Inequalities in road danger in London (2017-2021)

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MAYOR OF LONDON

TRANSPORT FOR LONDON

EVERY JOURNEY MATTERS

Executive summary

Deprivation, sex, age and mode of transport have a significant impact on casualty risk rate and casualty location rate in London. Twice as many people were killed or seriously injured per kilometre of road network in the most deprived 30 per cent of London, compared to the 30 per cent in the least deprived areas.

This is just one of the findings of this research, conducted by Transport for London, which looks at combining the national STATS19 collisions dataset (2017-2021), Indices of Multiple Deprivation (IMD) information and Office for National Statistics (ONS) census data, to examine if there are disparities for those injured in road collisions within Greater London.

The Mayor of London is committed to creating a fairer, more equal and integrated city as set out in the Healthy Streets approach within The Mayors Transport Strategy[1] and more broadly within the updated equality objectives[2]. The action within the Vision Zero Action Plan progress report states that 'TfL will investigate how unequal road outcomes manifest among different demographics and communities', supports this wider equity ambition as well as contributing to a greater understanding of road danger.

By examining collision data in a new way, this work assists TfL in planning to achieve its Vision Zero ambition to eliminate death and serious injury from the London transport network by 2041.

The inequalities in road danger report focuses on two areas:

- The collision location, **where** injuries happen, and
- The demographic characteristics of the **people** who are injured.

This report examines the rate of casualties on London's roads whereby a

- casualty location rate has been calculated by standardising the casualties per metre of road in each IMD deprivation group to give a rate per kilometre, and
- a casualty rate has been calculated by standardising the population size of the casualty's home postcode deprivation, sex, and age to give a casualty rate per 1,000 people

This analysis highlights the geographical areas of higher casualty location rate and those residents and communities who are at higher risk of harm on our road network.

The overall casualty rate and casualty location rate are falling over the period analysed (2017-2021). However, the killed or seriously injured rate has remained

[1] https://tfl.gov.uk/corporate/about-tfl/the-mayors-transport-strategy#:~:text=Mayor's%20Transport%20Strategy%202018,-See%20it%20on&text=%22At%20its%20heart%20is%20a,%22

[2] https://www.london.gov.uk/programmes-strategies/communities-and-social-justice/mayors-strategy-equality-diversity-and-inclusion/mayors-equality-diversity-and-inclusion-strategy-objectives-2022

stable for both measures. The exception to this was an increase in rate that was observed from 2020 to 2021 due to the pandemic recovery. Although there was a rise in rate from 2020 to 2021, it still shows that for casualty location rate and casualty rate, the rate for 2021 is still lower than the 2017-2019 baseline average. There was a notable greater decrease in casualty location rate on the most deprived roads. This finding is significant to support the drive to reduce unnecessary vehicle journeys, to reduce not only road danger and harm but also to improve air quality across London.

High level results (baseline average 2017-2019):

- Deprivation: Twice as many people were killed or seriously injured per kilometre of road network **in** the most deprived 30 per cent of London compared to the 30 per cent least deprived areas.
- Deprivation: Almost twice as many people **living in** the most deprived 30 per cent of London are killed or seriously injured in road collisions than people **living in** the least deprived 30 per cent per 1,000 resident population.
- Sex: Per thousand people, more men are injured than women. This difference between the sexes increases with deprivation and injury severity. Men have over double the rate of fatal or serious injuries per thousand residents than women **living in** the most deprived 30 per cent of London.
- Age: The 16-30 age group has the highest casualty rate, followed by the 31-59 age group
- Higher risk communities: Young men (aged 16-30) living in the most deprived 30 per cent of London, riding motorcycles have the highest killed or seriously injured rate (0.54 killed or seriously injured per 1,000 people), followed by young men (aged 16-30) **living in** the middle deprivation (IMD 4,5,6,7) 40 per cent of London, riding motorcycles (0.39 killed or seriously injured per 1,000 people).

This report, as a complementary data source to existing sources, will help inform our future programme planning and investment, both through identifying the locations where there is a higher rate of collisions and through focussing engagement, education and communications with those who are most impacted by road danger.

Further analysis is required at local lower super output area level to understand the causation of collisions in more depth before this prioritisation work takes place. Throughout this process, our focus will remain on reducing harm to those most at risk.

TfL will consider how the business plan funding is allocated over the lifetime of the business plan to 2025/26, ensuring the insight set out in this report feeds into decision making for scheme and programme planning and prioritisation.

Importantly this information will be shared with borough colleagues working in transport and public health, policing and other emergency services partners and stakeholders so they can take the findings into account in their own programme planning and prioritisation of investment. TfL seeks to work collaboratively to reduce death and serious injury across London and to narrow the inequality gaps which have been found.

1 Introduction

In 2021, 75 people were killed, 3,505 people were seriously injured and 23,092 people were slightly injured in collisions on London's roads[3]. These events change lives forever and every death on our roads is unacceptable. We are determined to achieve Vision Zero and eradicate all loss of life and serious injuries from London's streets by 2041.

The Mayor of London is committed to creating a fairer, more equal and integrated city as set out in the Healthy Streets approach within The Mayors Transport Strategy[4] and more broadly within the updated equality objectives[5]. The recently published equality objectives include: improving Londoners air quality, investment into the most deprived areas of London, assisting children and young people reach their potential and address the reasons for health inequalities of those living in the 30 per cent most deprived areas of London. The action within the Vision Zero action plan progress report[6], published in 2021, which states that 'TfL will investigate how unequal road outcomes manifest among different demographics and communities', supports this ambition as well as contributing to a greater understanding of road danger.

Road danger does not affect everyone equally. People walking, cycling or riding a motorcycle are at greatest risk of injury in London, making up 80 per cent of those killed or seriously injured, most frequently in collisions with cars, Heavy Goods Vehicles or motorcycles. Tackling road danger is key to enabling confidence to walk and cycle thereby unlocking fewer car journeys, creating less carbon and better air quality.

This analysis has focused on the people who are harmed in collisions. However, we remain committed to reducing road danger by tackling the sources of harm, namely by reducing the risk that motorised vehicles pose to people walking, cycling and motorcycling. Further information on the sources of harm including which vehicles most frequently cause injury and collisions by vehicle contributory factors can be found in the Road Safety data dashboard here.

The aim of this analysis is to contribute to a better understanding of road danger, thereby informing programme planning and investment in infrastructure schemes and communications across London. Further analysis is required at local level to understand the causation of collisions in more depth before this prioritisation work takes place. TfL has committed to publish the findings and work with boroughs,

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[3] https://content.tfl.gov.uk/casualties-in-greater-london-2021.pdf

[4] https://tfl.gov.uk/corporate/about-tfl/the-mayors-transport-strategy#:~:text=Mayor's%20Transport%20Strategy%202018,-See%20it%20on&text=%22At%20its%20heart%20is%20a,%22

[5] https://www.london.gov.uk/programmes-strategies/communities-and-social-justice/mayors-strategy-equality-diversity-and-inclusion/mayors-equality-diversity-and-inclusion-strategy-objectives-2022

[6] https://content.tfl.gov.uk/vision-zero-action-plan-progress-report-2021.pdf

police and other stakeholders to narrow road traffic injury inequalities and reduce harm overall.

This analysis uses the national STATS19 dataset, containing information on collisions and resulting casualties reported to and by the police in Greater London between 2017 and 2021.

Further data analysis tables can be found in the appendix section 7.1 Data tables and details of how this analysis was conducted can be found in more detail in our accompanying technical report in- the appendix section 7.2 Technical note.

1.1 Summary of results

Individuals' experience of deprivation, sex/gender, age and mode of travel results in different patterns of harm on the roads in London. A brief definition of terms is provided in section 2.3 Definition of terms.

- Twice as many people were killed or seriously injured per kilometre of road network **in** the most deprived 30 per cent of London compared to the 30 per cent least deprived areas.
- Almost twice as many people living in the most deprived 30 per cent of London are killed or seriously injured in road collisions than people **living in** the least deprived 30 per cent per 1,000 resident population.
- Per thousand people, more men are injured than women. This difference between the sexes increases with deprivation and injury severity. Men have over double the rate of fatal or serious injuries per thousand residents than women **living in** the most deprived 30 per cent of London.
- Per thousand people, young adults aged between 16 and 30 are more frequently killed or seriously injured, and slightly injured, than any other age group. The 31-59 age group have the next highest casualty rate.
- People riding a motorcycle, cycling, or walking are at greatest risk of injury per journey in London and make up 80 per cent of all those killed or seriously injured.

Combining deprivation, sex, age and mode of travel highlights which populations are most frequently killed or seriously injured on London's roads, referred to here as 'higher risk communities'. The communities with the greatest number of deaths or serious injuries per 1,000 people are:

1. Young men (aged 16-30) living in the most deprived 30 per cent of London, riding motorcycles (0.54 killed or seriously injured per 1,000 people)
2. Young men (aged 16-30) living in the middle deprivation 40 per cent of London, riding motorcycles (0.39 killed or seriously injured per 1,000 people)
3. Older men (age 70+) living in the most deprived 30 per cent of London, walking (0.34 killed or seriously injured per 1,000 people)
4. Secondary school age boys (12-15), living in the most deprived 30 per cent of London, walking (0.34 killed or seriously injured per 1,000 people)
5. Older men (age 70+) living in the middle deprivation 40 per cent of London, walking (0.29 killed or seriously injured per 1,000 people)

Overall, sex, followed by deprivation level, is the greatest predictor for the number of people injured per 1,000 after controlling for mode of travel.

2 Methodology

2.1 Approach

This report examines the rate of casualties on London's roads with reference to the deprivation of the collision location (where injuries happen, covered in Section A below) and the demographic characteristics of the person involved (who is injured, Section B below).

This report looks at the number of casualties, or the number of deaths and serious injuries, per kilometre or per 1,000 people of the same characteristic (age, sex, deprivation) at Lower Super Output Areas (LSOA) level. This gives us a measure of frequency, but not of exposure to traffic and the sources of harm (for example whether 16-30 year-olds travel more often than 60-69 year-olds in the same LSOA) because we do not hold the data at this geographical granularity.

Therefore, the casualty location rate (or killed or seriously injured location rate) in Section A has been calculated by standardising the casualties per metre of road in each deprivation group to give a rate per kilometre. In Section B, the casualty rate (and killed or seriously injured rate) is standardised by the population size of the casualty's home postcode deprivation ranking, sex, and age to give a casualty rate per 1,000 people.

The focus of this analysis is on the years 2017-19. The pandemic caused large changes in travel patterns and the impacts of this are still settling, therefore we have used the baseline years 2017-19 to provide an average rate of injury and highlighted notable differences in 2020 and 2021 by exception.

The majority of people killed, seriously injured or slightly injured on London's roads are walking, cycling, motorcycling, travelling by car or by bus at the time of the collision. The number of people injured while travelling by taxi, private hire, goods vehicle or other modes is comparatively low and so discussion of these modes has been excluded for brevity. More information and analysis of injury by mode of travel can be found in the TfL road danger reduction dashboard[7] or the Vision Zero Action Plan Progress Report[8].

[7] https://tfl.gov.uk/corporate/publications-and-reports/road-safety
[8] https://content.tfl.gov.uk/vision-zero-action-plan-progress-report-2021.pdf

2.2 Data sources

STATS19

The STATS19 database records road traffic collisions reported to or by the police involving one or more vehicles resulting in a death or personal injury, and which occurred on public roads. Information is collected by the police at the roadside or when the collision is reported to them by a member of the public. Data recorded includes the home postcode, age and sex of the person injured or killed, severity of injury, and details about the collision including mode of travel. In many cases the injured person involved in a collision is unable to self-report their personal information, such as gender/sex, and ethnicity, whereby the attending police officer will record details based on their best judgement or information available to them at the scene. For this reason, many protected characteristics [9](gender reassignment, disability, sexual orientation) are unable to be collected within Stats19 data.

Although some ethnicity data is captured within the Stats19, a third of collision records were recorded as 'Not stated' for ethnic group. Using this dataset could lead to invalid findings and therefore it was decided to omit from this analysis.

Indices of Multiple Deprivation 2019

The Index of Multiple Deprivation (IMD)[10] is the official measure of relative deprivation for small areas in England called Lower Super Output Areas (LSOAs). LSOAs are a standard statistical geography designed to be of a similar population size, with an average of approximately 1,500 residents or 650 households, to enable comparison. There are 32,844 LSOAs in England and 4,835 in London.

The IMD combines data on income, employment, education, skills and training, health and disability, crime, barriers to housing and services, and living environment. This information produces a score of deprivation, and this score is ranked for all LSOAs nationally. The results of this ranking are a deprivation decile from 1-10 where 1 represents the most deprived 10 per cent of LSOAs in England, and 10 represents the least deprived 10 per cent of LSOAs[11].

IMD ranking of LSOAs in London has been used as a measure of the deprivation of collision locations and of the home postcode of people injured in collisions. This analysis focuses on comparing outcomes for the 30 per cent most (IMD decile 1,2,3) and 30 per cent least (IMD decile 8,9,10) deprived locations and populations to examine the impact of deprivation on road danger. These are referred to as the most and least deprived communities. The middle (IMD 4,5,6,7) deprivation deciles are also discussed where relevant.

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9 https://www.gov.uk/discrimination-your-rights

10 https://www.gov.uk/government/statistics/english-indices-of-deprivation-2019

11 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/835115/IoD2019_Statistical_Release.pdf

Office for National Statistics (ONS) census 2011 estimated mid-2014 population

Office for National Statistics (ONS) census 2011 estimated Mid-2014[12] population data[13] was used to obtain population numbers for all LSOAs in London, broken down by age and sex of residents.

2.3 Definition of terms used in this report

- **Age (years)** – grouped in this report as 0-4, 5-11, 12-15, 16-30, 31-59, 60-69 and 70+ to allow targeted behaviour change interventions
- **Baseline** – 2017-19 are taken in this report as the 'baseline' years for analysis and comparison
- **Casualties** – people killed, seriously injured or slightly injured in road collisions according to Government definitions[14]
- **Casualty rate** – the number of people killed, seriously or slightly injured in a collision per 1,000 people of the same sex, age and deprivation
- **Casualty location rate** – the number of casualties from road collisions per kilometre
- **Collision location** – where a collision resulting in a casualty occurred
- **Deprivation** – a measure of relative deprivation according to the Index of Multiple Deprivation (IMD) of either the collision location, or of the home postcode of the person injured in the collision
- **Disability** – The Equality Act 2010 states that a person has a disability if they have a physical or mental impairment which has a 'substantial' and 'long term' adverse effect on their ability to carry out normal day to day activities. .
- **Gender** – The wider social roles and relationships that structure men's and women's lives. These change over time and vary between cultures[15]
- **Killed or seriously injured (KSI)** – a casualty killed or seriously injured in a road collision
- **Killed or seriously injured location rate** – the number of people killed or seriously injured in road collisions per kilometre
- **Killed or seriously injured rate** – the number of people killed or seriously injured per 1,000 people of the same sex, age etc

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[12] At time of writing 2021 census data was not available

[13] https://www.ons.gov.uk/peoplepopulationandcommunity/populationandmigration/populationestimates/datasets/populationestimatesforukenglandandwalesscotlandandnorthernireland

[14] https://www.gov.uk/government/publications/stats19-forms-and-guidance

[15] https://www.equalityhumanrights.com/en/publication-download/technical-guidance-public-sector-equality-duty-england

- **Sex -** Someone being a man or a woman. It is one of the nine protected characteristics under the Equality Act 2010[16]

3 Results: Section A – Casualties by collision location

3.1 Introduction

This section discusses collisions resulting in injury on London's roads between 2017 and 2021, focussing on the baseline years 2017-19, by looking at where the collision occurred. Each collision location has been mapped to a corresponding LSOA in London, providing the IMD of the area. Between 2017 and 2021, 143,866 casualties were recorded with an identifiable collision location, with 316 casualties excluded due to unidentifiable locations. The focus of this analysis will be on the baseline years 2017-2019, where 92,951 casualties were recorded with an identifiable location in London.

To understand the relationship between area deprivation and casualties, the average number of casualties per year per IMD is standardised by dividing by the total road length in the relevant IMD rank. This gives the collision location rate per kilometre in each deprivation decile.

A collision location rate of two for car occupants in the 30 per cent most deprived areas therefore represents an average of two car occupant casualties per kilometre of road in the bottom three IMD deciles in an average year. The calculation of the rate is shown in Figure 1 below. The killed or seriously injured location rate uses the same calculation, but only includes fatalities and serious injuries.

$$\text{Casualty location rate} = \frac{\text{Number of casualties}}{\text{Road length (m)}} \times 1000 \text{ metres of road}$$

Figure 1- Calculation to obtain casualty location rate

Note that this methodology is standardising the casualty numbers by the length of road in the relevant area of deprivation, not by how many people are travelling by a particular mode in that area. This is because journey data is not available at the same level of granularity as deprivation, impeding our ability to fully understand risk.

[16] https://www.equalityhumanrights.com/en/publication-download/technical-guidance-public-sector-equality-duty-england

3.2 Deprivation

Relationship between deprivation and collision location

In general for all casualty severities, the more deprived the area, the higher the frequency with which people are slightly injured, seriously injured or killed. The 30 per cent most deprived postcodes have more than double the number of casualties per kilometre of the least deprived 30 per cent (2.09 and 0.92 casualties per km respectively for baseline 2017-19). This translates to an average of 12,018 casualties a year across the most deprived areas of London, compared to an average of 4,618 casualties a year in the least deprived areas of London.

Figure 2 shows a clear linear relationship between deprivation and casualties per kilometre. The more deprived the location, the more casualties that occur per kilometre. This relationship is the same for all casualties, as shown in Figure 2, and for killed or seriously injured as shown in Figure 3.

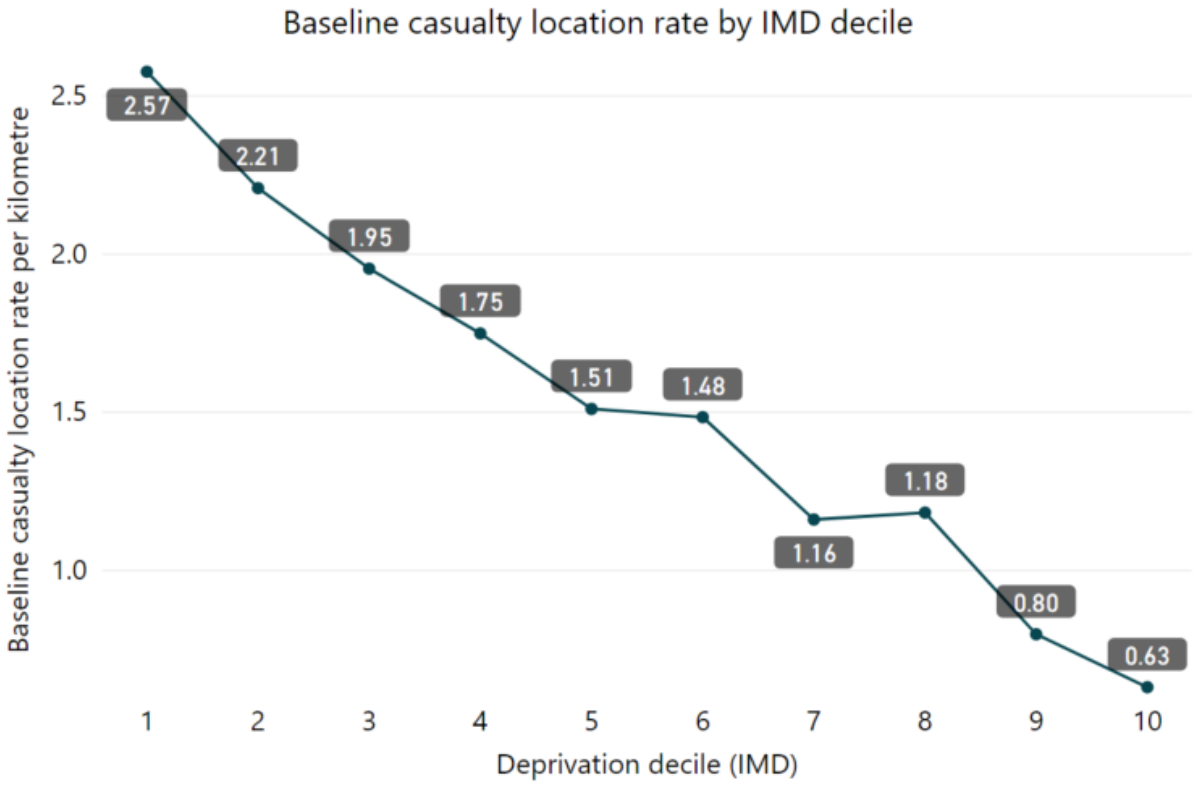

Figure 2 – Baseline average casualty location rate (2017-19 average) per kilometre of road by IMD decile

Twice as many people were killed or seriously injured per kilometre in the most deprived 30 per cent of London compared to the least deprived (0.26 and 0.12 casualties per kilometre respectively for 2017-19). This translates to an average of 1,489 deaths or serious injuries per year in the most deprived areas of London, compared to an average of 614 in the least deprived areas.

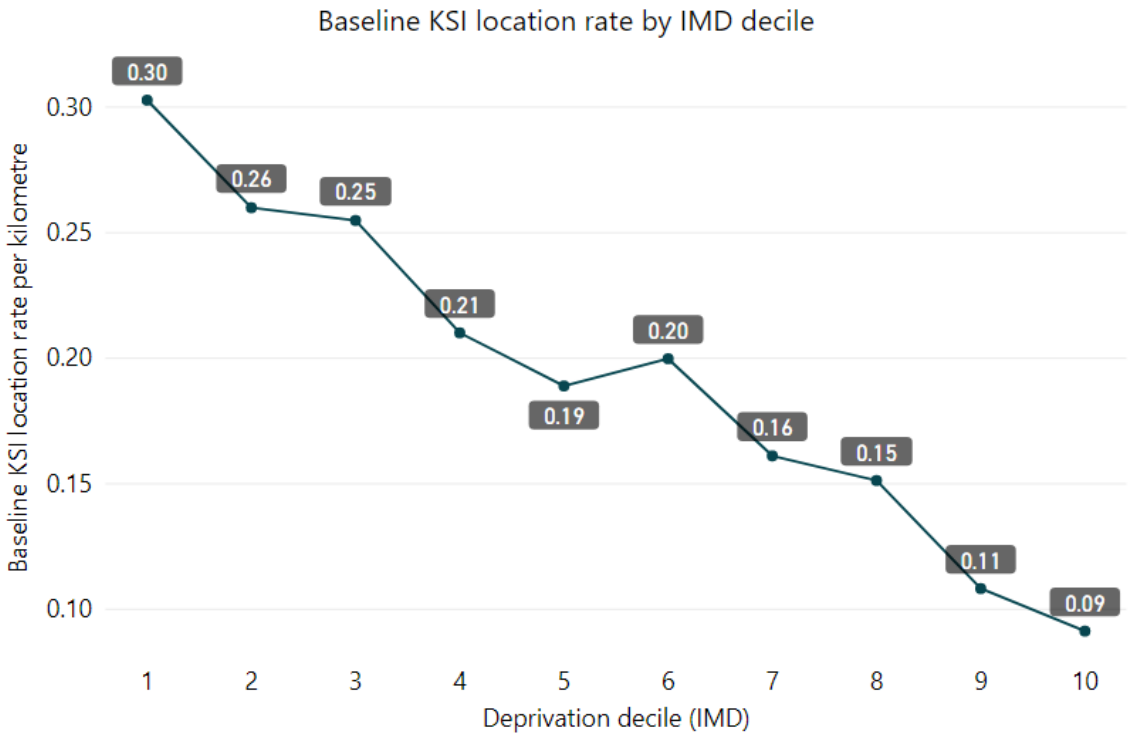

Figure 3 – Baseline average killed or seriously injured location rate (2017-19 average) per kilometre of road by IMD decile

The Department for Transport has also recently published statistics showing a similar relationship between deprivation and higher incidence of casualty and killed or seriously injured across England[17].

The casualty location rate and killed or seriously injured location rate for each borough in London is displayed in Figure 4 and Figure 5. In both maps, in general the rate is higher for inner London boroughs than outer London.

[17] https://www.gov.uk/government/statistics/reported-road-casualties-great-britain-casualties-and-deprivation-factsheet-england/reported-road-casualties-great-britain-casualties-and-deprivation

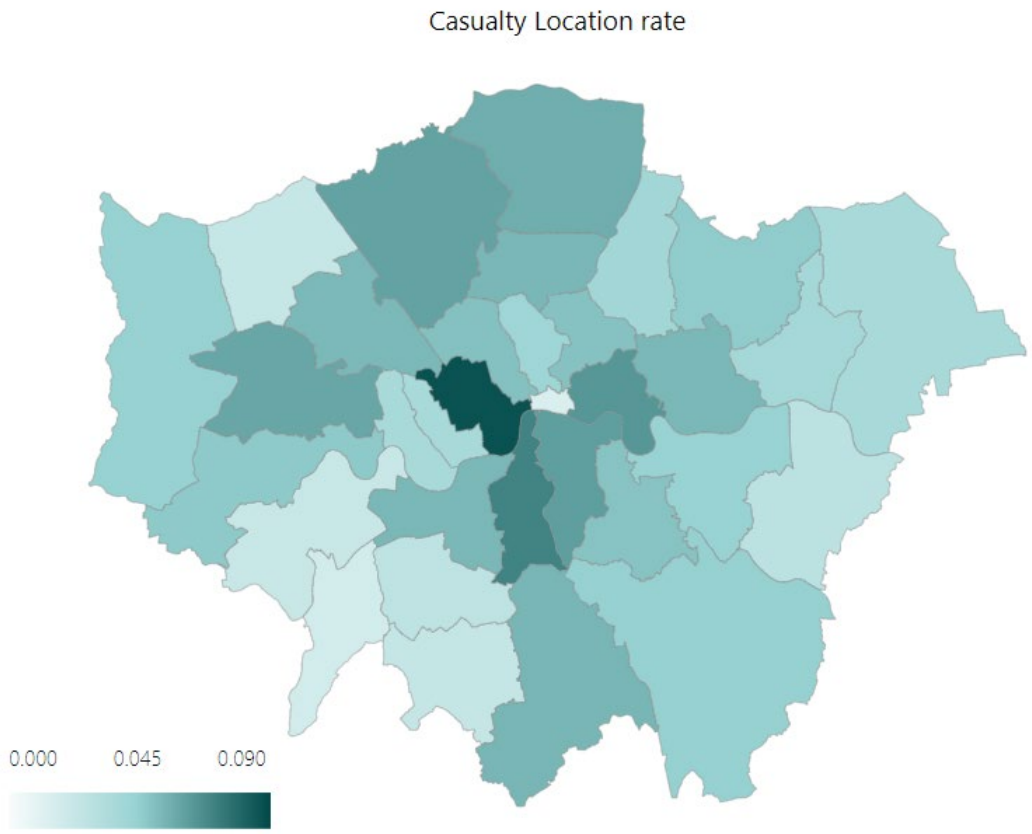

Figure 4 - Baseline casualty location rate (2017-19 average) by London Borough

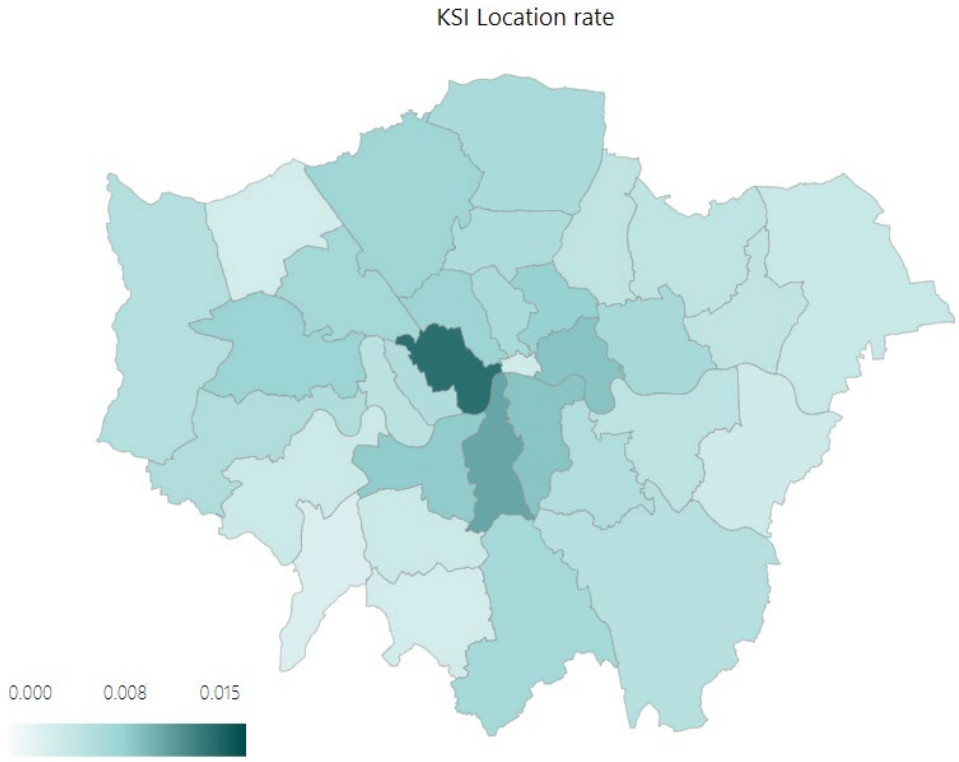

Figure 5 - Baseline killed or seriously injured location rate (2017-19 average) by London Borough

Trend over time

For all casualties in all deprivation locations, the casualty location rate has been falling over time (with the exception of the change between 2020 and 2021 where the pandemic recovery led to a higher casualty location rate). In 2017 the casualty location rate over all locations was 1.59 per kilometre, this fell to 1.47 in 2019. In 2021 pandemic travel patterns meant that London saw significantly fewer road casualties, including the lowest number of fatalities on record. Casualties per kilometre fell in 2021 compared to the 2017-19 baseline in all IMD deciles, but with the greatest decrease in casualty location rate on the most deprived roads as shown in Figure 6.

For people killed or seriously injured in London, the location rate remained similar from 2017-19, with a decrease in the most deprived locations in 2021 as shown in Figure 7.

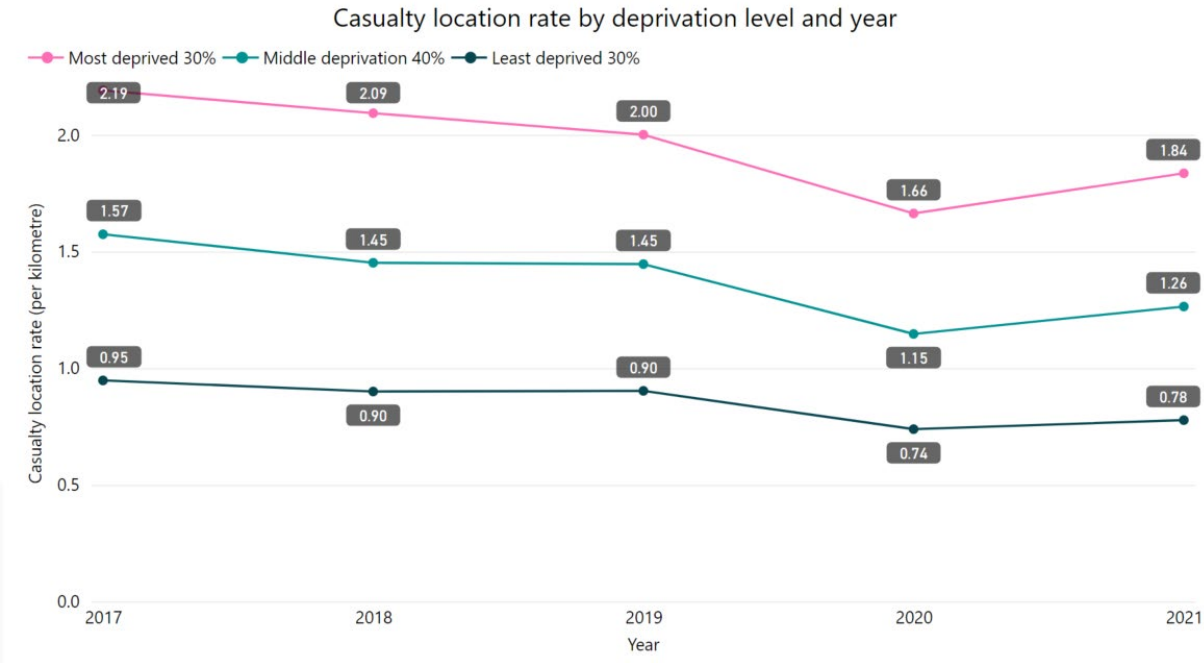

Figure 6 – Casualty location rate by year from 2017 - 2021 by deprivation level

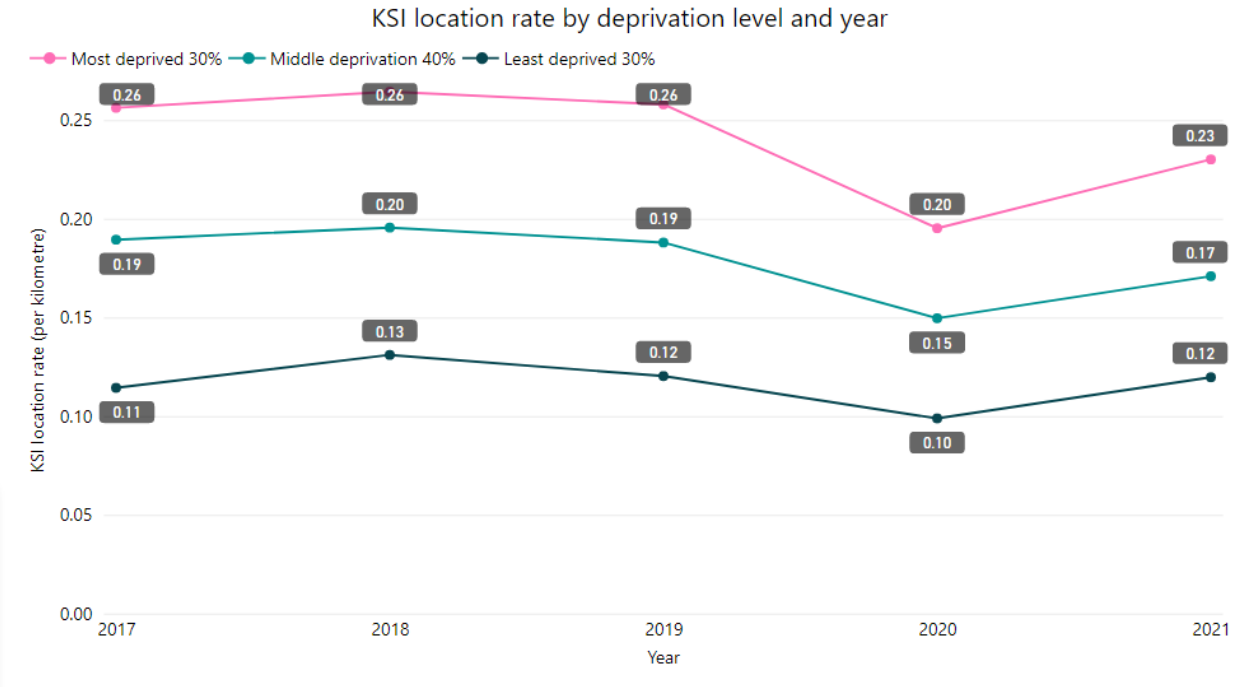

Figure 7 – Killed or seriously injured location rate by year from 2017 – 2021 by deprivation level

Relationship between deprivation, collision location, and mode of travel

Figure 8 below shows the average casualties per kilometre of road by level of deprivation, for users of each mode. Across all modes, the casualty location rate is higher on roads in the most deprived areas, and lower for those in the least deprived areas.

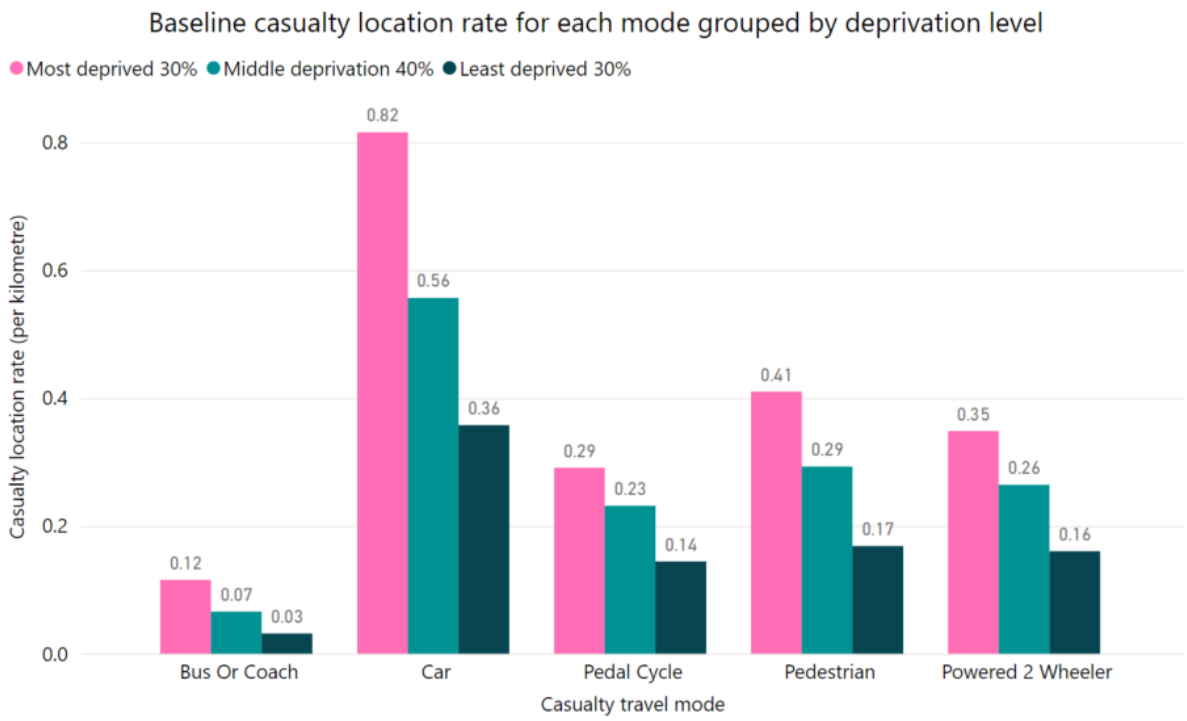

Figure 8 - Baseline average casualty location rate (2017-19) per kilometre of road by mode and deprivation level

The mode with the highest casualty location rate across all deprivation levels is found in car occupants, as people in cars make up the greatest proportion of slight injuries in London. The largest absolute disparity between deprivation casualty location rate is also for car occupants, where the most deprived 30 per cent areas have a rate of 0.82 casualties per kilometre of road, compared to 0.36 casualties per kilometre for the least deprived 30 per cent areas.

The highest percentage increase in rate of injury from the least deprived to the most deprived is found for bus and coach passengers, where more than triple the number of people are injured travelling on roads in the most deprived areas than on those in the least, though numbers remain comparatively low overall. From 2017 – 2019 this translates to an average of 663 total casualties in the most deprived areas, compared to 160 in the least deprived. This may be due to the number of bus kilometres or passenger journeys which take place on the most deprived roads versus the least deprived.

The rates for fatalities and serious injuries display a similar pattern. Figure 9 shows the baseline killed or seriously injured location rate by mode and level of deprivation.

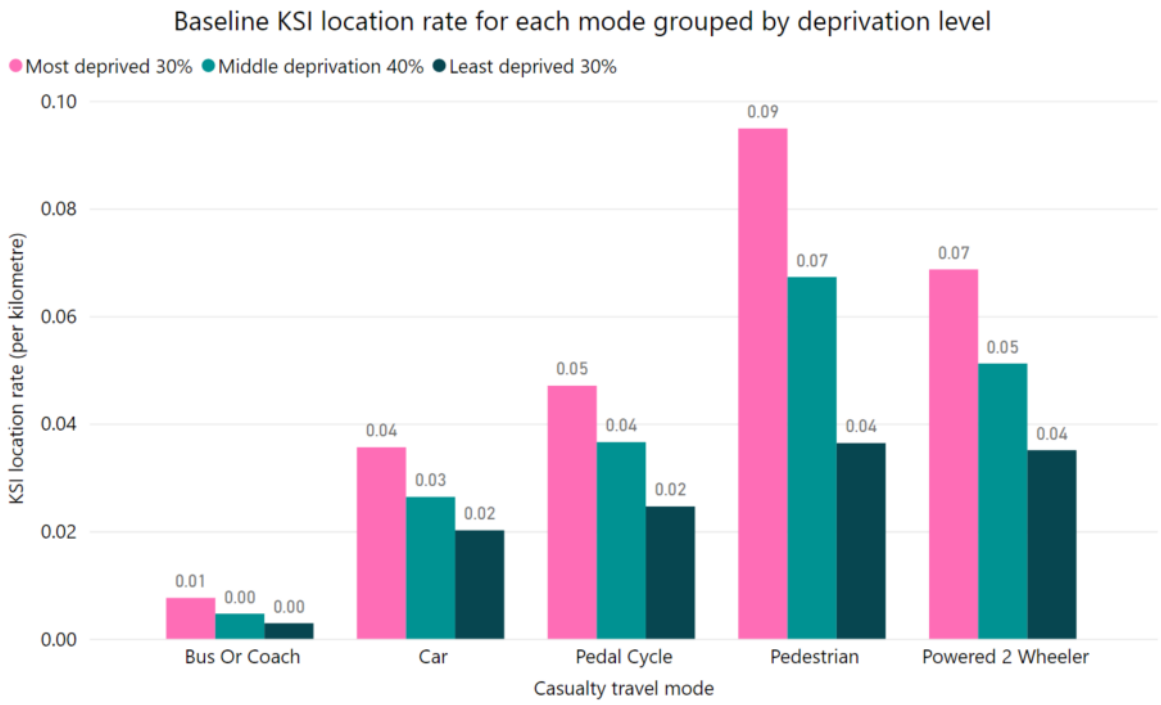

Figure 9 - Baseline average killed or seriously injured location rate (2017-19 per kilometre of road by mode and deprivation level. (Note that the numbers are rounded to two decimal places for brevity, where the numbers are the same for a particular mode, the differences in the sizes of the bars reflect difference in magnitude beyond two decimal places).

For serious injuries and fatalities, people walking in the most deprived locations are subject to the highest number of fatal and serious injuries per kilometre of road. The absolute disparity between people killed or seriously injured while walking in the most and least deprived areas is also the highest, with 0.09 deaths or serious injuries per kilometre of people walking on the most deprived roads compared to 0.04 deaths or serious injuries per kilometre on the least deprived roads.

4 Results: Section B – Casualties by population characteristic

4.1 Introduction

This section examines the injuries to London residents on London's roads. Road casualty data has been combined with demographic information about London's population to produce a casualty rate per 1,000 people of a particular age, sex, or home postcode deprivation ranking. Cases where the casualty lived outside of London, or there was not a usable postcode provided, have been excluded from this analysis. Once those casualties have been excluded from the data, 119,050 casualties remain in the data from 2017-2021, comprising 83 per cent of the total casualty dataset. The method for calculating the rate is shown in Figure 10 below.

$$\text{Casualty rate} = \frac{\text{Number of casualties}}{\text{Number of relevant population}} \times 1000 \text{ people}$$

Figure 10 - Calculation to obtain casualty rate

The average number of casualties per year is divided by the size of the demographic population that that person belongs to. For example, a casualty rate of two for male car occupants represents two car occupant casualties per 1,000 men per year. This method standardises the casualty numbers by the size of the relevant deprivation, age group and sex populations. Note that this methodology standardises casualties by population levels, not how many people are travelling by a particular mode. This is because the relevant ridership levels are not known at the LSOA granularity of sex, age or deprivation. In this analysis therefore, it is difficult to conclude why casualty rates are higher for different populations. In some cases, casualty rates may be higher simply because there are many more trips made by people from that population by that mode.

4.2 Deprivation

Relationship between deprivation and casualty home postcode

In general, for all casualty severities, the more deprived the area someone lives in, the higher the risk they will be slightly injured, seriously injured or killed in a traffic collision in London. People living in the 30 per cent most deprived home postcodes have nearly double the rate of injury of people living in the least deprived 30 per cent (3.7 and 1.9 casualties per 1,000 people respectively for the 2017-19 baseline).

Figure 11 shows a direct linear relationship between the deprivation of where someone lives and the number of casualties per 1,000 people living in areas in London with the same IMD ranking. The more deprived the area where people live, the more casualties there are per 1,000 people. This relationship is the same for all casualties and for serious injuries and fatalities as shown in Figure 12.

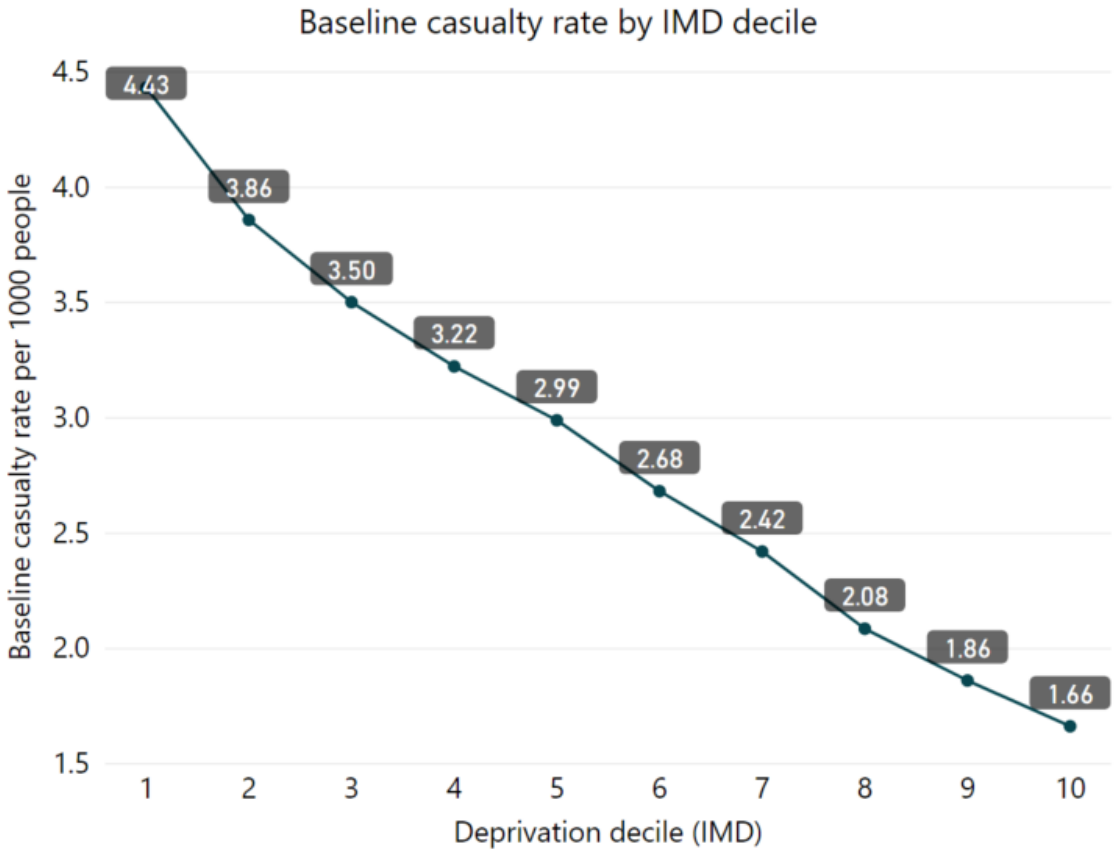

Figure 11 - Baseline average casualty rate (2017-19) per 1,000 people by IMD decile

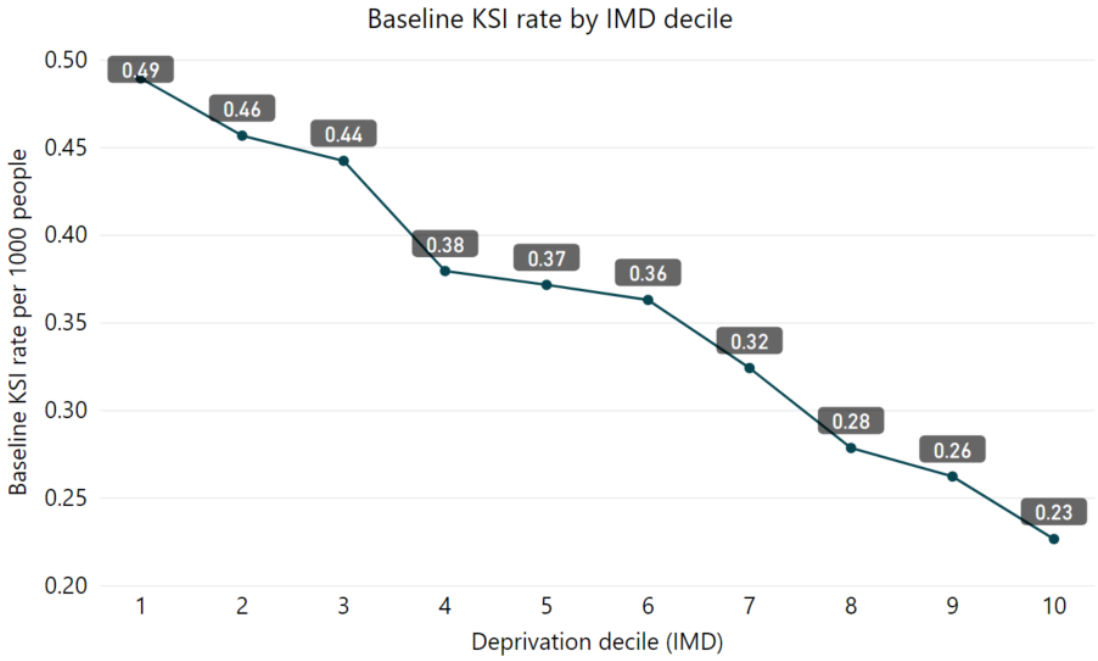

Figure 12 - Baseline average killed or seriously injured rate (2017 – 19) per 1,000 people by IMD decile

The casualty rate and killed or seriously injured rate for each borough in London is displayed in Figure 13 and Figure 14

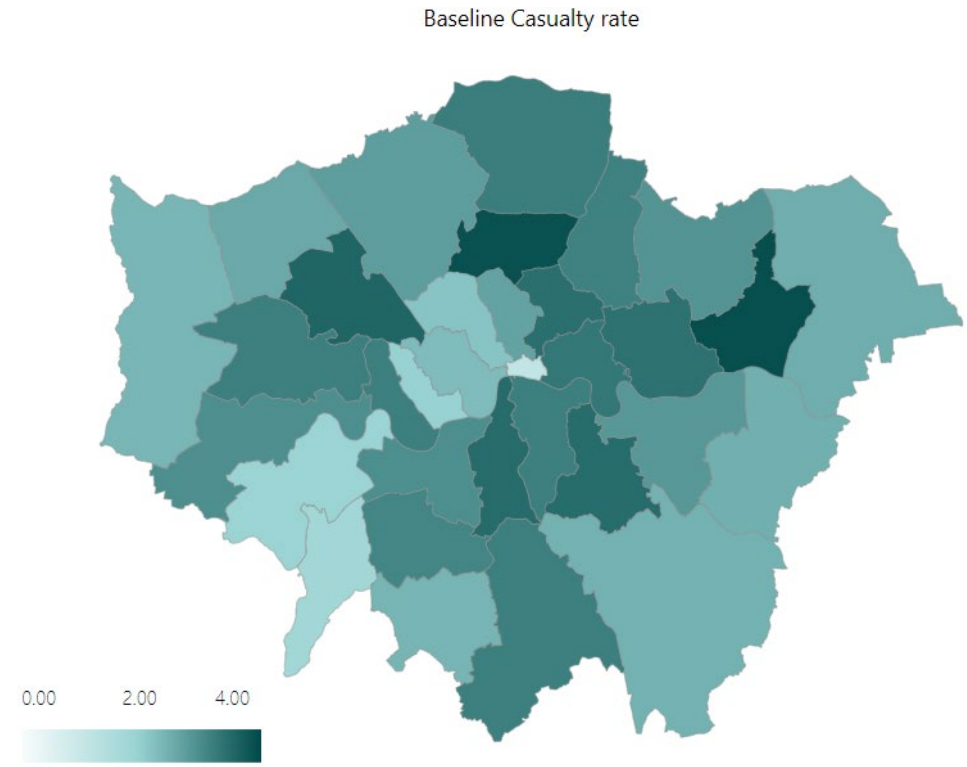

Figure 13 - Baseline casualty rate (2017-19 average) per 1,000 people by London Borough

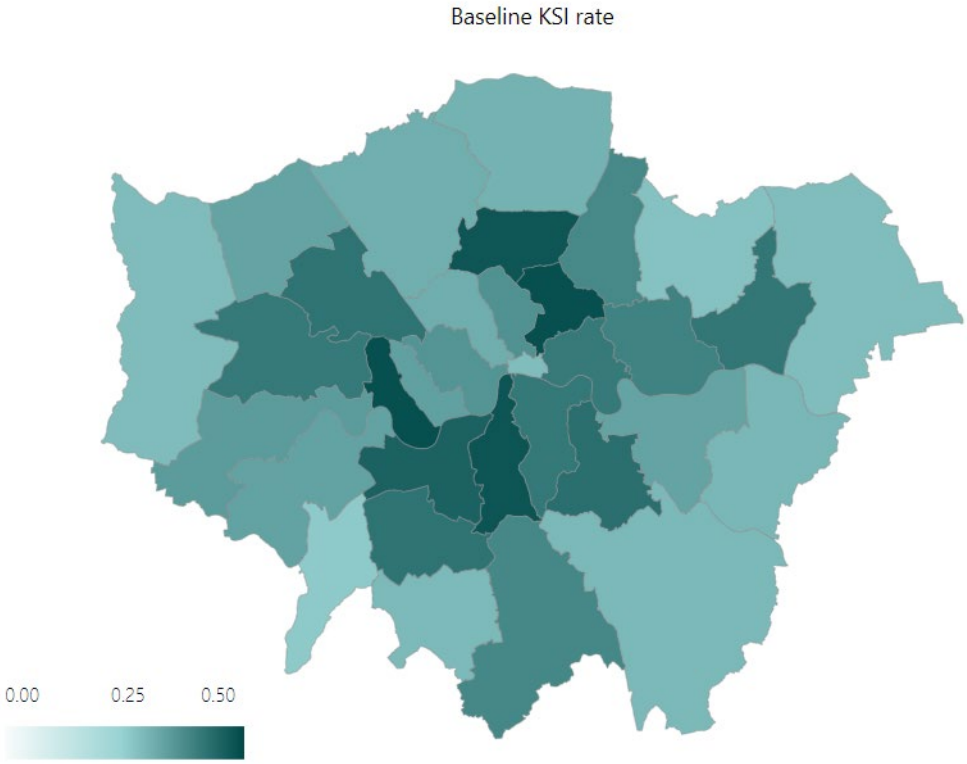

Figure 14 - Baseline killed or seriously injured rate (2017-19 average) per 1,000 people by London Borough

Trend over time

For casualties living in all deprivation deciles, the casualty rate has been falling over time (with an exception of the change between 2020 and 2021 where the pandemic recovery lead to a higher rate). In 2017 the casualty rate across all populations was 3.14, this fell to 2.83 in 2019, and to 2.65 in 2021. This trend is broken down by deprivation level in Figure 15.

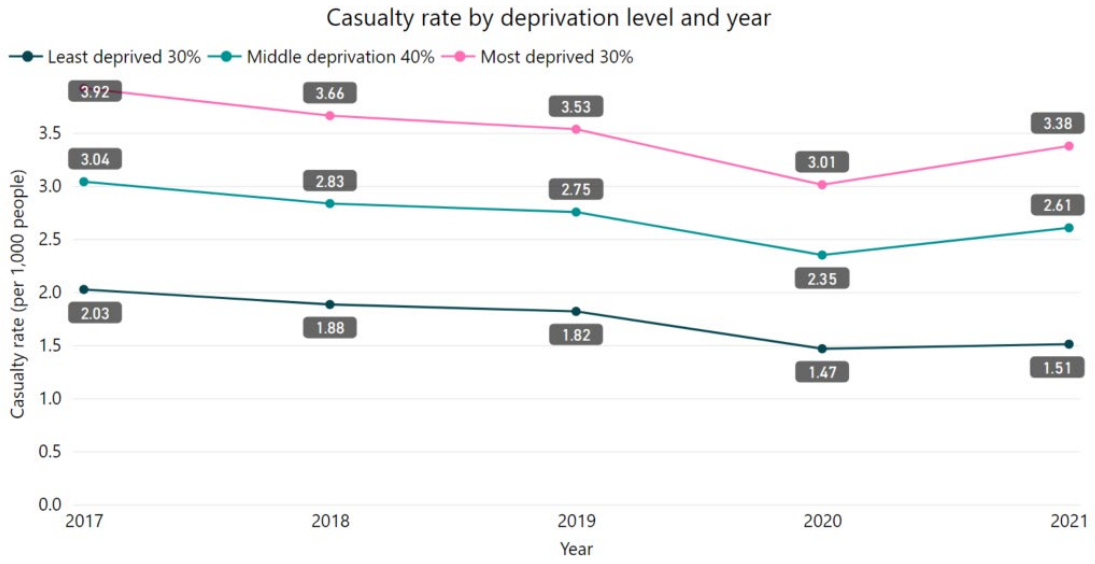

Figure 15 - Casualty rate by year from 2017 – 2021 by deprivation level

The trend over time for the killed or seriously injured rate per 1,000 people has remained at 0.36 for pan-London. When split by deprivation level, each group shows small fluctuations over time as shown in Figure 16.

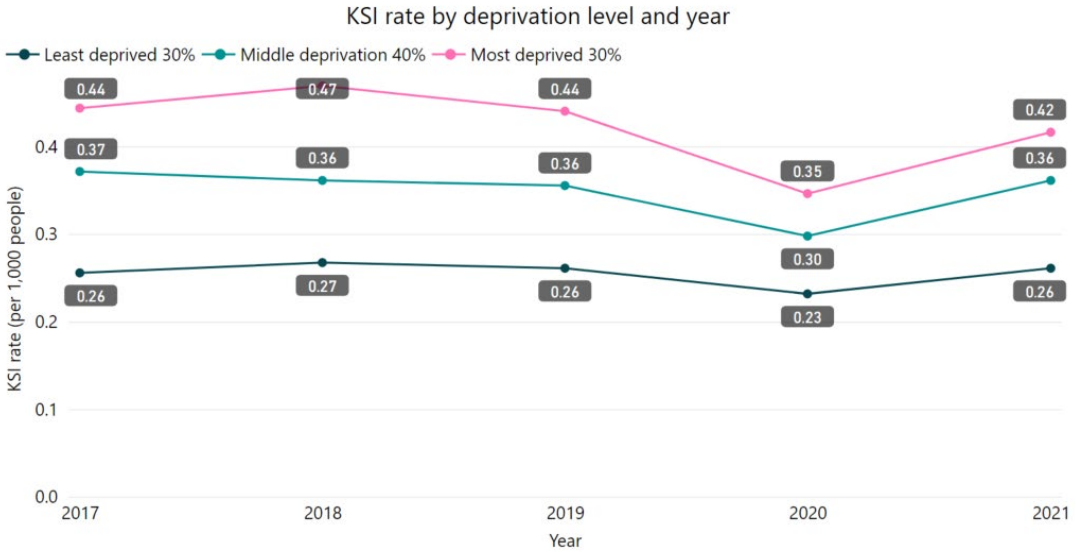

Figure 16 - Killed or seriously injured rate by year from 2017 - 2021 by deprivation level

Relationship between deprivation, casualty home postcode, and mode of travel

Figure 17 below shows the baseline casualty rate of residents of each deprivation level by mode. This chart shows that across all modes, people living in more deprived areas have a higher incidence of injury than people living in less deprived areas. Car occupants have the highest number of casualties per 1,000 people across all deprivation groups, as people in cars make up the greatest proportion of slight injuries in London. The largest absolute disparity between deprivation casualty rates is also by car, where the most deprived 30 per cent have a rate of 1.37 casualties per 1,000 people, compared to 0.74 casualties per 1,000 people for the least deprived 30 per cent.

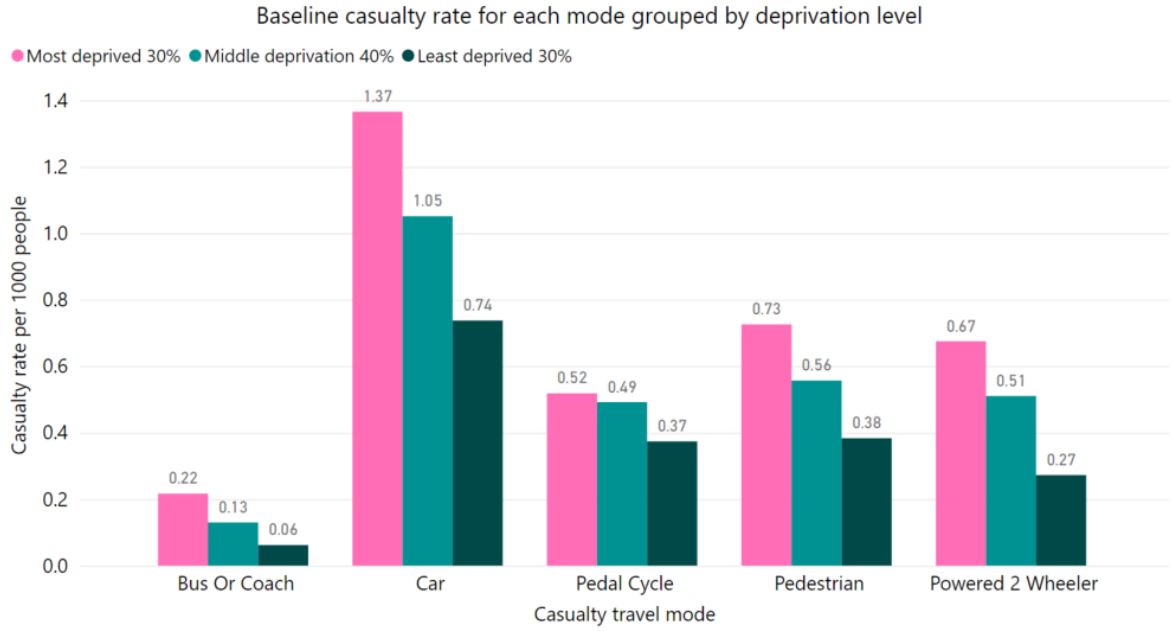

Figure 17 - Baseline average casualty rate (2017-19) by mode and deprivation level for all casualty severities

For serious injuries and fatalities however the highest casualty rate is found for pedestrians living in the most deprived areas as shown in Figure 18. The disparity between those pedestrians living in the most deprived and least deprived areas, is also the highest among modes, with 0.16 killed or serious injuries per 1,000 people living in the most deprived areas compared to 0.09 killed or serious injuries for people living in the least deprived areas.

The highest percentage increase in rate of injury from the least deprived to the most deprived is found for motorcycle riders, where the killed or seriously injured rate for people living in the most deprived is double that of people living in the least deprived areas as shown in Figure 18. When the absolute killed or seriously injured numbers are examined, this corresponds to an average of 366 a year amongst people riding motorcycles who were living in the most deprived areas, compared to 100 a year living in the least deprived.

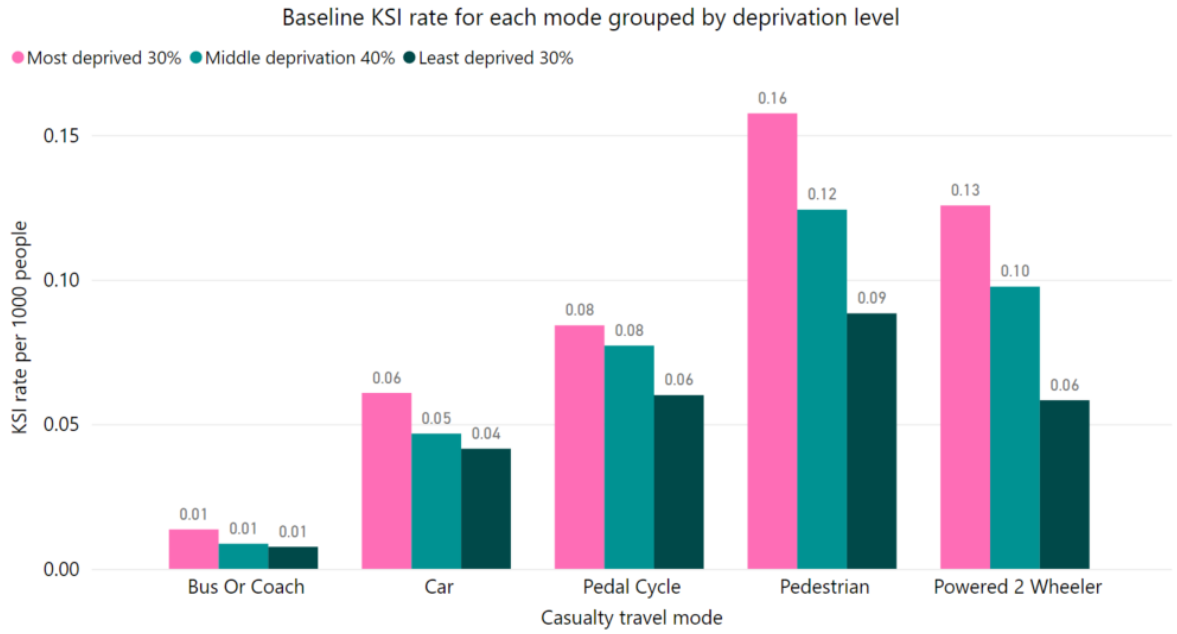

Figure 18 - Baseline average casualty rate (2017-19) by mode and deprivation level for killed and seriously injured casualties. (Note that the numbers are rounded to two decimal places for brevity, where the numbers are the same for a particular mode, the differences in the sizes of the bars reflect difference in magnitude beyond two decimal places).

4.3 Age group

To understand how the casualty rate varies by age, the report looks at age categories 0-4, 5-11, 12-15, 16-30, 31-59, 60-69 and 70+. These categories were chosen to try to group similar travel patterns, for example to early years settings, primary or secondary school, places of work, and retired age groups.

Relationship between age and deprivation

Figure 19 shows that the number of casualties per 1,000 people increases from early and primary school years (0-11) to peak at age 16-30, and then decreases in later life. For fatalities and serious injuries, this pattern of casualty rates is the same except for a higher peak in the 70+ age group as shown in Figure 20.

The 16-30 age group has the highest casualty rate, followed by the 31-59 age group. For all age groups, the casualty rate is higher amongst people living in the most deprived locations. From ages 0-69 the casualty rate is doubled for people who live in the most deprived areas, compared to the least deprived.

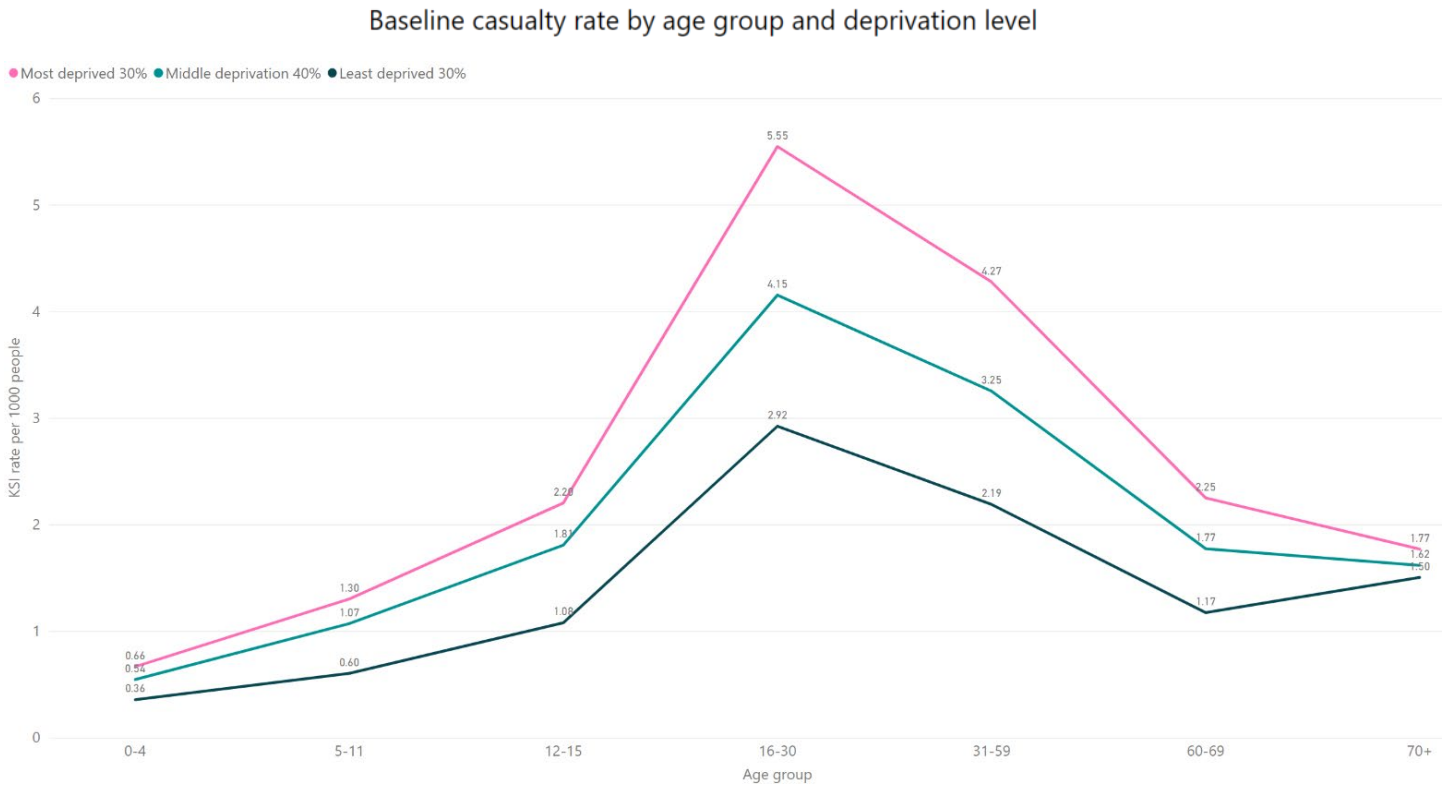

Figure 19 - Baseline average casualty rate (2017-19) for all casualties, by age and deprivation level

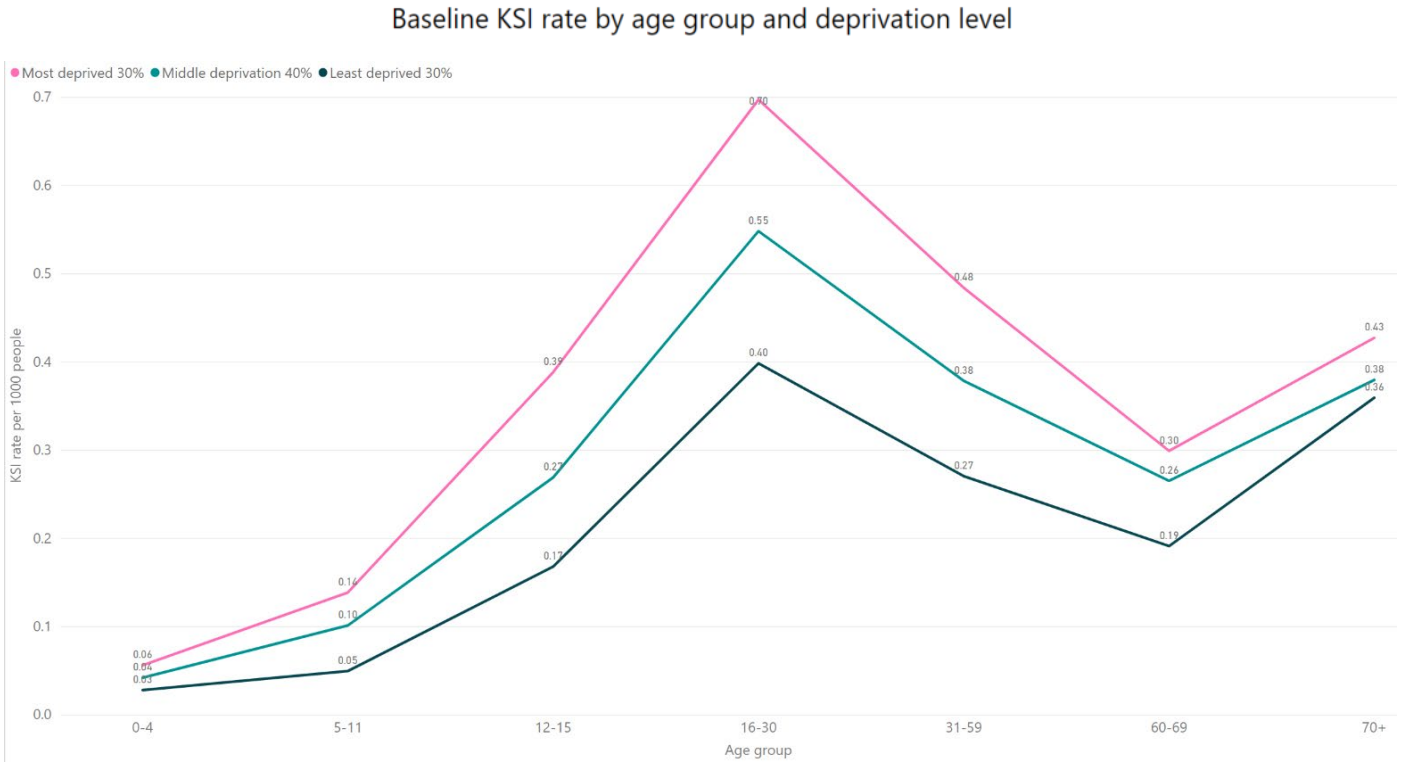

Figure 20 - Baseline average killed or seriously injured rate (2017-19) for killed and seriously injured casualties, by age and deprivation level

Relationship between age, deprivation and mode of travel

Table 1 in the appendix details the full table of casualty rates for all ages, deprivation and modes of travel. A summary of the casualty rates across the modes with the highest casualty rates is shown in Figure 21. The highest casualty rate mode of travel differs across the age groups, but for 0-4, 16-30, 31-59 and 60-69 the highest casualty rate is found in people travelling by car.

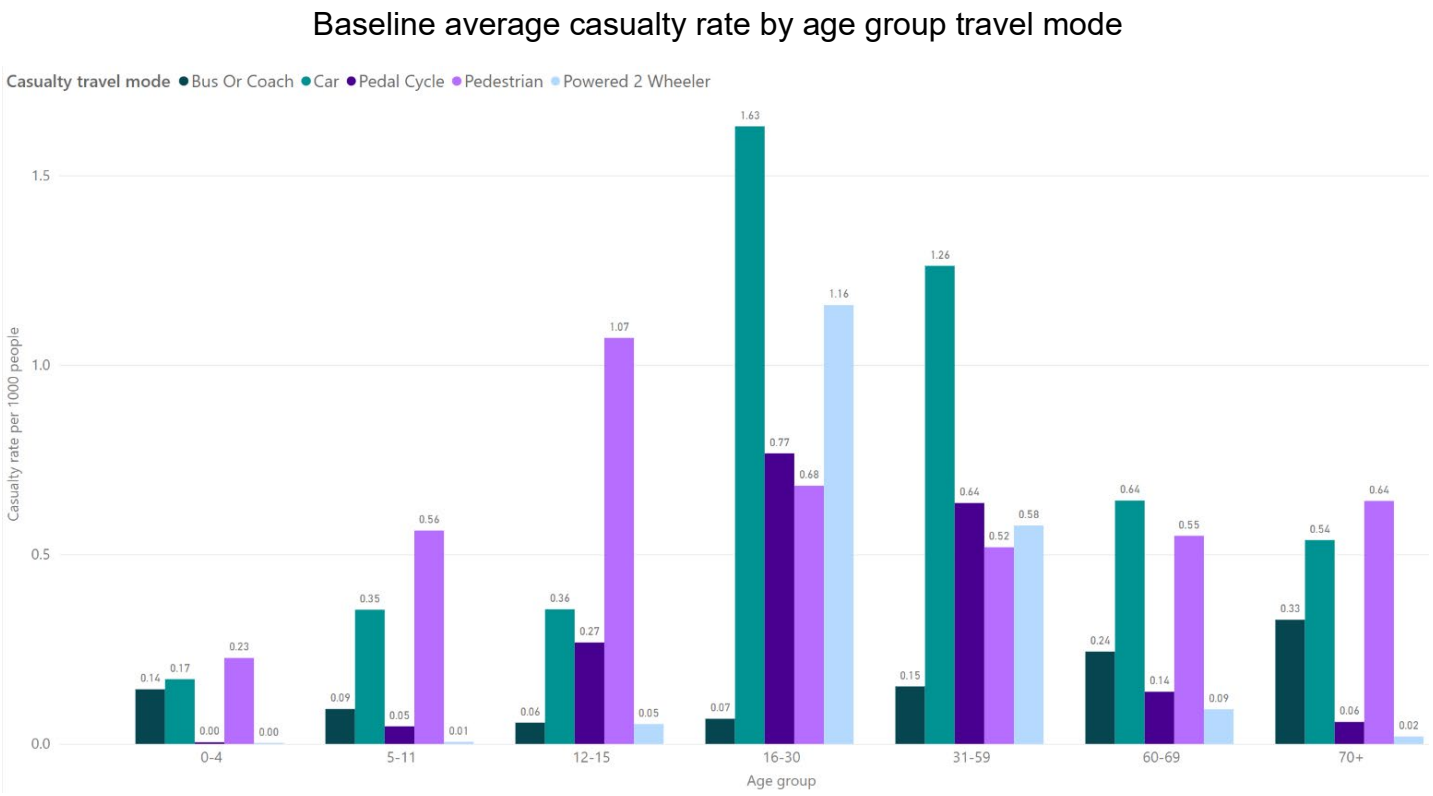

Figure 21 - Baseline average casualty rate (2017-19) per 1,000 people by age and casualty mode of travel

For children aged 0-15, the highest rate of injury is when walking. For pedestrians, the casualty rate increases with age from 0-4, 5-11, reaching a first peak at 12-15 for both the most and least deprived groups. The casualty rate for all of these age groups is higher in the most deprived communities. In the most deprived communities, the casualty rate for 5-11 and 12–15 year old children walking is more than double that of the least deprived communities.

For people travelling by bus, the casualty rate is highest for people aged 60 and over. Across all age groups, people living in the most deprived communities have a higher casualty rate than the least deprived when travelling on a bus.

Within cycling, ages 16-30 and 31-59 are most frequently injured per 1,000 people whilst on a bike. This mode shows a small disparity in rate between the least and most deprived communities, although it is still present.

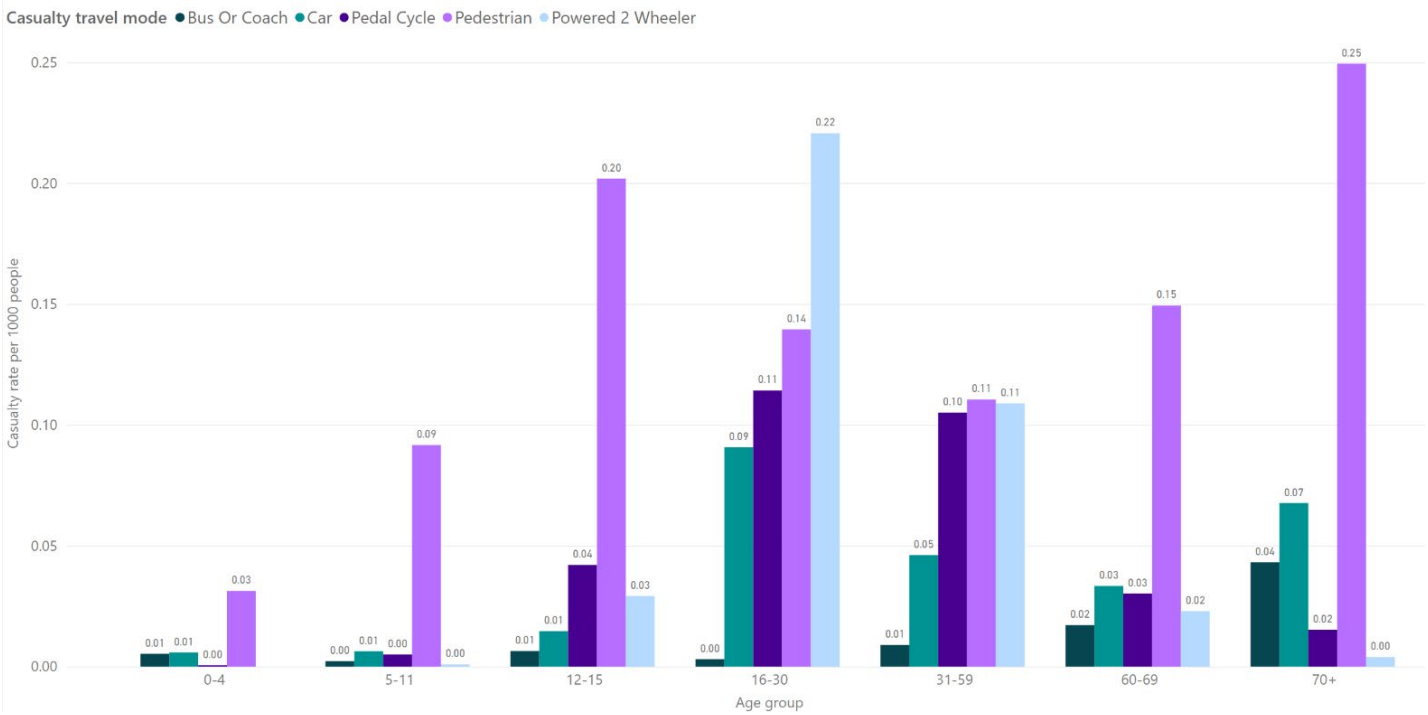

Figure 22- Baseline average (2017-19) Killed or Seriously injured rate per 1,000 people by age and casualty mode of travel

Fatalities and serious injuries show similar trends to the total casualties. The killed or seriously injured casualty rate is again highest amongst 16-30 year-olds living in the most deprived areas. Killed or seriously injured rates by age group, deprivation level and mode are displayed in

Table 2 in the appendix, and modal results are summarised in Figure 22 above.

When killed or seriously injured rates are examined by mode, the highest rate of death or serious injury per 1,000 people is for people walking aged over 70, closely followed by motorcycle riders aged 16-30, followed by children walking aged 12-15. Killed or seriously injured rates for car occupants are significantly lower than for all casualties, as they are less at risk of death or serious injury than less protected road users.

Similarly, as with all casualties, the pedestrian killed or seriously injured rate increases through the child age groups, reaching a first peak at age 12-15, then drops through middle age before picking up to the highest casualty rate for the over 70 group.

Table 2, found in the appendix, displays these results by deprivation level, and reveals that in the majority of age groups and modes, people living in the most deprived areas have higher killed or seriously injured rates. This difference is most stark for pedestrians and motorcycle riders.

4.4 Sex

The Stats19 dataset collects data on the sex of the casualty. In many cases the injured person involved in a collision is unable to self-report their personal information, such as gender/sex, whereby the attending police officer will record details based on their best judgement or information available to them at the scene. This section of the report should be interpreted in light of this collection method.

Men have a higher casualty rate, at 3.78 deaths, serious injuries or slight injuries per 1,000 men, than women at 2.13 injuries per 1,000 women, as shown in Figure 23. Men also have a higher killed or seriously injured rate, also shown in Figure 23.

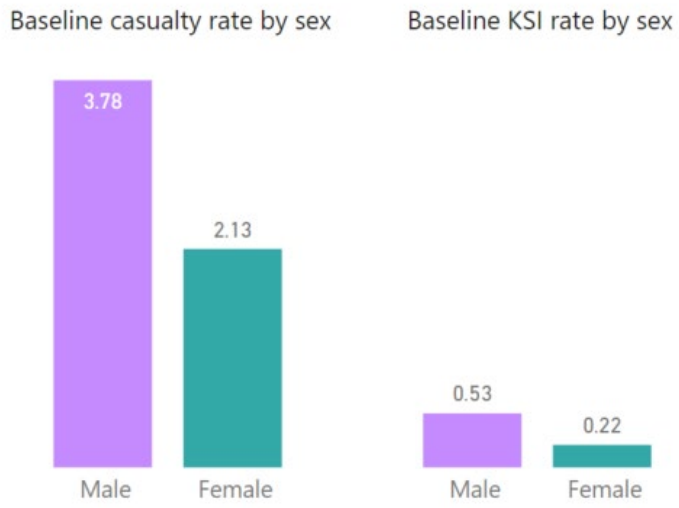

Figure 23 - Baseline average casualty rate (2017-19) ad baseline average killed or seriously injured rate (2017-19) split by sex

Relationship between sex and deprivation

For both sexes, the more deprived the area they live in, the higher the rate of injury, as shown in Figure 24. This chart shows that for both women and men, the more deprived the home postcode, the higher the casualty rate. This trend is more pronounced for men than it is for women, shown by the steeper slope of the line for male casualty rates.

For killed or seriously injured rates, shown in Figure 25, there is very little difference in the casualty rate for women living in different deprivation deciles, meaning that killed or seriously injured casualty rates for women do not vary as much depending on the deprivation of the home postcode. For male killed or seriously injured rates however, the most deprived groups have a higher killed or seriously injured casualty rate than the least deprived; men living in the most deprived 30 per cent of London have double the killed or seriously injured rate of men living in the least deprived 30 per cent (0.66 killed or seriously injured and 0.34 killed or seriously injured per 1,000 men living in the most and least deprived areas respectively).

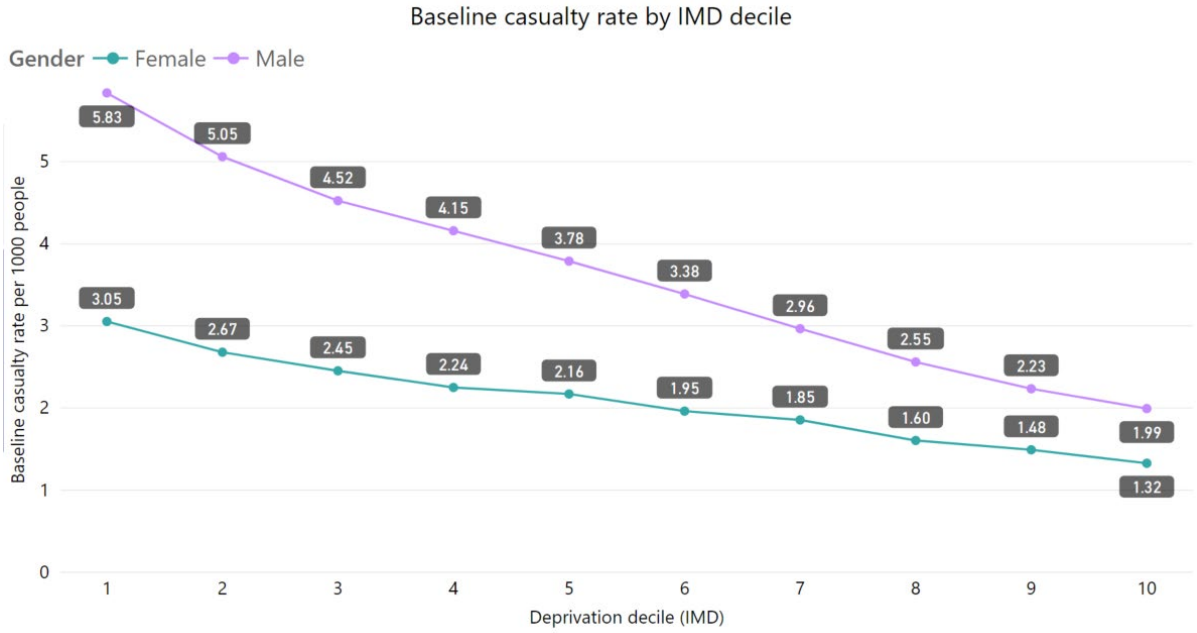

Figure 24 - Baseline average casualty rate (2017-19) by sex of casualty and deprivation decile

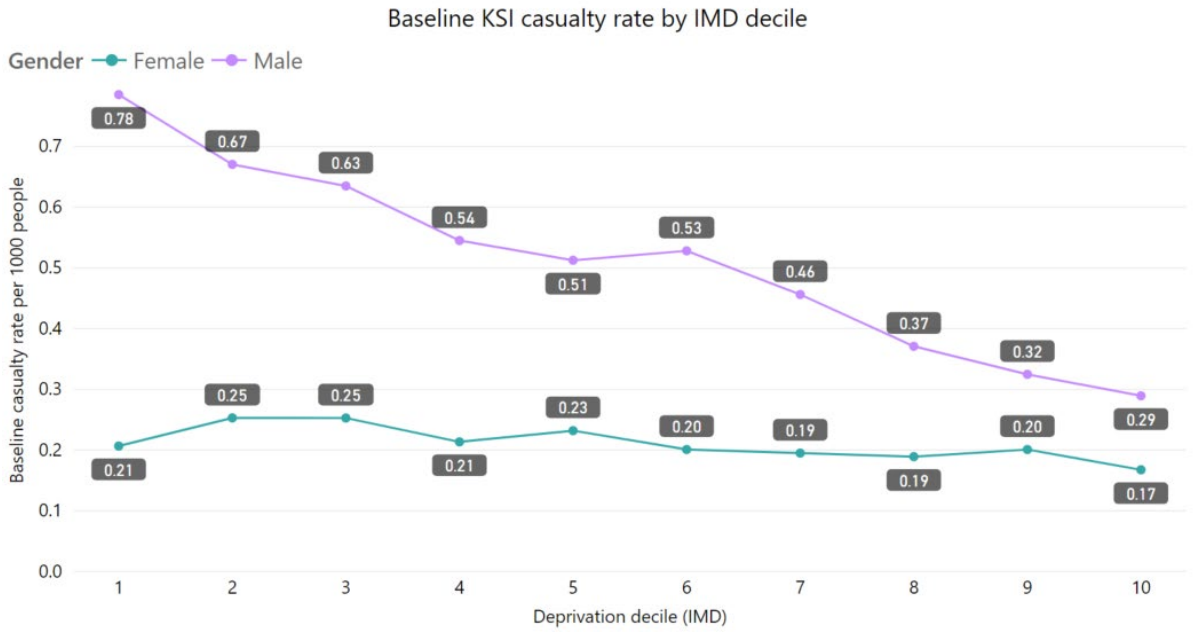

Figure 25 - Baseline average killed or seriously injured rate (2017-19) by sex of casualty and deprivation decile

Relationship between sex and mode of travel

Many more men than women are killed, seriously injured or slightly injured when travelling by motorcycle or by bicycle, as in Figure 26. This may be in part due to the different ridership levels of the sexes on these two modes. Casualty rates for

pedestrians and those travelling by car are more equal amongst the sexes. Women have a higher casualty rate when travelling by bus than males in a reversal of the trend for the other modes. The same pattern is seen for fatalities and serious injury rates.

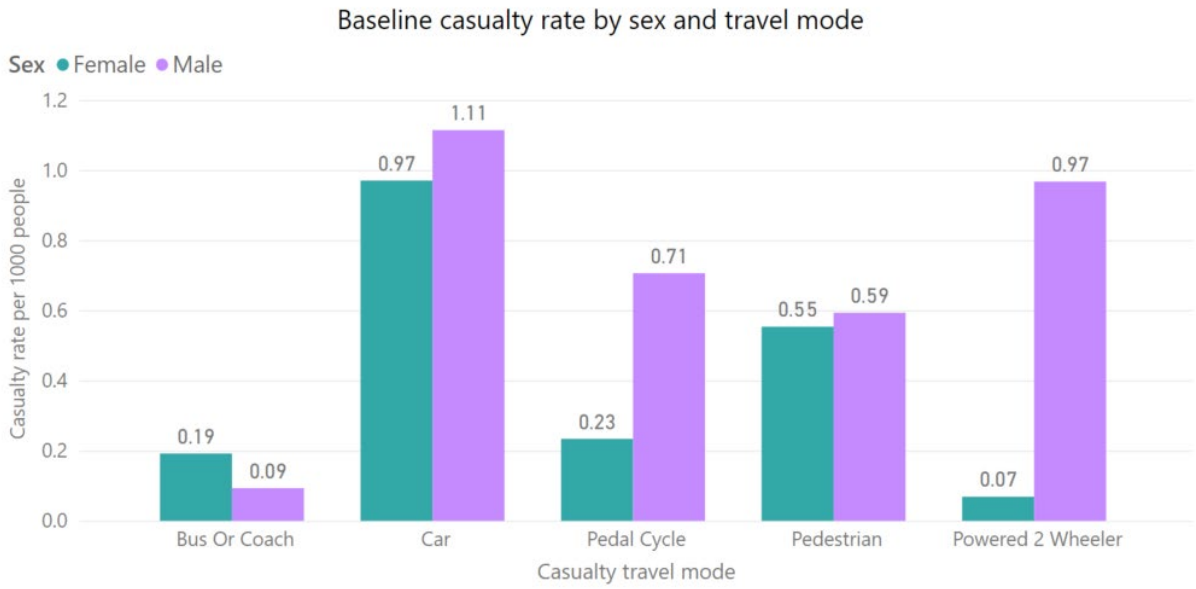

Figure 26 - Baseline average casualty rate (2017-19) per 1,000 people by sex and mode of travel

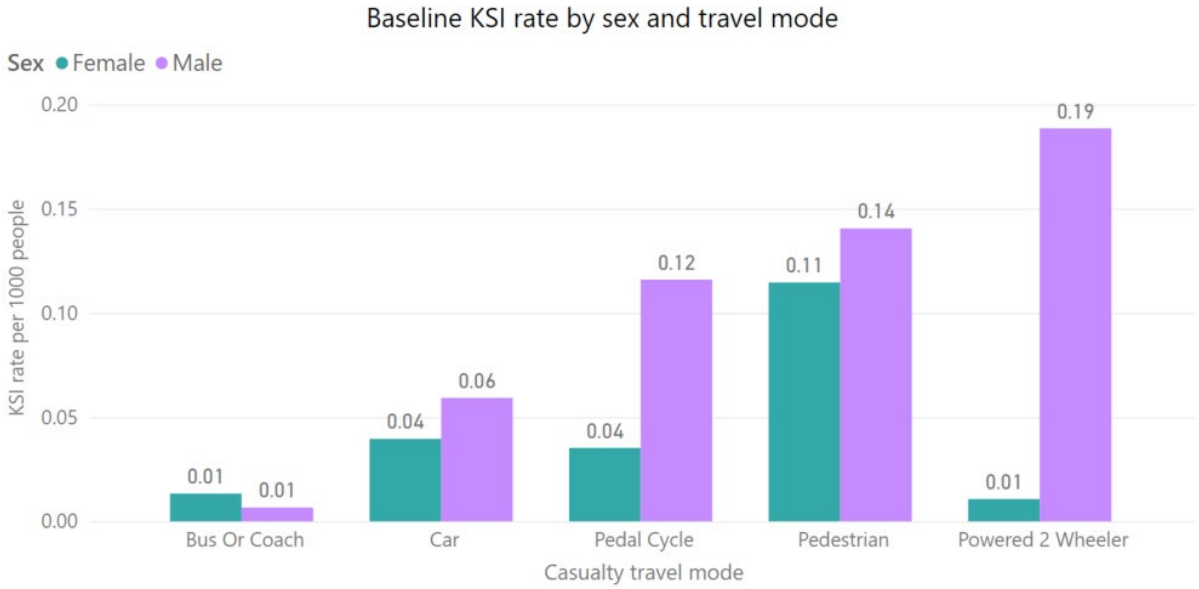

Figure 27 - Baseline average killed or seriously injured rate (2017-19) per 1,000 people by sex and mode of travel. (Note that the numbers are rounded to two decimal places, where the numbers are the same for a particular mode, the differences in the sizes of the bars reflect difference in magnitude beyond two decimal places).

For all casualties shown in Figure 26, the highest casualty rate for both sexes is when travelling by car, however for fatalities and serious injuries, shown in Figure 27,

the sexes diverge. For men the highest rate of serious injury or fatality is when travelling by motorcycle, whereas for women it is whilst walking. For both women and men for all modes the casualty rate is higher for the most deprived populations. A full breakdown of the casualty and killed or seriously injured rates by sex, mode and deprivation level can be found in Table 3 and Table 4 in the appendix.

4.5 Higher risk communities

When the deprivation of where people live, their sex, and age are examined together, it becomes possible to identify particular 'higher risk communities' with higher killed or seriously injured rates. A summary of the top ten highest killed or seriously injured rates are shown in Figure 28, broken down by sex, age, mode of travel and deprivation level. Full tables detailing the casualty and killed or seriously injured rates of all communities can be found in the appendix Table 6.

Higher risk communities: populations with the highest killed or seriously injured rate

Killed or seriously injured per 1,000 people	Mode of travel	Sex	Deprivation of home postcode	Age
0.54		Male	Most: 1, 2, 3	16-30
0.39		Male	Middle: 4, 5, 6, 7	16-30
0.34		Male	Most: 1, 2, 3	70+
0.34		Male	Most: 1, 2, 3	12-15
0.29		Male	Middle: 4, 5, 6, 7	70+
0.25		Male	Most: 1, 2, 3	31-59
0.25		Female	Most: 1, 2, 3	70+
0.25		Male	Least: 8, 9, 10	16-30
0.24		Male	Middle: 4, 5, 6, 7	12-15
0.23		Female	Middle: 4, 5, 6, 7	70+

Figure 28 - Top 10 highest baseline average killed or seriously injured rates (2017-19) per 1,000 of the population by mode, sex, age and deprivation. Note that the numbers are rounded to two decimal places, where the numbers are the same for a particular rate, the order of the rows of the table reflect the difference in magnitude beyond two decimal places.

The highest casualty and killed or seriously injured rate across age, sex, mode and deprivation level is found in male 16-30 motorcycle riders living in the most deprived 30 per cent of London. This rate is double that of their least deprived counterparts. For women, the highest killed or seriously injured rate is found in over 70s pedestrians living in the most deprived 30 per cent of London.

The top 10 highest killed or seriously injured rates are all found in people riding motorcycles or walking. Notably, across men and women, 12-15 year-old pedestrians living in the most deprived 30 per cent and living in the middle deprivation 40% appear in the top 10 highest killed or seriously injured rates.

A large proportion of the top ten most vulnerable communities are living in the most deprived 30 per cent of London, reinforcing the finding that people living in the most deprived communities have higher rates of injury on London's roads.

Highest risk communities for each mode of travel

To allow focus on individual modes, the table below summarises the population group with the highest killed or seriously injured rate on each mode of pedestrian, cycle, motorcycle, car and bus. The highest risk group for all of the modes below are found in the most deprived postcodes in London.

Mode of travel	Killed or Seriously injured per 1,000 people	Sex	Deprivation of home postcode	Age
	0.34	Male	Most: 1, 2, 3	70+
	0.21	Male	Most: 1, 2, 3	16-30
	0.54	Male	Most: 1, 2, 3	16-30
	0.16	Male	Most: 1, 2, 3	16-30
	0.07	Female	Most: 1, 2, 3	70+

Figure 29 - Highest baseline average killed or seriously injured rates for each mode of travel: (from top) pedestrian, cycle, motorcycle, car, bus

Understanding which factor has the biggest impact

Analysis was performed in order to understand which factor out of age, sex and deprivation had the largest influence on the killed or seriously injured rate. This analysis revealed that all of these factors significantly influence the killed or seriously injured rate, but when controlling for mode of travel, sex has the largest impact on

killed or seriously injured rate, due to significantly higher casualty rates among men than women. Deprivation had the second largest impact, with significantly higher casualty rates among people living in more deprived postcodes. A summary of the results of this analysis can be found in Table 13.

5 Discussion

These research findings have demonstrated a strong relationship between a) casualty location rate and deprivation and b) casualty rate and deprivation, age, sex and mode of travel. However, it is important to note that this analysis has not looked in detail at causation, so there is a limited understanding of why this relationship exists.

It is possible nevertheless to speculate about factors which may contribute to findings of inequality. Factors which could help explain differences between the most and least deprived areas include, (but are not exhaustive);

- greater exposure to motorised vehicles in more deprived areas and/or exposure to higher speed roads[18],
- mode of travel (choice)[19],
- lower quality environments[20],
- presence of parked cars on street[21],
- children playing in the street [22]
- more licence for young males to travel independently [23].

TfL wish to lead discussions and explore further analysis at local level with colleagues in London borough councils, policing partners and key stakeholders in both road danger reduction and public health, to understand the causation of collisions in more depth.

As previously mentioned, in many cases the injured person involved in a collision is unable to self-report their personal information, such as ethnicity and disability. This leaves a significant knowledge gap when trying to identify and tackle inequality in road danger.

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[18] Pedestrian safety in areas of deprivation, 2021 https://www.rospa.com/media/documents/road-safety/factsheets/Pedestrian-safety-in-areas-of-deprivation.pdf

[19] Equality, diversity and inclusion evidence base for London, 2019

[20] Road Safety Analysis The link between deprivation and road safety, 2015 https://roadsafetyanalysis.org/2015/12/the-link-between-deprivation-and-road-safety/

[21] Contributory factors in collisions, TfL Road Casualty data dashboard

[22] Why we need to view road safety through a public health lens? Nicola Christie, 2017 https://www.tandfonline.com/doi/full/10.1080/01441647.2018.1411226

[23] Deprivation and road traffic injury comparisons for 4–10 and11–15 year-olds, Journal of Transport & Health O'Toole, Christie, 2018

Although disability data is not collected within Stats19 there may be some insights that could be speculated on from these findings. Health deprivation and disability is one of the seven domains used to create the IMD measure. 'Close to half (44 per cent) of those in the most deprived tenth of the population are disabled' is one of the key findings published by the Institute of Financial Studies (IFS), in 2022, as summarised on the Disability rights UK webpage [24]. This is in comparison to 18 per cent among the whole working age population. As there is such a linear relationship between deprivation and casualty rate, it could be safe to suggest that disabled people are potentially disproportionately impacted by road danger.

With this in mind there are also potentially links with ageing and disability we can investigate further following on from these findings. The Family Resources Survey[25] has noted that 42 per cent of state pension aged adults have a disability, therefore a large proportion of those within the 60-69 and 70+ age categories could be disabled. TfL welcomes further discussions with stakeholders and London borough councils to explore these possible links further, to gain additional insight, building on the findings of this report.

With regard to ethnicity and other knowledge gaps we will look to other recent national research[26] and data sources to gain insights. Future research could also include investigating how individuals with other protected characteristics - sexual orientation and gender reassignment, are impacted.

TfL, through the Healthy Streets/ Vision Zero programme, is already committed to reducing harm on London's streets to those who are most impacted by road danger, those walking, cycling and riding a motorcycle, with schemes such as the Direct Vision Standard (DVS)[27][28] Bus Safety Standard[29], Lowering speed limits[30] [31], Schools streets, Safer routes to school, Safer Junctions, Cycle safety programme[32], marketing and educational campaigns, as well as future planned schemes such as the expansion of the Ultra Low Emission Zone (ULEZ). With this insight, TfL will

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[24] https://www.disabilityrightsuk.org/news/2022/july/disabled-people-make-nearly-half-most-deprived-working-age-adults-country#:~:text=Disability%20is%20strongly%20related%20to,the%20whole%20working%2Dage%20population.

[25] https://www.gov.uk/government/statistics/family-resources-survey-financial-year-2020-to-2021

[26] https://agilysis.co.uk/wp-content/uploads/sites/25/2021/05/Road-Traffic-Injury-Risk-amongst-GB-black-and-ethnic-minority-populations.pdf

[27] https://tfl.gov.uk/info-for/deliveries-in-london/delivering-safely/direct-vision-in-heavy-goods-vehicles

[28] https://tfl.gov.uk/info-for/media/press-releases/2023/february/tfl-sets-out-plans-to-further-improve-lorry-safety-in-london

[29] https://content.tfl.gov.uk/bus-safety-standard-executive-summary.pdf

[30] https://tfl.gov.uk/corporate/safety-and-security/road-safety/safe-speeds

[31] / https://tfl.gov.uk/info-for/media/press-releases/2023/february/new-data-shows-significant-improvements-in-road-safety-in-london-since-introduction-of-20mph-speed-limits

[32] https://tfl.gov.uk/corporate/safety-and-security/road-safety/cycle-safety

explore if these current programmes can go further to reduce harm on London's roads.

6 Conclusion

This research report confirms that there are unequal road outcomes within different communities and different areas of deprivation in London.

The findings within this report will give TfL, London borough councils, policing partners and stakeholders a better understanding of road danger by providing a more detailed method of reviewing collision data across London. By highlighting where the highest casualty location rate of road injury is posed, and who it has the greatest impact on within our communities will assist in future planning across London.

This additional road safety data analysis will be used in future planning by TfL to complement existing data sources to inform Vision Zero programme planning and investment for infrastructure schemes.

The findings of this report showing who is most impacted by road danger will also be used to optimise our engagement, education and communications, seeking to further protect these 'higher risk communities' from the causes of harm on the road network.

To ensure focus remains on these findings TfL will integrate key findings from this analysis into the 'Casualties in Greater London' annual factsheet, which can be found here.

However, as this report has highlighted, there is still more that we need to do in London to narrow the inequality gaps that have been discovered and further reduce deaths and serious injuries. Further research to fill our knowledge gaps will build a complete picture of who is most at harm on our streets.

The Mayor of London and TfL are committed to make London a fairer and a more equal place to live, work and travel as can be demonstrated through various existing strategies and action plans mentioned previously. Immediate action following these findings are to review TfL's current policies, processes, procedures and existing programmes. This additional data analysis will feed our Healthy Streets Pipeline Planning and Prioritisation approaches to improve our street environment. A review will be undertaken of TfL's current educational programmes within early years settings, schools, for young people and motorcycle riders. TfL will also review the reach of the current campaign materials, such as the 'Watch your speed' campaign to identify if any elements can be strengthened, whilst continuing to liaise with the Department for Transport, and THINK! Team, sharing insights and campaign materials where appropriate.

Processes and procedures are already in place within TfL to measure and track the benefits realised of road improvement schemes. TfL comply with the Public Sector Equality Duty and Equality Impact Assessments will be undertaken and taken

meaningfully into account for Healthy Streets-delivered schemes as appropriate. This report reinforces the need to ensure we have the correct policies and procedures in place and constant review of these is necessary to ensure the best outcomes for all road users. Next steps following this report will be to align the report with the upcoming Action on Inclusion document due to be published later in 2023.

TfL will consider how we will allocate our investment funding over the lifetime of the business plan, ensuring this insight feeds into decision making for scheme and programme planning and prioritisation.

TfL will share these findings and work in collaboration with London borough councils, police and other stakeholders seeking to narrow road traffic injury inequalities and continuing to strive to reduce harm overall as part of our Vision Zero ambition, of no death or serious injuries on the TfL transport network by 2041.

7 Appendix

7.1 Data tables

Table 1– Age group casualty rates: Baseline average casualty rate (2017-19), split by mode, deprivation level and casualty age. The deprivation level is displayed along the second row where 123 = 30% most deprived, 4,567 = Middle 40% deprivation and 8,910 = Least deprived 30%. Blank cells indicate no casualty data and a rate of 0. Cells are highlighted in darker purple according to the highest value in this table. Yellow shading is added to improve visibility of text.

Casualty Mode of Travel	Bus or Coach			Car			Pedal Cycle			Pedestrian			Powered 2 wheeler		
Deprivation decile	123	4,567	8,910	123	4,567	8,910	123	4,567	8,910	123	4,567	8,910	123	4,567	8,910
Age Group	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
0-4	0.17	0.15	0.07	0.21	0.16	0.12	0.00	0.01		0.26	0.22	0.16	0.00	0.00	
5-11	0.13	0.08	0.03	0.39	0.37	0.24	0.06	0.04	0.02	0.70	0.56	0.29	0.00	0.01	0.00
12-15	0.07	0.05	0.03	0.41	0.35	0.25	0.31	0.27	0.17	1.31	1.08	0.56	0.08	0.03	0.05
16-30	0.10	0.06	0.03	2.06	1.48	1.11	0.88	0.75	0.54	0.81	0.65	0.49	1.50	1.08	0.64
31-59	0.25	0.13	0.04	1.62	1.20	0.82	0.67	0.65	0.56	0.68	0.49	0.33	0.73	0.57	0.33
60-69	0.40	0.24	0.09	0.75	0.67	0.48	0.10	0.16	0.15	0.77	0.54	0.34	0.11	0.08	0.08
70+	0.50	0.32	0.18	0.42	0.53	0.66	0.03	0.07	0.07	0.76	0.64	0.53	0.02	0.02	0.02

Table 2 – Age group killed or seriously injured rates: Baseline average killed or seriously injured rate (2017-19), split by mode, deprivation decile and casualty age. The deprivation level is displayed along the second heading row where 123 = 30% most deprived, 4,567 = Middle 40% deprivation and 8,910 = Least deprived 30%. Blank cells indicate no casualty data and a risk rate of 0. Cells are highlighted in darker purple according to the highest value in this table. Yellow shading is added to improve visibility of text.

Casualty Mode of Travel	Bus or Coach			Car			Pedal Cycle			Pedestrian			Powered 2 wheeler		
Deprivation decile	123	4,567	8,910	123	4,567	8,910	123	4,567	8,910	123	4,567	8,910	123	4,567	8,910
Age Group	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
0-4	0.01	0.00		0.01	0.01			0.00		0.03	0.03	0.02			
5-11	0.00	0.00		0.01	0.00	0.01	0.00	0.01	0.00	0.12	0.09	0.04	0.00	0.00	
12-15	0.01	0.01		0.02	0.02	0.00	0.06	0.04	0.01	0.25	0.19	0.12	0.05	0.01	0.02
16-30	0.00	0.00	0.00	0.12	0.08	0.06	0.13	0.11	0.08	0.15	0.14	0.12	0.28	0.21	0.13
31-59	0.01	0.01	0.00	0.06	0.04	0.03	0.12	0.10	0.09	0.15	0.10	0.06	0.13	0.11	0.08
60-69	0.02	0.02	0.02	0.02	0.04	0.04	0.01	0.04	0.04	0.22	0.14	0.08	0.03	0.03	0.01
70+	0.06	0.04	0.04	0.06	0.05	0.09	0.01	0.02	0.02	0.29	0.26	0.20	0.01	0.01	

Table 3 – Casualty rates by sex: Baseline average casualty rate (2017-19), split by mode, deprivation level and casualty sex. The deprivation level is displayed along the second row where 123 = 30% most deprived, 4,567 = Middle 40% deprivation and 8,910 = Least deprived 30%. Blank cells indicate no casualty data and a risk rate of 0. Cells are highlighted in darker purple according to the highest value in this table. Yellow shading is added to improve visibility of text.

Casualty Mode of Travel	Bus or Coach			Car			Pedal Cycle			Pedestrian			Powered 2 wheeler		
Deprivation decile	123	4,567	8,910	123	4,567	8,910	123	4,567	8,910	123	4,567	8,910	123	4,567	8,910
Sex	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Female	0.29	0.17	0.08	1.15	0.94	0.73	0.25	0.25	0.17	0.66	0.54	0.39	0.08	0.07	0.05
Male	0.14	0.08	0.04	1.44	1.06	0.68	0.77	0.71	0.57	0.78	0.56	0.36	1.27	0.95	0.50

Table 4 – killed or seriously injured rates by sex: Baseline average killed or seriously injured rate (2017-19), split by mode, deprivation level and casualty sex. The deprivation level is displayed along the second row where 123 = 30% most deprived, 4,567 = Middle 40% deprivation and 8,910 = Least deprived 30%. Blank cells indicate no casualty data and a risk rate of 0. Cells are highlighted in darker purple according to the highest value in this table. Yellow shading is added to improve visibility of text

Casualty Mode of Travel	Bus or Coach			Car			Pedal Cycle			Pedestrian			Powered 2 wheeler		
Deprivation decile	123	4,567	8,910	123	4,567	8,910	123	4,567	8,910	123	4,567	8,910	123	4,567	8,910
Sex	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Female	0.02	0.01	0.01	0.05	0.03	0.04	0.04	0.04	0.03	0.13	0.11	0.10	0.01	0.01	0.01
Male	0.01	0.01	0.00	0.07	0.06	0.04	0.13	0.12	0.09	0.18	0.13	0.08	0.24	0.18	0.11

Table 5 –Casualty rates by age group and sex: Baseline average casualty rate (2017-19), split by mode, deprivation level, casualty sex and age. The deprivation level is displayed along the second row where 123 = 30% most deprived, 4,567 = Middle 40% deprivation and 8,910 = Least deprived 30%. Cells are highlighted in darker purple according to the highest value in this table. Yellow shading is added to improve visibility of text

Casualty Mode of Travel	Bus or Coach			Car			Pedal Cycle			Pedestrian			Powered 2 wheeler		
Deprivation decile	123	4,567	8,910	123	4,567	8,910	123	4,567	8,910	123	4,567	8,910	123	4,567	8,910
Sex_Age	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Female_0-4	0.18	0.14	0.06	0.20	0.14	0.12		0.01		0.19	0.15	0.13			
Female_5-11	0.18	0.09	0.04	0.42	0.41	0.27	0.01	0.01	0.02	0.55	0.41	0.28	0.00		
Female_12-15	0.09	0.07	0.03	0.42	0.42	0.28	0.03	0.06	0.07	1.23	1.03	0.45	0.00		
Female_16-30	0.14	0.08	0.04	1.75	1.28	1.03	0.47	0.45	0.33	0.81	0.71	0.54	0.15	0.13	0.11
Female_31-59	0.36	0.18	0.05	1.46	1.18	0.88	0.33	0.32	0.23	0.62	0.49	0.35	0.11	0.09	0.06
Female_60_69	0.49	0.33	0.13	0.69	0.69	0.53	0.02	0.07	0.07	0.72	0.56	0.38	0.01	0.01	0.01
Female_70+	0.61	0.39	0.23	0.33	0.46	0.67	0.01	0.03	0.02	0.64	0.56	0.50	0.01	0.00	0.00

Male_0-4	0.16	0.15	0.07	0.21	0.17	0.11	0.01	0.00		0.33	0.29	0.20	0.00	0.00	
Male_5-11	0.09	0.07	0.03	0.35	0.32	0.20	0.11	0.07	0.03	0.83	0.70	0.29	0.00	0.01	0.01
Male_12-15	0.06	0.04	0.03	0.39	0.28	0.21	0.58	0.47	0.27	1.39	1.12	0.67	0.15	0.06	0.09
Male_16-30	0.05	0.04	0.02	2.37	1.67	1.18	1.30	1.06	0.75	0.81	0.59	0.44	2.88	2.01	1.17
Male_31-59	0.15	0.08	0.03	1.77	1.22	0.75	1.00	0.96	0.89	0.74	0.48	0.30	1.36	1.04	0.60
Male_60_69	0.29	0.13	0.05	0.81	0.65	0.43	0.18	0.25	0.24	0.82	0.50	0.30	0.22	0.17	0.15
Male_70+	0.34	0.22	0.12	0.53	0.63	0.65	0.05	0.11	0.15	0.92	0.74	0.57	0.03	0.05	0.04

Table 6 – Killed or seriously injured rates by age group and sex: Baseline average killed or seriously injured rate (2017-19), split by mode, deprivation level, casualty sex and age. The deprivation level is displayed along the second row where 123 = 30% most deprived, 4,567 = Middle 40% deprivation and 8910 = Least deprived 30%. Blank cells indicate no casualty data and a risk rate of 0. Cells are highlighted in darker purple according to the highest value in this table. Yellow shading is added to improve visibility of text.

Casualty Mode of Travel	Bus or Coach			Car			Pedal Cycle			Pedestrian			Powered 2 wheeler		
Deprivation decile	123	4,567	8,910	123	4,567	8,910	123	4,567	8,910	123	4,567	8,910	123	4,567	8,910
Sex_Age	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Female_0-4	0.01			0.01	0.00			0.00		0.01	0.03	0.01			
Female_5-11	0.01	0.00		0.01	0.00	0.01				0.09	0.07	0.04			
Female_12-15	0.00			0.03	0.01	0.01	0.01	0.01	0.02	0.16	0.14	0.12	0.00		
Female_16-30	0.01	0.00	0.01	0.08	0.06	0.04	0.06	0.06	0.05	0.14	0.12	0.13	0.02	0.03	0.01
Female_31-59	0.02	0.01	0.00	0.05	0.03	0.03	0.05	0.04	0.04	0.11	0.10	0.07	0.02	0.01	0.01
Female_60_69	0.07	0.02	0.02	0.02	0.04	0.04	0.00	0.02	0.01	0.23	0.14	0.11			
Female_70+	0.01	0.05	0.05	0.06	0.03	0.11	0.00	0.01	0.01	0.25	0.23	0.20		0.00	
Male_0-4		0.00		0.01	0.01					0.05	0.04	0.04			
Male_5-11	0.01	0.00		0.00	0.00	0.01	0.01	0.01	0.00	0.15	0.11	0.03	0.00	0.00	
Male_12-15	0.00	0.01		0.00	0.02		0.10	0.07	0.01	0.34	0.24	0.13	0.10	0.02	0.05
Male_16-30	0.01			0.16	0.10	0.08	0.21	0.16	0.11	0.16	0.15	0.11	0.54	0.39	0.24
Male_31-59	0.01	0.01	0.00	0.07	0.05	0.04	0.18	0.16	0.14	0.19	0.11	0.06	0.25	0.20	0.14
Male_60_69	0.01	0.01	0.01	0.02	0.04	0.04	0.01	0.06	0.06	0.22	0.14	0.06	0.06	0.05	0.03
Male_70+	0.05	0.02	0.02	0.07	0.08	0.08	0.01	0.03	0.03	0.34	0.29	0.19	0.01	0.01	

7.2 Technical note

The inequalities in road safety report was written with findings from STATS19 road casualty data and national datasets describing the location of the collision and the population. This report outlines the technical process of compiling the datasets.

Section A: Casualties by collision location

This section of the report looks at the deprivation of the location of the collision. STATS19 data contains information about collisions that have occurred on London's roads. This information includes information about the person/people involved in the collision, as well as details of the collision, including coordinates of the collision location. This data has been used to understand how the deprivation level of the location varies with the risk of collision.

Casualty data

London (GLA) finalised road casualty data from STATS19 between 2017-2021 is used in this analysis. When exported from STATS19, the total casualties on London's roads within the GLA per year are shown in Table 7. A small amount of these casualties did not have an identifiable London location, and therefore are excluded from this analysis.

Table 7 - Casualty counts on London's roads from STATS19 per calendar year

Year	Total casualty count	Total casualty count – identifiable London location	Excluded casualty count
2017	32,567	32,490	77
2018	30,591	30,515	76
2019	30,007	29,946	61
2020	24,345	24,301	44
2021	26,672	26,614	58
Total	144,182	143,866	316

The casualty collision location has been used to link to the Lower Super Output Area (LSOA). LSOAs are small areas designed to be of a similar population size, with an average of approximately 1,500 residents or 650 households. This LSOA information allows linkage to other datasets containing relevant information about that location, including the deprivation level and the total road length, see sections below.

Deprivation

The Index of Multiple Deprivation, 2019 (IMD) is a national ranking where characteristics such as the employment rates, access to local services, crime and many others are combined and ranked across the country. The results of this ranking are a deprivation score from 1-10 where 1 is most deprived 10 per cent of LSOAs, 10 is least deprived 10 per cent of LSOAs.

This analysis provides the level of deprivation at London level by decile (1-10) and most/middle/least deprived groups.

- IMD deciles 1-3 = 30 per cent most deprived locations
- IMD deciles 4-7 = Middle 40 per cent deprivation locations
- IMD deciles 8-10 = 30 per cent least deprived locations

The deprivation decile of the LSOA in which the collision occurred is therefore known from this national dataset.

Road length data

Information on the number of casualties and the deprivation of the area is now known, however just comparing the number of casualties living in different IMD deciles in London may be misleading, as there will be many differences in these areas. One way to account for these differences is to standardise the number of casualties per IMD decile so that they can be more fairly compared. In order to standardise the number of casualties into a casualty rate, a denominator measure is needed. Data on the number of people travelling by each mode in each LSOA would be an ideal denominator, however data at this level is not available. There is data available on the road length within each IMD decile in London. Using this as a denominator would allow a proxy measure of exposure to the road, as on a basic level, the longer the road, the more exposure an individual has to potential collisions. Therefore the road length in each deprivation decile was calculated using GIS calculations from open source data on the London datastore. This road length is used as the denominator to create the rate in this section using the equation set out in Figure 1.

The rate therefore is interpreted as the number of casualties per 1,000 metres of road. The strengths of this approach are that it gives an overall measure of exposure; at a basic level the more road there is, the more road there is for a collision to occur. However this approach does not account for the volume of travellers, it also does not account for the type of road for example some roads may have a much higher frequency of junctions, roundabouts etc, which are known to lead to more collisions and injuries.

This rate will be used throughout the analysis, focussing in particular on the baseline average rate from 2017-2019 for each IMD group. For context, the total road length per IMD decile is shown below in Table 8.

Table 8 - Total road length in GLA split by IMD decile

IMD decile	Total road length (m)
1	331,664
2	2,420,784
3	2,984,961
4	2,738,523
5	2,432,586
6	2,275,332

7	2,177,974
8	2,010,654
9	2,052,525
10	973,917
Total	20,398,919

Section B: Casualties by home postcode

This section of the report looks at the demographic information of the person involved in the collision. STATS19 captures information on the age, sex and home postcode of a casualty. The home postcode has been used to link to the IMD data through the resident LSOA to give the deprivation level of the area the casualty lives in.

Casualty Data

London (GLA) finalised road casualty data from STATS19 between 2017-2021 is used in this analysis. This section of the report is limited to casualties on London's roads of London's residents. Therefore after the STATS19 data has been exported, only the casualties that have a usable home postcode within the GLA were used in this analysis. The total number of casualties, and the usable data from this dataset is displayed by calendar year below in Table 9.

Table 9 – Total casualty counts, and London resident casualty counts from STATS19 by calendar year

Year	Casualty counts	London Resident casualty counts	% London resident
2017	32,567	26,783	82%
2018	30,591	24,983	82%
2019	30,007	24,189	81%
2020	24,345	20,478	84%
2021	26,672	22,617	85%
Total	144,182	119,050	83%

Population Data

Information on the number of casualties and their age, sex and deprivation level of their home postcode is now known, however just comparing the number of casualties in these different groups may be misleading, as there will be different numbers of people in each demographic group, for example a higher number of casualties living in less deprived areas could be down to higher population numbers in the least deprived areas. One way to account for these differences is to standardise the number of casualties per 1,000 of the population group so that they can be more fairly compared. This analysis uses ONS census 2011 estimated Mid-

2014[33] population data to obtain population numbers for age, sex and deprivation decile of resident. Mid-2014 ONS population estimates gives 8,538,689 London residents. This data can be used to standardise the casualty numbers of each age, sex and deprivation group into a casualty rate per 1,000 people in the relevant population. The calculation to produce the casualty rate is shown in Figure 10.

The casualty rate therefore is interpreted as the number of casualties per 1,000 of the population. The strengths of this approach are that it gives standardised casualty rates for different groups of the population, so we can directly compare for example the rates of female casualties per 1,000 women compared to male casualties per 1,000 men. However this approach does not account for the volume of travellers, as we do not know the number of women or men travelling in a particular area by a particular mode. This rate will be used throughout the analysis, focussing in particular on the baseline average rate from 2017-2019 for each IMD group. For context, further detail on each demographic is outlined below.

Age

The exact age of the casualty is provided in STATS19, however there are 3,531 (3 per cent) resident casualties (between 2017 and 2021) that have been recorded as 'unknown age'. These cannot be assigned to corresponding age population groups, therefore these have been excluded from this analysis. To provide useful summary analysis, the following age groups were defined:

- 0-4
- 5-11
- 12-15
- 16-30
- 31-59
- 60-69
- and 70+

The numbers of these age group resident in London are summarised below by IMD decile in Table 10.

Table 10 - Populations of age groups resident in London split by IMD decile

IMD Decile	0-4	5-11	12-15	16-30	31-59	60-69	70+	Total
1	15,455	19,695	10,186	40,596	70,523	11,627	11,810	179,892
2	102,435	127,505	63,366	289,148	484,557	74,324	78,037	1,219,372
3	121,327	142,072	69,102	377,246	611,784	92,556	95,993	1,510,080
4	89,994	100,593	49,289	313,397	504,266	80,398	81,921	1,219,858

[33] At time of publishing 2021 census data was not available

5	73,811	82,229	39,224	237,480	426,445	72,819	75,038	1,007,046
6	65,258	72,503	35,383	219,750	395,088	72,360	77,794	938,136
7	51,507	58,465	28,778	160,349	320,676	65,273	70,262	755,310
8	43,905	52,216	26,516	142,982	292,260	64,873	71,946	694,698
9	42,270	53,515	27,458	119,391	279,095	68,024	75,531	665,284
10	22,625	29,936	15,659	55,076	145,518	38,265	41,934	349,013
Total	628,587	738,729	364,961	1,955,415	3,530,212	640,519	680,266	8,538,689

Sex

The sex of the casualty is recorded in STATS19, however there are 1,479 (1 per cent) resident casualties (between 2017 and 2021) that have been recorded as 'unknown sex'. These cannot be assigned to corresponding sex population groups, therefore these have been excluded from this analysis. The numbers of each sex resident in London are summarised below by IMD decile in Table 11.

Table 11 - Populations of each sex resident in London split by IMD decile

IMD Decile	Male	Female	Total
1	87,546	92,346	179,892
2	596,479	622,893	1,219,372
3	751,865	758,215	1,510,080
4	613,157	606,701	1,219,858
5	503,627	503,419	1,007,046
6	466,690	471,446	938,136
7	374,151	381,159	755,310
8	344,192	350,506	694,698
9	325,297	339,987	665,284
10	171,015	177,998	349,013
Total	4,234,019	4,304,670	8,538,689

Age and sex

The census data shows the populations of individuals by age and sex. Totals of these populations resident in London split by IMD decile are displayed below in Table 12.

Table 12 - Populations of each age and sex resident in London split by IMD decile

IMD	Sex	0-4	5-11	12-15	16-30	31-59	60-69	70+	Total
	Male								
1		7,935	10,164	5,173	20,014	33,632	5,535	5,093	87,546
2		52,682	64,645	32,386	141,247	236,923	35,378	33,218	596,479
3		62,140	72,612	35,159	188,008	308,714	44,257	40,975	751,865
4		46,151	51,518	25,477	157,806	258,455	38,517	35,233	613,157
5		37,692	41,739	20,090	119,021	218,106	34,854	32,125	503,627
6		33,023	37,037	18,155	109,365	201,017	34,590	33,503	466,690
7		26,541	29,776	14,726	80,130	161,980	31,082	29,916	374,151
8		22,666	26,667	13,608	72,196	146,981	30,982	31,092	344,192
9		21,655	27,392	13,902	59,038	137,880	32,524	32,906	325,297
10		11,600	15,256	8,148	28,034	71,073	18,579	18,325	171,015
Male Total		322,085	376,806	186,824	974,859	1,774,761	306,298	292,386	4,234,019
	Female								
1		7,520	9,531	5,013	20,582	36,891	6,092	6,717	92,346
2		49,753	62,860	30,980	147,901	247,634	38,946	44,819	622,893
3		59,187	69,460	33,943	189,238	303,070	48,299	55,018	758,215
4		43,843	49,075	23,812	155,591	245,811	41,881	46,688	606,701
5		36,119	40,490	19,134	118,459	208,339	37,965	42,913	503,419
6		32,235	35,466	17,228	110,385	194,071	37,770	44,291	471,446
7		24,966	28,689	14,052	80,219	158,696	34,191	40,346	381,159
8		21,239	25,549	12,908	70,786	145,279	33,891	40,854	350,506
9		20,615	26,123	13,556	60,353	141,215	35,500	42,625	339,987
10		11,025	14,680	7,511	27,042	74,445	19,686	23,609	177,998

Female Total		306,502	361,923	178,137	980,556	1,755,451	334,221	387,880	4,304,670
	Total								
Total		628,587	738,729	364,961	1,955,415	3,530,212	640,519	680,266	8,538,689

Demographic factors not used

Some ethnicity data is captured in the Stats19 data, however, 38,871 (33%) of collision records were recorded as 'Not stated' for ethnic group. Using this dataset could lead to invalid findings and therefore it was decided to omit from this analysis. Disability data is not collected within Stats 19.

Multiple regression analysis

In order to quantify the influence on the population factors on the killed or seriously injured rate, a multiple linear regression analysis was performed. This regression model looked at the contribution of mode, age, sex and deprivation level to the overall killed or seriously injured rate. The model results are shown below in Table 13. These results show that the mode of travel has a significant impact on the killed or seriously injured rate, although this is not the focus of this analytical report. When controlling for mode of travel, the sex, deprivation level, and age all had significant impacts on the killed or seriously injured rate. The sex_male coefficient shows that males have a significantly higher killed or seriously injured rate than females. The deprivation level coefficient is negative, and therefore shows that the lower the deprivation decile (and therefore the higher the deprivation), the higher the killed or seriously injured rate. The age coefficient is the smallest in magnitude of the three factors analysed here, indicating that there is a weaker relationship between age and killed or seriously injured rate.

Coefficients:

	Coefficient estimate	Std. Error	t value	Pr(>|t|)	Significance
(Intercept)	-0.0062	0.0101	-0.6180	0.5373	
sex_male	0.0199	0.0052	3.8500	0.0001	***
mode_Bus_or_Coach	0.0105	0.0110	0.9570	0.3393	
mode_Car	0.0356	0.0110	3.2500	0.0013	**
mode_Goods_Vehicle	0.0000	0.0110	0.0000	0.9996	
mode_Other_Vehicle	-0.0005	0.0110	-0.0410	0.9672	
mode_Pedal_Cycle	0.0411	0.0110	3.7550	0.0002	***
mode_Pedestrian	0.1327	0.0110	12.1230	0.0000	***
mode_Powered_2_Wheeler	0.0510	0.0110	4.6610	0.0000	***
mode_Private_Hire	-0.0004	0.0110	-0.0410	0.9674	
age	0.0003	0.0001	3.3480	0.0009	***
deprivation_level	-0.0024	0.0009	-2.6130	0.0094	**

Signif. codes: 0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 0.050 on 366 degrees of freedom
Multiple R-squared: 0.438
Adjusted R-squared: 0.422
F-statistic: 26.02 on 11 and 366 DF
p-value: < 2.2e-16