%	3.1%	0.8%	0.7%	4.6%	2.5%
Inner	**38.8%**	**2.4%**	**0.1%**	**16.5%**	**1.8%**	**1.0%**	**1.3%**	**1.8%**	**3.3%**	**1.8%**	**4.9%**	**1.9%**	**3.5%**	**8.6%**	**5.5%**	**2.8%**	**1.6%**	**2.6%**
Camden	45.6%	3.3%	0.1%	19.3%	1.2%	0.8%	1.8%	1.9%	2.6%	0.6%	5.0%	2.2%	3.8%	4.8%	1.6%	1.6%	1.5%	2.3%
Hackney	36.0%	2.1%	0.2%	16.1%	2.0%	1.2%	1.2%	2.0%	3.1%	0.8%	2.5%	1.4%	2.7%	11.4%	7.9%	4.0%	0.7%	4.6%
Hammersmith and Fulham	45.2%	3.5%	0.1%	19.6%	1.5%	0.8%	1.5%	1.7%	1.9%	0.9%	0.6%	1.7%	4.0%	5.7%	3.9%	2.1%	2.9%	2.7%
Haringey	35.3%	2.8%	0.1%	22.8%	1.9%	1.0%	1.5%	2.1%	2.3%	0.8%	1.7%	1.5%	3.1%	8.9%	7.0%	2.6%	0.9%	3.8%
Islington	48.2%	4.1%	0.1%	16.0%	2.1%	1.0%	1.4%	2.1%	1.5%	0.4%	2.4%	1.8%	2.5%	6.1%	4.1%	2.8%	0.9%	2.4%
Kensington and Chelsea	39.4%	2.4%	0.1%	28.9%	1.1%	0.7%	1.9%	2.0%	1.6%	0.6%	0.6%	2.4%	4.7%	3.5%	2.1%	1.0%	4.1%	3.1%
Lambeth	38.9%	2.5%	0.1%	15.5%	2.8%	1.4%	1.2%	2.3%	1.6%	1.1%	0.7%	1.2%	1.9%	11.7%	9.9%	4.9%	0.5%	1.9%
Lewisham	41.6%	1.9%	0.1%	10.0%	3.1%	1.3%	1.1%	1.9%	1.7%	0.6%	0.5%	2.2%	4.3%	11.7%	11.2%	4.4%	0.5%	2.1%
Newham	17.0%	0.7%	0.1%	11.5%	1.3%	1.1%	0.9%	1.3%	13.5%	9.6%	12.0%	1.3%	6.5%	12.4%	4.9%	2.4%	1.2%	2.3%
Southwark	40.2%	2.1%	0.1%	12.0%	2.0%	1.3%	1.0%	1.9%	1.8%	0.5%	1.1%	2.7%	2.5%	16.8%	6.5%	4.3%	0.8%	2.5%
Tower Hamlets	31.3%	1.5%	0.1%	12.5%	1.1%	0.6%	1.2%	1.2%	2.8%	1.0%	31.4%	3.4%	2.3%	3.7%	2.1%	1.5%	1.0%	1.3%
Wandsworth	53.7%	2.5%	0.1%	15.5%	1.5%	0.7%	1.3%	1.5%	2.8%	3.1%	0.5%	1.2%	3.1%	4.7%	4.0%	1.8%	0.8%	1.3%
Westminster	34.4%	2.3%	0.0%	23.5%	0.9%	0.9%	1.6%	1.9%	3.2%	1.1%	3.0%	2.3%	4.7%	4.4%	2.2%	1.4%	7.8%	4.2%
Outer	**50.4%**	**2.0%**	**0.1%**	**9.9%**	**1.3%**	**0.7%**	**1.2%**	**1.2%**	**8.5%**	**3.2%**	**1.1%**	**1.2%**	**5.6%**	**5.8%**	**3.4%**	**1.6%**	**1.1%**	**1.8%**
Barking and Dagenham	50.0%	0.9%	0.1%	7.7%	1.4%	1.1%	0.7%	1.0%	3.9%	4.2%	4.0%	0.7%	2.7%	15.4%	2.8%	1.7%	0.5%	1.0%
Barnet	46.0%	2.4%	0.0%	16.0%	0.9%	0.9%	1.6%	1.4%	7.8%	1.5%	0.6%	2.3%	6.1%	5.4%	1.2%	1.0%	1.4%	3.3%
Bexley	77.9%	1.1%	0.3%	3.1%	0.7%	0.4%	0.6%	0.6%	3.0%	0.3%	0.3%	1.1%	1.8%	6.5%	1.0%	0.5%	0.1%	0.6%
Brent	18.1%	4.0%	0.1%	14.3%	1.4%	0.9%	1.2%	1.6%	18.7%	4.7%	0.6%	1.1%	9.1%	7.6%	7.5%	3.3%	3.7%	2.1%
Bromley	77.7%	1.4%	0.2%	5.2%	1.2%	0.4%	1.0%	0.8%	2.0%	0.3%	0.4%	0.9%	1.5%	3.1%	2.1%	0.7%	0.3%	0.6%
Croydon	48.2%	1.5%	0.1%	6.1%	2.6%	0.9%	1.4%	1.6%	6.7%	2.9%	0.7%	1.0%	4.8%	7.8%	8.6%	3.5%	0.5%	1.3%
Ealing	31.0%	3.1%	0.1%	15.4%	1.2%	0.6%	1.4%	1.3%	13.9%	4.2%	0.5%	1.2%	9.2%	5.1%	3.9%	1.9%	2.9%	3.1%
Enfield	40.8%	2.2%	0.1%	18.2%	1.5%	0.8%	1.3%	1.8%	3.8%	0.8%	1.8%	0.8%	4.0%	8.8%	5.5%	2.6%	0.6%	4.5%
Greenwich	53.0%	1.7%	0.2%	8.5%	1.6%	1.0%	0.9%	1.3%	3.1%	1.0%	0.6%	2.0%	4.8%	13.3%	3.1%	2.1%	0.4%	1.4%
Harrow	31.1%	3.1%	0.1%	8.1%	1.0%	0.4%	1.4%	1.1%	26.5%	3.2%	0.6%	1.1%	11.2%	3.5%	2.8%	1.8%	1.5%	1.4%
Havering	83.5%	1.3%	0.1%	3.0%	0.8%	0.3%	0.5%	0.5%	2.1%	0.6%	0.4%	0.6%	1.1%	3.1%	1.2%	0.4%	0.1%	0.4%
Hillingdon	53.2%	2.2%	0.1%	6.0%	1.0%	0.5%	1.3%	1.0%	13.3%	3.2%	0.9%	1.0%	6.3%	3.9%	1.6%	1.5%	1.0%	1.8%
Hounslow	38.6%	1.9%	0.1%	11.5%	0.9%	0.7%	1.3%	1.2%	18.6%	5.3%	0.8%	0.9%	8.1%	4.2%	1.3%	1.0%	1.4%	2.1%
Kingston upon Thames	63.1%	1.7%	0.1%	9.5%	0.8%	0.4%	1.6%	1.1%	4.0%	1.9%	0.6%	1.8%	8.2%	1.6%	0.6%	0.2%	1.5%	1.2%
Merton	48.9%	2.2%	0.1%	14.1%	1.3%	0.6%	1.4%	1.3%	4.0%	3.6%	1.1%	1.3%	7.8%	5.2%	4.0%	1.1%	0.7%	1.2%
Redbridge	35.7%	1.4%	0.0%	6.6%	1.2%	0.6%	1.2%	1.2%	16.0%	10.8%	5.6%	1.1%	7.2%	4.3%	3.2%	1.2%	0.5%	2.1%
Richmond upon Thames	71.4%	2.6%	0.1%	12.0%	0.7%	0.4%	1.5%	1.0%	2.8%	0.6%	0.5%	1.0%	2.5%	0.9%	0.4%	0.2%	0.6%	1.0%
Sutton	71.1%	1.7%	0.1%	5.8%	1.2%	0.4%	1.2%	0.9%	3.4%	1.3%	0.6%	1.2%	5.0%	2.9%	1.4%	0.5%	0.5%	0.7%
Waltham Forest	37.2%	1.5%	0.1%	14.2%	1.8%	0.9%	1.0%	1.6%	3.5%	9.9%	1.8%	1.0%	4.4%	7.2%	7.2%	2.7%	1.4%	2.6%

Table 2-D Average ethnicity data at LSOA level within Greater London

(Source: Office for National Statistics, 2011)

Areas	Christian	Buddhist	Hindu	Jewish	Muslim	Sikh	Other	None	Not stated
All London	**48.9%**	**1.0%**	**4.9%**	**1.8%**	**12.0%**	**1.5%**	**0.6%**	**20.9%**	**8.5%**
CCZ	**42.9%**	**1.6%**	**1.9%**	**1.6%**	**10.7%**	**0.3%**	**0.5%**	**27.6%**	**12.9%**
Camden	31.6%	1.8%	1.7%	1.1%	15.0%	0.3%	0.5%	25.2%	22.7%
City of London	45.5%	1.2%	1.9%	2.3%	6.5%	0.3%	0.4%	33.3%	8.7%
Hackney	33.5%	0.8%	1.1%	1.7%	2.7%	0.1%	0.6%	50.1%	9.4%
Islington	40.9%	1.2%	1.8%	0.7%	8.1%	0.3%	0.5%	29.0%	17.5%
Lambeth	51.1%	1.9%	1.3%	0.5%	7.8%	0.1%	0.6%	27.7%	8.9%
Southwark	46.2%	1.4%	2.4%	0.6%	10.0%	0.4%	0.5%	30.4%	8.1%
Tower Hamlets	23.4%	0.9%	1.4%	0.7%	29.1%	0.2%	0.3%	24.6%	19.3%
Westminster	46.9%	1.7%	2.1%	3.5%	10.8%	0.3%	0.6%	24.4%	9.6%
Inner	**45.8%**	**1.1%**	**2.1%**	**1.7%**	**14.2%**	**0.4%**	**0.5%**	**23.9%**	**10.3%**
Camden	34.5%	1.2%	1.4%	5.2%	11.5%	0.2%	0.6%	25.5%	20.0%
Hackney	38.8%	1.2%	0.6%	6.3%	14.2%	0.8%	0.5%	27.9%	9.6%
Hammersmith and Fulham	54.3%	1.1%	1.1%	0.6%	9.9%	0.2%	0.5%	23.8%	8.4%
Haringey	44.9%	1.1%	1.7%	3.0%	14.0%	0.3%	0.5%	25.5%	9.0%
Islington	40.3%	1.0%	0.9%	1.0%	9.7%	0.3%	0.5%	30.1%	16.3%
Kensington and Chelsea	54.4%	1.5%	0.9%	2.1%	10.1%	0.2%	0.5%	20.4%	10.1%
Lambeth	53.5%	0.9%	1.0%	0.4%	7.1%	0.1%	0.6%	27.8%	8.7%
Lewisham	52.9%	1.3%	2.4%	0.2%	6.4%	0.2%	0.5%	27.1%	8.9%
Newham	40.3%	0.8%	8.6%	0.1%	31.5%	2.1%	0.4%	9.7%	6.4%
Southwark	53.4%	1.3%	1.1%	0.3%	8.2%	0.2%	0.5%	26.3%	8.6%
Tower Hamlets	27.2%	1.1%	1.8%	0.5%	33.9%	0.3%	0.3%	19.3%	15.5%
Wandsworth	53.1%	0.8%	2.1%	0.5%	7.9%	0.3%	0.4%	27.0%	7.9%
Westminster	44.5%	1.4%	1.8%	3.3%	19.8%	0.2%	0.6%	19.2%	9.3%
Outer	**50.9%**	**0.9%**	**6.7%**	**1.9%**	**10.6%**	**2.2%**	**0.7%**	**18.9%**	**7.2%**
Barking and Dagenham	56.2%	0.4%	2.3%	0.2%	13.5%	1.6%	0.3%	19.0%	6.4%
Barnet	41.3%	1.3%	6.1%	15.2%	10.2%	0.4%	1.1%	16.1%	8.4%
Bexley	62.2%	0.6%	1.5%	0.1%	2.4%	1.8%	0.3%	24.1%	7.0%
Brent	41.4%	1.4%	17.9%	1.5%	18.5%	0.6%	1.2%	10.6%	6.9%
Bromley	60.8%	0.5%	1.6%	0.3%	2.5%	0.2%	0.4%	25.9%	7.8%
Croydon	56.7%	0.6%	5.9%	0.2%	7.9%	0.4%	0.6%	20.0%	7.6%
Ealing	44.1%	1.2%	8.4%	0.3%	15.5%	7.7%	0.6%	15.3%	6.9%
Enfield	53.7%	0.6%	3.5%	1.4%	16.5%	0.3%	0.6%	15.5%	7.7%
Greenwich	53.0%	1.6%	3.5%	0.2%	6.6%	1.4%	0.4%	25.8%	7.6%
Harrow	37.4%	1.1%	25.4%	4.4%	12.3%	1.2%	2.5%	9.5%	6.2%
Havering	65.7%	0.3%	1.2%	0.5%	2.0%	0.8%	0.3%	22.4%	6.7%
Hillingdon	49.8%	0.8%	8.0%	0.7%	10.2%	6.6%	0.6%	16.8%	6.4%
Hounslow	42.2%	1.4%	10.1%	0.3%	13.8%	8.9%	0.6%	16.1%	6.5%
Kingston upon Thames	53.2%	1.1%	4.8%	0.5%	6.0%	0.8%	0.5%	25.3%	7.9%
Merton	56.3%	0.9%	6.0%	0.4%	8.0%	0.2%	0.4%	20.7%	7.1%
Redbridge	37.4%	0.7%	11.1%	3.8%	22.7%	6.1%	0.5%	11.3%	6.5%
Richmond upon Thames	55.3%	0.9%	1.6%	0.8%	3.3%	0.8%	0.5%	28.4%	8.5%
Sutton	58.6%	0.7%	4.2%	0.3%	4.0%	0.2%	0.4%	24.6%	7.1%
Waltham Forest	48.8%	0.8%	2.2%	0.5%	21.4%	0.5%	0.4%	18.1%	7.3%

Table 2-E Religion of population data at LSOA level within Greater London

(Source: Office for National Statistics, 2011)

3 Employment and Income

Employment and income influence a range of factors, including access to housing, education, services and social networks, as well as diet, lifestyle and coping skills. These are key determinants of a variety of physical and mental health impacts and ultimately health and wellbeing. Table 3-A below presents the breakdown of the employment and economic activity within the London area assessment zones.

Areas	Number In employment (16-74) - 2011	Number of jobs in area - 2012	Average Employment rate (%) (16-74) - 2011
All London	**3998897**	**4591200**	**65.5%**
CCZ	**92550**	**1373900**	**62.7%**
Camden	15666	196500	51.6%
City of London	4747	400000	75.3%
Islington	12829	113000	59.3%
Lambeth	12859	51400	65.6%
Southwark	16002	75600	63.0%
Westminster	30447	537400	66.8%
Inner	**1408755**	**1390600**	**65.2%**
Camden	93300	119600	65.1%
Hackney	118556	94700	62.9%
Hammersmith & Fulham	99618	130300	68.4%
Haringey	124296	63600	64.7%
Islington	93936	79800	65.6%
Kensington & Chelsea	81387	125100	64.6%
Lambeth	153635	82800	70.4%
Newham	132454	88200	57.8%
Southwark	131386	125300	65.9%
Tower Hamlets	120873	240400	60.8%
Wandsworth	178582	111200	73.3%
Westminster	80732	129600	62.3%
Outer	**2497592**	**1826700**	**65.7%**
Barking & Dagenham	75217	49100	59.0%
Barnet	170658	119700	66.1%
Bexley	110159	67400	66.5%
Brent	147461	109000	63.0%
Bromley	151368	102000	67.9%
Croydon	172987	116000	65.6%
Ealing	164820	123200	65.1%
Enfield	137622	99900	61.7%
Greenwich	117821	71300	63.2%
Harrow	113900	68000	65.2%
Havering	112846	76300	65.9%
Hillingdon	130290	193600	65.7%
Hounslow	127032	140400	66.8%
Kingston upon Thames	81957	73200	68.5%
Lewisham	136057	63200	65.8%
Merton	104822	75800	70.0
Redbridge	124692	71400	62.9
Richmond upon Thames	99204	74200	71.9
Sutton	97658	70100	70.4
Waltham Forest	121021	62900	63.4

Table 3-A Employment and economic activity data at Ward level within Greater London
(Source: The London Datastore, 2014)

4 Transport

Transport plays a vital role in the health and wellbeing of communities through the provision of access to a range of services and amenities required to treat illness, as well as to manage and promote healthy living.

Any activity that promotes a modal shift to active, public or green transport (including cycling, walking and the use of clean technologies) will contribute to a healthier lifestyle and environment, reduce the reliance on the use of non-renewable fuels, reduce emissions to air, diminish risk from accident and injury, and promote physical activity. Equally, those who own their own cars are more able to access jobs and services outside of their local area and are less likely to suffer from social exclusion, than those who do not.

Table 4-A to Table 4-I presents the number of people using different modes of transport within Greater London.

Car	Bus (incl. tram)	Walk	Tube	Rail	Cycle	Taxi/ PHV	Motor-cycle	DLR
32.90%	21.40%	20.60%	11.00%	9.60%	1.90%	1.30%	0.60%	0.90%

Table 4-A Percent modal share of daily journey stages within Greater London, 2012
(Source: Transport for London, 2013)

Year	Public Transport	Private Transport	Walk	Cycle
1993	6.89	10.66	5.16	0.27
1994	7.01	10.77	5.18	0.27
1995	7.24	10.71	5.21	0.27
1996	7.41	10.81	5.25	0.27
1997	7.74	10.85	5.28	0.27
1998	7.97	10.87	5.32	0.27
1999	8.25	11.11	5.39	0.27
2000	8.63	10.97	5.45	0.29
2001	8.84	10.89	5.52	0.32
2002	9.12	10.87	5.56	0.32
2003	9.61	10.65	5.57	0.37
2004	10.15	10.52	5.60	0.38
2005	10.16	10.40	5.66	0.42
2006	10.56	10.48	5.72	0.47
2007	11.69	10.57	5.80	0.47
2008	12.10	10.16	5.89	0.49
2009	12.16	10.19	5.98	0.51
2011	12.94	10.20	6.18	0.57
2012	13.41	10.10	6.26	0.58

Table 4-B Aggregate travel volumes in Greater London, estimated daily average number of journey stage in millions, 1993 to 2012, seven-day week
(Source: Transport for London, 2013)

Year	Central London cordon	Inner London cordon	London boundary cordon	Thames screenline
2000	54	29	9	30
2001	51	27	9	32
2002	61	25	9	34
2003	65	28	9	38
2004	72	31	9	41
2005	87	34	10	47
2006	98	37	10	52
2007	103	41	11	57
2008	104	44	13	61
2009	120	48	14	64
2010	137	52	15	67
2011	147	55	15	76
2012	149	57	-	84

Table 4-C Long-term trends in cycling across strategic cordons and screenlines within Greater London, 24-hour weekdays, both directions, in thousands

(Source: Transport for London, 2013)

Year	Number of hires
Jun-Dec 2010	2,180,813
Jan-Dec 2011	7,142,449
Jan-Dec 2012	9,519,283
Jan-July 2013	4,807,338

Table 4-D Trend in cycle hires using the Barclays Cycle Hire Scheme

(Source: Transport for London, 2013)

Year	Walk trips under 5 minutes	Walk trips over 5 minutes
2005/06	5.56	3.73
2006/07	6.17	3.99
2007/08	6.08	3.78
2008/09	5.54	3.63
2009/10	5.63	3.71
2010/11	5.91	3.92
2011/12	6.31	4.07
2012/13	6.43	4.10

Table 4-E Number of recorded daily walk all the way trips made by London residents within Greater London, in millions

(Source: Transport for London, 2013)

Compact	Mini	Super mini	Small family	Family	Multi-purpose vehicle	Prestige saloon	Premium sports	SUV (4x4)
3.6%	29.8%	2.1%	34.6%	21.8%	2.6%	1.9%	0.7%	2.8%

Table 4-F Percentage of cars, by market segment group, seen by TfL automatic number plate registration cameras over a 6-month period (mid October 2009 to mid-April 2010)

(Source: Transport for London, 2013)

Boroughs	Average no. of Cars per household
All London	**0.84**
CCZ	**0.36**
Camden	0.26
City of London	0.39
Islington	0.34
Lambeth	0.39
Southwark	0.37
Westminster	0.42
Inner	**0.54**
Camden	0.52
Hackney	0.42
Hammersmith & Fulham	0.55
Haringey	0.61
Islington	0.43
Kensington & Chelsea	0.57
Lambeth	0.53
Newham	0.61
Southwark	0.53
Tower Hamlets	0.42
Wandsworth	0.69
Westminster	0.48
Outer	**1.02**
Barking & Dagenham	0.82
Barnet	1.07
Bexley	1.18
Brent	0.84
Bromley	1.21
Croydon	1.00
Ealing	0.92
Enfield	1.01
Greenwich	0.80
Harrow	1.20
Havering	1.22
Hillingdon	1.23
Hounslow	1.01
Kingston upon Thames	1.13
Lewisham	0.67
Merton	0.94
Redbridge	1.08
Richmond upon Thames	1.07
Sutton	1.18
Waltham Forest	0.80

Table 4-G Average number of cars per household data at ward level within Greater London, 2011

(Source: Office for National Statistics, 2011)

4.1 Collision and casualty data

Road injuries and deaths have considerable social, health and economic impacts on those involved. Road Traffic Incidents (RTIs) tend to be more prevalent in urban areas and casualties affect mostly economically active persons generating a ripple effect on their dependents, causing suffering and poverty.

Casual Severity	User Group	Casualty numbers			Percentage change in 2012 over	
		2005-2009 average	2011	2012	2011	2005-2009 average
Fatal[1]	Pedestrians	96.0	77	69	-10%	-28%
	Pedal Cyclists	16.6	16	14	-13%	-16%
	Powered two-wheeler	43.4	30	27	-10%	-38%
	Car occupants	49.4	32	19	-41%	-62%
	Bus or coach occupants	2.4	1	2	+100%	-17%
	Other vehicle occupants	3.2	3	3	+0%	-6%
	Total	**211**	**159**	**134**	**-16%**	**-36%**
Fatal and serious	Pedestrians	1216.4	980	1123	+15%	-8%
	Pedal Cyclists	420.6	571	671	+18%	+60%
	Powered two-wheeler	791.2	599	629	+5%	-21%
	Car occupants	949	499	448	-10%	-53%
	Bus or coach occupants	139.6	86	94	+9%	-33%
	Other vehicle occupants	109.8	70	53	-24%	-52%
	Total	**3626.6**	**2805**	**3018**	**+8%**	**-17%**
Slight	Pedestrians	4214	4466	4143	-7%	-2%
	Pedal Cyclists	2718.2	3926	3942	+0%	+45%
	Powered two-wheeler	3806.4	4077	4022	-1%	+6%
	Car occupants	12426.8	11293	11217	-1%	-10%
	Bus or coach occupants	1429.8	1384	1232	-11%	-14%
	Other vehicle occupants	1004.8	1306	1206	-8%	+20%
	Total	**25600**	**26452**	**25762**	**-3%**	**+1%**
All severities	Pedestrians	5430.4	5446	5266	-3%	-3%
	Pedal Cyclists	3138.8	4497	4613	3%	+47%
	Powered two-wheeler	4597.6	4676	4651	-1%	+1%
	Car occupants	13375.8	11792	11665	-1%	-13%
	Bus or coach occupants	1569.4	1470	1326	-10%	-16%
	Other vehicle occupants	1114.6	1376	1259	-9%	13%
	Total	**29226.6**	**29257**	**28780**	**-2%**	**-2%**

[1] Fatal data is also included in *Fatal and Serious*

Table 4-H Road Collisions casualties within Greater London in 2012 compared with 2005-2009 average and 2011

(Source: Transport for London, 2013)

Areas	Total	Severity			Type				
		Fatal	Serious	Slight	Pedestrians	Pedal Cyclists	Powered two-wheelers	Car Occupants	Other
Barking & Dagenham	545	3	45	497	82	44	63	310	46
Barnet	1520	9	123	1388	241	82	173	913	111
Bexley	589	2	66	521	87	53	63	333	53
Brent	928	3	81	844	191	81	145	441	70
Bromley	816	3	87	726	124	88	104	445	55
Camden	964	7	105	852	251	234	176	189	114
City of London	380	1	40	339	113	127	57	33	50
City of Westminster	1599	4	182	1413	450	308	331	282	228
Croydon	1122	5	82	1035	211	71	135	599	106
Ealing	1053	4	81	968	211	100	151	498	93
Enfield	1075	7	91	977	170	55	85	644	121
Greenwich	852	5	99	748	147	72	124	399	110
Hackney	898	5	98	795	172	197	128	309	92
Hammersmith & Fulham	690	2	72	616	126	167	174	172	51
Haringey	984	1	78	905	212	96	127	447	102
Harrow	551	2	37	512	104	30	41	349	27
Havering	793	5	58	730	99	34	66	528	66
Hillingdon	1080	8	75	997	122	80	93	726	59
Hounslow	975	7	90	878	119	110	137	547	62
Islington	833	2	79	752	189	232	169	163	80
Kensington & Chelsea	792	3	77	712	171	187	220	152	62
Kingston	427	1	45	381	57	61	58	224	27
Lambeth	1293	2	154	1137	253	273	262	338	167
Lewisham	938	3	105	830	178	123	143	400	94
Merton	458	2	37	419	88	64	76	204	26
Newham	911	5	76	830	216	90	86	456	63
Redbridge	938	3	73	862	156	42	76	583	81
Richmond	475	1	71	403	79	110	97	165	24
Southwark	1149	8	157	984	206	265	229	336	113
Sutton	481	2	47	432	68	40	70	261	42
Tower Hamlets	970	6	85	879	181	177	158	387	67
Waltham Forest	786	2	65	719	129	76	76	448	57
Wandsworth	1024	3	99	922	188	238	244	292	62
Inner London	**12382**	**51**	**1352**	**10979**	**2625**	**2600**	**2415**	**3452**	**1290**
Outer London	**16507**	**75**	**1408**	**15024**	**2766**	**1407**	**1922**	**9121**	**1291**
London	**28889**	**126**	**2760**	**26003**	**5391**	**4007**	**4337**	**12573**	**2581**

Table 4-I Road Casualties by severity and road user type data at borough-level within Greater London

(Source: Office for National Statistics, 2011)

JACOBS

5 Housing

Housing is a frequently underrated determinant of health. It is not only required to provide shelter, security and a family base, but the quality of housing is also associated with economic, social, mental and physical wellbeing (Hartig and Lawrence, 2014, pp. 455 - 473). The health impacts associated with poor housing can include a range of physical illness brought on from poor shelter and subsequent exposure to cold, damp or pollutants (Platt, Martin, Hunt, and Lewis, 1989, pp.1673-8). The risk of communicable diseases is increased if there is overcrowding, while stress related and mental illness can be brought about through a lack of affordable housing or high rent (Shaw and Dorling et al., 1999). As a result, deprived communities, children and the elderly (Salvage, 1988) are particularly sensitive to health outcomes associated with poor housing.

Table 5-A below presents the IMD Barriers to Housing and Services Domain across the three London assessment areas. The Department of Communities and Local Government (2010a) details that the *"… Domain measures the physical and financial accessibility of housing and key local services. The indicators fall into two sub-domains: 'geographical barriers', which relate to the physical proximity of local services, and 'wider barriers' which includes issues relating to access to housing such as affordability*."

Areas	Number of LSOA					
	<5%	5-10%	10-20%	20-50%	50-100%	Total
All London	710	733	1165	1765	392	4765
CCZ	8	26	34	26		94
Camden			7	13		20
City of London		2	2	1		5
Islington			1	12		13
Lambeth	1	3	7			11
Southwark	1	9	7			17
Tower Hamlets	1	1				2
Westminster	5	11	10			26
Inner	467	412	535	333	1	1748
Camden		1	14	97	1	113
Hackney	130	7				137
Hammersmith and Fulham		6	49	56		111
Haringey	88	51	5			144
Islington		1	18	86		105
Kensington and Chelsea	48	40	15			103
Lambeth	3	44	116	3		166
Lewisham	6	28	115	17		166
Newham	97	59	3			159
Southwark	15	51	76	6		148
Tower Hamlets	41	59	28			128
Wandsworth	5	19	82	68		174
Westminster	34	46	14			94
Outer	235	295	596	1406	391	2923
Barking and Dagenham	2	5	20	81	1	109
Barnet	2	13	38	148	9	210
Bexley	1	3	18	48	76	146
Brent	47	90	37			174
Bromley	1	3	19	104	70	197
Croydon	5	26	89	94	6	220
Ealing	24	48	101	22		195
Enfield	8	11	49	108	5	181
Greenwich	3	9	18	109	4	143
Harrow	2	5	21	107	2	137
Havering		1	16	57	75	149
Hillingdon	16	19	34	88	6	163
Hounslow	12	18	56	53		139
Kingston upon Thames	3	6	27	58	3	97
Merton			2	37	85	124
Redbridge	1	3	16	125	14	159
Richmond upon Thames			10	88	16	114
Sutton	2	4	17	79	19	121
Waltham Forest	106	31	8			145

Table 5-A IMD2010 barriers to housing and services domain within Greater London, data at 2010 LSOA level

(Source: Department of Communities and Local Government, 2010)

6 Crime

The study '*Exploring the Impacts of Crime on Health and Health Services: a feasibility study'* (Robinson and Keithley *et al*., 1998) concluded that crime has serious health impacts, both direct and indirect. Violent crime results in physical and psychological injury, which can require emergency treatment and long-term intervention. Furthermore, theft and burglary can materially affect living standards and have psychological effects for the people involved, with consequences for health.

Individuals who have been the victims of violence and other forms of crime often suffer damage to their health beyond immediate injuries. Damage to physical health can result from the stress caused by the experience of victimisation: for example, the heart attack suffered by the elderly victim of burglary or the self-harm induced by abuse.

Fear from crime and antisocial behaviour may also have significant effects on health. In particular, older people, women and children may become constrained in their use of public spaces and make more use of car transport. They may withdraw from social life, including interaction with neighbours, and avoid going out at night. They may take protective or defensive action which can in itself pose a threat to health; for example, carrying a weapon, or barricading themselves in their homes.

Violence also disproportionately affects certain groups in society, including young people and those who are deprived. In many ways these inequalities mirror those which are found in health, suggesting that crime is likely to be a contributory factor in the substantial and widening health inequalities that exist in contemporary England.

Crime results in physical and psychological injury, which can require emergency treatment and long-term intervention. Fear of crime can lead to a wide range of psychological disorders and self-limited mobility, while exposure to crime may increase the incidence of health-damaging behaviour, such as smoking or excessive alcohol consumption.

The British Crime Survey suggests that crime is likely to be a contributory factor in the substantial and widening health inequalities that exist in England today (Mirrlees-Black, Mayhew and Percy 1996).

Table 6-A presents the number of crimes on various forms of London public transport 2010-2014.

Travel Mode	Type of crime	Number of crimes			
		2010/11	2011/12	2012/13	2013/14
Bus	Burglary	82	66	60	53
	Criminal Damage	260	1775	1501	1208
	Drugs	887	724	806	709
	Fraud / Forgery	316	294	213	6
	Other Notifiable Offences	253	228	195	230
	Robbery	2665	2783	2285	1670
	Sexual Offences	514	495	483	513
	Theft & Handling	10621	978	9583	8856
	Violence against the person	6576	5651	4994	4893
London Underground (LU) and Docklands Light Railway (DLR)	Theft of railway property burglary	602	353	276	189
	Criminal Damage	1066	738	635	607
	Drugs	727	960	591	913
	Serious Fraud	227	231	208	175
	Other Serious Offences	111	86	106	103
	Robbery	161	112	101	83
	Sexual Offences	300	384	327	429
	Theft of passenger property	6520	6021	7282	5102
	Violence against the person	1971	1792	1897	2077
	Line of route	112	74	90	65
	Motor vehicle /cycle Offences	368	415	401	332
	Serious Public Order	1307	979	890	883
London Overground	Theft of railway property burglary	43	25	17	16
	Criminal Damage	70	49	34	39
	Drugs	72	73	88	118
	Serious Fraud	5	9	7	4
	Other Serious Offences	10	6	9	11
	Robbery	24	13	13	11
	Sexual Offences	11	5	11	22
	Theft of passenger property	121	156	24	232
	Violence against the person	128	171	191	197
	Line of route	7	5	5	3
	Motor vehicle /cycle Offences	31	91	11	71
	Serious Public Order	90	108	116	122
London Tramlink	Theft of railway property burglary	10	3	4	4
	Criminal Damage	47	46	28	32
	Drugs	29	46	54	40
	Serious Fraud	9	7	3	0
	Other Serious Offences	2	4	2	6
	Robbery	15	40	29	24
	Sexual Offences	5	8	10	8
	Theft of passenger property	57	39	72	55
	Violence against the person	86	80	85	76
	Line of route	33	35	27	27
	Motor vehicle /cycle Offences	16	20	11	13
	Serious Public Order	52	50	36	37

Table 6-A Number of crimes on various forms of London public transport 2010-2014
(Source: Transport for London, 2013)

Period	Bus	LU/ DLR	Tramlink	Overground
2004/05	18.6	17.9	-	-
2005/06	21.6	18.4	-	-
2006/07	20.5	17.2	17.0	-
2007/08	15.2	14.4	15.1	-
2008/09	12.1	13.1	15.1	-
2009/10	11.1	12.8	15.4	-
2010/11	10.5	11.4	13.0	-
2011/12	9.3	9.6	13.2	6.9
2012/13	8.6	9.6	12.0	6.7

Table 6-B Crime on TfL's public transport network, rate per million passenger journeys
(Source: Transport for London, 2013)

7 Health of the Community

Table 7-A presents resident's self-assessment of their general health within the boroughs of Greater London.

Borough	Health				
	Very Good	Good	Fair	Bad Health	Very Bad
Barking and Dagenham	87819	62720	24042	8686	2644
Barnet	183453	117508	39172	12197	4056
Bexley	111323	80446	29015	8688	2525
Brent	149695	108169	36731	12339	4281
Bromley	154998	105574	36098	9904	2818
Camden	117692	67334	22963	9174	3175
City of London	4112	2374	643	190	56
Croydon	174584	128634	43473	12734	3953
Ealing	166385	116712	38421	12817	4114
Enfield	146351	109394	39699	12840	4182
Greenwich	127641	83875	29386	10420	3235
Hackney	128442	75699	26837	11183	4109
Hammersmith and Fulham	103036	53374	17188	6531	2364
Haringey	126485	85567	28444	10650	3780
Harrow	113731	86069	28329	8289	2638
Havering	109131	84378	31492	9464	2767
Hillingdon	133627	96647	31492	9404	2766
Hounslow	124442	89064	28552	9085	2814
Islington	106386	63382	23113	9771	3473
Kensington and Chelsea	91764	45189	14464	5357	1875
Kingston upon Thames	84332	53598	16425	4438	1267
Lambeth	160326	97286	31188	10729	3557
Lewisham	135428	93850	32289	10755	3563
Merton	103891	67098	21025	5930	1749
Newham	149269	106549	34839	12763	4564
Redbridge	134230	97595	33470	10479	3196
Richmond upon Thames	107217	57088	16662	4617	1406
Southwark	154204	90004	29935	10544	3596
Sutton	92668	67563	22127	6072	1716
Tower Hamlets	128468	83209	27062	11228	4129
Waltham Forest	121652	91954	31133	10053	3457
Wandsworth	176198	91935	27299	8749	2814
Westminster	118808	65807	22027	9263	3491
All London	**4127788**	**2725645**	**915035**	**305343**	**100130**

Table 7-A General health of residents, data at borough level within Greater London
(Source: Office for National Statistics, 2011)

The health of people in the area can also be assessed using estimates of life expectancy. Areas with a life expectancy lower than the average tend to have poorer health then areas with higher levels of life expectancy. Table 7-B presents the life expectancy at birth by gender. The data is at borough level within Greater London.

Borough	Life expectancy at birth	
	Males	Females
Barking and Dagenham	76.5	81
Barnet	80.2	84.3
Bexley	79.4	83.1
Brent	78.8	84
Bromley	79.9	83.8
Camden	78	83.3
City of London	No data	
Croydon	79.5	82.8
Ealing	78.9	83.3
Enfield	79.1	82.9
Greenwich	75.8	81.9
Hackney	77.2	82.6
Hammersmith and Fulham	78.1	84.3
Haringey	76.6	83.7
Harrow	81.2	84.6
Havering	78.8	83
Hillingdon	78.6	83.4
Hounslow	77.8	82.1
Islington	75.4	81.2
Kensington and Chelsea	84.4	89
Kingston upon Thames	80.7	83.7
Lambeth	76.4	81.1
Lewisham	76.3	81.3
Merton	80.5	83.8
Newham	76.2	80.5
Redbridge	79.4	83
Richmond upon Thames	81	85.4
Southwark	77.8	82.9
Sutton	79.4	83.1
Tower Hamlets	76	80.9
Waltham Forest	77.1	81.6
Wandsworth	77.8	82.1
Westminster	83.4	86.5
London (total)	**78.6**	**83.1**

Table 7-B   Life expectancy at birth by genders data at borough level within Greater London
(Source: Office for National Statistics, 2011)

Table 7-C below presents the IMD2010 Health and Disability Domain across the three London assessment areas. The Department of Communities and Local Government (2010a) details that the *"…domain measures premature death and the impairment of quality of life by poor health. It considers both physical and mental health. The domain measures morbidity, disability and premature mortality but not aspects of behaviour or environment that may be predictive of future health deprivation.*"

Areas	Number of LSOA					
	<5%	5-10%	10-20%	20-50%	50-100%	Grand Total
All London	**39**	**142**	**492**	**1738**	**2354**	**4765**
CCZ	**1**	**3**	**14**	**44**	**32**	**94**
Camden			1	15	4	20
City of London				1	4	5
City of Westminster				5	21	26
Islington		1	7	5		13
Lambeth		1	5	4	1	11
Southwark		1	1	13	2	17
Tower Hamlets	1			1		2
Inner	**29**	**105**	**364**	**869**	**381**	**1748**
Camden	2	8	27	37	39	113
City of Westminster		2	10	26	56	94
Hackney	1	15	50	69	2	137
Hammersmith and Fulham	1	2	14	65	29	111
Haringey		2	20	90	32	144
Islington	10	22	48	23	2	105
Kensington and Chelsea			3	23	77	103
Lambeth	3	5	22	123	13	166
Lewisham	1	5	25	117	18	166
Newham	3	15	53	88		159
Southwark	1	5	17	88	37	148
Tower Hamlets	6	20	51	40	11	128
Wandsworth	1	4	24	80	65	174
Outer	**9**	**34**	**114**	**825**	**1941**	**2923**
Barking and Dagenham			17	85	7	109
Barnet				9	201	210
Bexley			1	28	117	146
Brent	1	2	13	74	84	174
Bromley		2	3	30	162	197
Croydon		3	6	70	141	220
Ealing	1	1	10	81	102	195
Enfield			2	59	120	181
Greenwich	7	25	35	58	18	143
Harrow			1	15	121	137
Havering				27	122	149
Hillingdon			4	56	103	163
Hounslow				44	95	139
Kingston upon Thames				5	92	97
Merton				20	104	124
Redbridge			1	44	114	159
Richmond upon Thames					114	114
Sutton			3	19	99	121
Waltham Forest		1	18	101	25	145

Table 7-C IMD2010: Health and Disability Domain within Greater London, data at LSOA 2010 level

(Source: Department of Communities and Local Government, 2010)

8 Indices of Multiple Deprivation

The IMD provides a relative measure of deprivation at small area levels in England (Lower Super Output Areas). Areas are ranked from least deprived (100%) to most deprived (<5%). The English Indices of Deprivation 2010 are collated over a range of socioeconomic domains into the following 7 overarching domains of deprivation (Department of Communities and Local Government, 2010a):

- *income deprivation;*
- *employment deprivation;*
- *health deprivation and disability;*
- *education, skills and training deprivation;*
- *barriers to housing and Services;*
- *living environment deprivation; and*
- *crime.*

Table 8-A below presents the number of LSOA, which sit within a range of percentiles of deprivation for each London Borough (and assessment area).

Areas	Number of LSOA					
	<5%	5-10%	10-20%	20-50%	50-100%	Grand Total
All London	**710**	**733**	**1165**	**1765**	**392**	**4765**
CCZ	**8**	**26**	**34**	**26**		**94**
Camden			7	13		20
City of London		2	2	1		5
City of Westminster	5	11	10			26
Islington			1	12		13
Lambeth	1	3	7			11
Southwark	1	9	7			17
Tower Hamlets	1	1				2
Inner	**467**	**412**	**535**	**333**	**1**	**1748**
Camden		1	14	97	1	113
City of Westminster	34	46	14			94
Hackney	130	7				137
Hammersmith and Fulham		6	49	56		111
Haringey	88	51	5			144
Islington		1	18	86		105
Kensington and Chelsea	48	40	15			103
Lambeth	3	44	116	3		166
Lewisham	6	28	115	17		166
Newham	97	59	3			159
Southwark	15	51	76	6		148
Tower Hamlets	41	59	28			128
Wandsworth	5	19	82	68		174
Outer	**235**	**295**	**596**	**1406**	**391**	**2923**
Barking and Dagenham	2	5	20	81	1	109
Barnet	2	13	38	148	9	210
Bexley	1	3	18	48	76	146
Brent	47	90	37			174
Bromley	1	3	19	104	70	197
Croydon	5	26	89	94	6	220
Ealing	24	48	101	22		195
Enfield	8	11	49	108	5	181
Greenwich	3	9	18	109	4	143
Harrow	2	5	21	107	2	137
Havering		1	16	57	75	149
Hillingdon	16	19	34	88	6	163
Hounslow	12	18	56	53		139
Kingston upon Thames	3	6	27	58	3	97
Merton			2	37	85	124
Redbridge	1	3	16	125	14	159
Richmond upon Thames			10	88	16	114
Sutton	2	4	17	79	19	121
Waltham Forest	106	31	8			145

Table 8-A IMD2010 within Greater London, data at LSOA 2010 level

(Source: Department of Communities and Local Government, 2010)

Appendix A provides figures showing the extent of the CCZ, inner London area and outer London area within the Greater London area; the Income Deprivation Affecting Children Index – the proportion of children (<16 years old) that live in low income households; and the IDAOPI – the proportion of people aged 60 and over who are Income Support (IS)/Job Seekers Allowance (IB) (JSA(IB)) claimants that live in low income households.

9 Public Health England: 2014 Health Profiles for London

PHE's 2014 Health Profiles use a range of health indicators collected at ward level to rank the overall health of boroughs within Greater London against the average levels in England. Table 9-A presents results for all *2014 Health Profile* indicators for all London boroughs against the average England level. Each borough's specific health indicator distinguishes whether it is better, similar or worse than the average England level using the following colour codes:

- *green = better;*
- *orange = similar; and*
- *red = worse.*

Indicator	Period	England	London	Barking and Dagenham	Barnet	Bexley	Brent	Bromley	Camden	Croydon	Ealing	Enfield	Greenwich	Hackney	Hammersmith and Fulham	Haringey	Harrow	Havering	Hillingdon	Hounslow	Islington	Kensington and Chelsea	Kingston upon Thames	Lambeth	Lewisham	Merton	Newham	Redbridge	Richmond upon Thames	Southwark	Sutton	Tower Hamlets	Waltham Forest	Wandsworth	City of Westminster
Deprivation	2012	**20.4**	27.5	52.5	5.7	9.5	27.9	7.8	24.8	17.2	20.9	27.7	43.6	79.7	26.1	57.3	2	7.6	7.1	8.4	52.7	23.5	1.1	36.6	36.5	1.5	83.8	7.3	0	36	4.8	69.7	53.6	11.7	23.3
Children in poverty (under 16s)	2011	**20.6**	26.5	33.9	19.9	19.7	28.1	17.4	32.5	25.2	24.6	32.8	29.4	34.8	28.9	31.2	19.7	20	22.2	24.3	38.3	23.8	13.6	31.6	30.5	17.5	32	23	10	30.7	16.6	43.6	28.3	21.6	35.4
Statutory homelessness	2012/13	**2.4**	4.6	9.5	4.1	3.3	5.7	4.1	1.1	6	2.9	4.6	2.9	7.5	3.7	6	1.3	2	0.8	6.6	4.6	7.8	2.6	5.1	5.2	1.1	7.8	4	4.1	4.4	1.8	4.1	11.4	5.1	6.2
GCSE achieved (5A*-C inc. Eng & Maths)	2012/13	**60.8**	65	60.2	71.5	66	62.9	73.9	60.4	64.4	60.9	63.2	65.4	61.2	66.5	63.5	65.4	63.7	61.6	66.7	63.5	81.9	71.6	65.9	58	62.6	58.4	69.2	68.3	65.2	75.4	64.9	58.5	61.5	69.6
Violent crime (violence offences)	2012/13	**10.6**	15.3	17.7	9.6	10.5	16	11	18.3	15.5	17.3	12.2	17.8	19.4	17.6	16.2	10.4	11.8	15	17.3	20.2	13.8	11.6	18.7	17.4	10.7	18.2	12.5	8.8	18.6	11.6	20	16.4	11	25.7
Long term unemployment	2013	**9.9**	10.6	15.9	6.8	7.2	12.8	7.1	8.7	10	9.6	14	12	16.2	10.3	14.8	5.1	8.6	5.3	5.9	12.5	7.4	3.7	16.8	14.7	7.2	13.5	8.9	3.5	15.4	6.9	16.6	16	8.3	8.5
Smoking status at time of delivery	2012/13	**12.7**	5.7	14.2	4.8	9.8	4.3	5.2	4.3	7.8	3.8	5.5	9.4	4.8	3.5	4.3	4.4	13	8.5	3.8	7.7	-[1]	4.8	4.4	6.6	6.5	5.7	5.5	2.5	4.8	6.5	3	6.3	4	2.3
Breastfeeding initiation	2012/13	**73.9**	86.8	73.7	89.2	71.1	84.8	84.7	91.1	86	88.3	88.8	79.8	91.4	89.7	94.7	84.8	71.3	83.4	85.7	89.5	-[2]	86	92	88.5	85.5	87.4	86.5	90.5	89.6	85.5	86.8	89.1	92.1	89.8
Obese children (Year 6)	2012/13	**18.9**	22.4	24.4	19.1	24.3	23.7	17.1	21.8	22.3	22.7	24.1	24.7	25.2*	20.1	23.4	20.4	19.9	19.8	24.6	21.8	20.1	17	23.4	23.3	21.3	27.3	21.3	13.8	26.7	19.6	26.5	22.9	20.2	25.3
Alcohol-specific hospital stays (under 18)	2010/11 - 12/13	**44.9**	29.8	28.4	26.8	-[3]	17.5	30.5	35.5	26.2	36.9	20.7	20.6	21.7	37.9	26.6	19.5	31.3	46.9	37.5	43.7	35.9	28.4	23.1	24.1	38.2	17.5	29.2	39.1	15.2	49.9	48.9	40.5	41.2	29.4
Under 18 conceptions	2012	**27.7**	25.9	35.4	14.7	25.8	19.6	24.2	18.1	28.6	22.4	26.4	34.7	28.8*	25.6	33.1	14.2	26.4	27.7	30.4	30.1	17.7	20	33.2	42	25.5	24.1	16.2	19.9	31.8	25.8	24.3	29.9	25.5	21.2
Smoking prevalence	2012	**19.5**	18	21.9	13.9	17.7	15.2	17.8	17.9	17.1	19.6	18	18.4	22.6	23.8	20.6	13.2	19.3	17.5	16.9	22	17.5	15.1	21.3	21.4	15.2	15.7	14.7	14	19.7	16.8	19.3	23.1	13.8	17

JACOBS

Indicator	Period	England	London	Barking and Dagenham	Barnet	Bexley	Brent	Bromley	Camden	Croydon	Ealing	Enfield	Greenwich	Hackney	Hammersmith and Fulham	Haringey	Harrow	Havering	Hillingdon	Hounslow	Islington	Kensington and Chelsea	Kingston upon Thames	Lambeth	Lewisham	Merton	Newham	Redbridge	Richmond upon Thames	Southwark	Sutton	Tower Hamlets	Waltham Forest	Wandsworth	City of Westminster
Percentage of physically active adults	2012	**56**	57.2	48.9	56	51.4	52.3	62.1	55.9	56.8	52.3	59.3	53	58.1	64.9	60.7	54.5	55.3	56.4	54.5	62	65.3	56.4	63.5	54.3	54.4	51.4	53.5	67.6	58.7	62	55.1	58	65	55
Obese adults	2012	**23**	19.6	31.6	20.5	23	19.5	21.2	13.7	24.3	18.2	26.4	23.6	15.9	13.3	18.8	20.8	22.3	23.7	21.8	20.5	11.2	14.6	14.4	23.6	18	20	20.5	12.1	20.6	24.4	13.6	17.1	14.7	17.9
Excess weight in adults	2012	**63.8**	57.3	63.5	55.6	66.1	54.3	65	50.1	62.1	57.3	64.2	64.4	48.7	49.7	59	59	63.3	67.2	62.8	53.6	45.9	55.1	51.8	61.2	58.3	56.8	55.4	47.6	56.3	62.5	47.2	54.6	52.2	52.6
Incidence of malignant melanoma	2009-11	**14.8**	9.2	8.8	10.9	12.2	4.7	12.2	10.7	12.6	6	6.8	7.6	4.8	11	6.9	8.4	14.2	10.5	8.7	8.7	8.8	14.3	5.8	6.4	12.6	3.6	5.9	15.2	6.1	14.6	-[4]	7.2	15.1	3.9
Hospital stays for self-harm	2012/13	**188**	103.2	147.7	111.1	88	50.4	118.3	86.2	124.8	125.6	70.6	108.2	102.3*	128.6	94.1	84.5	113.3	123.6	141	128.7	63.5	62.2	89.3	115.5	88.2	117.9	109.8	119.9	89.8	140.9	92.1	146.6	86.6	73.2
Hospital stays for alcohol related harm	2012/13	**637**	554	552	507	563	518	506	650	526	550	546	593	644	631	653	462	442	597	547	849	426	386	641	614	502	620	523	431	641	515	634	615	529	552
Drug misuse	2012/11	**8.6**	9.3	8.4	6.2	4.8	8.7	5.1	14.8	6.9	10.2	7.3	10.2	12.7	11.3	10.3	5.4	5.7	7.5	8.9	15.4	13.3	4.9	12	10.8	6	11.6	7.8	5	12.1	8.2	16.3	8.3	7.4	13.9
Recorded diabetes	2012/13	**6.01***	5.82*	6.83*	5.90*	6.71*	7.84*	5.17*	4.01*	6.39*	6.81*	6.83*	5.77*	5.48*	4.31*	5.72*	8.18*	5.73*	6.43*	6.28*	4.90*	4.26*	4.80*	4.71*	5.67*	5.37*	7.15*	7.53*	3.69*	4.94*	5.71*	6.34*	6.26*	4.25*	4.33*
Incidence of TB	2010 - 12	**15.1**	41.4	35	30	11.6	98.3	11.3	30	33.3	69.1	26.6	47.1	36.1	30.7	43.9	66.1	8	47.8	74.4	34.4	24	13.7	33.3	31.9	32	112.3	54.1	8	37.8	16.3	53.5	46.9	30	26.9
Acute sexually transmitted infections	2012	**804**	1337	1067	802	538	1413	614	1736	1314	996	676	1104	2335	1937	2000	636	742	965	808	1875	1652	1027	3210	1468	1037	1347	721	692	2199	798	1926	1342	1838	1910
Hip fractures in people aged 65 and over	2012/13	**568.1**	531.8	695.8	538.2	565.6	403.1	496.8	430.4	564.1	468.9	505.9	539	472.2*	703.3	582.3	503.3	541.5	555.1	559.7	578.6	465.8	532.4	450.6	541.5	510.5	434.5	617.1	518.5	653.7	536.9	625.6	496.2	569.3	459.4
Excess winter deaths (three	Aug 2009 - Jul 2012	**16.5**	17.2	16.4	20.2	16.7	14.4	23.8	16.5	13.9	18.7	21.8	15.6	12.1*	17.6	14.6	15.5	17.7	20.1	21.3	12.4	12.9	21	11.5	16.6	16.1	19.9	13.2	12.5	17.7	15.8	8.1	23.2	25.3	12.6

Indicator	Period	England	London	Barking and Dagenham	Barnet	Bexley	Brent	Bromley	Camden	Croydon	Ealing	Enfield	Greenwich	Hackney	Hammersmith and Fulham	Haringey	Harrow	Havering	Hillingdon	Hounslow	Islington	Kensington and Chelsea	Kingston upon Thames	Lambeth	Lewisham	Merton	Newham	Redbridge	Richmond upon Thames	Southwark	Sutton	Tower Hamlets	Waltham Forest	Wandsworth	City of Westminster
year)																																			
Life expectancy at birth (Male)	2010 - 12	**79.2**	79.7	77.6	81.4	80.3	79.9	81	80.5	79.2	79.2	80.5	78.5	77.7	79.1	79.4	82	79.3	79.9	79.5	77.8	82.1	81.4	78.2	78.2	80.2	77.7	80.3	81.7	78	80.5	77.1	79.2	79.1	81.1
Life expectancy at birth (Female)	2010 - 12	**83**	83.8	82	84.5	84.4	84.5	84.5	85.4	83.2	84.2	84	82.2	82.8	83.3	83.8	85.6	83.8	83.5	83.3	83.2	85.8	84.8	83	82.6	84.2	82.6	84	85.9	83.1	84	82	83.4	83.2	85.1
Infant mortality	2010 - 12	**4.1**	4.1	4	3	2.6	4.7	1.9	4.2	3.9	3.5	5.8	4.2	5.4	3.8	3.9	5.9	4.7	4	4.4	2.2	3.1	3.6	5.5	4.7	4.5	4.7	3.8	2.7	4.2	2.3	5.3	5.5	3.8	3.8
Smoking related deaths	2010 - 12	**291.9**	279.3	386	203.5	286.3	228.5	249.9	276.3	269.6	254.5	249.7	357.2	363.8	342.2	288.4	185.8	301.6	279.9	275.8	365.2	254.7	249.4	339.3	333.4	248.4	287.9	226.4	250.4	346.9	289.4	404.7	307	295	247.4
Suicide rate	2010 - 12	**8.5**	7.5	6.2	6.9	7.4	6.8	7.5	7.2	6.2	9.4	5.1	6.3	8.1	10.1	9.4	4.8	7.7	8.2	8	9.7	6.8	7	7	7.5	8.2	5.2	6.6	8.3	8.7	7.5	7.7	7.6	8	11.2
Under 75 mortality rate: cardiovascular	2010 - 12	**81.1**	83.1	101	62.1	72.1	94	65.5	83.2	84.1	90.8	76.8	96.6	118.5	95.8	85.8	70.4	81	80.4	80	101.9	57.3	71	93.2	91	88.2	112.7	76.4	57.2	100.6	67.4	117.9	87.3	83.1	84.2
Under 75 mortality rate: cancer	2010 - 12	**146.5**	139.1	180.5	125.3	136.7	127.2	131.5	140.1	138.7	129.6	126	147.3	161.8	149	143.3	113.5	148	138.9	137.1	160	122.8	120.3	159.1	159.9	125.6	136.9	134.4	128.7	162	144.1	175.4	145.5	141.5	127.8
Killed and seriously injured on roads	2010 - 12	**40.5**	35.4	25.7	35.9	24.6	25.8	28	49.4	27.7	23.5	29.9	35.4	48.3	42.2	34.4	16.9	30.1	29	31.8	49	53.9	25.8	52.1	37.6	24.9	24.9	29	34.3	47.1	23.7	47.1	26.2	35	81

[1]Value not published for data quality reasons
[2]Value not published for data quality reasons
[3]Disclosure control applied
[4]Value suppressed to avoid disclosure by differencing

Table 9-A 2014 health profiles indicators for London boroughs, benchmarked against England
(Source: Public Health England, 2014)

Indicators where London is doing better than England:

For some indicators where London is doing better than the England average, results across London are mixed, with some boroughs doing worse than the national average. For other indicators, however, very few boroughs are significantly worse than England as a whole.

- **Hospital stays for self harm** – London had a significantly better rate of hospital admissions for self harm than England as a whole in 2012/13 (103 per 100,000 population, compared with 188 in England). All London boroughs had a significantly better rate than England. The rate in Brent (50.4 per 100,000) was the lowest in England.
- **Smoking status at time of delivery** – 5.7% of mothers were recorded as smoking at time of delivery in London in 2012/13, significantly better than in England as a whole (12.7%). Within London, percentages ranged from 2.3% in Westminster to 14.2% in Barking and Dagenham. Overall, 29 boroughs were significantly better than England and only one borough, Barking and Dagenham, was significantly worse.
- **Breastfeeding initiation** – London had a significantly better rate of breastfeeding initiation than England as a whole with 86.8% of mothers breastfeeding within 48 hours of delivery in 2012/13, compared with 73.9% in England. Within London, 28 boroughs had significantly better rates than England, with the highest rate in Haringey (94.7%). Two boroughs, Bexley and Havering, had significantly worse rates than England.
- **Incidence of malignant melanoma** – London had a malignant melanoma incidence rate of 9.2 per 100,000 population in 2009-11, significantly better than the rate of 14.8 in England. Within London, 23 boroughs had significantly better incidence rates than England, with the lowest rate in Newham (3.6 per 100,000). No London borough was significantly worse than England.
- **Hospital stays for alcohol-related harm** – The rate of admissions for alcohol-related harm in London in 2012/13 was 554 per 100,000 population, significantly better than the England rate of 637. Within London, rates ranged from 386 per 100,000 in Kingston, to 849 in Islington (the only borough significantly worse than England). London was also doing better than the England average for **alcohol-specific hospital admissions for under 18s.** In 2010/11 to 2012/13, the London rate was 29.8 per 100,000 population, compared with 44.9 in England.
- **Excess weight in adults** – The percentage of adults who were overweight or obese in London in 2012 was 57.3%, significantly better than England (63.8%). Within London, percentages ranged from 45.9% in Kensington & Chelsea, to 67.2% in Hillingdon, but no boroughs were significantly worse than England. The four local authorities in England with the lowest percentage of excess weight were all in London: Kensington & Chelsea, Tower Hamlets, Richmond, and Hackney.

Figure 9-A Description of the 2014 health profile indicators

(Source: Public Health England, 2014)

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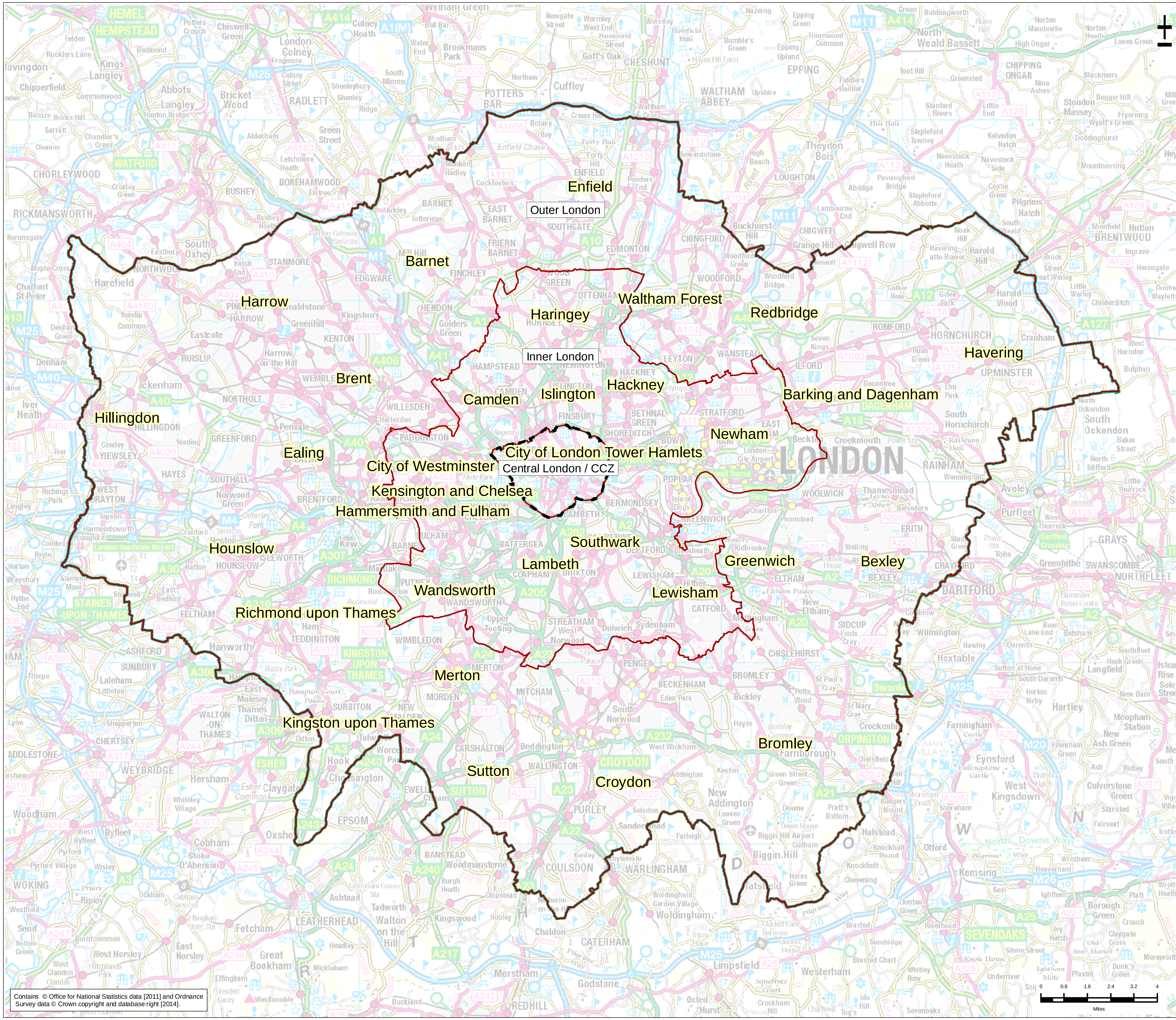
Appendix A Figures

- *Figure 1: Central London (CCZ), Inner London and Outer London*
- *Figure 2: IMD2010 – Income Deprivation Affecting Children Index (IDACI) by quintile*
- *Figure 3: IMD2010 – Income Deprivation Affecting Older People Index (IDAOPI) by quintile*



Appendix 1 - Figure 1

Key

- CCZ / Proposed ULEZ
- LAEI 2010 Zone Boundaries
- Study Area (GLAA)

Rev.	Date	Purpose of revision	Drawn	Check'd	Rev'd	Appr'd
0	29/10/14	Created to aid integrated assessment	BW	MH	RK	MB

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Drawing Title

Central London (CCZ), Inner London and Outer London

Drawing Status

FINAL

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Appendix 1 - Figure 1

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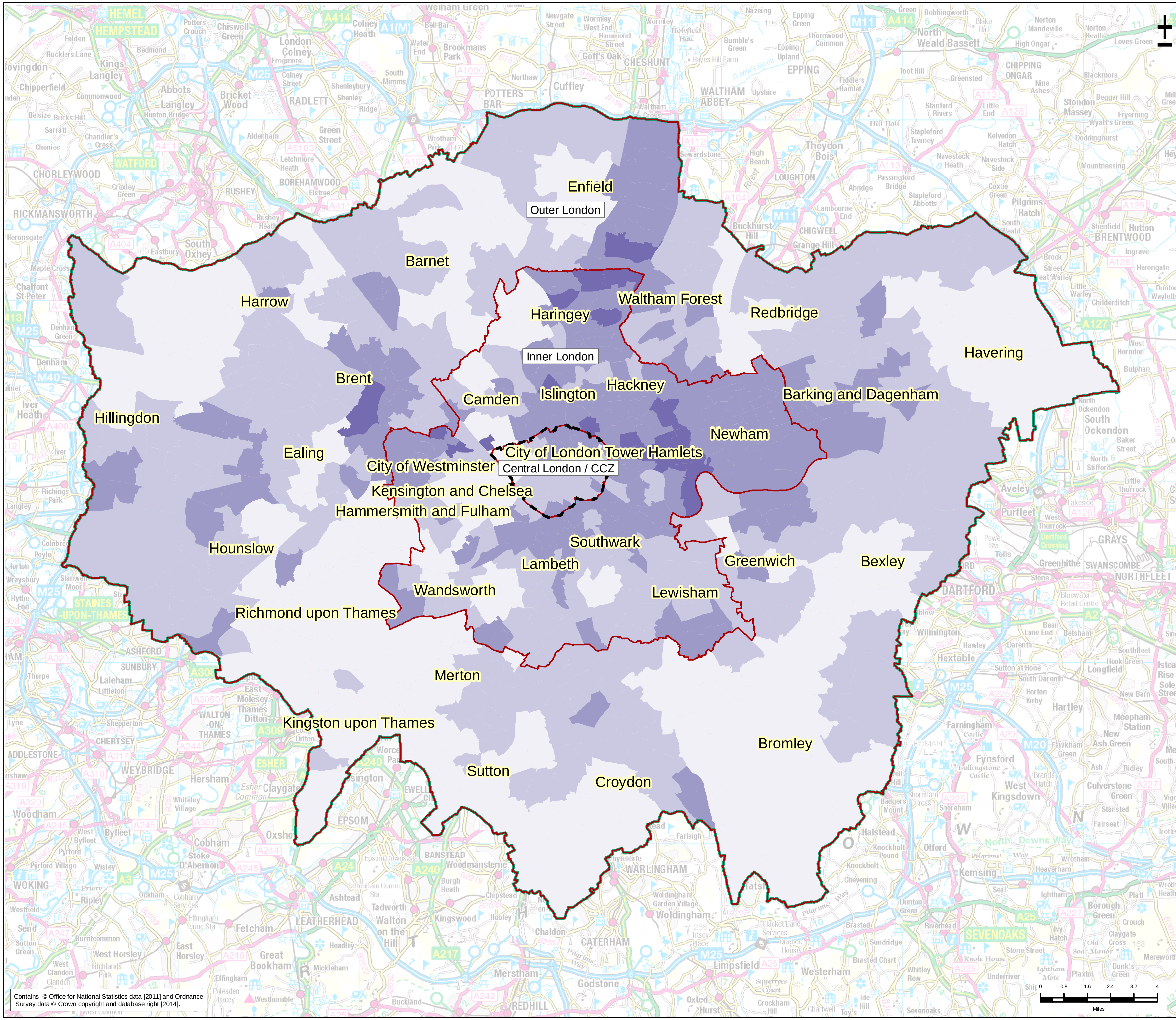
Appendix 1 - Figure 2



Key

IMD 2010 - Wards

Income Deprivation Affecting Children Index by quintile (0-20% = most deprived)

- 0 - 20%
- 21 - 40%
- 41 - 60%
- 61 - 80%
- 81 -100%
- CCZ / Proposed ULEZ
- LAEI 2010 Zone Boundaries
- Study Area (GLAA)

Rev.	Date	Purpose of revision	Drawn	Check'd	Rev'd	Appr'd
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IMD 2010 - Income Deprivation Affecting Children Index (IDACI) by quintile

Drawing Status

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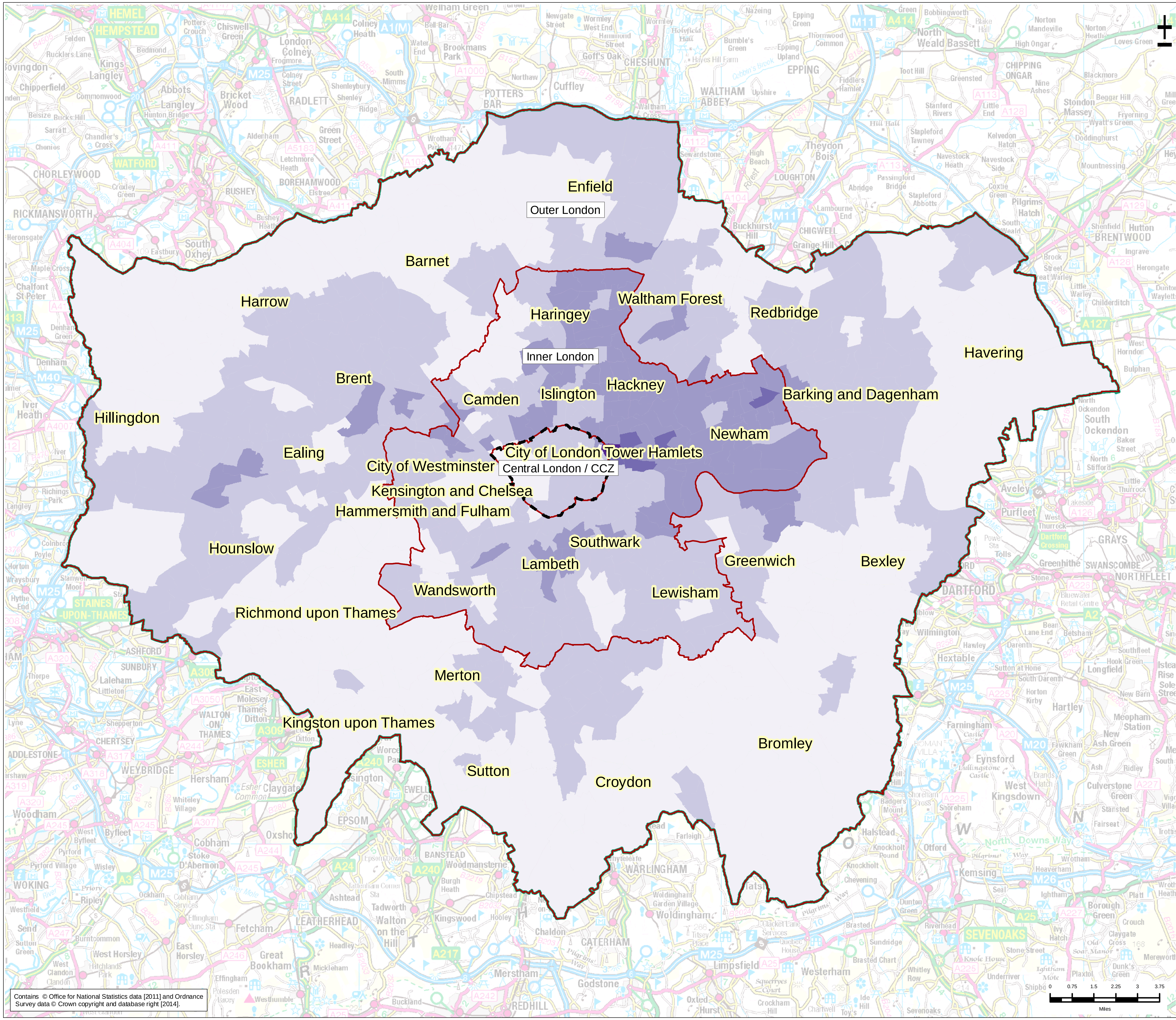
Appendix 1 - Figure 3



Key

IMD 2010 - Wards

Income Deprivation Affecting Older People Index by quintile (0-20% = most deprived)

- 0 - 20%
- 21 - 40%
- 41 - 60%
- 61 - 80%
- 81 -100%
- CCZ / Proposed ULEZ
- LAEI 2010 Zone Boundaries
- Study Area (GLAA)

0	16/10/14	Created to aid integrated assessment	BW	MH	RK	MB
Rev.	Date	Purpose of revision	Drawn	Check'd	Rev'd	Appr'd

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Drawing Title

IMD 2010 - Income Deprivation Affecting Older People Index (IDAOPI) by quintile

Drawing Status

FINAL

Scale @A3	1:200,000		DO NOT SCALE
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Drawing No.

Appendix 1 - Figure 3

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Appendix 2 Ricardo-AEA Air Quality Analysis

[TfL ULEZ Air Quality Health Impact Assessment]

Authors: Sally Cooke, John Stedman, Rebecca Rose, David Birchby and Betty Ng (Ricardo-AEA)

1.1 Introduction

The analysis described in the following sections was carried out as part of the health impact assessment (HIA) of the proposed ultra low emission zone (ULEZ). The focus of this part of the HIA was on air quality and the impacts on health.

Modelled concentrations of various pollutants for a basecase and a ULEZ scenario were provided by Kings College London. These were used to calculate the impact of the ULEZ scenario on exceedances of the limit value and to quantify the health effects. The following sections describe the methodology used and the results. The initial sections focus on air quality, followed by the health effects, valuation of the health effects, the distribution of the impacts on air quality and finally a summary of the conclusions.

1.2 Air Quality Assessment Methodology

King's College London (KCL) provided predictions of annual mean concentrations of NO_2, PM_{10} and $PM_{2.5}$ and number of days with PM_{10} daily mean concentration above 50 μgm^{-3} by for a basecase (current policies without ULEZ) and a ULEZ scenario for the years 2020 and 2025. These predicted concentrations were modelled and mapped at a high resolution (20 m x 20 m) and then averaged to Output Area (OA) level in a Geographic Information System (GIS) environment.

ONS 'usually resident' population data for 2012 down to OA level and split by age and sex[1] were projected to 2020 and 2025 using the GLA projected population data (central estimate)[2] at ward level. OA level populations for 2020 and 2025 were estimated assuming that the proportion of each OA to its respected ward will be the same as in 2012. Thus the OA population data were normalised such that the total population in 2020 and 2025 matched the GLA projection. Population data were stratified by:

- sex London-wide
- age (aggregated into five year classes) London-wide
- total population by borough
- total population by central/inner/outer/London-wide

OAs were assigned to boroughs and central/inner/outer London using the London Atmospheric Emissions Inventory (LAEI) 2010 GIS file provided in support of the LAEI[3]. This GIS file provided a map of borough and central/inner/outer boundaries over the area of the LAEI.

Additional stratification of population by Index of multiple deprivation (IMD) was carried out using government statistics[4] processed by Jacobs to include a percentage deprivation metric[5]. That data set was provided at the Lower Super Output Area (LSOA) level and differs from the population data as it is provided at the 2001 definition for LSOA. The data was mapped to 2011 OA definition within ArcGIS as the 2011 OA definitions are the most recent available and were used for the rest of the analysis. This should not affect the results greatly as the majority of OA and LSOA definitions are unchanged between 2001 and 2011[6]. The ONS website states that 97.4% of the 2001 OA are unchanged in the 2011 set of OA.

Social deprivation of the population in the study area was categorised by where they appear in the scale of deprivation across the whole of the UK, namely: <5%, 5-10%, 10-20% and >50%, where the lower the percentage the more deprived the area (e.g. <5% applies to the 5% most deprived areas in the UK). This level of categorisation highlights the most deprived at the highest level of specificity.

Table D1: European limit values (LVs) for the protection of human health (Directive 2008/50/EC)[7].

Metric	Limit value
Annual mean NO_2	40 μgm^{-3}
Annual mean PM_{10}	40 μgm^{-3}
Annual mean $PM_{2.5}$	25 μgm^{-3}
Daily mean PM_{10}	50 μgm^{-3} not exceeded > 35 days per year
Hourly mean NO_2*	200 μgm^{-3} not exceeded >18 times per year

*Model results are not available for comparison with the hourly LV for NO_2.

Mapped pollutant concentrations at the OA level were assessed within an Access database to see which OAs exceed the European limit values (LV) for the protection of human health listed in Table D1. It is worth noting that model predictions are not available for comparison with the hourly LV for $NO_{2.}$ By linking to the projected population at OA level, the population above the LV was calculated. Outputs are provided for the basecase and the ULEZ scenario split by:

- all people, borough
- all people, central/inner/outer/London-wide
- sex London-wide
- age (aggregated into 5 year classes) London-wide
- IMD and central/inner/outer/London-wide

Data were only included for the GLA area, not for the whole of the LAEI extent in the analysis.

In addition, calculations of population-weighted mean concentrations were also carried out in an Access database. The concentration in each OA was multiplied by the population in each OA and the population-weighted mean was calculated by dividing the sum product of these OA based values by the total population for the area of interest. Outputs are provided for the basecase and ULEZ scenario split by:

- all people, borough
- all people, central/inner/outer/London-wide
- sex London-wide
- age (aggregated into 5 year classes) for London-wide area
- IMD and central/inner/outer/London-wide

Averaging the high resolution maps of model predictions of annual mean concentrations of pollutants to OA will smooth out the peaks in the model results. However, population information is not available at the same 20 m x 20 m resolution as the modelled concentration maps. In our view averaging concentrations by OA will introduce fewer errors than making assumptions that distribute populations at OA into a 20 m x 20 m grid that matches that of the pollutant concentration data.

The reductions in concentrations calculated from the KCL modelled results are presented in the figures below.

Figure D1: Mapped reductions in annual mean NO_2 concentrations in 2020 as a result of ULEZ scenario

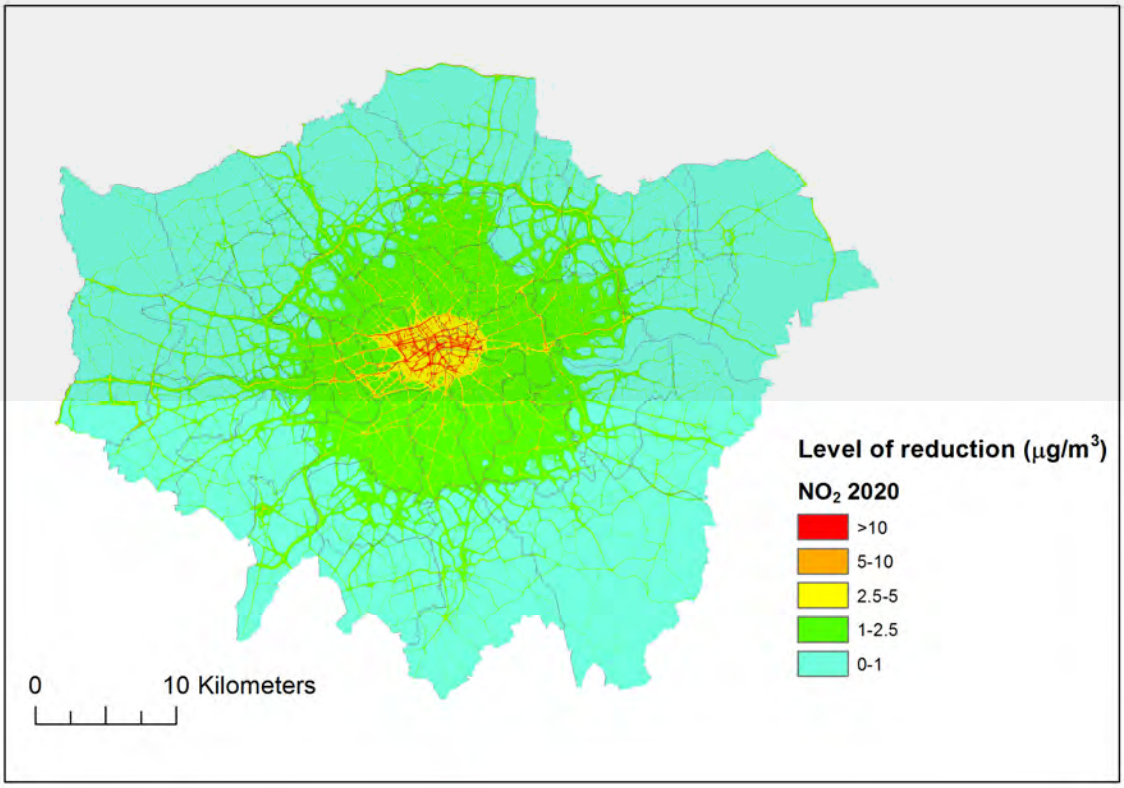


Figure D2: Mapped reductions in annual mean NO_2 concentrations in 2025 as a result of ULEZ scenario

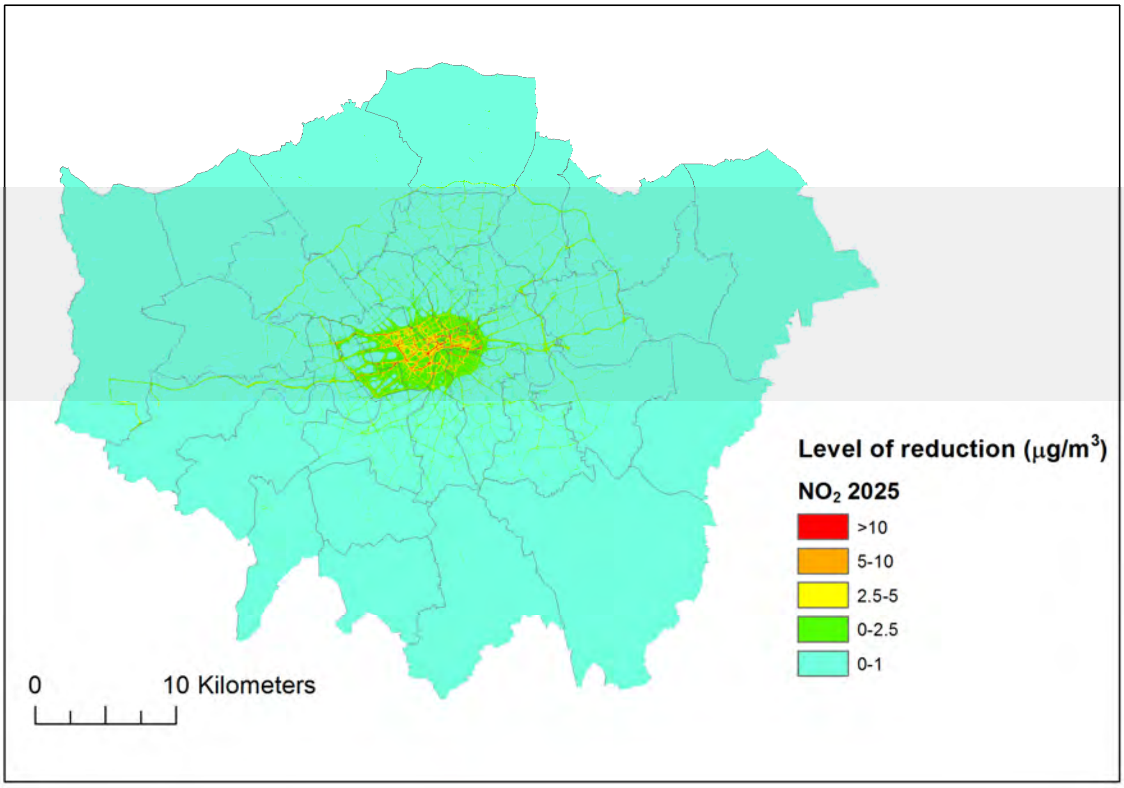


Figure D3: Mapped reductions in annual mean PM_{10} concentrations in 2020 as a result of ULEZ scenario

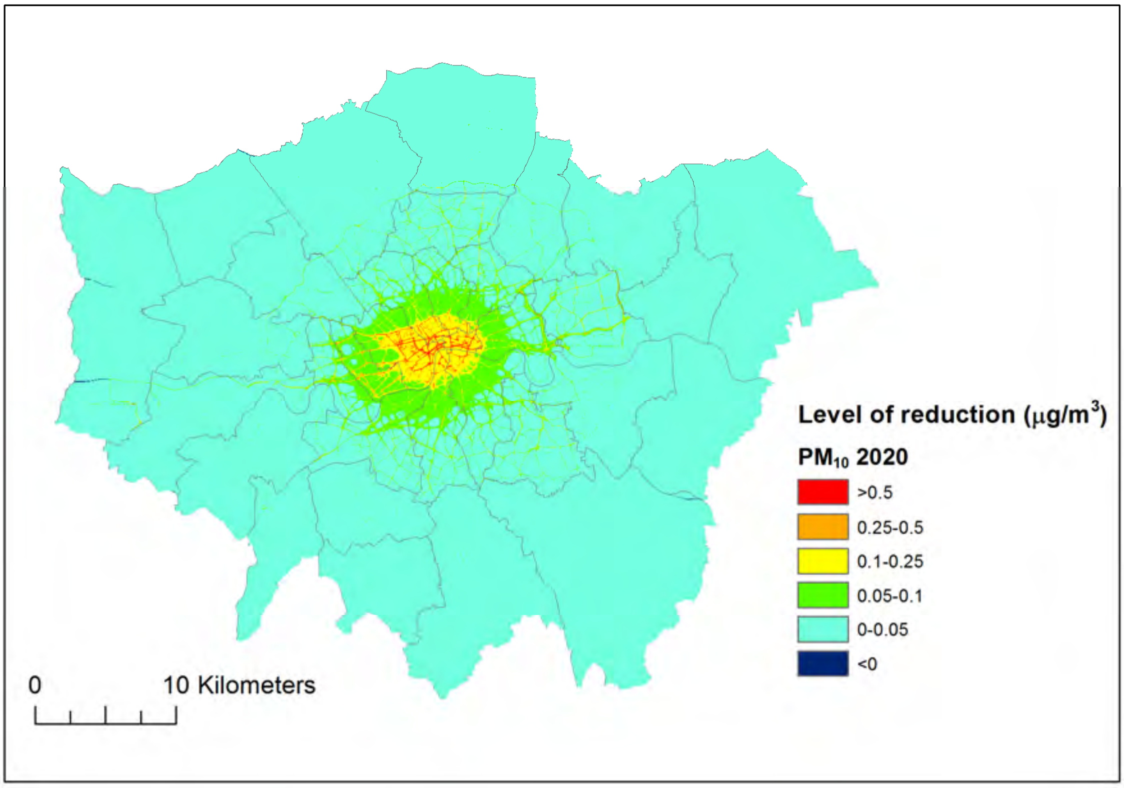


Figure D4: Mapped reductions in annual mean PM_{10} concentrations in 2025 as a result of ULEZ scenario

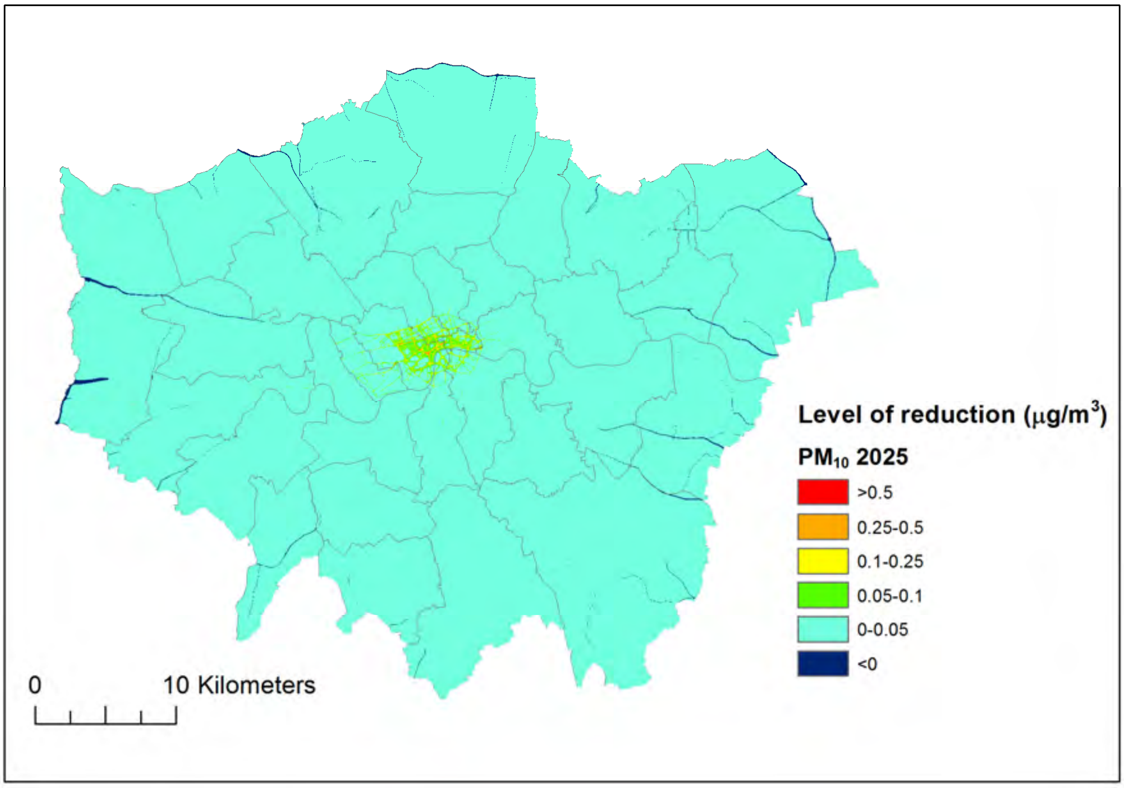


Figure D5: Mapped reductions in annual mean $PM_{2.5}$ concentrations in 2020 as a result of ULEZ scenario

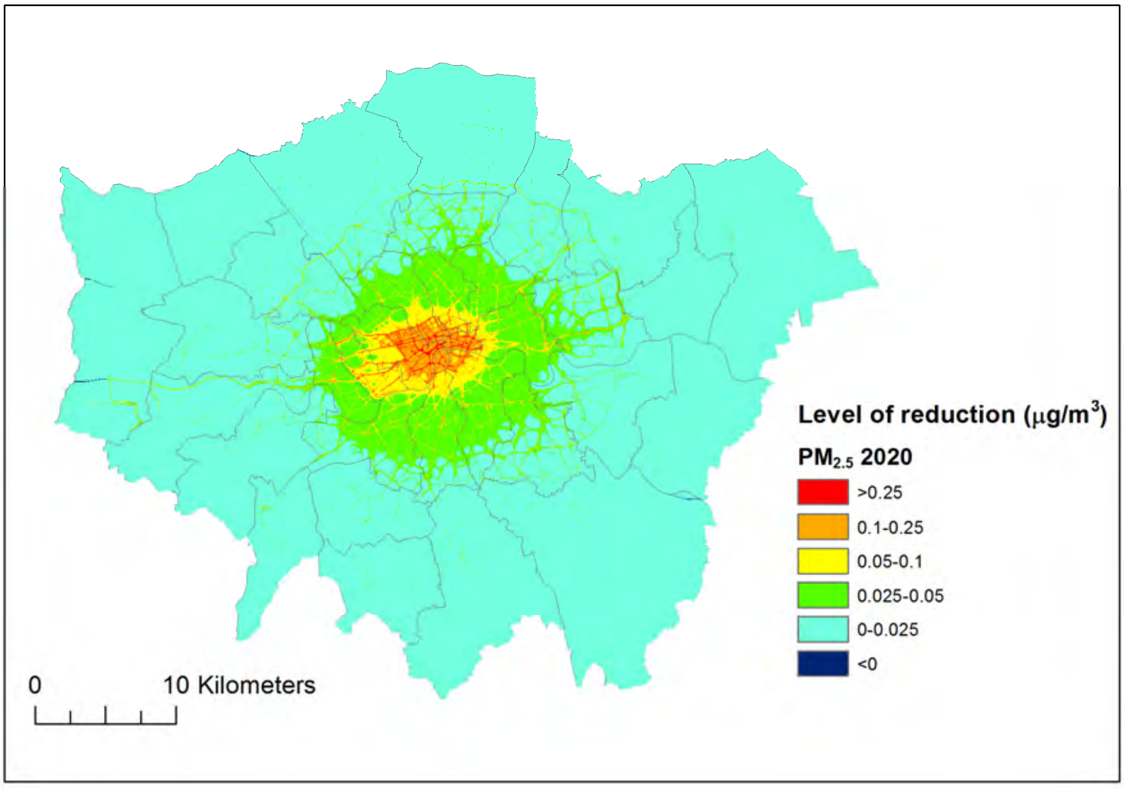


Figure D6: Mapped reductions in annual mean $PM_{2.5}$ concentrations in 2025 as a result of ULEZ scenario

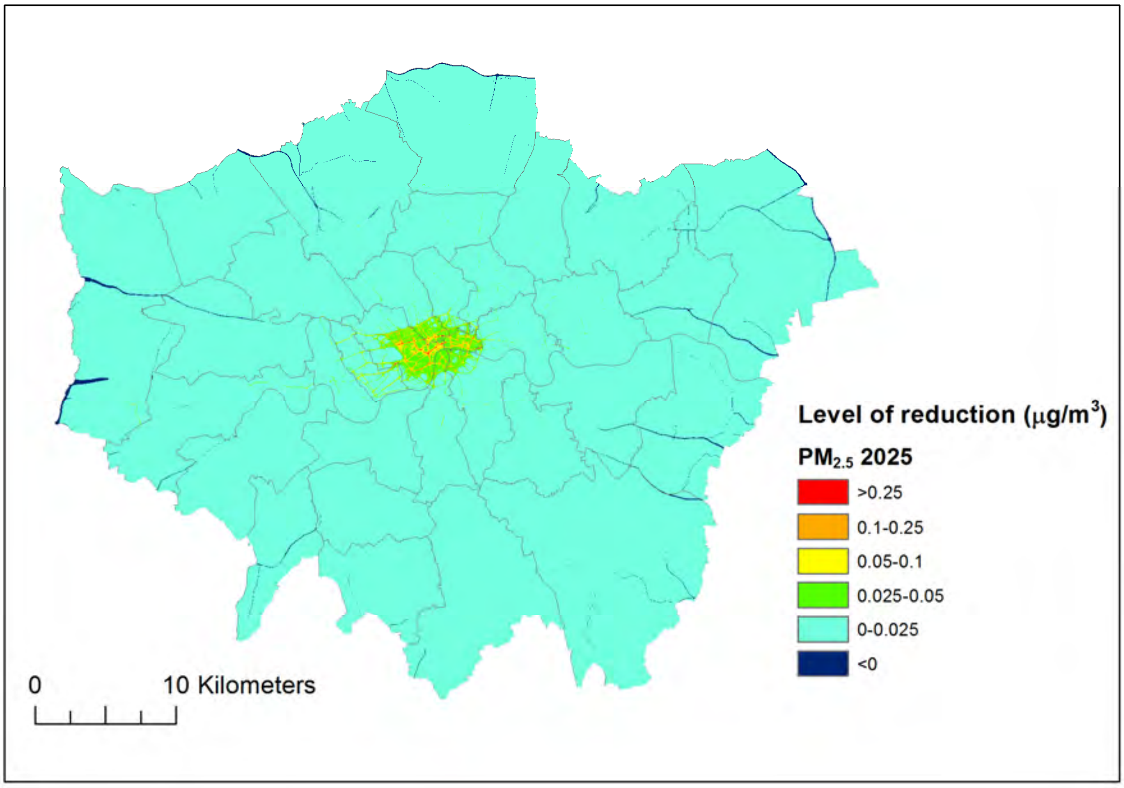


Figure D7: Mapped reductions in the number of days that daily mean PM_{10} concentrations are above 50 µgm^{-3} in 2020 as a result of ULEZ scenario

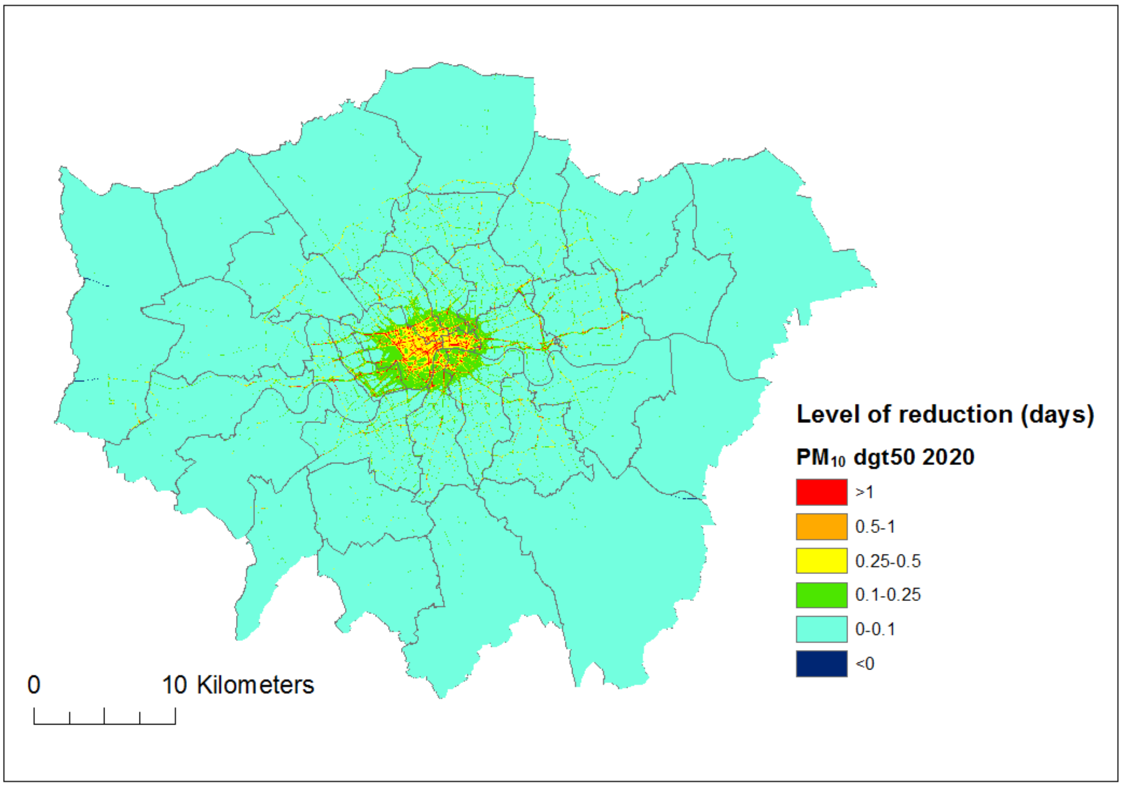
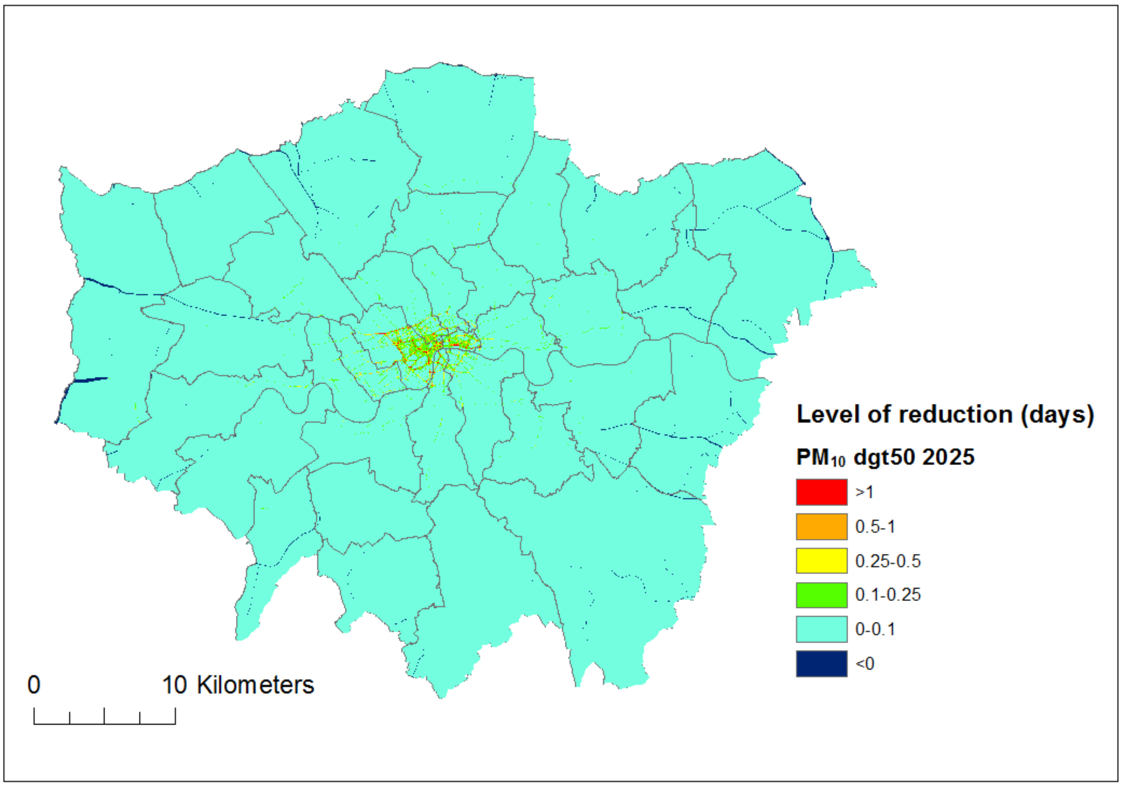


Figure D8: Mapped reductions in the number of days that daily mean PM_{10} concentrations are above 50 µgm-3 in 2025 as a result of ULEZ scenario



1.3 Number of people living in areas with concentrations above the air quality limit values

The number of people living in areas with predicted ambient NO_2 concentrations above the NO_2 annual mean limit value are given below, for the basecase and the ULEZ scenario. Only NO_2 annual mean limit value results are shown because there is compliance with the PM_{10} and $PM_{2.5}$ limit values almost everywhere in the basecase in 2020 and 2025 and the impact of the scenario on PM concentrations is also much smaller than that on the NO_2 concentrations.

The results show that the impact of the ULEZ scenario on the percentage of population living in areas above the NO_2 annual limit value is much larger in central London than in inner or outer London. The results also show that the impact is much larger in 2020 than in 2025.

Table D2: Population living in areas above the NO_2 annual limit value in 2020 and 2025

Year		Population 2020	Number of people		%	
			Basecase	ULEZ	Basecase	ULEZ
2020	Central	195,877	123,454	32,127	63.0%	16.4%
	Inner	3,408,410	434,290	212,934	12.7%	6.2%
	Outer	5,523,280	95,207	54,719	1.7%	1.0%
	London-wide	9,127,567	652,951	299,780	7.2%	3.3%
2025	Central	201,003	34,374	6,491	17.1%	3.2%
	Inner	3,522,547	77,528	45,009	2.2%	1.3%
	Outer	5,756,814	10,658	6,707	0.2%	0.1%
	London-wide	9,480,364	122,559	58,207	1.3%	0.6%

The plots below show the impact of the ULEZ scenario on the population living in areas above the NO_2 annual limit value for each London borough.

Figure D9: Population living in areas exceeding the NO_2 annual Limit Value by borough for the basecase and ULEZ scenario in 2020. Boroughs have been ordered with decreasing population in exceedance areas in the basecase from left to right.

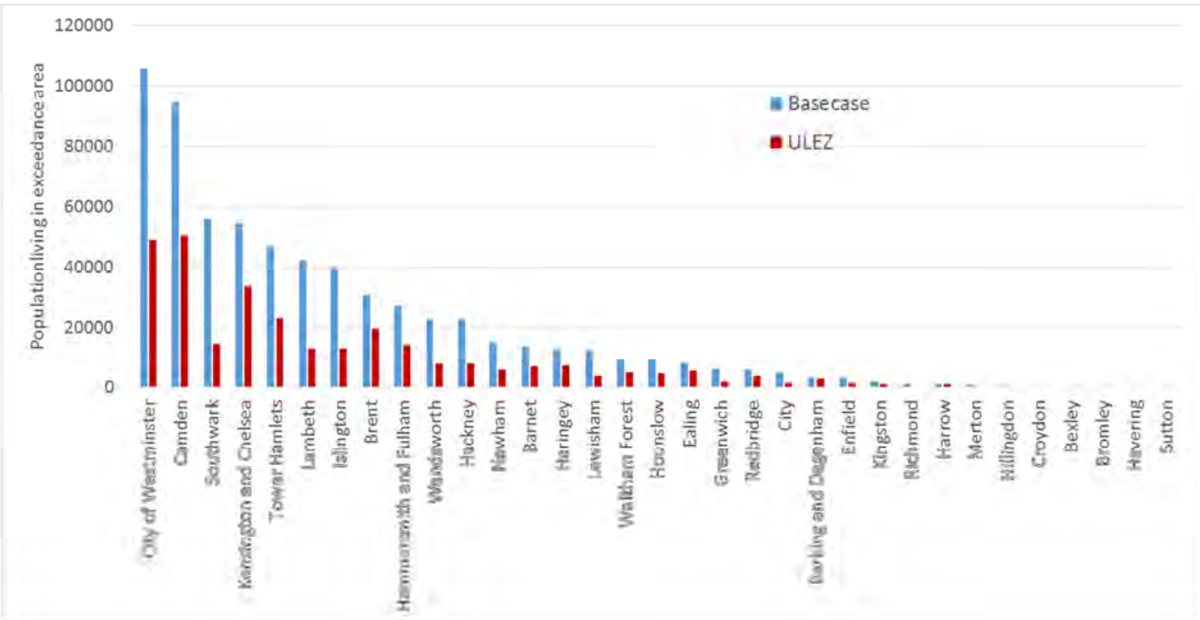
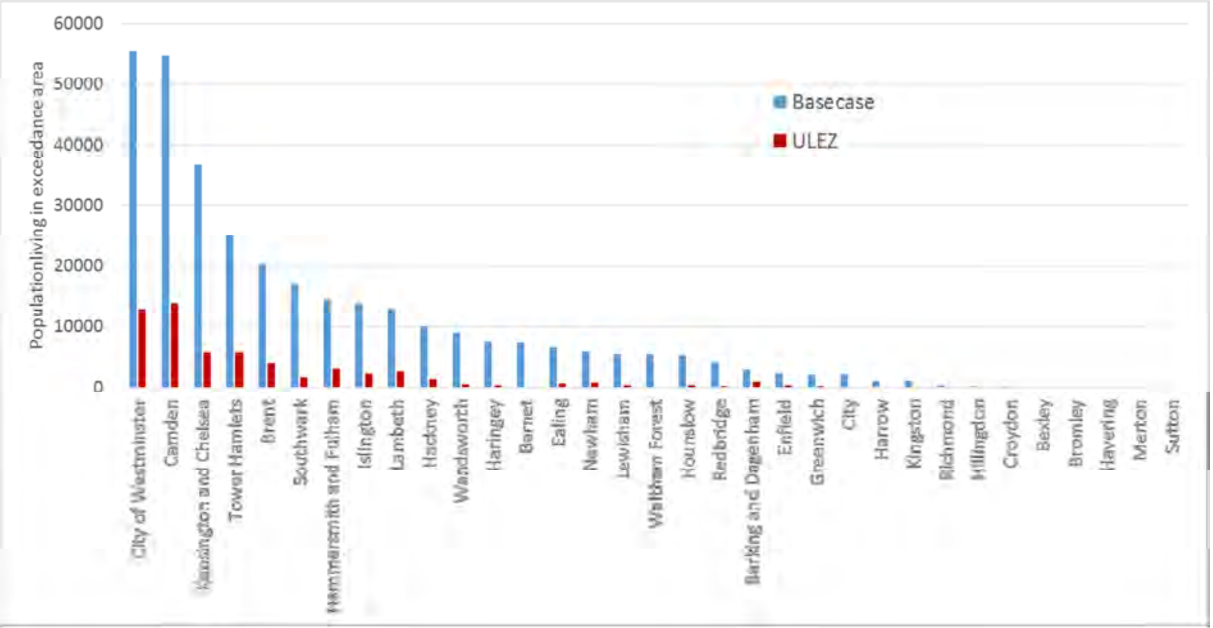


Figure D10: Population living in areas exceeding the NO_2 annual Limit Value by borough for the basecase and scenario in 2025. Boroughs have been ordered with decreasing population in exceedance areas in the basecase from left to right**.**



The figures show that the impact of the ULEZ is larger for the most central boroughs and smaller for the boroughs in outer London. This can be seen in the results for both 2020 and 2025.

1.4 Population-weighted average concentrations

Emissions reductions as a result of the implementation of the ULEZ scenario lead to decreases in the concentrations of air pollutants in the GLA area.

The impacts of the ULEZ scenario have been modelled for two different years: 2020 and 2025. The modelled ambient NO_2, PM_{10} and $PM_{2.5}$ concentrations are presented in the tables below.

Table D3: Population-weighted mean of annual mean NO_2 concentration by area (central/inner/outer and London-wide) in 2020 for each scenario.

Scenario	Location	Population weighted annual mean concentration (µgm^{-3})	Difference from basecase (µgm^{-3})	Percentage difference from basecase
Basecase	Central	42.5	-	-
	Inner	34.7	-	-
	Outer	28.2	-	-
	London-wide	31.0	-	-
ULEZ	Central	37.0	-5.4	-12.8%
	Inner	32.9	-1.8	-5.3%
	Outer	27.3	-0.9	-3.3%
	London-wide	29.6	-1.4	-4.4%

Table D4: Population weighted mean of annual mean NO_2 concentration by area (central/inner/outer and London-wide) in 2025 for each scenario.

Scenario	Location	Population weighted annual mean concentration (μgm^{-3})	Difference from basecase (μgm^{-3})	Percentage difference from basecase
Basecase	Central	36.5	-	-
	Inner	30.5	-	-
	Outer	25.0	-	-
	London-wide	27.3	-	-
ULEZ	Central	33.8	-2.7	-7.4%
	Inner	29.8	-0.7	-2.3%
	Outer	24.7	-0.3	-1.1%
	London-wide	26.8	-0.5	-1.8%

Table D5: Population weighted mean of annual mean PM_{10} concentration by area (central/inner/outer and London-wide) in 2020 for each scenario.

Scenario	Location	Population weighted annual mean concentration (μgm^{-3})	Difference from basecase (μgm^{-3})	Percentage difference from basecase
Basecase	Central	24.7	-	-
	Inner	22.6	-	-
	Outer	21.0	-	-
	London-wide	21.7	-	-
ULEZ	Central	24.5	-0.2	-0.8%
	Inner	22.5	-0.1	-0.2%
	Outer	21.0	0.0	-0.1%
	London-wide	21.6	0.0	-0.2%

Table D6: Population weighted mean of annual mean PM_{10} concentration by area (central/inner/outer and London-wide) in 2025 for each scenario.

Scenario	Location	Population weighted annual mean concentration (μgm^{-3})	Difference from basecase (μgm^{-3})	Percentage difference from basecase
Basecase	Central	24.3	-	-
	Inner	22.3	-	-
	Outer	20.8	-	-
	London-wide	21.4	-	-
ULEZ	Central	24.3	-0.1	-0.2%
	Inner	22.3	0.0	0.0%
	Outer	20.8	0.0	0.0%
	London-wide	21.4	0.0	0.0%

Table D7: Population weighted mean of annual mean $PM_{2.5}$ concentration by area (central/inner/outer and London-wide) in 2020 for each scenario.

Scenario	Location	Population weighted annual mean concentration (μgm^{-3})	Difference from basecase (μgm^{-3})	Percentage difference from basecase
Basecase	Central	14.4	-	-
	Inner	13.1	-	-
	Outer	12.3	-	-
	London-wide	12.6	-	-
ULEZ	Central	14.3	-0.2	-1.1%
	Inner	13.1	0.0	-0.3%
	Outer	12.3	0.0	-0.1%
	London-wide	12.6	0.0	-0.2%

Table D8: Population weighted mean of annual mean $PM_{2.5}$ concentration by area (central/inner/outer and London-wide) in 2025 for each scenario.

Scenario	Location	Population weighted annual mean concentration (μgm^{-3})	Difference from basecase (μgm^{-3})	Percentage difference from basecase
Basecase	Central	13.9	-	-
	Inner	12.6	-	-
	Outer	11.8	-	-
	London-wide	12.2	-	-
ULEZ	Central	13.9	0.0	-0.3%
	Inner	12.6	0.0	-0.1%
	Outer	11.8	0.0	0.0%
	London-wide	12.2	0.0	0.0%

Table D9: Population weighted mean of days when predicted daily averaged PM_{10} is greater than 50 μgm^{-3} by area (central/inner/outer and London-wide) in 2020 for each scenario.

Scenario	Location	Population weighted mean (days)	Difference from basecase (days)	Percentage difference from basecase
Basecase	Central	7.3	-	-
	Inner	3.8	-	-
	Outer	2.0	-	-
	London-wide	2.8	-	-
ULEZ	Central	6.8	-0.4	-6.1%
	Inner	3.7	-0.1	-2.2%
	Outer	1.9	0.0	-0.9%
	London-wide	2.7	-0.05	-1.9%

Table D10: Population weighted mean of days when predicted daily averaged PM_{10} is greater than 50 μgm^{-3} by area (central/inner/outer and London-wide) in 2025 for each scenario.

Scenario	Location	Population weighted mean (days)	Difference from basecase (days)	Percentage difference from basecase
Basecase	Central	6.1	-	-
	Inner	2.5	-	-
	Outer	0.7	-	-
	London-wide	1.5	-	-
ULEZ	Central	6.0	-0.1	-2.2%
	Inner	2.5	0.0	-0.7%
	Outer	0.7	0.0	-0.3%
	London-wide	1.5	0.0	-0.7%

The plots below show the impact of the ULEZ scenario on the population weighted mean annual mean NO_2 concentrations by borough.

Figure D11: Population weighted mean NO_2 concentration by borough in 2020. Boroughs have been ordered with decreasing concentration in the basecase from left to right

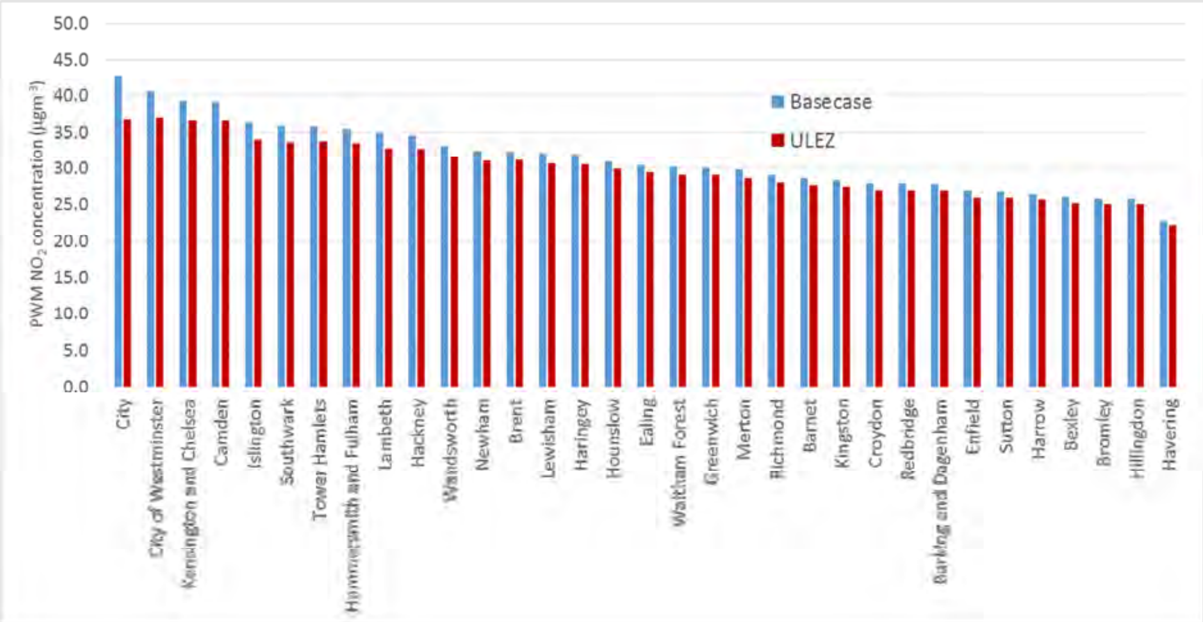
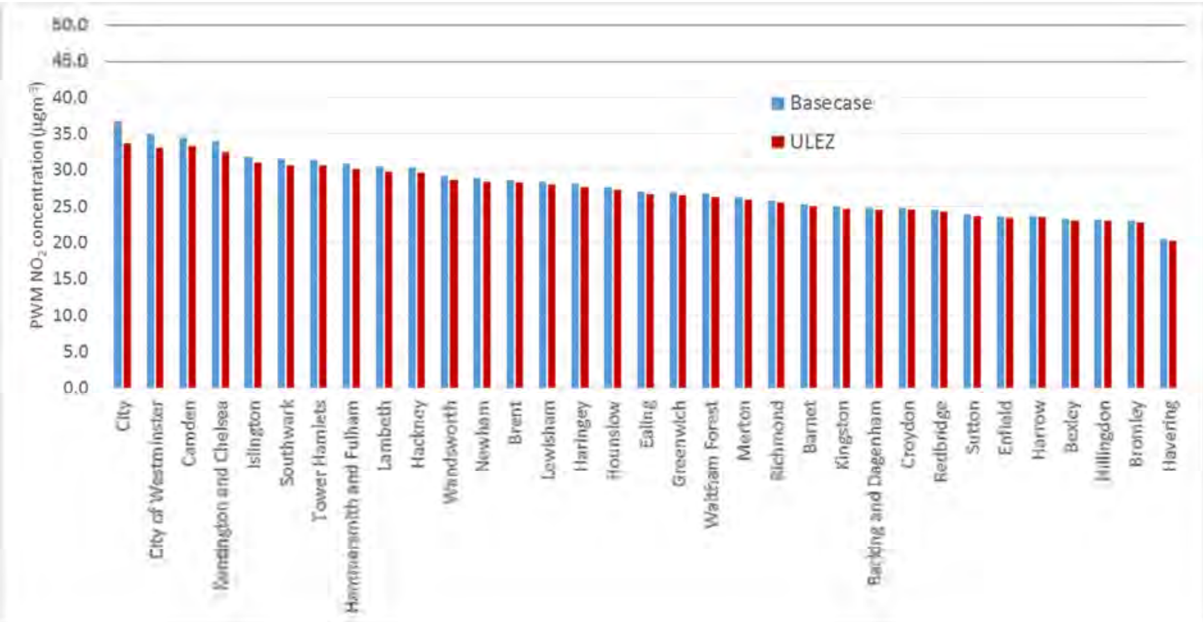


Figure D12: Population weighted mean NO_2 concentration by borough in 2025. Boroughs have been ordered with decreasing concentration in the basecase from left to right



The figures show that the impact of the ULEZ is larger for the most central boroughs and smaller for the boroughs in outer London. This can be seen in the results for both 2020 and 2025.

1.5 How does air quality impact health?

The understanding of the effect that air pollution has on human health has increased considerably in the last 20 years, largely through the findings of many epidemiological studies undertaken for populations in various parts of the world. It had previously been recognised that air pollution episodes with very high levels of ambient air pollution are associated with clear and measurable increases in adverse health effects. The infamous London smog of December 1952 is perhaps the most well known example of this. More recent studies also reveal smaller increases in adverse health effects at the current levels of ambient air pollution typically present in urban areas. The health effects associated with short-term (acute) exposure include premature mortality (deaths brought forward), respiratory and cardio-vascular hospital admissions, exacerbation of asthma and other respiratory symptoms.

The evidence for these health effects from acute exposure is strongest for particles (usually reported in terms of fine particles (PM_{10} and $PM_{2.5}$)) and for ozone (O_3). For these pollutants, the relationships revealed by epidemiological studies are widely accepted as causal.

Studies also strongly suggest that long-term (chronic) exposure to particles ($PM_{2.5}$) may also damage health and that these effects (measured through changes in life expectancy) are substantially greater than the effects of acute exposure described above. There is also increasing evidence that chronic exposure to NO_2 may be important but the evidence for an association that is suitable for quantification of the impacts is less strong than for particles and not yet sufficiently convincing to be used widely.

UK and European legislation has been introduced to regulate ambient air quality, using standards intended to protect human health. The UK Government (the Air Quality Strategy for England, Wales and Northern Ireland, 2000, and its Addendum, 2003) and the EU (Air Quality Directive) have introduced air quality targets for ambient concentrations of pollutants, referred to as ‘objectives’ in the UK Air Quality Strategy (UK AQS) and ‘limit values’ in the EU Directive, that are to be achieved by given dates. The ULEZ is considered to be an important mechanism for helping London progress towards meeting these targets.

The most challenging limit value for NO_2 is the annual mean concentration, set at 40 $\mu g/m^3$, which was due to be met by January 2010 (EU (Air Quality Directive). For PM_{10}, the annual mean limit value of 40 $\mu g/m^3$ to be achieved by January 2005, is met throughout London. The daily PM_{10} limit value of no more than 35 days with daily mean concentration greater than 50 $\mu g/m^3$ is somewhat more challenging to achieve. The annual mean $PM_{2.5}$ limit value of 25 $\mu g/m^3$ (to be achieved by January 2015) is met through London.

1.6 How are the health effects of air quality quantified?

This quantification of health impacts as a result of changes in air pollution follows the widely-recognised Impact Pathway Approach (IPA). For each impact pathway, the concentration response function (CRF) (which defines a given health impact per unit change in the ambient concentration of a pollutant) is multiplied by:

- the underlying risk rate of the health outcome (for example, number of hospital admissions per 100,000 persons per increase in $\mu g/m^3$);
- the population data; and
- the change in population-weighted mean pollutant concentrations of the relevant averaging time.

This provides a quantitative estimate of the health impact in terms of the relevant health outcome.

For example, to calculate the number of respiratory hospital admissions associated with exposure to PM_{10} for the GLA area in 2020 for the basecase, the following methodology is used. The CRF linking exposure to PM_{10} to a change in hospital admissions (0.8% change in admissions per 10 μgm^{-3} change in population-weighted PM_{10}) is combined with the baseline rate of respiratory hospital admissions (916 per 100,000 persons), population data (9.13m persons in 2020) and the modelled population-weighted annual average concentration of PM_{10} (21.7 μgm^{-3} in 2020). This implies that 1,448 respiratory admissions in 2020 for the basecase would be attributable to particulate exposure.

The UK Department of Environment, Food and Rural Affairs (Defra) has produced guidance[8] to steer the assessment of air quality impacts and the valuation of associated economic costs. These processes are designed to support evidence gathering to inform policy development or evaluation in the UK. This guidance sets out a peer-reviewed set of CRFs and unit health values to be used when appraising the impacts of changes in air quality following the Impact Pathway Approach. The assessment of health impacts in this report draws heavily on this guidance (with slight variations as noted in the methodology section below), combined with London-specific data where available to estimate borough and GLA-wide health impacts.

More recently, the World Health Organisation (WHO) led ‘HRAPIE’ project[9] developed concentration response functions (CRF) for application in impact assessment. This report provides the new standard basis for analysis undertaken for the European Commission. That evidence was developed through an intensive review process involving a wide range of experts in air pollution and health. One of these new concentration response functions (for the impact of chronic exposure to NO_2) has been included in our analysis of the impact of the ULEZ on health only as a sensitivity test.

1.7 Quantifiable health impacts

1.7.1 Scope and methodology of air quality health impacts analysis

Five health impact pathways have been included in the scope of this air quality health impacts analysis. These are:

- Mortality associated with long-term exposure to particulate matter ($PM_{2.5}$)
- Respiratory hospital admissions associated with acute exposure to particulate matter (PM_{10})
- Cardio-vascular hospital admissions associated with acute exposure to particulate matter (PM_{10})
- Mortality associated with long-term exposure to NO_2
- Respiratory hospital admissions associated with acute exposure to NO_2

Concentration response functions (CRFs) are used in the IPA to link a given change in air pollutant concentration to a specific health response. This air quality health impacts analysis has drawn on the methodology and set of CRFs for the specific health pathways set out in Defra's published and peer-reviewed air quality impact assessment guidance to link the change in particulate concentrations to changes in health outcomes. These form the set of CRFs and health impact pathways used in the 'Core' air quality health impacts analysis.

In addition, the approach has also included a CRF from the Defra guidance[8] linking acute exposure to NO_2 to respiratory hospital admissions. As recommended in the guidance, the resulting health impacts are only included as part of sensitivity analysis.

Given the importance of the impact of the ULEZ scenario on NO_2 emissions and concentrations, the sensitivity analysis also includes the impact on mortality of chronic exposure to NO_2. The CRF for this health pathway is sourced from the recently published HRAPIE study[9]. This CRF was included by HRAPIE in its 'A*' category: i.e. 'a pollutant-outcome pair for which enough data are available to enable reliable quantification of effects'. However, given that the outputs of HRAPIE have yet to be reviewed by COMEAP to assess their suitability for application in the UK and are not currently adopted by the Defra guidance, this impact pathway has been included alongside the other NO_2 impact pathway only in the sensitivity analysis of this air quality health impacts analysis.

The Defra appraisal guidance also recommends that the impacts of other pollutants (notably SO_2 and O_3) should be captured in an impact assessment. However, these have been excluded from the scope of this study. Furthermore, the acute mortality impacts of particulate matter have also been excluded as advised by COMEAP guidance to avoid overlaps with the chronic impacts of exposure already captured.

The CRFs used in the analysis are presented in the table below. The relationship between air pollutant concentrations and health outcomes is uncertain. Both the Defra and HRAPIE guidance include low and high sensitivities around the central CRF value. Given the scope of the analysis, only the central CRFs were used in this analysis and were applied according to the guidance set out in the table below.

Table D11: CRFs used in this analysis

Impact Pathway	Pollutant	Inclusion of impact in analysis	CRF (% change in risk rate per 10 µgm^{-3} change in pollutant concentration)	Source	Pollutant Threshold	Other
Chronic Mortality	$PM_{2.5}$	Core	6%	Defra	N/A	Ages 30+ years, uses the lag profile recommended by COMEAP
Respiratory hospital admissions	PM_{10}	Core	0.8%	Defra	N/A	All ages
CVD hospital admissions	PM_{10}	Core	0.8%	Defra	N/A	All ages
Chronic Mortality	NO_2	Sensitivity	5.5%	HRAPIE	>20 µgm^{-3}**	Ages 30+ years Impacts should be reduced by (up to) 33% to account for possible overlap with effects from long-term PM2.5 exposure uses the lag profile recommended by COMEAP
Respiratory hospital admissions	NO_2	Sensitivity	0.5%	Defra	N/A	All ages

** Population-weighted means for annual mean NO_2 minus 20 µgm^{-3} were calculated specifically for this task. Negative values for individual OAs were set to zero

Population forecast data for both 2020 and 2025, split by borough and aggregated region, are taken from GLA's 'Demographic Projections: 2013 Round Projections'. Only central projections are used.

Data for the base rate of hospital admissions (for both respiratory and cardiovascular disease (CVD) separately) are sourced from HSCIC's Hospital Episode Statistics (HES)[10] database. The analysis assumes the same rates of admissions per 100,000 of the population as the average rate from 2008/09 to 2012/13 (as the most appropriate for 2020 and 2025).The base rate of life years lost (LYL) associated with chronic mortality is taken from existing life-table calculations undertaken for the ULEZ Health Impacts report. These life-table calculations were originally undertaken for different CRFs, a different geographical scope and base year[1]: they are based on UK population data in 2012 (and not the London population in 2020 and 2025). As such, the original results of the life-tables calculations were scaled in proportion to the London populations for the assessment years. In addition, the life table calculation results were based on PM CRFs and were scaled and used for the NO_2 chronic mortality effects sensitivity analysis.

1.7.2 Health impacts

The estimated health impacts are presented in the tables below. These tables show for each study year, the health 'burden' associated with the absolute levels of pollutant concentrations under the basecase and ULEZ scenario, and the relative impact of the ULEZ scenario relative to the basecase (i.e. the health benefit associated with ULEZ implementation, calculated as the difference between the basecase and ULEZ burdens). Hospital admissions (HA) show the burden or relative change in burden in the study year (2020 or 2025) associated with the pollutant change in that year. Chronic mortality values reflect the total burden or change in burden in LYL over a 100-year assessment period associated with the change in pollution in the initial assessment year (2020 or 2025).

[1] The original life-table calculations applied a 1 µgm^{-3} change in $PM_{2.5}$ using the HRAPIE-recommended central CRF (6.2% change in mortality risk rate per 10 µgm^{-3} change in pollutant) to whole-UK population and mortality data for 2012. The present analysis assumes the same amount of LYL per 100,000 persons aged 30 and over per µgm^{-3} of $PM_{2.5}$ as calculated UK-wide for 2012.

Table D12: Results of air quality health impacts analysis for the basecase and ULEZ scenario in 2020: Bold numbers are core results and those in italics are NO_2 impacts included in the extended sensitivity tests.

Scenario	Region	Chronic mortality $PM_{2.5}$ (LYL)	Chronic mortality NO_2 (LYL)	Respiratory HA PM_{10} (HA)	Respiratory HA NO_2 (HA)	CVD HA PM_{10} (HA)	Total chronic mortality All (LYL)	Total Respiratory HA (HA)
Basecase	Central	**1,436**	*1,363*	**35**	*38*	**28**	*2,799*	*74*
	Inner	**22,899**	*15,733*	**563**	*542*	**445**	*38,632*	*1,106*
	Outer	**36,347**	*14,880*	**850**	*714*	**672**	*51,227*	*1,563*
	London-wide	**60,731**	*32,206*	**1,448**	*1,294*	**1,145**	*92,937*	*2,742*
ULEZ	Central	**1,420**	*1,033*	**35**	*33*	**28**	*2,454*	*68*
	Inner	**22,830**	*13,778*	**562**	*514*	**444**	*36,608*	*1,076*
	Outer	**36,310**	*13,203*	**849**	*690*	**671**	*49,513*	*1,539*
	London-wide	**60,608**	*28,206*	**1,446**	*1,237*	**1,143**	*88,815*	*2,683*
ULEZ - change in burden	Central	**15**	*330*	**0**	*5*	**0**	*345*	*5*
	Inner	**69**	*1,955*	**1**	*29*	**1**	*2,024*	*30*
	Outer	**36**	*1,677*	**1**	*23*	**1**	*1,714*	*24*
	London-wide	**123**	*4,000*	**2**	*57*	**2**	*4,123*	*59*

*Totals may differ from individual sub-values due to rounding

Table D13: Results of air quality health impacts analysis for the basecase and ULEZ scenario in 2025: Bold numbers are core results and those in italics are NO_2 impacts included in the extended sensitivity tests.

Scenario	Region	Chronic mortality $PM_{2.5}$ (LYL)	Chronic mortality NO_2 (LYL)	Respiratory HA PM_{10} (HA)	Respiratory HA NO_2 (HA)	CVD HA PM_{10} (HA)	Total chronic mortality All (LYL)	Total Respiratory HA (HA)
Basecase	Central	**1,448**	*1,052*	**36**	*34*	**28**	*2,500*	*69*
	Inner	**23,302**	*11,797*	**576**	*492*	**455**	*35,100*	*1,067*
	Outer	**37,113**	*9,691*	**876**	*660*	**692**	*46,804*	*1,535*
	London-wide	**61,908**	*22,720*	**1,487**	*1,185*	**1,176**	*84,628*	*2,672*
ULEZ	Central	**1,443**	*880*	**36**	*31*	**28**	*2,323*	*67*
	Inner	**23,288**	*10,999*	**575**	*480*	**455**	*34,287*	*1,056*
	Outer	**37,106**	*9,154*	**876**	*652*	**692**	*46,260*	*1,528*
	London-wide	**61,882**	*21,195*	**1,487**	*1,164*	**1,176**	*83,078*	*2,650*
ULEZ - change in burden	Central	**4**	*172*	**0**	*2*	**0**	*176*	*3*
	Inner	**15**	*798*	**0**	*11*	**0**	*813*	*12*
	Outer	**7**	*537*	**0**	*8*	**0**	*543*	*8*
	London-wide	**26**	*1,524*	**0**	*21*	**0**	*1,550*	*22*

*Totals may differ from individual sub-values due to rounding

The results of the Core air quality health impacts analysis suggest that the ULEZ delivers positive health benefits relative to the basecase in both modelled years of the study. For example, through the reductions in concentrations achieved in 2020, the ULEZ is estimated to achieve a London-wide reduction of 123 life-years lost and 4 hospital admissions. It is important to note that not all the mortality benefits will fall in that year: this health impact is associated with reductions in chronic exposure and these impacts are modelled to accrue over the 100-year period following the concentration change through the life-tables approach.

However, the size of the benefit is seen to reduce between 2020 and 2025 corresponding to the decrease in the pollutant reduction impact between the two study years. For example, the life-years saved through reductions in pollutant concentrations in 2020 and 2025 reduces from 123 to 26 respectively for the London-wide area.

The health benefits increase substantially under the sensitivity analysis. For example, the reduction in LYL associated with pollution reductions in 2020 increases from 123 for the GLA area to 4,123 under the sensitivity analysis when the mortality impacts of NO_2 are included alongside $PM_{2.5}$. The benefits associated with reductions in NO_2 concentrations are larger than those delivered through reductions in particulate matter due predominantly to the greater reductions in NO_2 achieved by the ULEZ.

1.7.3 Monetised health impacts

The health impacts associated with the ULEZ scenario can be valued (i.e. presented in monetary terms) to show the economic benefit associated with reductions in air pollution. The valuation of health improvements captures a number of economic effects, including the direct impact on the utility of the affected individual (commonly captured by the 'willingness-to-pay' of the individual to avoid the detrimental health outcome), reduction in medical costs and increase in productivity. Monetising the health impacts in this way is a common approach which allows the economic benefits of improved health outcomes to be compared to the costs of delivering the ULEZ in cost-benefit analysis.

The Defra IPA Guidance[8] recommends a range of unit values to value different health endpoints. These values have been used in this study to value the impacts on health and are presented in the table below. These values draw upon a range of supporting studies, in particular a Defra-led study by Chilton et al (2004)[11] which aimed to identify the willingness to pay to reduce the health impacts associated with air pollution, using survey-style contingent valuation approach.

To value chronic mortality, the approach uses the concept of the 'Value of a life year' (VOLY). This is combined with the number of life-years saved under the ULEZ scenario to estimate a monetary benefit.

The value of a hospital admission saved includes the resource cost (e.g. NHS cost), opportunity cost (lost productivity) and dis-utility[2] associated with an admission. These are combined with the impact on hospital admissions to estimate the associated benefit.

Table D14: IGCB(A) recommended health values (2012 prices)

Health effect	Form of measurement valuations apply to	Central value	Sensitivity
Chronic mortality	Number of years of life lost due to air pollution. Life expectancy losses assumed to be in normal health.	£35,000	£26,300 – £43,800 (sensitivity around the 95% confidence interval)
Respiratory hospital admissions	Case of a hospital admission, of average duration 8 days	£2,600 – £10,700	
Cardiovascular hospital admissions	Case of a hospital admission, of average duration 9 days	£3,000 – £9,900	

The monetised benefits of each health outcome split by borough, assessment year and sensitivity are presented in the tables below. In these tables a benefit is presented as a positive value.

The impacts are presented in 2014 prices (the Defra unit values have been uprated to 2014 prices using the HM Treasury (HMT) gross domestic product (GDP) deflators[12]). All impacts have been

2 Note COMEAP, in the quantification report, presents the functions for respiratory hospital admissions as 'brought forward and additional', recognising that some or all of these cases would have occurred in the absence of the additional pollution. As is usual in most HIA work, we have assumed that hospital admissions attributable to air pollution are additional to those that would have occurred anyway, and not simply the bringing forward of admissions that would otherwise still have occurred, but only later. In practice, there is likely to be a mixture of both, but the underlying time series studies are strictly uninformative about the balance between them. We highlight that this assumption does not have a significant impact on the overall economic benefits (because the effects of respiratory hospital admissions are so low compared to the overall values)

discounted to 2014 using the social discount rate of 3.5% as recommended by the HMT Green Book[13].

In addition, health values are uplifted by 2% per year over the appraisal period in keeping with the Defra guidance: this recognises that willingness-to-pay to reduce detrimental health outcomes tends to increase with income and hence could be expected to rise over time with real income growth.

Table D15: 2020 Core ULEZ health benefit (i.e. valuation of relative impact, £000's): Low and high sensitivities for the valuation of hospital admissions correspond to the range around the monetary unit values recommended in the Defra guidance for valuing hospital admissions only.

Region	Chronic mortality	Respiratory HA		CVD HA		Total	
		Low	High	Low	High	Low	High
Barking & Dagenham	28.9	0.1	0.2	0.0	0.2	29.0	29.3
Barnet	70.7	0.1	0.5	0.1	0.3	70.9	71.5
Bexley	30.7	0.0	0.2	0.0	0.1	30.8	31.1
Brent	78.5	0.1	0.5	0.1	0.4	78.7	79.4
Bromley	48.7	0.1	0.3	0.1	0.2	48.9	49.3
Camden	203.8	0.3	1.4	0.3	1.0	204.4	206.2
City of London	21.0	0.0	0.1	0.0	0.1	21.1	21.3
Croydon	61.7	0.1	0.4	0.1	0.3	61.9	62.4
Ealing	61.6	0.1	0.4	0.1	0.3	61.8	62.3
Enfield	54.5	0.1	0.4	0.1	0.3	54.7	55.2
Greenwich	59.1	0.1	0.4	0.1	0.3	59.3	59.8
Hackney	134.9	0.2	1.0	0.2	0.7	135.4	136.6
Hammersmith & Fulham	90.9	0.2	0.7	0.1	0.5	91.2	92.0
Haringey	95.6	0.2	0.7	0.2	0.5	96.0	96.8
Harrow	28.9	0.0	0.2	0.0	0.1	29.0	29.2
Havering	24.9	0.0	0.2	0.0	0.1	25.0	25.2
Hillingdon	26.4	0.0	0.2	0.0	0.1	26.5	26.7
Hounslow	50.6	0.1	0.3	0.1	0.2	50.7	51.1
Islington	154.1	0.3	1.1	0.2	0.8	154.6	156.0
Kensington & Chelsea	168.0	0.2	1.0	0.2	0.7	168.5	169.8
Kingston upon Thames	27.0	0.0	0.2	0.0	0.1	27.1	27.3
Lambeth	184.4	0.3	1.3	0.3	1.0	185.0	186.7
Lewisham	103.5	0.2	0.8	0.2	0.6	103.9	104.8
Merton	47.2	0.1	0.3	0.1	0.2	47.4	47.8
Newham	110.6	0.2	0.9	0.2	0.7	111.0	112.2
Redbridge	52.1	0.1	0.4	0.1	0.3	52.3	52.8
Richmond upon Thames	36.6	0.1	0.2	0.0	0.2	36.7	37.0
Southwark	211.0	0.4	1.6	0.3	1.1	211.7	213.7
Sutton	32.2	0.0	0.2	0.0	0.1	32.3	32.6
Tower Hamlets	163.2	0.3	1.3	0.3	1.0	163.9	165.5
Waltham Forest	66.0	0.1	0.5	0.1	0.3	66.3	66.8
Wandsworth	131.7	0.2	1.0	0.2	0.7	132.1	133.3
Westminster	317.7	0.5	2.0	0.5	1.5	318.7	321.3
Central	370.0	0.6	2.6	0.6	1.9	371.2	374.5
Inner	1,692.7	3.0	12.2	2.7	8.9	1,698.3	1,713.8
Outer	889.5	1.4	5.8	1.3	4.3	892.2	899.6
Greater London	**2,997.9**	**5.0**	**20.7**	**4.6**	**15.1**	**3,007.5**	**3,033.7**

*Totals may differ from individual sub-values due to rounding

Table D16: 2020 Extended sensitivity ULEZ health benefit (i.e. valuation of relative impact, £000's): Low and high sensitivities for the valuation of hospital admissions correspond to the range around the monetary unit values recommended in the Defra guidance for valuing hospital admissions only.

Region	Chronic mortality	Respiratory HA		CVD HA		Total	
		Low	High	Low	High	Low	High
Barking & Dagenham	1,407.6	1.9	8.0	0.0	0.2	1,409.7	1,416.0
Barnet	3,406.3	4.2	17.1	0.1	0.3	3,410.7	3,424.2
Bexley	1,638.9	2.0	8.1	0.0	0.1	1,640.9	1,647.3
Brent	3,171.4	4.0	16.3	0.1	0.4	3,175.6	3,188.6
Bromley	2,347.7	2.7	11.1	0.1	0.2	2,350.5	2,359.3
Camden	5,219.7	6.4	26.5	0.3	1.0	5,226.7	5,248.6
City of London	490.4	0.5	2.1	0.0	0.1	490.9	492.7
Croydon	2,994.0	3.7	15.1	0.1	0.3	2,997.9	3,009.9
Ealing	2,981.3	3.7	15.3	0.1	0.3	2,985.2	2,997.3
Enfield	2,636.4	3.3	13.6	0.1	0.3	2,639.9	2,650.6
Greenwich	2,378.2	3.0	12.4	0.1	0.3	2,381.4	2,391.3
Hackney	4,047.4	5.2	21.4	0.2	0.7	4,053.0	4,070.5
Hammersmith & Fulham	2,762.5	3.5	14.5	0.1	0.5	2,766.3	2,778.0
Haringey	3,349.1	4.2	17.2	0.2	0.5	3,353.6	3,367.5
Harrow	1,662.1	2.0	8.2	0.0	0.1	1,664.2	1,670.6
Havering	1,353.9	1.7	6.9	0.0	0.1	1,355.6	1,361.1
Hillingdon	1,659.5	2.2	8.9	0.0	0.1	1,661.7	1,668.7
Hounslow	2,362.8	3.0	12.3	0.1	0.2	2,366.0	2,375.7
Islington	4,217.6	5.4	22.3	0.2	0.8	4,223.5	4,241.8
Kensington & Chelsea	3,829.3	4.3	17.6	0.2	0.7	3,834.0	3,848.7
Kingston upon Thames	1,423.5	1.8	7.3	0.0	0.1	1,425.3	1,431.1
Lambeth	5,440.5	6.9	28.4	0.3	1.0	5,448.0	5,471.2
Lewisham	3,606.4	4.5	18.7	0.2	0.6	3,611.3	3,626.3
Merton	1,994.0	2.4	9.9	0.1	0.2	1,996.5	2,004.5
Newham	3,672.3	5.1	21.2	0.2	0.7	3,677.9	3,695.1
Redbridge	2,483.0	3.2	13.1	0.1	0.3	2,486.4	2,496.8
Richmond upon Thames	1,710.6	2.0	8.2	0.0	0.2	1,712.7	1,719.2
Southwark	5,847.5	7.6	31.1	0.3	1.1	5,855.8	5,881.3
Sutton	1,566.4	1.8	7.6	0.0	0.1	1,568.3	1,574.3
Tower Hamlets	4,591.2	6.4	26.2	0.3	1.0	4,598.2	4,619.7
Waltham Forest	2,611.5	3.3	13.8	0.1	0.3	2,615.0	2,626.0
Wandsworth	4,166.9	5.3	21.9	0.2	0.7	4,172.7	4,190.5
Westminster	7,180.9	8.5	35.1	0.5	1.5	7,190.4	7,219.5
Central	8,438.0	10.8	44.3	0.6	1.9	8,450.0	8,486.8
Inner	49,472.4	63.1	259.8	2.7	8.9	49,541.1	49,753.2
Outer	41,879.7	51.8	213.3	1.3	4.3	41,934.2	42,103.1
Greater London	**100,755.3**	**125.7**	**517.4**	**4.6**	**15.1**	**100,890.6**	**101,308.4**

*Totals may differ from individual sub-values due to rounding

Table D17: 2025 Core ULEZ health benefit (i.e. valuation of relative impact, £000's): Low and high sensitivities for the valuation of hospital admissions correspond to the range around the monetary unit values recommended in the Defra guidance for valuing hospital admissions only.

Region	Chronic mortality	Respiratory HA		CVD HA		Total	
		Low	High	Low	High	Low	High
Barking & Dagenham	4.2	0.0	0.0	0.0	0.0	4.2	4.2
Barnet	11.2	0.0	0.1	0.0	0.0	11.2	11.3
Bexley	4.2	0.0	0.0	0.0	0.0	4.2	4.2
Brent	13.7	0.0	0.1	0.0	0.1	13.8	13.9
Bromley	7.0	0.0	0.0	0.0	0.0	7.0	7.1
Camden	41.9	0.1	0.3	0.1	0.2	42.1	42.4
City of London	4.9	0.0	0.0	0.0	0.0	4.9	4.9
Croydon	9.0	0.0	0.1	0.0	0.0	9.0	9.1
Ealing	9.6	0.0	0.1	0.0	0.0	9.6	9.7
Enfield	8.5	0.0	0.1	0.0	0.0	8.5	8.6
Greenwich	9.6	0.0	0.1	0.0	0.0	9.6	9.7
Hackney	24.3	0.0	0.2	0.0	0.1	24.4	24.6
Hammersmith & Fulham	15.3	0.0	0.1	0.0	0.1	15.3	15.5
Haringey	15.3	0.0	0.1	0.0	0.1	15.4	15.5
Harrow	4.0	0.0	0.0	0.0	0.0	4.0	4.0
Havering	3.5	0.0	0.0	0.0	0.0	3.5	3.5
Hillingdon	3.3	0.0	0.0	0.0	0.0	3.3	3.4
Hounslow	8.5	0.0	0.1	0.0	0.0	8.5	8.5
Islington	30.5	0.1	0.2	0.0	0.2	30.6	30.9
Kensington & Chelsea	34.1	0.0	0.2	0.0	0.1	34.1	34.4
Kingston upon Thames	3.8	0.0	0.0	0.0	0.0	3.9	3.9
Lambeth	34.2	0.1	0.2	0.1	0.2	34.3	34.6
Lewisham	16.0	0.0	0.1	0.0	0.1	16.1	16.2
Merton	7.5	0.0	0.0	0.0	0.0	7.5	7.6
Newham	17.4	0.0	0.1	0.0	0.1	17.5	17.6
Redbridge	7.8	0.0	0.0	0.0	0.0	7.8	7.9
Richmond upon Thames	5.7	0.0	0.0	0.0	0.0	5.7	5.7
Southwark	41.9	0.1	0.3	0.1	0.2	42.0	42.4
Sutton	4.7	0.0	0.0	0.0	0.0	4.8	4.8
Tower Hamlets	29.9	0.1	0.2	0.0	0.2	30.0	30.3
Waltham Forest	11.4	0.0	0.1	0.0	0.1	11.4	11.5
Wandsworth	21.6	0.0	0.1	0.0	0.1	21.7	21.9
Westminster	71.0	0.1	0.4	0.1	0.3	71.2	71.8
						-	-
Central	87.3	0.2	0.6	0.1	0.5	87.6	88.4
Inner	304.4	0.5	1.9	0.4	1.4	305.3	307.8
Outer	137.5	0.2	0.8	0.2	0.6	137.9	138.9
Greater London	**537.7**	**0.8**	**3.4**	**0.8**	**2.5**	**539.3**	**543.6**

*Totals may differ from individual sub-values due to rounding

Table D18: 2025 Extended sensitivity ULEZ health benefit (i.e. valuation of relative impact, £000's): Low and high sensitivities for the valuation of hospital admissions correspond to the range around the monetary unit values recommended in the Defra guidance for valuing hospital admissions only.

Region	Chronic mortality	Respiratory HA		CVD HA		Total	
		Low	High	Low	High	Low	High
Barking & Dagenham	368.4	0.5	2.1	0.0	0.0	369.0	370.6
Barnet	941.1	1.1	4.7	0.0	0.0	942.3	945.9
Bexley	402.4	0.5	2.0	0.0	0.0	402.9	404.4
Brent	953.4	1.2	4.9	0.0	0.1	954.6	958.4
Bromley	559.6	0.7	2.8	0.0	0.0	560.3	562.4
Camden	1,953.6	2.4	9.9	0.1	0.2	1,956.1	1,963.9
City of London	213.7	0.2	0.9	0.0	0.0	213.9	214.7
Croydon	751.9	0.9	3.8	0.0	0.0	752.9	755.8
Ealing	805.9	1.0	4.1	0.0	0.0	807.0	810.2
Enfield	713.7	0.9	3.7	0.0	0.0	714.6	717.5
Greenwich	686.2	0.9	3.6	0.0	0.0	687.1	689.8
Hackney	1,304.3	1.7	6.8	0.0	0.1	1,306.0	1,311.4
Hammersmith & Fulham	893.4	1.1	4.7	0.0	0.1	894.5	898.2
Haringey	1,016.8	1.3	5.2	0.0	0.1	1,018.1	1,022.2
Harrow	411.5	0.5	2.0	0.0	0.0	412.0	413.6
Havering	193.8	0.4	1.7	0.0	0.0	194.2	195.5
Hillingdon	394.5	0.5	2.2	0.0	0.0	395.1	396.8
Hounslow	712.6	0.9	3.7	0.0	0.0	713.5	716.4
Islington	1,490.9	1.9	7.9	0.0	0.2	1,492.9	1,499.1
Kensington & Chelsea	1,752.4	2.0	8.2	0.0	0.1	1,754.5	1,760.9
Kingston upon Thames	355.2	0.4	1.8	0.0	0.0	355.6	357.0
Lambeth	1,747.0	2.2	9.1	0.1	0.2	1,749.3	1,756.4
Lewisham	1,052.0	1.3	5.4	0.0	0.1	1,053.4	1,057.6
Merton	526.9	0.6	2.6	0.0	0.0	527.6	529.6
Newham	1,175.9	1.6	6.7	0.0	0.1	1,177.5	1,182.7
Redbridge	690.4	0.9	3.7	0.0	0.0	691.3	694.1
Richmond upon Thames	454.1	0.5	2.2	0.0	0.0	454.6	456.3
Southwark	1,955.1	2.5	10.3	0.1	0.2	1,957.8	1,966.0
Sutton	401.7	0.5	1.9	0.0	0.0	402.2	403.7
Tower Hamlets	1,610.9	2.2	9.1	0.0	0.2	1,613.2	1,620.3
Waltham Forest	813.5	1.0	4.3	0.0	0.1	814.6	817.9
Wandsworth	1,248.7	1.6	6.6	0.0	0.1	1,250.3	1,255.5
Westminster	3,229.7	3.9	15.9	0.1	0.3	3,233.8	3,246.3
						-	-
Central	3,631.4	4.6	19.0	0.1	0.5	3,636.3	3,651.5
Inner	16,725.5	21.2	87.5	0.4	1.4	16,747.7	16,816.3
Outer	11,178.0	14.0	57.7	0.2	0.6	11,192.4	11,237.2
Greater London	**31,902.7**	**39.9**	**164.2**	**0.8**	**2.5**	**31,944.1**	**32,072.7**

*Totals may differ from individual sub-values due to rounding

Under the Core set of health pathways, the improved health outcomes associated with reduced air pollution in 2020 under the ULEZ for the GLA area are estimated to have a total monetised benefit of between £3.01m and £3.03m, reducing to between £0.539m and £0.544m for pollutant reductions in 2025 (all impacts are discounted to 2014). The range in these results represents the sensitivity around the valuation of hospital admissions advised by the Defra valuation guidance only. This does not explore sensitivity around the estimation of the underlying health impacts or the valuation of mortality effects.

Across boroughs and sub-GLA area groupings, the sizes of impacts scale with the level of underlying health impacts. These impacts in turn scale according to the level of population and specific changes in air pollutant concentrations in the boroughs given other inputs into valuation (CRF, base rates of health impacts, monetary unit values) are not varied by borough.

Relative to the direct health outcomes presented above, the impact of ULEZ on chronic mortality gains even greater importance when monetised given the higher value of a LYL relative to a hospital admissions.

Including the impacts of the ULEZ on NO_2 concentrations as part of the sensitivity analysis causes the valuation of beneficial impacts to increase substantially. For the GLA area, air pollution reductions in 2020 under the ULEZ sensitivity analysis is estimated to deliver a benefit in the range of £100.9m to £101.3m and £31.9m to £32.1m for pollution reductions in 2025. This again underlines the potential importance of the beneficial impacts of ULEZ on detrimental health outcomes through exposure to NO_2 concentrations and presents a more favourable case relative to the costs of intervention in comparison to just taking into account impacts on particulate matter concentrations. The CRF for the impact of chronic exposure to NO_2 was included by HRAPIE in its 'A*' category: i.e. 'a pollutant-outcome pair for which enough data are available to enable reliable quantification of effects'. However, given the outputs of HRAPIE have yet to be reviewed by COMEAP to assess their suitability for application in the UK and are not currently adopted by the Defra guidance, this impact pathway has been included alongside the other NO_2 impact pathway in the sensitivity analysis of this air quality health impacts analysis.

1.7.4 Health impacts not quantified

This air quality health impacts analysis has captured a range of key health impacts directly associated with changes in concentrations of air pollutants. The effects captured are the impact of chronic exposure to particulate matter concentrations on mortality and the impact of acute exposure to particulate matter concentrations on respiratory hospital admissions and cardio-vascular hospital admissions. In the extended set of sensitivity analysis, the assessment also includes the impact of chronic exposure to NO_2 concentrations on mortality and the impact of acute exposure to NO_2 concentrations on respiratory hospital admissions.

Alongside these effects, exposure to air pollutants has been associated with a wider range of health impacts which have not been included in this assessment. These include additional health impacts from PM and NO_2 improvements which have not been quantified and the potential health benefits from reductions in other pollutants. These are discussed below

For the health impact pathways included here, this assessment has followed the published Defra IPA guidance to guide its assessment. Given the importance of NO_2 impacts of the ULEZ, it also includes the impact on mortality from chronic exposure to NO_2 from the published HRAPIE guidance. However, HRAPIE have also included a number of other health impact pathways (with varying confidence in the strength of the relationship) in their published guidance. These are not included within the Defra guidance and have therefore not been included in our assessment. These pathways are as follows:

- PM_{10} and infant mortality
- PM_{10} and chronic bronchitis in children and adults
- $PM_{2.5}$ and restricted activity days
- $PM_{2.5}$ and work days lost
- PM_{10} and asthmatic symptoms in children
- NO_2 and chronic bronchitis in children
- NO_2 and acute mortality.

Furthermore, previous published studies of the impacts of air quality on health in the EU (based on the EU CAFE approach14) and the US (based on the US EPA's approach15) have also included an assessment of health pathways outside those included in the recent HRAPIE work, including the impacts of particulate matter on respiratory medication use, lower respiratory symptoms and school days lost.

The ULEZ may also lead to small reductions in the emissions of other pollutants (e.g. SO_2 and the precursor species to ozone production). These pollutants are included in the Defra guidance (and recently published HRAPIE report); in particular, the impacts of acute exposure to SO_2 and O_3 on mortality and respiratory hospital admissions. However, the impacts on health of these other pollutants could not be quantified in this assessment because the impacts of the ULEZ on pollutants other than PM and NO_2 have not been modelled. The impact on ozone concentrations could, in fact, be quite complex, leading to either decrease or increase in ozone concentrations and this has not been investigated in this study.

In addition we have limited the assessment to the impacts of the ULEZ within London. There is likely to be some additional impact of the ULEZ on concentrations of pollutants outside of London, but this has not been fully quantified and therefore the health impacts could not be calculated in this study.

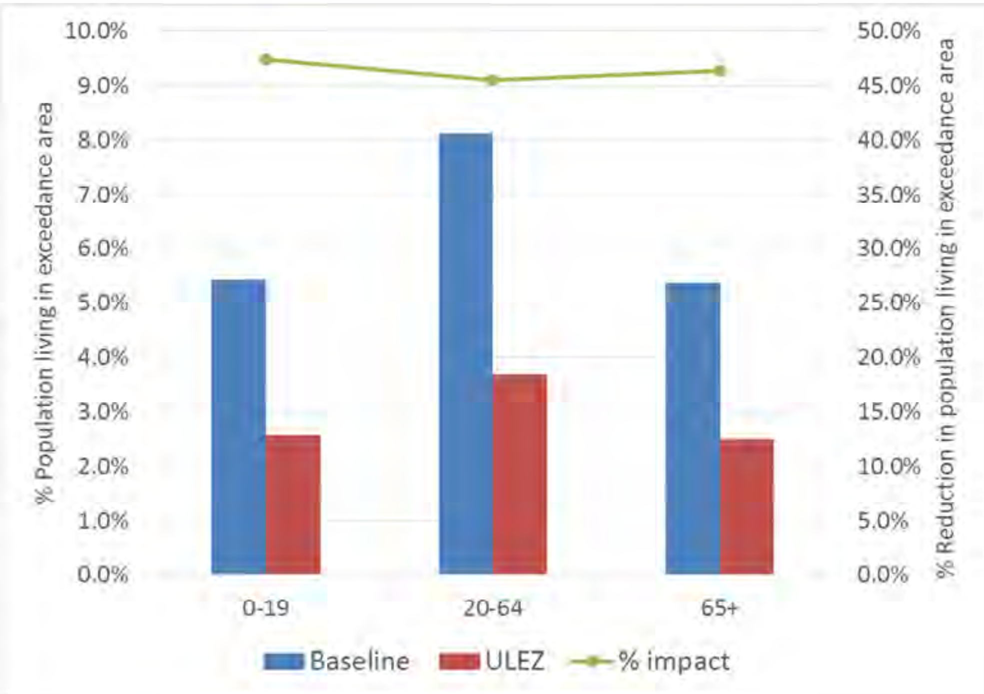
1.8 What are the distributional impacts associated with AQ?

1.8.1 Above LV

1.8.1.1 AQ impacts split by age

An analysis has been undertaken to assess the proportion of different age groups exposed to different levels of NO_2 concentrations across London. The population in areas above the limit values split by age was calculated from the average concentration by output area data described in section 1.2. Figure D9 shows the proportion of people exposed to concentrations NO_2 above the annual LV within three age categories: the young (aged 0-19), the elderly (65+) and the adult population (20-64).

Figure D13: The population in areas exceeding NO2 LV in 2020 split by age group.



The figure shows that the age groups potentially most vulnerable to health impacts associated with air quality, namely children and the elderly, have lower proportions of their population in areas where NO_2 concentrations exceed the annual LV relative to the average and adult populations. An assessment of the impact of the ULEZ shows that the proportion of the population living in areas exceeding the NO_2 annual limit value decreases by at least 45% for all age categories, and the impact is slightly greater for children and the elderly.

However, there is not a clear pattern difference in the impact of the ULEZ scenario for different age groups and we therefore have not included further plots showing the impacts of the ULEZ split by different age groups.

1.8.1.2 AQ impacts at sensitive receptors

An analysis of the impact of the ULEZ scenario on the concentration of pollutants at schools, hospitals and care homes has been carried out. These receptor site types are considered to be particularly sensitive as a high density of potentially vulnerable people congregate in these locations.

Locations of schools, hospitals and care homes in London were extracted from the UKMaps point of interest map data product[16]. For larger hospitals with multiple buildings or wings, the database includes multiple locations for a single hospital which may have the same name, or different names associated with the hospital department. Where a school or care home has more than one building or site (e.g. a primary school has separate infant and junior sites) UKMaps provides a point location for each site.

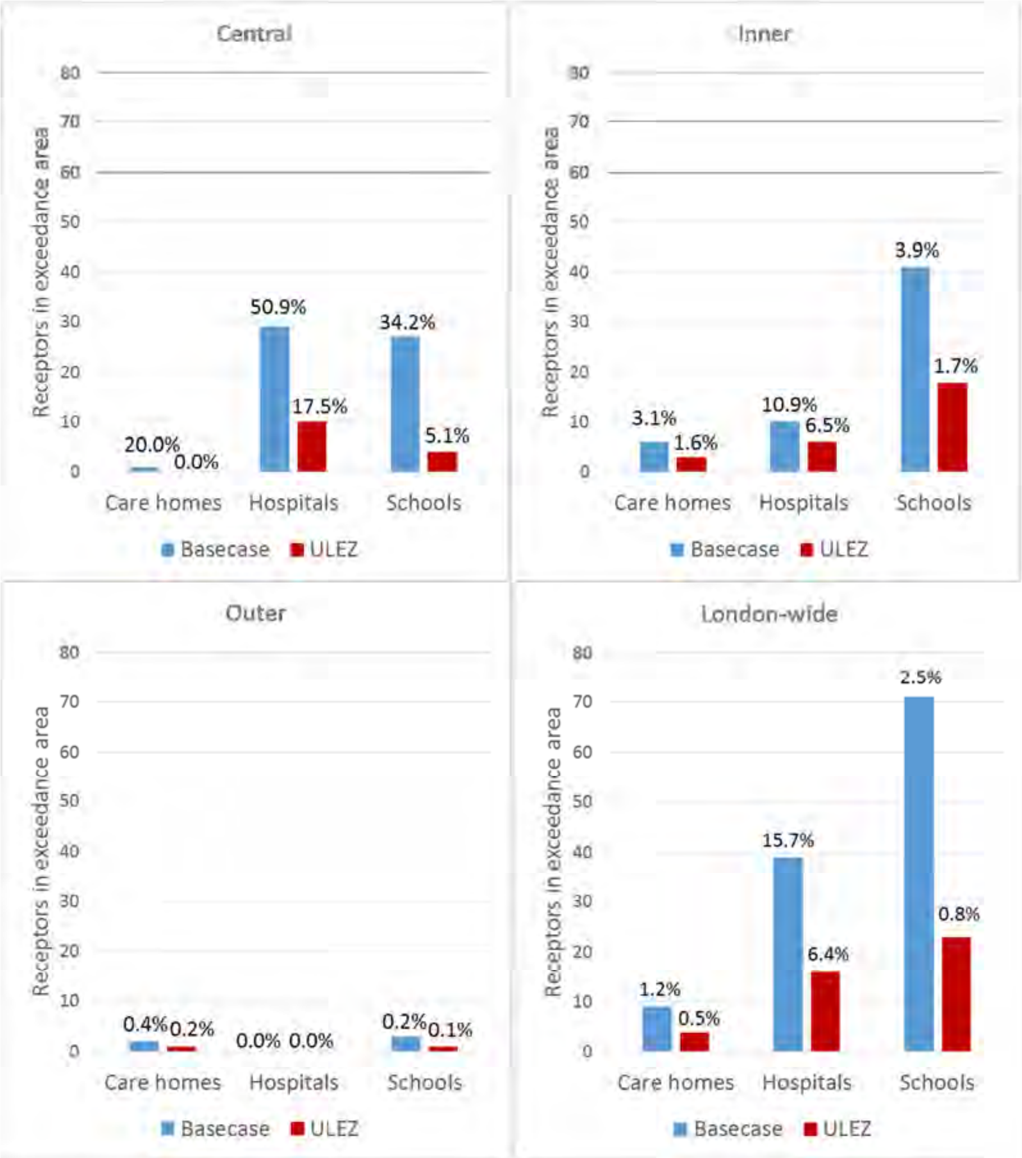
Annual mean concentrations of NO_x, NO_2, PM_{10} and $PM_{2.5}$ were sourced from the 20 m x 20 m resolution maps from King's College London (KCL) for the basecase and ULEZ scenario in 2020 and 2025.

Annual mean concentrations of NO_x, NO_2, PM_{10} and $PM_{2.5}$ for the basecase and ULEZ scenario were extracted from the high resolution maps from KCL at the sensitive receptor site locations. This analysis was carried out within GIS. An assessment of the number of sites for which the annual mean concentration exceeded the LVs in Table D1 was carried out. The results were aggregated by central/inner/outer London and London-wide and the impact due to the ULEZ was summarised.

The locations of sensitive sites are taken to be a point location approximately at the centre of a site location and pollutant concentrations are extracted from the high resolution maps at this location. However, buildings may be located across several grid squares within the high resolution maps, or may be larger than map resolution of 20 m x 20 m. Pollutant concentrations within these grid squares may have differing values. No averaging across grid squares is carried out to take account of this. Where site locations are provided for separate buildings or wings of a hospital, school or care home these data have not been aggregated and are considered to be separate sensitive sites.

The number of sensitive receptor sites in areas above the NO_2 annual mean limit value are presented in the figure below. Only NO_2 annual mean limit value results are shown because there is compliance with the PM_{10} and $PM_{2.5}$ limit values almost everywhere in the basecase in 2020 and 2025 and the impact of the scenario on PM concentrations is also much smaller than on NO_2 concentrations.

Figure D14: Number of sensitive receptor sites in areas above the NO2 annual limit value. The bars indicate the number of receptor sites in each category (care home, hospital and school) for the basecase and ULEZ scenario, and the percentage of the total number of receptor sites in each category are provided above each bar.



The impact of the ULEZ on the number of care homes, schools and hospitals in areas above the NO_2 annual mean limit value is greatest is central London, where the highest proportion of these sites are located in areas above the limit value. When considering the London-wide average it can be seen that the number of these sensitive receptor sites in areas above the limit value is more than halved in the ULEZ scenario. It is noted that there is a larger impact on the number of schools exceeding the NO_2 annual mean limit value than care homes and hospitals. This is despite the fact the hospitals are disproportionately located in central and inner London, whereas care homes tend to be distributed as per population (i.e. more sites in outer and inner regions, few in central areas).

1.8.2 Population-weighted mean concentrations

1.8.2.1 AQ impacts split by index of multiple deprivation

The impacts of the ULEZ on the population weighted annual mean concentration split by IMD were calculated based on the output from the calculation described in section 1.2 The results are shown in the figures below.

Figure D15: Population weighted annual mean NO_2 concentration in 2020 by IMD across the Greater London Area. The bars show the population weighted average annual mean NO_2 concentration by deprivation status for the basecase and ULEZ scenario, & the grey line indicates the percentage reduction in annual mean NO_2 concentration for the scenario compared to the basecase.

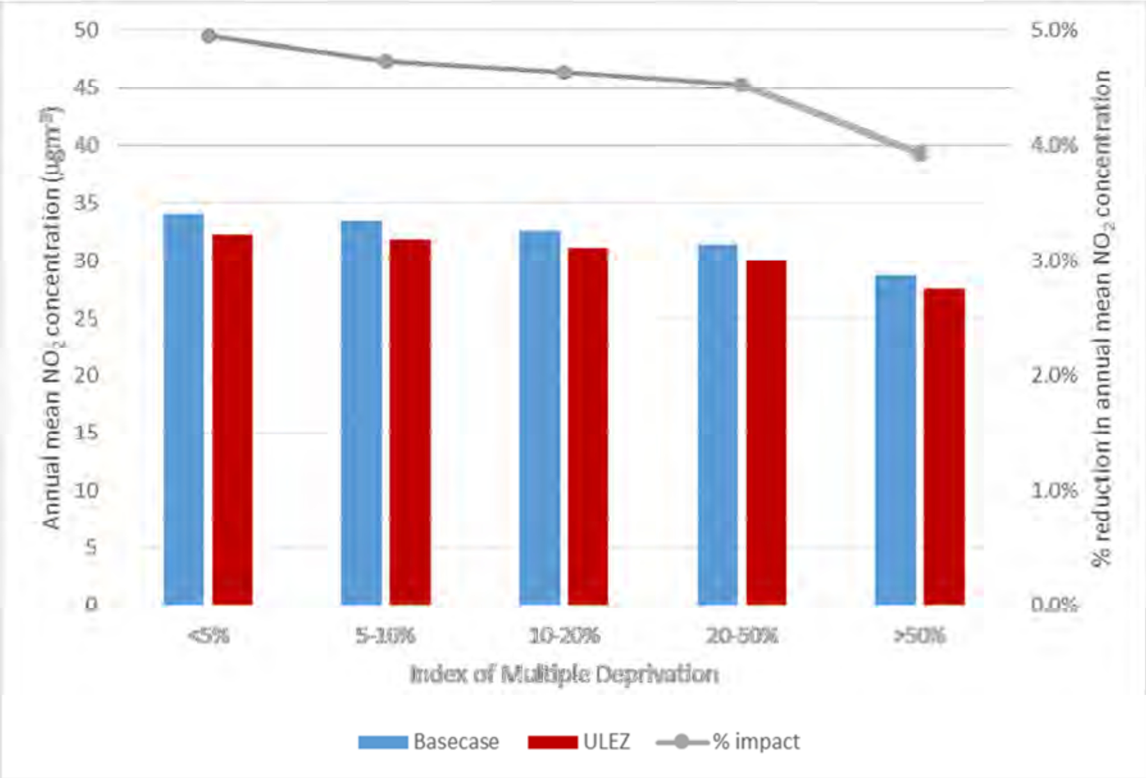
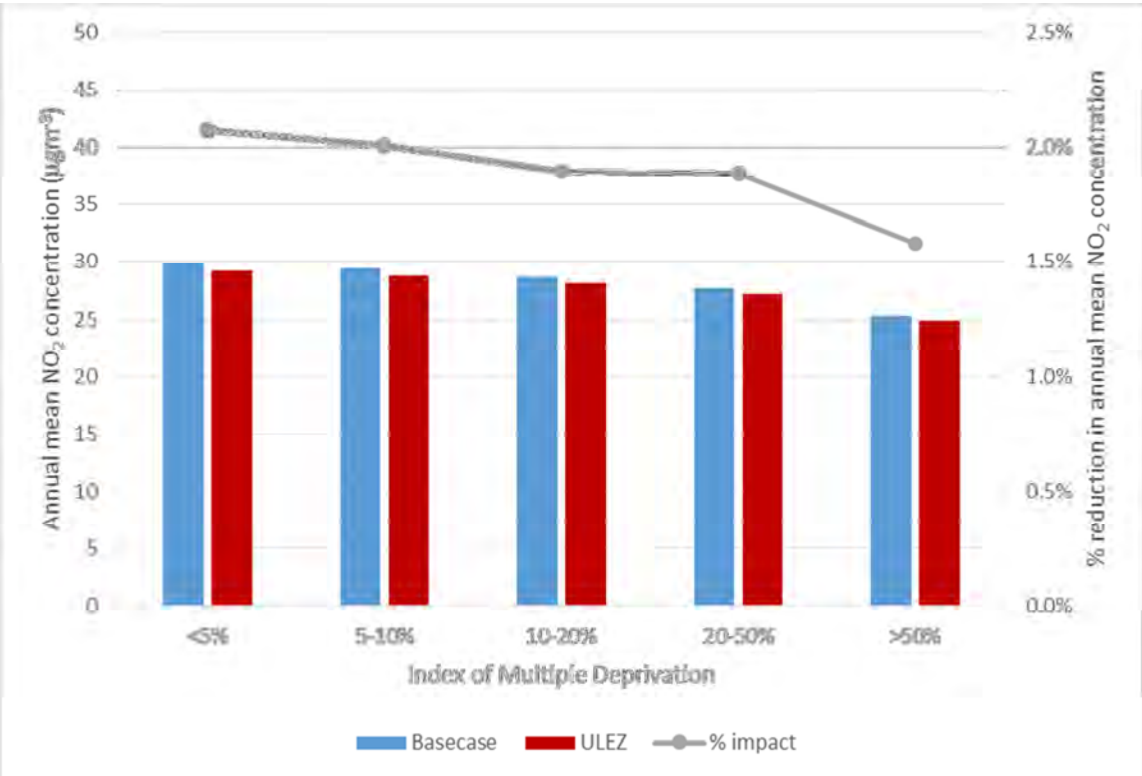


Figure D16: Population weighted annual mean NO_2 concentration in 2025 by IMD across the Greater London Area. The bars show the population weighted average annual mean NO_2 concentration by deprivation status for the basecase and ULEZ scenario, & the grey line indicates the percentage reduction in annual mean NO_2 concentration for the scenario compared to the basecase.



The results indicate that those with a higher deprivation status (i.e. the lowest IMD) are living in areas with higher annual mean NO_2 concentration in both 2020 and 2025. The average exposure to NO_2 is reduced on average for all people for the ULEZ scenario compared to the basecase in both years. However, the ULEZ scenario has (on average) a greater impact on those with a lower deprivation status.

The impact of the ULEZ on PM_{10} and $PM_{2.5}$ is much smaller than the impact on NO_2 and there is no distinct difference between the impacts on those with higher deprivation status compared to those with lower deprivation status. Therefore figures showing the annual mean concentrations and impact of the ULEZ split by IMD are not shown here.

1.8.2.2 AQ impacts split by age

The results for average annual mean concentration split by age, like the number of people in areas with concentrations above the limit value, did not show any distinct patterns. Therefore the results are not presented here.

1.8.2.3 AQ impacts at sensitive receptors

The impacts of the ULEZ on the average concentration at sensitive receptors were calculated based on the output from the calculation described in section 1.8.1.2. The results are shown in the figures below.

Figure D17: Average annual mean NO_2 concentrations at sensitive receptor sites (2020)

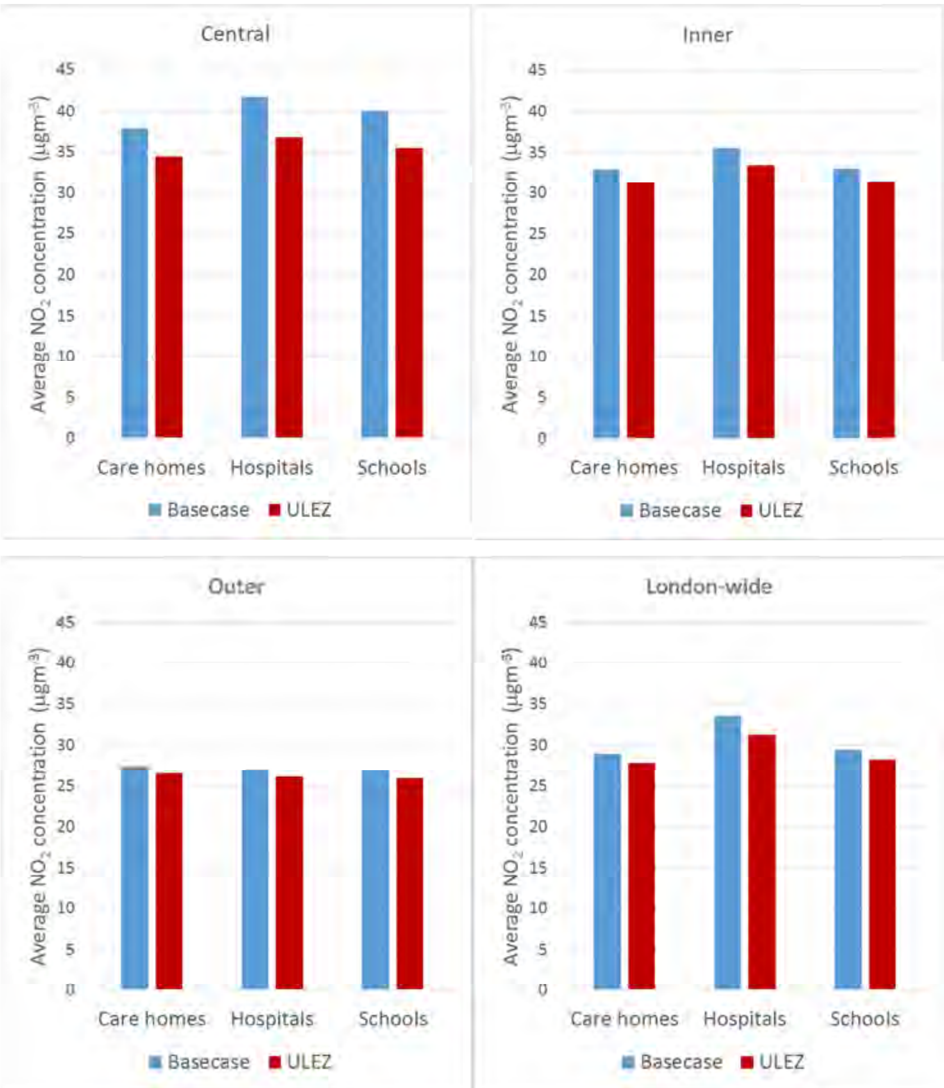


Figure D18: Average annual mean PM_{10} concentrations at sensitive receptor sites (2020)

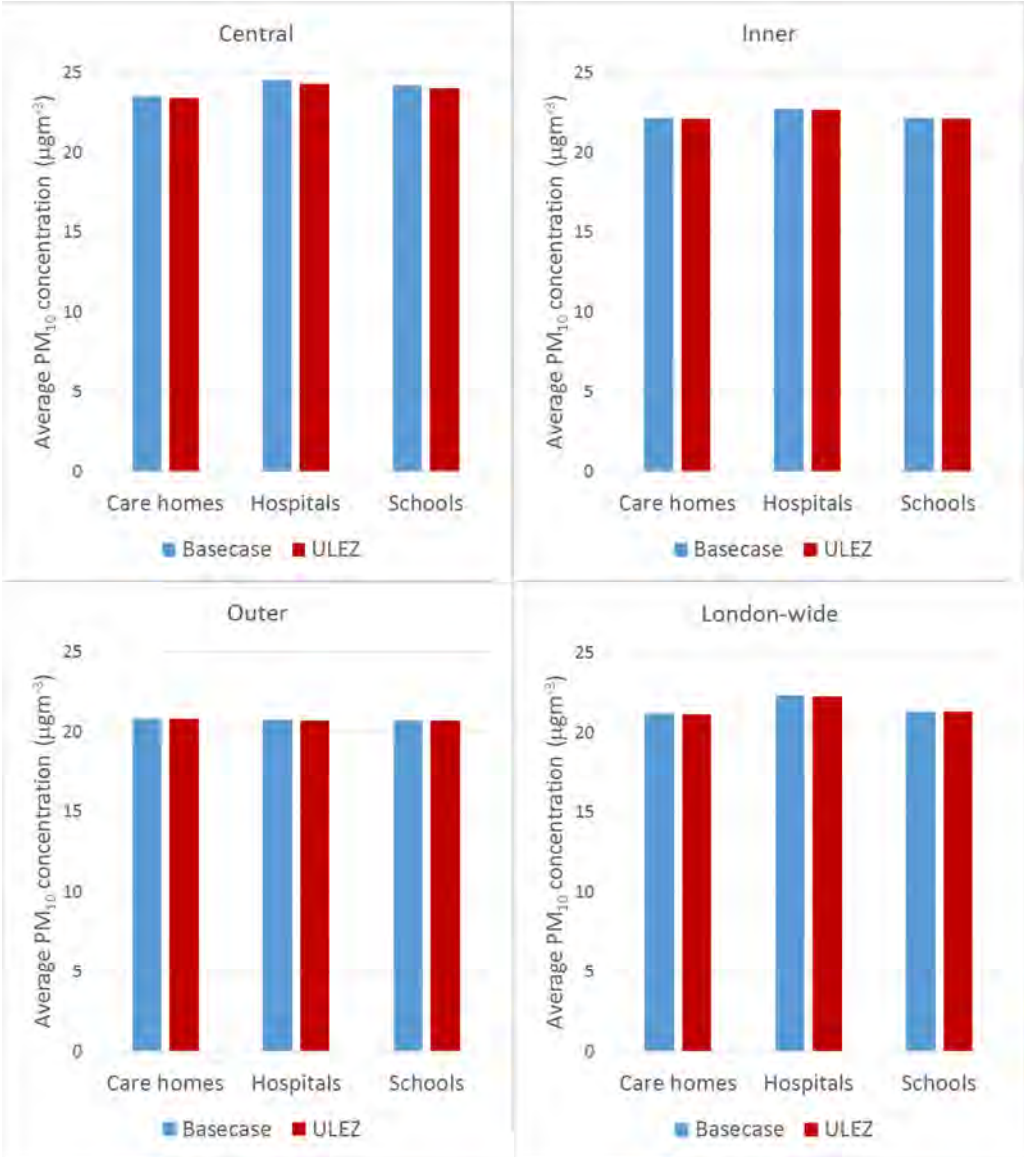
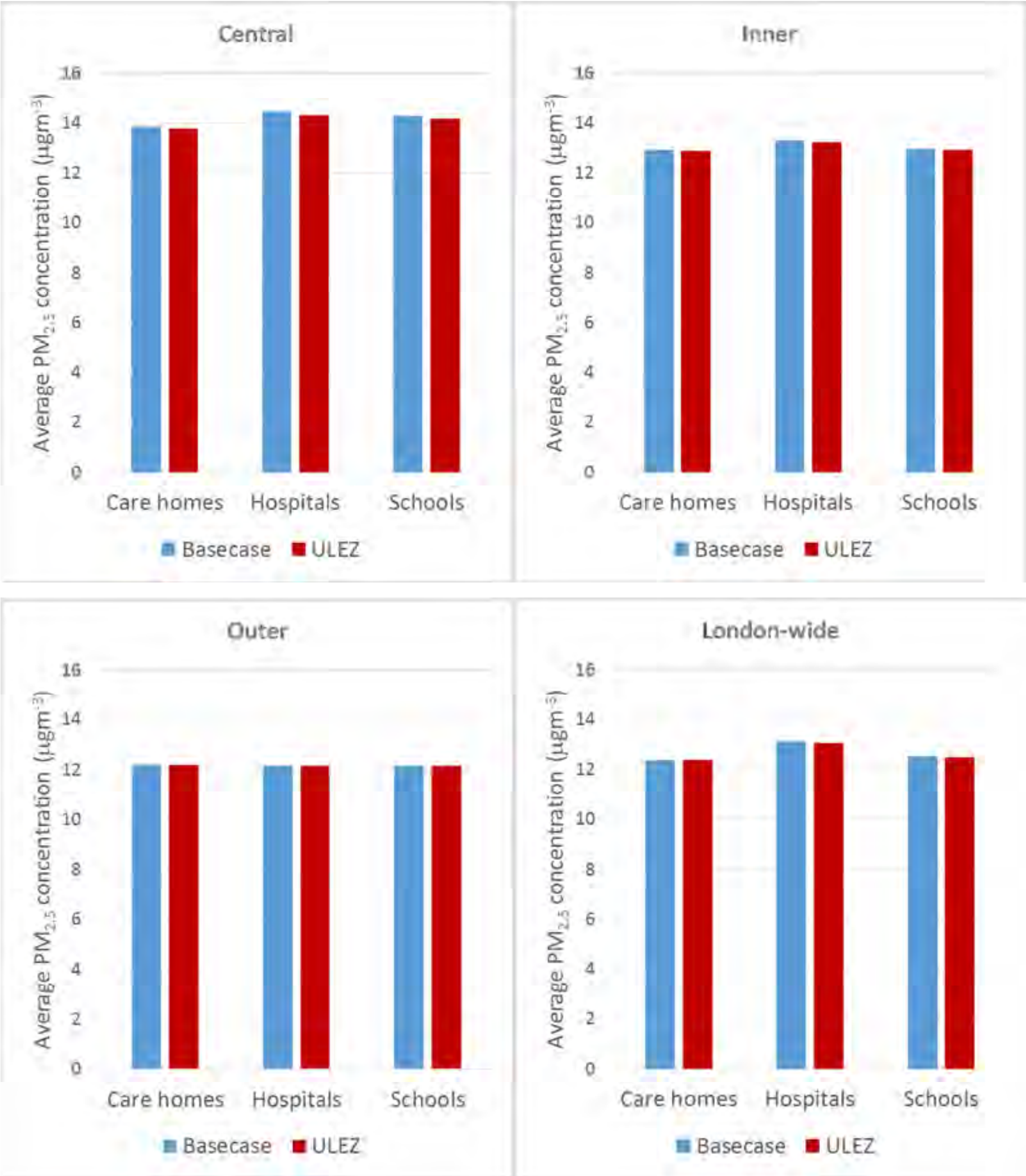


Figure D19: Average annual mean $PM_{2.5}$ concentrations at sensitive receptor sites (2020)



The plots show that the impact of the ULEZ on the annual mean concentrations of NO_2, PM_{10} and $PM_{2.5}$ at sensitive receptor locations for care homes, hospitals and schools is greatest in central London and lowest in outer London. There is a larger impact on annual average NO_2 concentrations than annual average PM_{10} and $PM_{2.5}$ concentrations at these sensitive receptor sites. Annual average concentrations are higher at hospital sites than schools and care homes within the central and inner London areas. On average there is a slightly larger impact at hospital locations than at care homes or schools, particularly when the whole of London is considered. In general, concentrations of NO_2 and PM are higher at hospital sites than schools and care homes. This is because hospitals are disproportionately in central and inner areas, whereas schools and care homes tend to be distributed as per population (i.e. more sites in outer and inner regions, few in central areas).

1.9 Exposure statistics that reflect the large working population and short-term exposure of pedestrians and cyclists in central London

Traditional exposure statistics, are based on location of residence and do not account for time spent working away from the place of residence, or the short term exposure that may be encountered when travelling (including walking and cycling). A full study of the exposure to workers in London, including short term exposure encountered during a commute, would require analysis of:

- Total populations who commute into and out of central London for work
- Time spent in London by commuters
- Origin-destination commuting data that provides information on the flow of commuters from their place of residence to place of work
- Method of transport used by commuters
- Understanding of the increase in exposure encountered when commuting, by mode of transport

A full study would be an extensive piece of work and is beyond the scope of this work. Instead, a literature review was carried out to gather available information about the population commuting to and within London and the short term exposure to pedestrians, cyclists and other travellers to air pollution in London, This information was used to perform a sensitivity analysis for the population weighted mean pollutant concentrations which reflect the large working population in London and account for hours spent at home, commuting and at work.

A daytime population-weighted mean concentration for the GLA area for each pollutant, year and the basecase and ULEZ scenario has been calculated from the population-weighted mean derived for the resident population for each borough. A weekday daytime population for 2012 for each borough has been extracted from the GLA datastore. This total daytime population includes workers, those not in work, those at school and visitors. The weekday daytime population-weighted mean concentrations for the GLA area have been calculated by population-weighting the concentrations for each borough by the weekday daytime population. Note that this daytime population dataset includes population not normally resident in the GLA area.

To estimate the additional exposure due to travel we considered only modes of transport where there is evidence in literature that commuters are exposed to levels of pollution comparable with roadside pollution levels:

- Bus
- Taxi
- Car
- Van/Lorry
- Motorcycle
- Walking

Travel by London Underground was not considered as no measures in the ULEZ scenario affect levels of pollutants within the underground. Travel by train is not considered as there is evidence that exposure of train commuters to pollution is comparable to background levels of pollution.

We have assumed that journeys by bus, taxi, car, van/lorry, motorcycle, cycle and walking will be subject to an additional roadside increment above the background concentration that has been calculated as the area average of output areas (OA). We have assumed that all other journeys do not result in an additional exposure to ambient air pollution. The roadside increment of concentrations has been calculated for each pollutant, year and the basecase and ULEZ scenario by comparing the average of the modelled concentrations at the original 20 m x 20 m model resolution provided by KCL at roadside and kerbside monitoring sites in the London Air Quality Network (LAQN) with the average modelled concentrations for urban background and suburban monitoring sites. We verified that the proportion of sites in central, inner and outer London are very similar for these two groups of sites. To calculate the contribution to the population weighted mean from commuting exposure we estimated the average commuter travel time and the average additional exposure due to travel.

The London Travel Demand Survey has provided the daily average of the total time spent commuting by bus, taxi, car, van/lorry, motorcycle, cycle and walking for the average of the 2010, 2011, 2012, 2013 surveys. Note that these data only include the population normally resident in the GLA area. We have summed these durations and then divided by the 2012 total resident GLA population in order to calculate the average time spent commuting via these modes of transport. The proportion of a whole day represented by this average duration has then been calculated.

The average additional population exposure to the roadside increment of ambient air pollution as a result of this time spent commuting has been calculated by multiplying this average proportion of day spent commuting by the relevant roadside increment for each pollutant, year and the base case and ULEZ scenario.

An estimate of the population-weighted mean including daytime population and commuting exposure has been calculated by as a time weighted average of the weekday daytime population-weighted mean (23.8% of the time, calculated as 8 hours /24 hours times 5 days / 7 days) and the resident population-weighted mean (76.2% of the time) plus the additional roadside increment for commuters.

1.9.1 Results

The results for this sensitivity analysis are presented in the tables below. The usually resident pwm column is the population-weighted mean based on the location of GLA residents. The daytime pwm column is the population-weighted mean based on the daytime population of boroughs. The time weighted average pwm combines the usually resident and daytime population-weighted means. The travel increment is the additional increment due to time spent commuting. The estimated pwm inc working population and commuting is the result of adding the travel increment to the time weighted average.

An analysis of the impact of each scenario is presented in the final two columns of the tables. The difference to basecase presents the difference between the scenario estimated pwm (including working population and commuting) and basecase estimated pwm (including working population and commuting). The scenario sensitivity / scenario standard gives an indication of the difference between the impact of scenarios on the pwm for the sensitivity calculation (which includes working population and commuting), compared to the impact of scenarios on the pwm calculated simply using usually resident population statistics. The values presented are the ratio of the difference to the basecase (for the sensitivity pwm calculation) and difference to the basecase (for the standard pwm calculation using usually resident population).

Given the data available it was not possible to produce results split by central/inner/outer London.

Table D19: Summary results from calculations of population weighted mean including daytime population in London and exposure during commute by pollutant and scenario in 2020.

Pollutant	Scenario	Usually resident pwm (μgm^{-3})	Daytime pwm (μgm^{-3})	Time weighted average pwm (μgm^{-3})	Travel increment (μgm^{-3})	Estimated pwm inc. working population and commuting (μgm^{-3})	Difference to basecase (μgm^{-3})	Scenario sensitivity/ scenario standard
NO_2	Basecase	31.0	32.9	31.4	0.1	31.5	-	-
	Scenario 1	29.6	31.0	29.9	0.1	30.0	-1.5	1.10
PM_{10}	Basecase	21.7	22.1	21.8	0.0	21.8	-	-
	Scenario 1	21.6	22.1	21.7	0.0	21.8	-0.1	1.04
$PM_{2.5}$	Basecase	12.6	12.9	12.7	0.0	12.7	-	-
	Scenario 1	12.6	12.9	12.7	0.0	12.7	0.0	1.17

Table D20: Summary results from calculations of population weighted mean including daytime population in London and exposure during commute by pollutant and scenario in 2025.

Pollutant	Scenario	Usually resident pwm (μgm^{-3})	Daytime pwm (μgm^{-3})	Time weighted average pwm (μgm^{-3})	Travel increment (μgm^{-3})	Estimated pwm inc. working population and commuting (μgm^{-3})	Difference to basecase (μgm^{-3})	Scenario sensitivity/ scenario standard
NO_2	Basecase	27.3	28.8	27.7	0.1	27.7	-	-
	Scenario 1	26.8	28.1	27.1	0.1	27.2	-0.6	1.16
PM_{10}	Basecase	21.4	21.9	21.5	0.0	21.6	-	-
	Scenario 1	21.4	21.8	21.5	0.0	21.5	0.0	0.91
$PM_{2.5}$	Basecase	12.2	12.4	12.2	0.0	12.2	-	-
	Scenario 1	12.2	12.4	12.2	0.0	12.2	0.0	1.23

It can be seen from the data that for both the basecase and the scenario and the years 2020 and 2025 the difference between the population-weighted mean calculated using the usually resident population and the population-weighted mean calculated including the working population and commuting time is quite small.

The impact of the scenario is generally slightly larger for the sensitivity population-weighted mean than the usually resident population-weighted mean. We have calculated the impact using this sensitivity population-weighted mean is likely to have on the overall valuation of the scheme. This is presented in the table below.

Table D21: Valuation of ULEZ using the sensitivity population-weighted means

Area	Year	Low or high	Core pathways (£000s)	Core pathways including non-resident and commuting (£000s)	Including sensitivity pathway (£000s)	Including sensitivity pathway including non-resident and commuting (£000s)
Greater London	**2020**	**Low**	3,007	3,517	100,891	111,501
Greater London	**2020**	**High**	3,034	3,545	101,308	111,961
Greater London	**2025**	**Low**	539	662	31,944	37,055
Greater London	**2025**	**High**	544	666	32,073	37,203

The small increase in population-weighted mean and the small increase in the impact of the scenario for the sensitivity population-weighted mean leads to an increase in the impact of the ULEZ on health pathways. Therefore the valuation of the scheme impact calculated using the sensitivity population-weighted means is slightly larger than that calculated using the resident population-weighted means in section 1.7.3 above. However, it should be noted that the concentration response functions used for calculating health impacts were not derived using this type of exposure estimate and the difference in population-weighted mean is small in relation to uncertainty in the concentration response functions themselves. In addition there are many non-commuters in the population (young people, old people, these at home) and the concentration response functions were derived for the whole community, as they are based on epidemiology where the population is large, diverse and resident across an urban area typically, not just commuters

1.10 Conclusion

Summary and key results

- From this analysis, it is clear that the ULEZ would bring about important reductions in the health impacts associated with air pollution, and would therefore be an important part of London's overall strategy for improving air quality and limiting the associated health impacts. This is in evidence from the analysis of the number of people who are no longer in exceedance areas for NO_2 after the introduction of the ULEZ, analysis of the mean exposure to NO_2 and PM, and from the quantification of actual health benefits.
- The size of the benefit is seen to reduce between 2020 and 2025 corresponding to the decrease in the impact of the ULEZ on pollutant reductions between the two study years.
- The benefit realised from avoided mortality increases substantially under the sensitivity analysis when the benefits associated with reductions in NO_2 are included. This highlights the importance of the impact of ULEZ on NO_2 concentrations.
- The improvements in health outcomes under the ULEZ are estimated to have a total London-wide economic benefit valued around £3m in 2020, reducing to around £0.5m in 2025, with the greatest benefit being provided through reductions in mortality. However, when the impacts of the ULEZ on NO_2 concentrations are included as part of the sensitivity analysis, the valuation of impacts increases substantially to around £101m in 2020 and £32m in 2025 for the London-wide area (all impacts are in 2014 prices and discounted to 2014).
- There are significant differences in the distribution of these benefits. Central London boroughs appear to experience the highest level of benefit due to the fact that this is where the ULEZ would be located and air quality problems are the most severe. It is the most deprived communities that on average experience the most significant reductions. Although the relative reductions are small, this is still important given that such communities are thought to be more vulnerable to air quality impacts on health. Other vulnerable groups, determined on the basis of age, do not appear to experience very different levels of impact of the ULEZ.

Appendices

Appendix 1: References

Appendix 1: References

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