



REPORT OF THE SECOND STAGE OF A STUDY OF LONDON BUS DRIVER MORTALITY FROM COVID-19

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EXECUTIVE SUMMARY

Following the tragic deaths, related to COVID-19, of a number of colleagues among bus companies operating routes within London in March to May 2020, TfL commissioned UCL Institute of Health Equity in May 2020 to undertake a study. This consisted of a rapid, short term review of the actions and measures implemented then as well as commissioning a more detailed study to understand the pattern of infection with deaths and sickness from COVID-19 in bus drivers in March to May 2020. The rapid review was published in July 2020, with recommendations on the further immediate actions required.

This report updates the analysis undertaken then with new data from bus operators and the Office for National Statistics to provide a better indication of the extent of excess mortality among London bus drivers in the first wave of the COVID-19 pandemic in London in March to May 2020. It also reports on the results of a survey of drivers of buses on TfL routes in London (London bus drivers) in October and November 2020. This points to both pre-existing and new risks to their health and wellbeing and informs the further short- and longer-term recommendations provided in this report.

BACKGROUND

The COVID-19 pandemic spread to the United Kingdom in late January 2020 and the first confirmed case of COVID-19 in London was detected on 12 February 2020. The first reported COVID-19 death in England was on 6 March 2020. By mid-March, there were almost 500 confirmed cases and 43 deaths were recorded as being due to COVID-19, of which 23 were in London. By early May there had been 46,000 more deaths in England compared to what would be expected in the same period based on death rates in 2015-19, 9,000 of which were in London. After May, COVID-19 death rates in London fell to lower levels than in other regions until November 2020, after which they increased steadily to exceed the rates for all other regions by January 2021. This report is focused on the deaths of London bus drivers in March to May 2020.

Following the tragic deaths of a number of colleagues among bus operators within London in that period, Transport for London (TfL) required a full understanding of the COVID-19 prevention and control measures required to protect the health, safety and wellbeing of bus workers in London. To do this, TfL indicated their wish to understand the pattern of infection with, and deaths from, COVID-19 in the London bus worker population in March to May 2020 to inform recommendations on any additional occupational health measures that should be put in place to protect this key-worker population.

To this end, this report presents the results of a two-stage review, commissioned by TfL of the potential risks for mortality from COVID-19 among bus drivers and related actions and measures that have been implemented to date. The aim is to consider what is working and whether any elements should be amended or further improved.

PATTERNS IN LONDON BUS DRIVER MORTALITY

Among the 10 bus companies operating for TfL, 34 of the 30,000 employees were reported to have died of COVID-19 up to mid-June 2020. Of these deaths, 29 were to the 26,000 London bus drivers. However, one occurred to a driver who went on sick leave for other reasons before February 2020 and another in June 2020. To align with other data available at the time our

analyses were performed, this report covers deaths in the three months March to May 2020 and focuses on the 27 deaths to London bus drivers who were working since the start of the epidemic in London (February 2020) – 24 full-time employees, one part-time employee and two agency workers.

Since May 2020, there have been 15 deaths to London bus drivers up to the end of January – three between June and Mid December, three in late December and nine in January. These form a smaller proportion of deaths in London than those in March to May, but it is too early to draw definitive conclusions about these later deaths which are outside the main focus of this review.

The analysis we undertook of the deaths in March to May 2020, using new data from the Office for National Statistics and bus operators, indicates around a three-fold excess in age-standardised mortality in London bus drivers, compared to the population of the country as a whole. Other national studies suggest that a number of inter-related factors contributed to this excess, in particular a higher proportion of BAME staff than in the general population and living in disadvantaged urban settings with high rates of COVID-19 mortality. After taking account of these known risk factors, London bus drivers had a statistically significant, two-fold excess in mortality in the first wave of the epidemic.

These high rates of mortality were largely a result of infections acquired before lockdown on 23 March. This is consistent with recent national analyses. First that, rates of death involving COVID-19 were statistically significantly lower in all occupation groups during lockdown, when compared with the rates where the infection is likely to have been acquired before lockdown was introduced on 23 March 2020. Second that, in BAME groups, lockdown after 23 March was associated with reductions in their excess COVID-19 mortality risk, even after accounting for a broad range of factors that are known to have contributed to higher BAME mortality from COVID-19 – including living in more deprived urban environments, household living arrangements, occupational risk factors and some pre-existing health conditions.

ACTIONS TAKEN BY BUS COMPANIES

In our analysis, reported in the first report, we focused on 14 actions to prevent COVID-19 transmission, each of which was reported by a minimum of eight companies. These actions comprised those related to vehicles (daily antiviral cleaning, enhanced cleaning, holes on assault screens, restricted access to front seats and middle door boarding), to drivers (communications, HR policies and advice, hand sanitiser, wipes and masks) and to premises (access to toilets, enhanced cleaning, adapted premises/social distancing, health and safety/union reps stood down and cleaning inspections). On average, bus companies had completed 13.3 out of the 14 by early June. Timing of actions varied across companies – between four and eight actions were initiated by companies before lockdown on 23 March – an average of 5.3 per company. Further actions were taken subsequently to make drivers' cabs more secure from COVID-19 transmission. These were beyond the scope of our first report.

A number of companies also initiated actions shortly after lockdown – an average of 2.6 per company were initiated between 23 March and 3 April. Companies also initiated a number of actions after 3 April, by which time mortality had peaked (an average of 5.4 actions per company after this date) with some companies initiating the majority of their actions before lockdown and others initiated the majority after 3 April.

The majority, 59 percent, of the London bus drivers who died of COVID-19 by May 2020 had ceased work during the week ending on the 27 March, which was the week during which lockdown took place (23 March), and the following week. In this context, the incubation period (the time from exposure to development of symptoms) is believed to be between two and 14 days, with the average being five days. Since over 80 percent of drivers who subsequently died had ceased work by 3 April, this suggests that most of those who died had become infected in March. This timing makes it unlikely that the actions taken by bus operators affected the majority of infections leading to death.

In the survey we commissioned, undertaken in October/November 2020, London bus drivers were asked a broad range of questions relating to their work patterns and driving conditions, travel to and from work, their pre-existing health and health-related conditions, their experiences of COVID-19, their demographic characteristics and living conditions and their views on the safety actions taken by bus operators.

One set of questions specifically related to their views on the safety measures they could recall being introduced before the 23 March. The majority of bus drivers responding agreed that the new measures improved their safety at work. Views were more mixed on the inconvenience to drivers of the measures taken, with some indicating the extra efforts they felt it necessary to take.

In our first report, we indicated that around 70 percent of deaths to London bus drivers in March to May 2020 occurred to drivers working for three of the ten bus operators. Using new information on age, sex and region of residence of drivers working for each bus operator, we confirmed that in two cases, there was a statistically significant excess of deaths. Taking account of the ethnic composition of the bus drivers working for these operators reduced, but did not remove, the statistically significant excesses. We have not been able to identify any factors that explain these excesses in this review.

While the answers given to the questions on drivers' views of safety measures showed some variation across ethnic groups and bus operators, there was no clear pattern of association with variation in high mortality across bus operators. Similarly, in our first report we concluded that delays in taking action are unlikely to have contributed to the death rates from COVID-19. This does not mean that all the actions were ineffective – simply that so many were taken close to or after lockdown on 23 March and hence they were not really tested. Lockdown changed the environment both within buses (fewer passengers) and in the community (more people staying at home, furloughed and implementing other preventative measures) and were effective at reducing mortality for bus drivers as well as other key worker occupations and the general population.

Government and WHO guidelines and the availability of materials limited implementation of some of the actions by bus operators in March 2020. These constraints have all changed since then. Similarly, scientific evidence about specific preventative measures for buses has improved. With the benefit of hindsight, some of the deaths to London bus drivers and other key workers who were infected in March 2020, would not have happened if lockdown had been introduced earlier and all the measures and evidence described above were in place and achievable then.

WORKING CONDITIONS

As well as being asked questions about the measures implemented before and after 23 March 2020, drivers were asked about the current demands of driving a bus. Some drivers identified increased difficulties in dealing with passengers and increased aggression. First the difficult role drivers considered that they had in dealing with passenger non-compliance in mask-wearing and social distancing rules with a perceived lack of support from enforcement staff. Second the difficulties they considered to be associated with incomplete passenger compliance when some buses were classified as school services and others not - particularly when buses were full. Third they indicated that the design of some street space measures introduced by TfL and the boroughs had reduced traffic flow in some locations, leading to congestion at pinch points and access to bus stops more difficult in some locations, despite the overall reduction in traffic and passenger numbers. Fourth there was some evidence from their responses of long working days – both being asked to work longer shifts combined with a pre-existing a pattern of lengthy commutes, mainly involving further driving. Fifth, there was an evident safety concern among some bus drivers about lack of social distancing during transfers, bus changeovers and in bus depots.

HEALTH, WELLBEING AND SOCIAL CHARACTERISTICS OF BUS DRIVERS

Bus drivers are more likely to be in the upper half of the working age range than the general population, with a sizeable minority working at ages 65 and over. From the survey and partially confirmed, albeit by incomplete data held by bus operators, a slight majority of bus drivers are from BAME backgrounds – particularly from Black groups, well above the levels in London as a whole. While bus drivers were less likely than the general population to live in the most deprived neighbourhoods (the most deprived decile) they were more likely than others to live in the second to fourth most deprived deciles- with clear differences by ethnic group in where they lived. The majority live in rented accommodation (more so than the general population), particularly so among those in more deprived areas and among Black bus drivers.

The information collected in the survey from bus drivers on their pre-existing health conditions shows that rates of diabetes, hypertension and being overweight are broadly similar to those collected on the general population in the Health Survey for England, with exceptions in specific age groups. Among younger bus drivers, there seems to be more obesity than in the general population while in those in their seventies there was more high blood pressure than in the general population. Although we have no basis for comparison with the general population, there was also a steep increase in heart problems in this older age group while the proportion with breathing problems increased steadily with age (from nine to 18 percent from the youngest to the oldest age group).

Bus drivers were asked in the survey to provide information on their recall of having COVID-19 symptoms or a positive test. As with all information in a self-completed survey, this cannot be clinically verified. Only a minority of those reporting symptoms also indicated that they had a positive test, which may reflect reduced levels of community testing in the months that they had symptoms. We cannot however draw any inferences on what proportion of those without a positive test did not actually have COVID-19.

COVID-19 symptoms or a positive test were more likely to be reported by women and Asian bus drivers and, there was weak evidence of slightly greater rates of reporting among those overweight or obese. There were no systematic differences by deprivation decile.

Among those who reported COVID-19 symptoms or a positive test, the survey also asked about continuing symptoms. Tiredness was reported most commonly (40 percent), followed by breathing problems (22 percent). While both of these have been reported in the literature as sequelae of COVID-19, it is also worth noting that London bus drivers reporting a high level of fatigue was a finding of an earlier study of this population by Loughborough University. In view of the retrospective nature of the survey, we cannot be sure that these symptoms are solely due to COVID-19. However, we can conclude that the issue of breathing problems and fatigue among some bus drivers may well have been exacerbated by the impact of COVID-19 infection and lockdown.

RECOMMENDATIONS

- 1) All bus drivers and particularly those with identified risk factors need continued protection by reducing exposure to COVID-19 as long as it persists in the community. Social distancing and mask wearing must continue to be observed consistently in all locations where bus drivers are out of their cabs including transfers, depots and canteens. Promotion and enforcement of compliance of these measures by all, to ensure consistent adherence, remains a priority, as it does for all passengers when travelling on public transport.
- 2) In the longer term, early interventions on ill-health prevention are needed to reduce obesity in the population as a whole, with responsible employers playing their part. In particular, measures are needed among younger London bus drivers who have higher rates than other young people of the same age.
- 3) Fatigue is a pre-existing issue for some bus drivers, with some evidence that COVID-19 infection and lockdown has contributed to this. Action, already being taken following previous research into factors contributing to tiredness, should be enhanced to address any new issues arising from the pandemic, following a short-term review of shift lengths, patterns and rotas.
- 4) Drivers who have clinically verified ongoing symptoms of COVID-19 infection will continue to need financial, psychological and clinical support from the bus companies and the NHS, as will need to be the case for all those working for responsible employers.
- 5) Some bus drivers report several factors that have increased the demands on them despite reduced passenger and traffic numbers - passenger aggression and non-compliance and some new traffic measures. In anticipation of increased passenger and traffic numbers, TfL should support drivers in the short term through both ensuring communication of guidance to the public is clear on measures in force and those that change at any point in time, accompanied by enforcement action to support drivers.
- 6) Monitoring the health of London bus drivers is a priority following the ongoing presence of COVID-19 infection in the community. As well as the measures described above for other identified at-risk groups, more complete and consistent recording of the ethnicity of bus drivers is required. We recommend that in the coming months, bus operators ensure more complete recording of ethnicity. To ensure consistency across operators and with other organisations, TfL should issue similar guidance on harmonised ethnic recording to that currently being implemented across the NHS, based on the March 2021 Census ethnic classification.
- 7) Breathing problems appear to be a pre-existing issue reported by many London bus drivers, exacerbated in those self-reporting COVID-19 symptoms. In the longer term, air quality on London roads, to which bus drivers have particularly high levels of exposure, needs to be a priority for the Government and Mayor.

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BACKGROUND

Following the tragic deaths of a number of colleagues among bus companies operating routes within London in March to May 2020, TfL required a full understanding of the COVID-19 prevention and control measures required to protect the health, safety and wellbeing of the bus community in London. The bus operators, along with all responsible employers, should continue to take appropriate, effective evidence-based action to minimise the risk to bus workers from COVID-19. TfL will continue to support their efforts.

To do this, TfL wish to better understand the pattern of infection with and deaths from COVID-19 in London bus drivers in March to May 2020. This will inform recommendations on any additional occupational health measures that should be put in place to protect this key-worker population.

To this end, TfL commissioned UCL Institute of Health Equity in May 2020 to:

- First undertake a rapid, short term review of the actions and measures that have been implemented to date, to consider what is working and whether any elements should be amended or further improved.
- Second, in parallel, to commission a more detailed study to understand the pattern of infection with deaths and sickness from COVID-19 in bus drivers to inform recommendations on any additional occupational health measures that should be put in place to protect this key worker population.

The report of the first stage of the review was published in July 2020 (1). This report relates to the second stage of the review and covers:

- Assessing the social and demographic characteristics of bus drivers using newly obtained data including ethnicity, deprivation, household characteristics and age.
- Validating and further exploring the level of excess bus driver mortality in the period March to May 2020 using these newly obtained data.
- Relating these findings to information that has become available since the first report on the COVID-19 situation nationally and in London.
- Reporting on and analysing the results of a survey to ascertain more detail on the social situations of bus drivers, the incidence of both COVID-19 and some of the post-viral signs and symptoms experienced by drivers - often referred to as “long COVID” (2), the health risk factors for adverse outcomes from COVID-19 and the views of bus drivers on the measures taken to protect them and other changes in their work conditions.

From this evidence we indicate:

- What conclusions can be drawn about the perceived efficacy and acceptability of the measures taken?
- What further actions are suggested by this analysis, in addition to those already in place.

1. INTRODUCTION

This report updates the interim report of this review of bus driver deaths from COVID-19 infection in March to May 2020 (1) with new evidence from:

- tables provided by operators of the numbers of bus drivers by age, sex, bus garage, ethnicity and local authority of residence
- a survey of bus drivers in which data were collected on demographic and social characteristics, drivers' perceptions and views covering pre-existing health and health-related factors, COVID-19 infection and subsequent signs and symptoms, measures taken by bus operators and changes in working conditions
- data and analyses published or made available by national organisations since July 2020.

The risk of infection from COVID-19 is now known to be related to factors that increase exposure at work, in the home and in the community and to be transmitted either through manual transfer from an infected surface to the respiratory system or through aerosol transmission (3). The main community control measure taken during March to May 2020 was the introduction of lockdown on 23 March. The principal measures taken by bus operators to protect both drivers and passengers were implemented progressively over March and into April. In our analyses we separately identified those actions taken to prevent infection before and after lockdown.

The susceptibility to more severe outcomes once infected and the ability to survive once infected by the virus is affected by both viral load, individual risk factors and effectiveness of treatment (4) (5) (6) (7) (8). While the first of these is affected by exposures described in the previous paragraph and is increased by close proximity to infected individuals, the second is socially patterned, including higher rates of adverse outcomes in Black, Asian and other minority ethnic groups (BAME) (9) (10) (11) (12) (13) (14), and the third is limited by medical knowledge and resources at the time. In our initial analyses, we attempted to distinguish, among drivers who subsequently died, between those infected before and after lockdown. To do this we made the assumption that, at that time, the modal time from infection to death was about three weeks. In this report we present more recent evidence on the validity of that assumption.

A key feature of a mortality study of an occupation, such as bus drivers, is that the individuals share certain types of exposure and also have measurable differences in exposure that allows inferences to be drawn on the effect of exposure (15). We have tried to exploit both these features in this analysis, aided by the new information described in paragraph 1. At the same time, these similarities and differences may reflect factors outside the work environment that are shared by all workers or differentiate between those with similar work patterns. These include the social and ethnic groups to which they belong, home circumstances and potential differences in exposure in the need to travel to work. We have used what information is available to us to explore both the role of factors intrinsic to the workplace and those that are extrinsic.

As discussed in our interim report, in their analysis of COVID-19 related occupational mortality, the Office for National Statistics (ONS) identified a number of characteristics of occupational

groups that may have contributed to raised levels of COVID-19 mortality. These included proximity to others, exposure to disease, median hourly pay, and the percentages of the workforce that are female, aged 55 years and over and from a BAME background (6) (7). At a national level, bus and coach drivers were classified by ONS as having arms-length proximity to others (i.e. a proximity score of 75 on a scale of zero to 100) (7), slightly below the national median hourly pay, a low percent of female workers (nine percent compared to an average of 49 percent) and a relatively high percent of Black, Asian and other Minority Ethnic group (BAME) workers (19 percent compared to an average of 11 percent) and an older workforce (41 percent aged 55 and over compared to an average of 21 percent) (7).

Among all occupations ONS identified 17 larger occupation units that had elevated levels of COVID-19 mortality in men, including bus and coach drivers. These had proximity to others ranging from 48 (cleaners and domestics) to 90 (nursing auxiliaries and assistants). Among these 17 occupation units there were moderate statistical correlations between proximity score and mortality from COVID-19 and between percent BAME and COVID-19 mortality. There was a weaker relationship between percent BAME and proximity (6). This suggests that some part of higher BAME COVID-19 mortality is linked to a greater propensity to work in jobs with greater proximity to others.

In the next section, we first describe the new sources of data collected for use in this report and assess the representativeness of the survey data compared to that provided by bus operators. We then describe the methods used to analyse these data, including comparison with national data sources. In the third section we present the new analysis of the mortality of bus drivers in March to May 2020 that is now possible using the data on the demographic and workplace characteristics of all bus drivers provided by bus operators and disaggregation of mortality in the wider population of London provided by ONS. We also assess these findings against newly available published data, including a brief overview of deaths that have occurred since June 2020 – although this is outside the main focus of this report. In the fourth section we examine the bus drivers' views of the actions taken by bus operators to protect the safety of drivers and passengers and their views of the changing conditions for driving a bus in London during the pandemic.

In the fifth section we use the survey data to examine the socio-economic conditions in which bus drivers live and compare these to those of the wider population of London. In the sixth section we similarly look at the pre-existing health conditions of bus drivers and compare these to the wider population in England. In the seventh section we look at the reporting of COVID-19 symptoms among bus drivers and in the eighth section the reporting of long-lasting symptoms after a reported episode of COVID-19 infection.

Finally, we conclude by drawing together the inferences that can be drawn from information provided by bus operators, bus drivers, mortality records and newly published external analyses of data.

2. DATA AND METHODS

This report updates our first report with new data and analyses from various sources. In terms of mortality, this report focuses on the 27 deaths to London bus drivers in the period March to May 2020, the first wave of the COVID-19 pandemic in London. Since the first wave, COVID-19 death rates in London fell to be lower than in other regions until November 2020, after which they increased steadily to exceed the rates for all other regions by January 2021 (16). Sadly, this latest wave is continuing to claim lives both of Londoners and London bus drivers. However, there is limited data available on population rates in London to undertake a thorough analysis of these latest deaths and, unfortunately, this wave of the pandemic is not yet over. For these reasons, in Section 3 we provide a detailed re-analysis of the deaths in the first wave in March to May 2020 and a brief overview of the situation in London and amongst London bus drivers since that wave.

The re-analysis of mortality has been enhanced by the use of the following new sources of information:

2.1 BASELINE RISK

Public Health England (PHE) have published regional analyses of deaths due to COVID-19 by factors such as age and ethnicity (17). This has provided better comparability of bus driver mortality with that of the wider population living in London than was previously available.

ONS staff have published statistical bulletins and papers on mortality by ethnic group, covering the influence of social factors, pre-existing health conditions, housing, numbers of people in households and mortality following pre-and post-lockdown infection (14). These results provide the context for population risk factors affecting bus drivers. Based on the data used in these analyses, ONS staff have provided us with death rates of broad ethnic groups living in London compared to those outside London. This has enabled us to take account of the ethnic composition of the bus driver workforce in re-analysing their mortality.

ONS have also extended their previous analysis of COVID-19 mortality by occupation, to cover deaths up to December 2020 (19). This has made it possible for them to identify a greater number of at-risk occupations and we are now able to compare national bus driver COVID-19 mortality levels with a broader range of occupations with similar or higher levels of mortality.

2.2 POPULATION AT RISK

With the assistance of TfL, bus operators supplied tables of numbers of their bus driver employees disaggregated by age and sex. The first of these indicated the garages in which their drivers were based and the second the ethnicity of the drivers within each local authority of residence. Information on age was derived from date of birth and local authority of residence from postcode. These tables were used, first, to establish the representativeness of the survey sample in terms of age, sex and ethnicity and, second, in combination with data from ONS to calculate how many COVID-19 deaths would be expected among drivers based on factors such as age, sex, ethnicity and local authority of residence – see Section 3.

2.3 SURVEY INFORMATION

This report provides in depth analyses of factors that may have influenced COVID-19 outcomes among London bus drivers. To inform this analysis, all London bus drivers were invited to

complete an online survey (or respond to the survey by telephone if they preferred). The survey sought information from bus drivers on the following categories:

- Patterns of work and commuting (e.g. duration of shifts and commuting, bus routes driven, mode of travel to work)
- Views on bus operator COVID-19 related interventions before and after lockdown on 23 March
- Views on changes in the demands of driving a bus
- Views on the safety of bus changeovers and transfers
- Pre-existing health conditions
- Experience of COVID-19 symptoms and testing
- Experience of long-term signs and symptoms after having COVID-19 symptoms or a positive test
- Biometric and recreational information (e.g. height, weight and recreational activity)
- Household information (e.g. type of housing, geographic location, number of people in the household)
- Demographic information (e.g. age, sex, ethnicity)

A full list of the questions in the survey instrument is at Annex A. Due to the timing of the survey no questions were asked about COVID-19 vaccination – no vaccines had been approved when the survey started.

The survey was run by the survey company NATCen from 21 October to 29 November 2020- and was subsequently re-opened until 4 January 2021 to enable those respondents who had not been able to do so (due to a coding error) to record their age. A total of 3880 drivers responded out of 26,365 employees identified as bus drivers by bus operators (a 15 percent response rate). Drivers could choose not to answer any of the questions in the survey. We have chosen not to impute answers to drivers who chose to skip any questions. For this reason, numbers shown in tables as responding to an individual question is generally less than 3880 and varies from question to question. Where tables are based on two or more questions, the number available for analysis reduces further. To avoid disclosing the characteristics of item non-respondents, we only show the total number of respondents available for analysis in a table.

One exception to this relates to a failure to obtain the age of the majority of drivers in the survey, essential to calculating age specific responses to health-related questions. Due to a programming error in the online survey, only those who reported either having had COVID-19 symptoms or a positive COVID-19 test were asked to provide information on their age. To overcome this problem, the survey was re-opened until 4 January 2021 and drivers were requested to add their age to their survey response. In all 592 drivers provided data on age in the main survey and a further 427 provided this information when the survey was re-opened.

2.4 ANALYSIS

Death rates of bus drivers were calculated using information provided by bus operators on the demographic characteristic both of those who died and of all other employees. These data were also used, in combination with national and regional death rates involving COVID-19, to calculate numbers of deaths expected among bus drivers in March to May 2020. The deaths were disaggregated by age, sex, area of residence and date of death. The corresponding populations were also disaggregated by ethnicity. Directly standardised death rates were

obtained by multiplying driver death rates by age and sex to the European Standard population. Indirectly standardised mortality ratios were obtained by dividing numbers of deaths in each group of interest by the number expected by applying ONS death rates by age, sex and, in some cases region of residence and ethnicity, to corresponding bus operator supplied population figures. While direct standardization provides better comparability between groups with different age structures than indirect standardisation, results are sensitive to rates based on small numbers of deaths in any age group. For this reason, while we have calculated an overall directly standardised rate we have validated it with an indirect standardization and used indirect standardisation for more disaggregated analyses.

Analyses of survey responses by bus drivers were undertaken in several ways. First, by simply tabulating responses they provided and calculating percentages giving each response. Second, for health and health-related questions percentages reporting symptoms were calculated by dividing by the appropriate population at risk of doing so. Third, logistic regressions were undertaken to obtain odds ratios of giving particular responses or reporting symptoms. All these analyses of the survey data were performed using the software package STATA 15 (20). As indicated above, where analysis of survey questions relating to health risks or other responses was required, it was essential to use the distribution of the survey population by age and sex. This required us to gross-up the 427 age-specific responses received when the survey reopened and then add this grossed-up estimate to the 592 age-specific responses in the original survey. These overall estimates of the age distribution of the survey population were then compared to the tables by age provided by bus operators to assess the extent of age bias in the survey sample.

While information provided by bus operators was largely complete in terms of age, sex and bus garage, there were gaps in the information provided on local authority of residence and ethnicity. Only a small proportion of records had missing information on local authority of residence (one percent) due to either having no postcode information or one that did not map to the simplified postcode directory we supplied for use. The number of missing items was too small to materially affect our analyses.

Bus operators were not able to provide ethnicity from about a quarter of bus driver records. To assess whether this introduced a bias in our analysis of mortality, we compared the data with drivers' own perceptions as recorded in the survey (see Section 3). Furthermore, there appeared to be an issue with the more granular ethnic classification we provided. Drivers of Asian origin were predominantly recorded as "other Asian" with few of Indian, Bangladeshi or Pakistani backgrounds. For these reasons, in our analyses, we firstly grouped up ethnic groups into four categories -White, Black, Asian and Mixed/other- and then reallocated those with no ethnicity recorded to these four categories in proportion to the numbers in each category with a valid code. The validity of this approach is assessed in Section 3.

3. OVERALL MORTALITY OF BUS DRIVERS IN MARCH TO MAY 2020

3.1 SUMMARY OF FINDINGS ON MORTALITY IN THE INTERIM REPORT

As we reported in the interim report, across the bus companies operating for TfL, 34 workers are reported to have died of COVID-19 when the interim report was produced. Of these deaths, 29 were to bus drivers. However, one occurred to a driver who went on sick leave for other reasons before February 2020 and the other occurred in June 2020. Thus 27 deaths occurred between March and May 2020, the period covered by this review, and were to bus drivers working since the start of the epidemic in London, February 2020. Two of these drivers were described as agency workers and one as “part-time”, so that their occupational exposure may have differed from others working full-time for the same company (1).

It should be noted that all 27 deaths to bus drivers were to male drivers and therefore comparisons with other male rates are the most appropriate. For those aged under 65, we were able to estimate the directly age standardised COVID-19 rate for male bus drivers in London in March to May 2020. It was 68 per 100,000, compared to 44 for all male bus and coach drivers in England and Wales and 19 for all male occupations in England and Wales.

To the extent that was possible with the available data, we identified several main patterns in the mortality data. First, over 80 percent of drivers (22 out of 27) who subsequently died had ceased work by 3 April. This suggests that they became infected before lockdown. After lockdown, death rates came down among drivers as they did in London as a whole and nationally. Second, among 13 death certificates provided to us by relatives of drivers who died, in seven cases, hypertension was identified by the certifying doctor as a contributory factor to the death. Third, among the deaths there were a high proportion of drivers from BAME backgrounds. But we did not at that stage have sufficient detail either about the ethnicity of all employees or death rates of ethnic groups in the general population of London to estimate how much this contributed to the death rates in London bus drivers. Fourth, a high proportion of deaths were to drivers living in areas of above average deprivation, known to be associated with higher COVID-19 death rates (21). Three-quarters of those who died lived in the quarter of London Boroughs with the highest COVID-19 death rates in April 2020. Fifth, crude death rates varied between bus companies but, without more detail of age structure and other characteristics, it was not possible to draw conclusions about whether the differences were statistically significant and/or explained by other factors. We undertook to consider this in the current stage of the review.

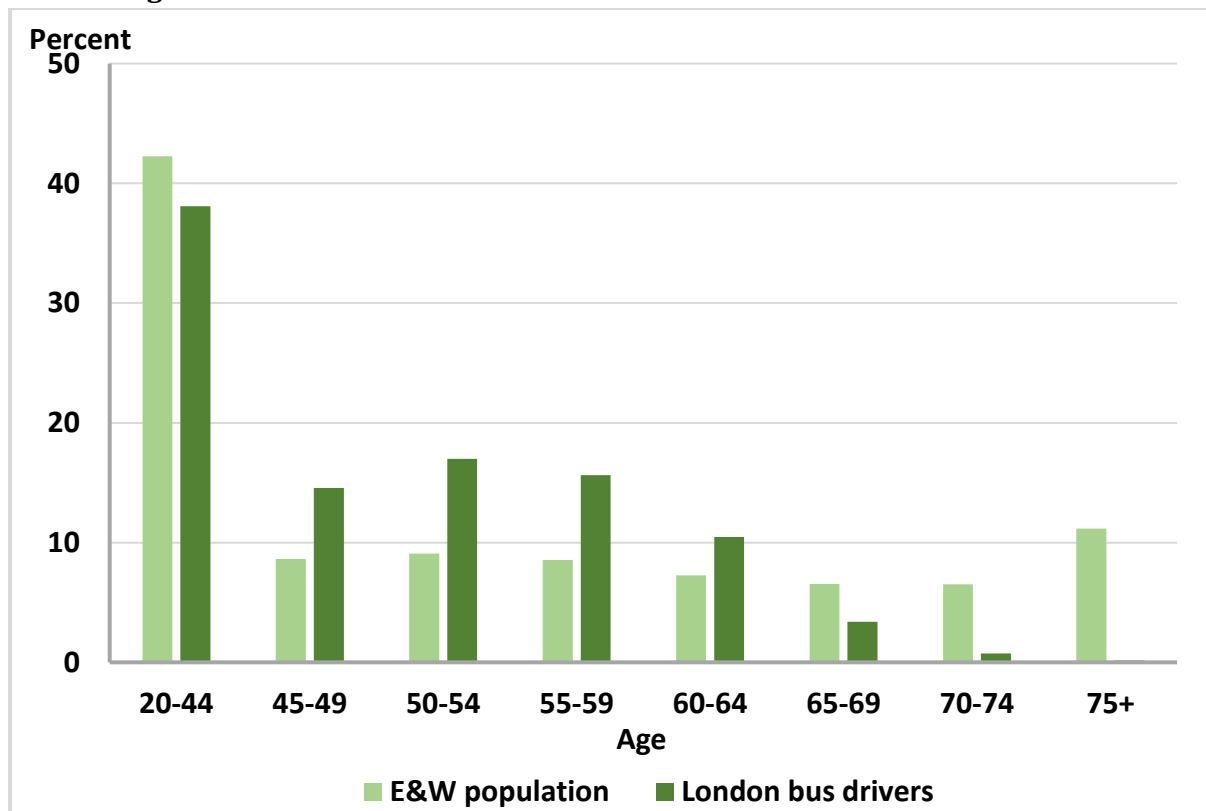
3.2 NEW ANALYSES OF MORTALITY

In this section, we focus on the use of the improved information on age and sex distribution of bus drivers provided by bus operators to make comparisons between the mortality of drivers of all ages with death rates in this period in England and Wales as a whole, as well as the regions in which these drivers live. This enables us to extend and validate the interim findings of excess mortality.

Figure 3.1 shows the comparison between the age distribution of bus drivers and the population of England and Wales at ages 20 and over. The key differences are that drivers are more likely to be aged 45 to 64 and less likely to be 65 and over. Nonetheless, there are sufficiently many bus drivers aged 65 and over (four percent of the workforce) to increase the overall risk of adverse

outcomes (including death) from COVID-19 infection in the bus driver population as a whole, given the high rates of adverse outcomes that are experienced at older ages.

Figure 3.1 Age distribution of London bus drivers and the 2019 population of England and Wales at ages 20 and above



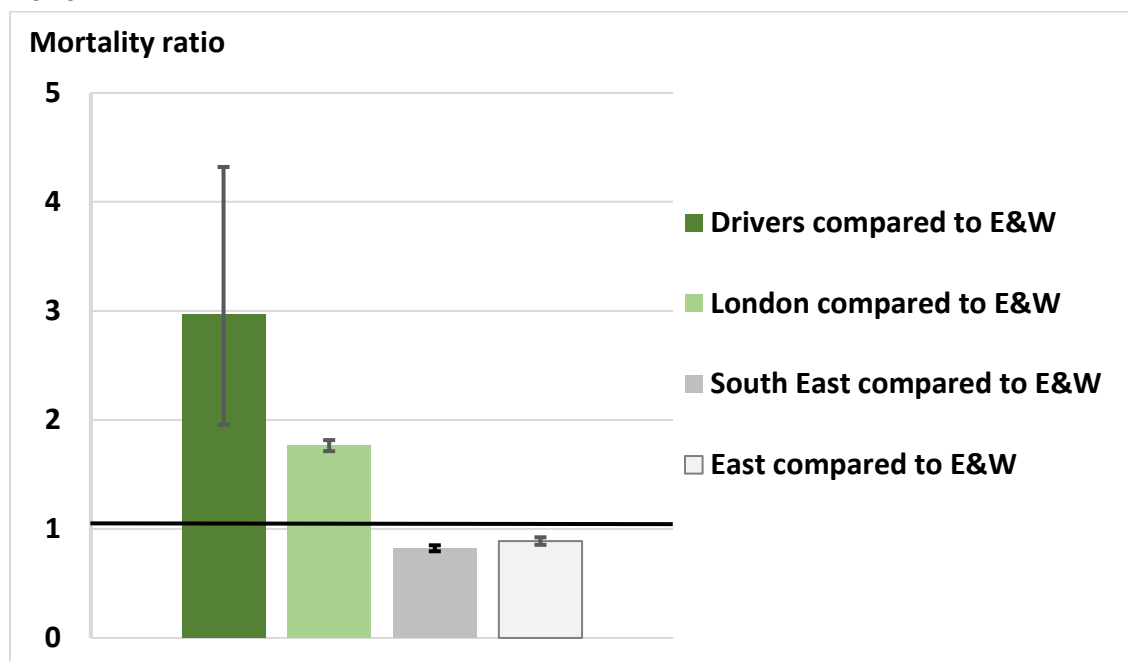
Source: Bus operator employee records and ONS (22)

This difference in age structure, combined with limited numbers of deaths in some age groups and the substantially different proportions of male and female drivers warrants caution in making comparisons between bus driver mortality and that of the general population. In terms of these comparisons, it should also be noted that while the majority of London bus drivers lived in London (88 percent), there were 6 percent living in the East Region and 6 percent in the South East Region. Their mortality cannot therefore simply be compared to that of others living in London.

Figure 3.2 updates the directly standardised male COVID-19 mortality rates of London bus drivers previously reported at ages under 65 with that at all ages. The figure presents male mortality ratios compared to the rate for England and Wales as a whole in the period March to May 2020, both for London bus drivers and residents of the three regions in which most bus drivers lived. This indicates that male bus drivers' directly age standardised mortality was 2.97 times that in the country as a whole and significantly greater than that for male residents of London. In London, the male mortality rate was 1.76 times that in the country as a whole while in the South East and East it was lower than the country average (ratios of 0.82 and 0.89). Thus, the rate for male bus drivers was over one and a half that for Londoners and over three times that in the East and South East Regions. The preliminary findings in the interim report for male drivers dying at ages under 65 (see Section 3.1) pointed to a slightly larger ratio compared to the country as a whole (3.57 at ages under 65). Using the more accurate population data by age and sex now available, we estimate the rate to be almost identical – 69 per hundred thousand.

While that report also indicated the comparison with male bus and coach drivers aged under 65 nationally, a ratio of 1.55, such comparisons must be treated with caution. First, deaths to London bus drivers under the age of 65 comprised approximately 40 percent of all bus and coach driver COVID-19 related deaths nationally between March and May 2020. Therefore, the age standardised rate for bus and coach drivers other than London bus drivers would have been lower than the national average – suggesting that the ratio of London bus drivers to all other bus and coach drivers would have been higher, possibly around a two-fold excess in that period. Second, the ratios in Figure 3.2 relate to death at all ages. ONS figures for numbers of deaths at ages 65 and over relate to all those recording their last main occupation as being a bus or coach driver, most of whom would have been retired at death. This report is only concerned with current employees and is not therefore comparable to ONS data at ages 65 and over.

Figure 3.2 Directly age standardised COVID-19 male mortality ratios for bus drivers and residents of three regions compared to the rate for England and Wales, March to May 2020



Sources: Deaths and populations of London bus drivers provided by bus operators, all other rates from ONS (22)

Notes

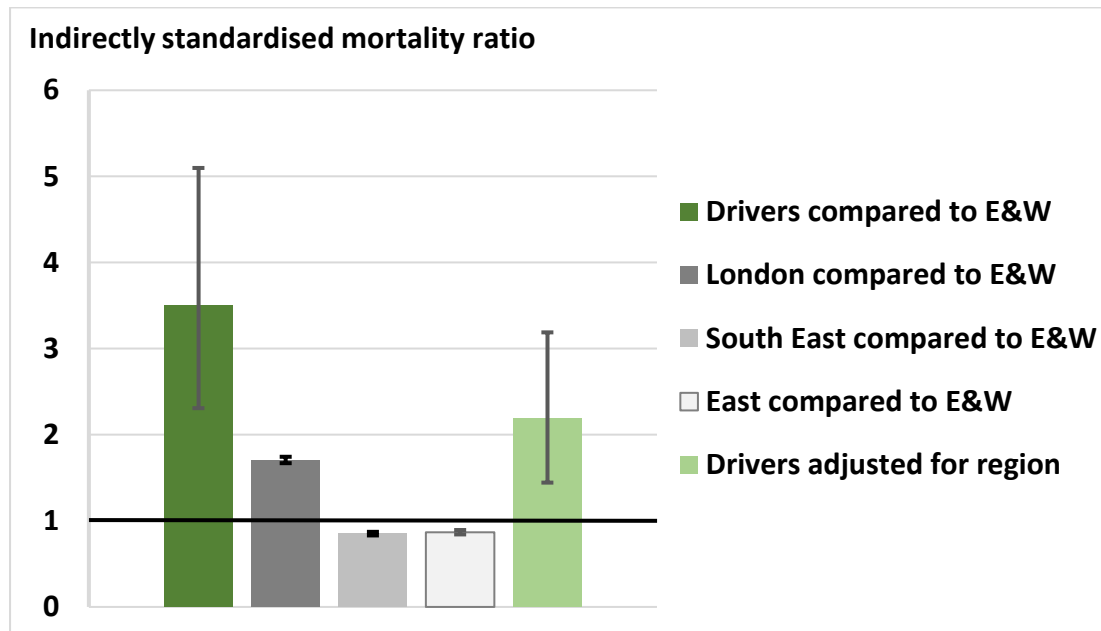
Vertical bars represent approximate 95 percent confidence intervals and

The horizontal bar represents parity with the England and Wales mortality rate.

As indicated in Section 2, the directly standardised rate is sensitive to those age-specific death rates that are based on small numbers of deaths and cannot therefore be further disaggregated. For this reason, in Figure 3.3, we have cross-checked this result using indirect standardisation (see Section 2) and adjusted the mortality ratio by taking account of the mortality rates in the three regions of residence shown in Figure 3.2. This indicates a COVID-19 mortality ratio of 3.5 for bus drivers, compared to England and Wales using this method – significantly greater than the ratio based on indirect standardisation for London, the East and the South East Regions (1.71, 0.87 and 0.85, respectively) and broadly in line with the directly age standardised figure of 2.97 in Figure 3.2, taking into account the wide confidence intervals. When the numbers of deaths expected among bus drivers is adjusted for the region in which they lived, the mortality ratio is reduced to 2.29, which still represents a statistically significant excess. In other words,

region of residence does not account for the raised level of COVID-19 mortality in March to May 2020.

Figure 3.3 Indirectly age standardised COVID-19 mortality ratios for bus drivers and residents of three regions compared to the rate for England and Wales, March to May 2020

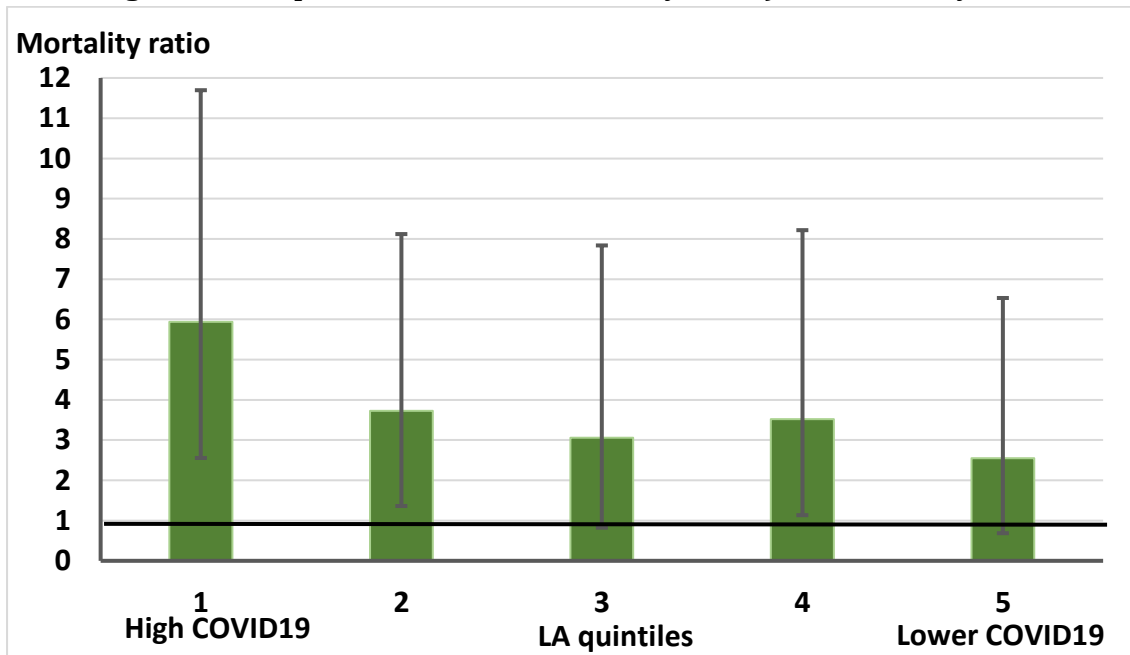


Sources: Deaths and populations of London bus drivers provided by bus operators, all other rates from ONS (22)
Notes

Vertical bars represent approximate 95 percent confidence intervals and
The horizontal bar represents parity with the England and Wales mortality rate.

As noted in Section 3.1, a larger number of bus driver deaths in March to May 2020 occurred in local authorities with high COVID-19 mortality rates. To establish whether or not this simply reflected where most bus drivers lived, we have ranked local authorities in both London and other regions according to their COVID-19 mortality rates in that period. We have then grouped them into quintiles, with each quintile having approximately a fifth of all bus drivers living in the authorities included in that quintile. Thus, each quintile has a similar number of drivers in it. We have then calculated the observed and expected numbers of bus driver COVID-19 deaths in these quintiles. Figure 3.4 shows that bus driver COVID-19 mortality did increase with the overall level of local authority mortality. However, it also shows statistically significant mortality excesses in three out of the five quintiles, suggesting that living in a local authority with higher levels than others does not entirely account for the excess COVID-19 mortality in London bus drivers in March to May 2020.

Figure 3.4 Bus drivers’ mortality ratios, compared to England and Wales rates, based on groups of local authorities in which they lived (local authorities grouped into quintiles according to their all persons’ COVID-19 mortality levels), March to May 2020



Sources: Deaths and populations of London bus drivers provided by bus operators, all other rates from ONS (22)
Notes

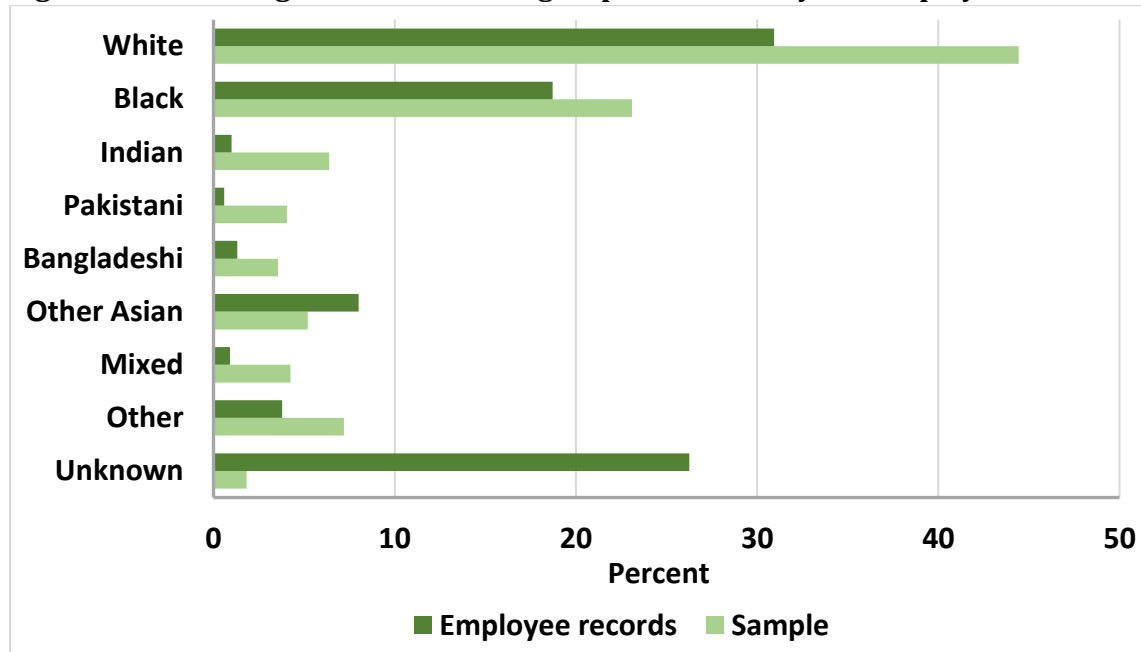
Vertical bars represent approximate 95 percent confidence intervals and
The horizontal bar represents parity with the England and Wales mortality rate.

3.3 EFFECT OF ETHNIC DIFFERENCES IN MORTALITY

As remarked in Section 3.1, we were not able to quantify the contribution of the ethnic composition of the bus driver workforce on mortality levels in the interim report – although it is known that several BAME groups had raised levels of COVID-19 mortality in March to April 2020. In this section we were able to use the information provided by bus operators on the ethnic composition of their bus driver workforce and new information provided by ONS on mortality rates of ethnic groups inside and outside London to quantify the effect on bus driver death rates.

We indicated in Section 2 that recording of ethnicity in the tables provided by bus operators was incomplete, both in terms of uncoded records and coding of the majority of Asian drivers as “other Asian”. Figure 3.5 compares the levels of recording in employee records with the information provided by bus drivers in the survey and illustrates these two issues.

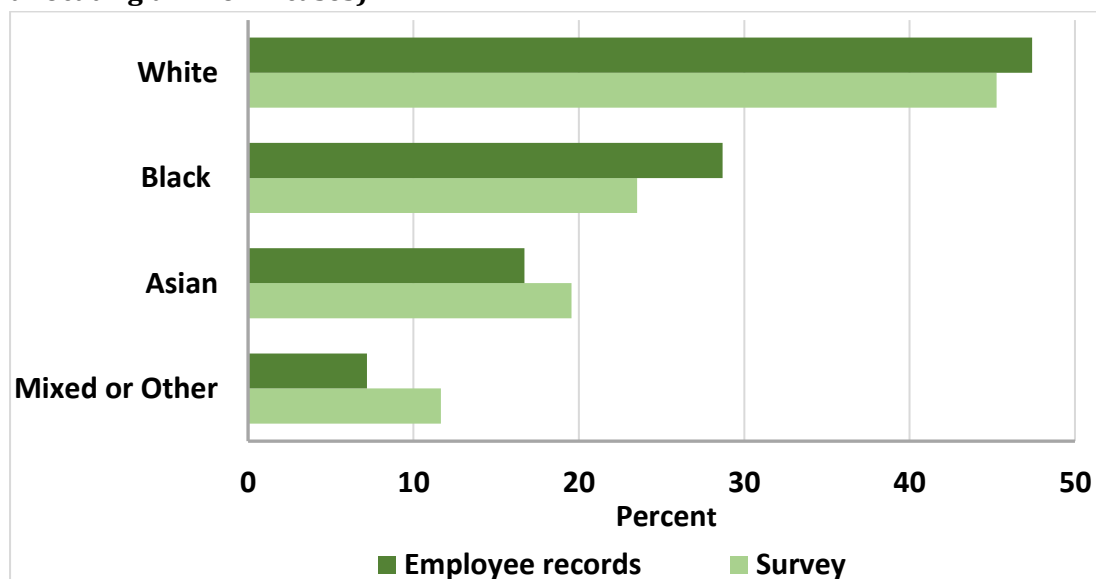
Figure 3.5 Recording of detailed ethnic groups in the survey and employee records



Sources: Populations of London bus drivers provided by bus operators, sample data collected by NATCen

To undertake the mortality analysis, we needed to address the inconsistencies in ethnic recording on employee records. To do this we have combined the ethnicity data into four broad groups shown in Figure 3.6 and re-allocated unknown records in proportion to known ethnicities. Once this is done, there is reasonable agreement at this broad level between survey responses and employee records. On this basis we felt able to proceed with the mortality analysis. Comparing the two sources, suggests that about 45 to 47 percent of drivers are White, 24 to 29 percent Black, 17 to 20 percent Asian and seven to 12 percent mixed or other ethnic groups. This contrasts with the Annual Population Survey estimates for London in 2019 – 65 percent White, 11 percent Black, 16 percent Asian and 8 percent mixed or other ethnicities.

Figure 3.6 Recording of broad ethnic groups in the survey and employee records (re-allocating unknown cases)



Sources: Populations of London bus drivers provided by bus operators, sample data collected by NATCen

Using the approach adopted in Figure 3.5, we have been able to assess the impact of the age distribution and ethnic composition of bus drivers working for each operator on the higher crude death rates among the employees of some operators that were highlighted in the interim report. As Table 3.1 shows, when we apply overall London death rates to the numbers of male bus drivers in each age group employed by each operator, death rates are confirmed to be statistically significant for two operators. When we apply the death rates within each ethnic group and region to the same populations, the size of the excesses reduces but the clusters remain statistically significant. Importantly, the table also shows that adjusting the mortality rate of all London drivers for ethnicity also reduced the mortality ratio from 2.3 compared to London to 2.0. However, this twofold excess remains statistically significant.

Table 3.1 Indirectly standardised mortality ratios by bus operator, March to May 2020

Bus operator	Observed deaths	Expected deaths based on London rates				Expected deaths based on rates by ethnic group			
		Expected deaths	Mortality ratio	LCL	UCL	Expected deaths	Mortality ratio	LCL	UCL
Abellio	2	0.9	2.1	0.2	7.7	1.2	1.6	0.2	5.9
Arriva London	2	2.3	0.9	0.1	3.2	2.9	0.7	0.1	2.5
Go Ahead	6	2.8	2.1	0.8	4.6	1.9	3.0*	1.1	6.7
HCT	1	0.2	4.3	0.1	24.0	0.3	2.9	0.0	16.4
Metroline	8	1.9	4.2*	1.8	8.2	2.8	2.8*	1.2	5.5
RATP Dev	2	1.4	1.4	0.2	5.0	1.7	1.1	0.1	4.1
Stagecoach London	1	1.6	0.6	0.0	3.4	1.9	0.5	0.0	2.9
Sullivans	0	0.1				0.1			
Tower Transit	5	0.5	10.6*	3.4	24.7	0.6	7.4*	2.5	18.0
UNO	0	0.0				0.0			
All London bus drivers	27	11.9	2.3*	1.5	3.3	13.6	2.0*	1.3	2.9

Sources: Deaths and populations of London bus drivers by age, sex, ethnicity and region provided by bus operators, all other rates from ONS (22), (23)

Notes:

*Significant at a 95 percent level

LCL – lower confidence limit

UCL- upper confidence limit

In subsequent sections we examine the factors that may have contributed to the excess mortality described in this section, using both ONS more recent analyses of national data and evidence from our survey of London bus drivers.

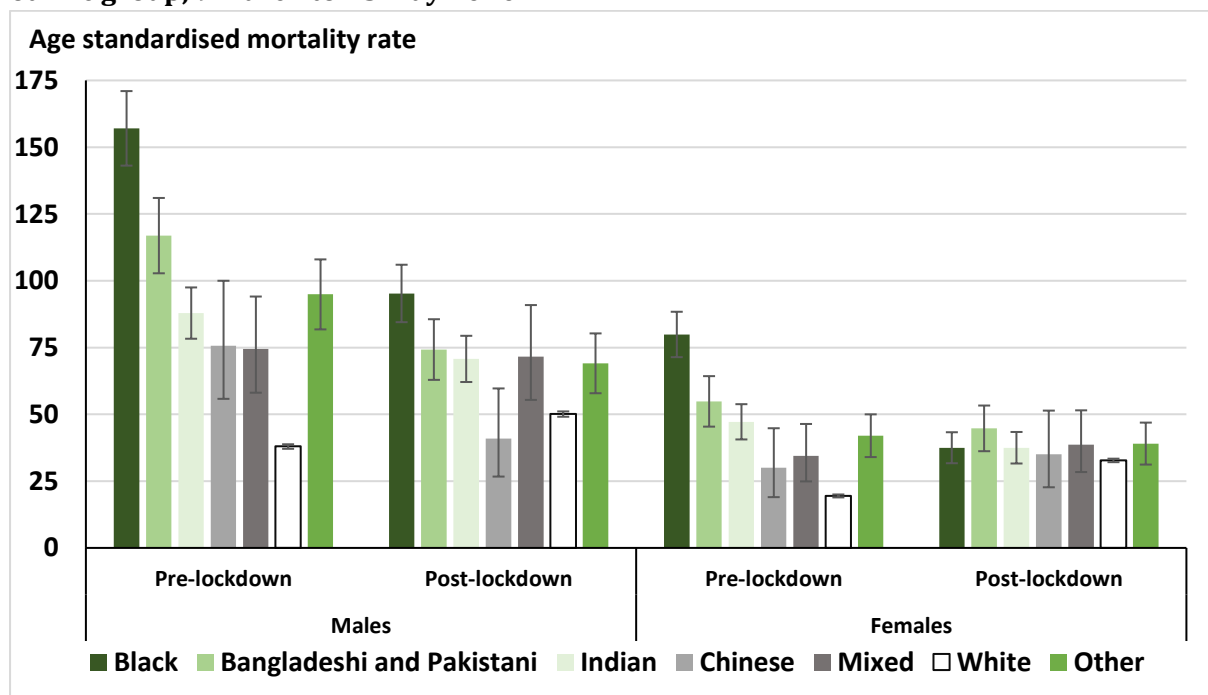
3.4 NEW ANALYSES PRODUCED BY ONS

A key finding in our interim report, as indicated in Section 3.1, was that many of the deaths to bus drivers were likely to have been a result of infection acquired before lockdown on 23 March. Since our report was published, ONS has undertaken a review of the timing of lockdown in relation to deaths by occupation involving COVID-19 in England and Wales (at ages 20 to 64) registered between 9 March and 30 June 2020 (18). They conclude that 72 percent of the 5,330 deaths in this period were likely to be the result of an infection acquired before lockdown. For both sexes, age-standardised rates of death involving COVID-19 by occupation were statistically significantly lower during lockdown than before lockdown.

ONS indicate that, across the entire period March to June 2020, some groups of occupations continued to have high rates of death involving COVID-19, when compared with rates among those of the same age and sex in the population. Among men, four of the nine major occupation groups (elementary; caring, leisure and personal services; process, plant and machine operatives; and skilled trades) had statistically significantly higher rates of death involving COVID-19 both before and during lockdown, when compared with rates among those of same age and sex in the population. They concluded that reasons for these findings are complex, but factors like the level of exposure to others before and during lockdown, the ability to work from home, whether an occupation was furloughed, and where someone lives could all be playing a role.

More recently a paper by ONS researchers and others has similarly investigated the link between excess COVID-19 mortality in BAME groups and the likely date of acquiring infection. (14). As Figure 3.7 shows, among men most BAME groups had significantly higher mortality than White groups if infection was likely to have been acquired before lockdown. However, rates for all BAME groups were substantially lower after lockdown.

Figure 3.7 Age standardised mortality rates (ASMRs) of death involving COVID-19 per 100,000 of the population, before and after lockdown plus 21 days, stratified by sex and ethnic group, 9 March to 15 May 2020



Source: Ayoubkhani et al. (14)

Notes:

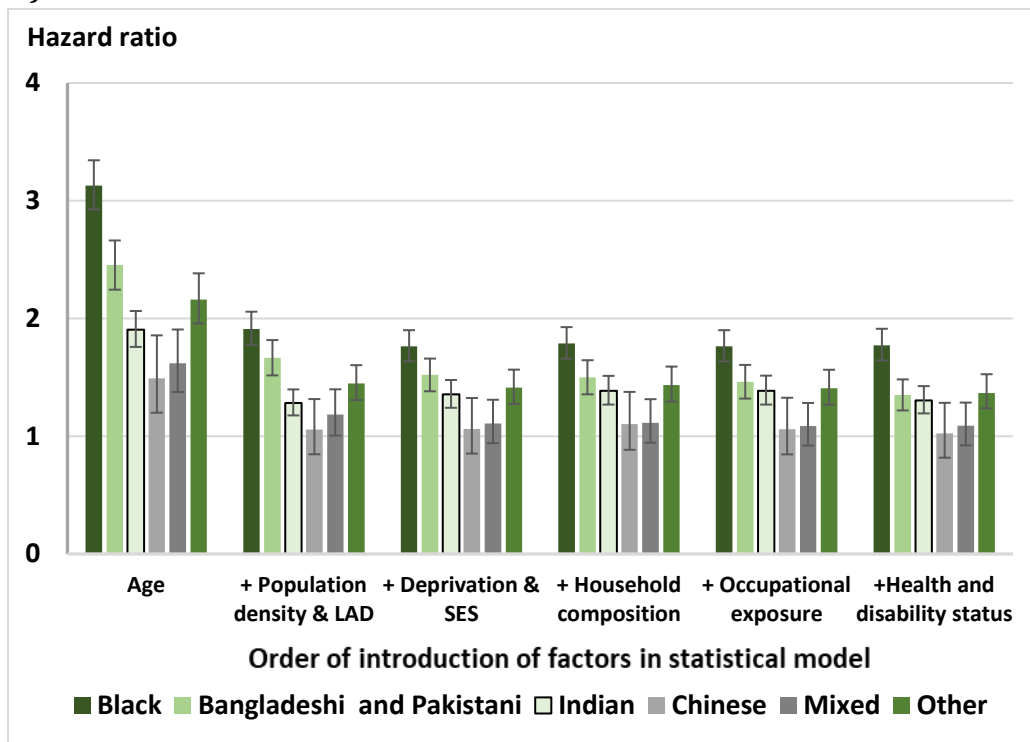
Estimates for each ethnic group are stratified by a time variable indicating pre- and post-lockdown periods.

Errors bars represent limits of 95% confidence intervals of the hazard ratio.

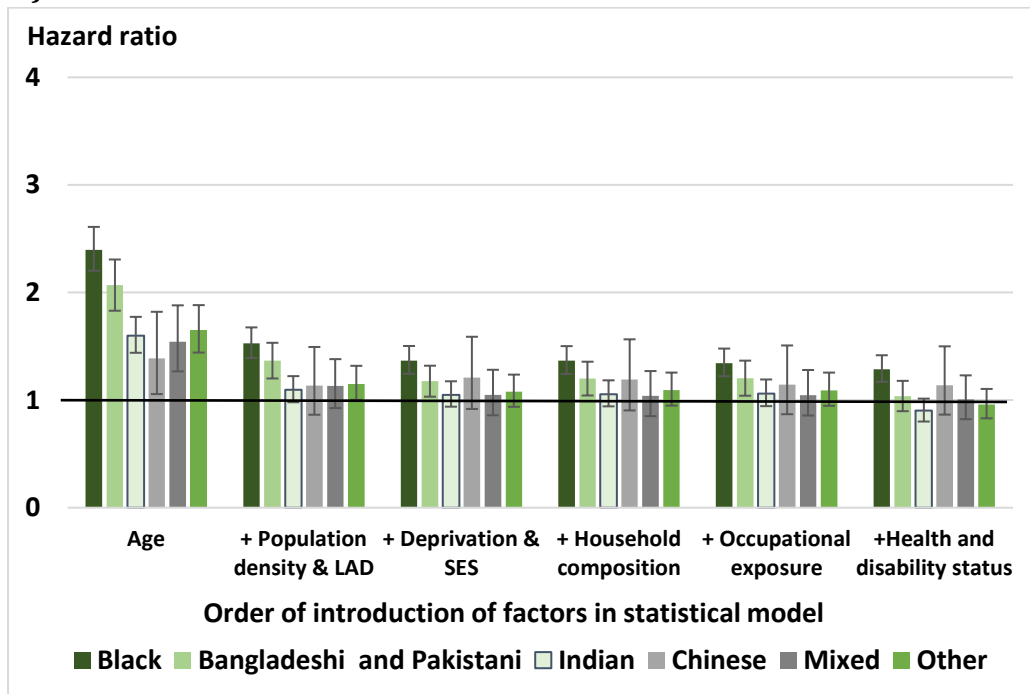
Figure 3.8 shows how hazard ratios for BAME groups, when compared to the White population over the whole period 9 March to 15 May, were reduced by including successive adjustments for a broad range of potential risk factors.

Figure 3.8 ONS estimates of hazard ratios for COVID-19 related death for ethnic-minority groups compared with the White population, stratified by sex, 9 March to 15 May 2020

a) Males



b) Females



Source: Ayoubkhani et al. (14)

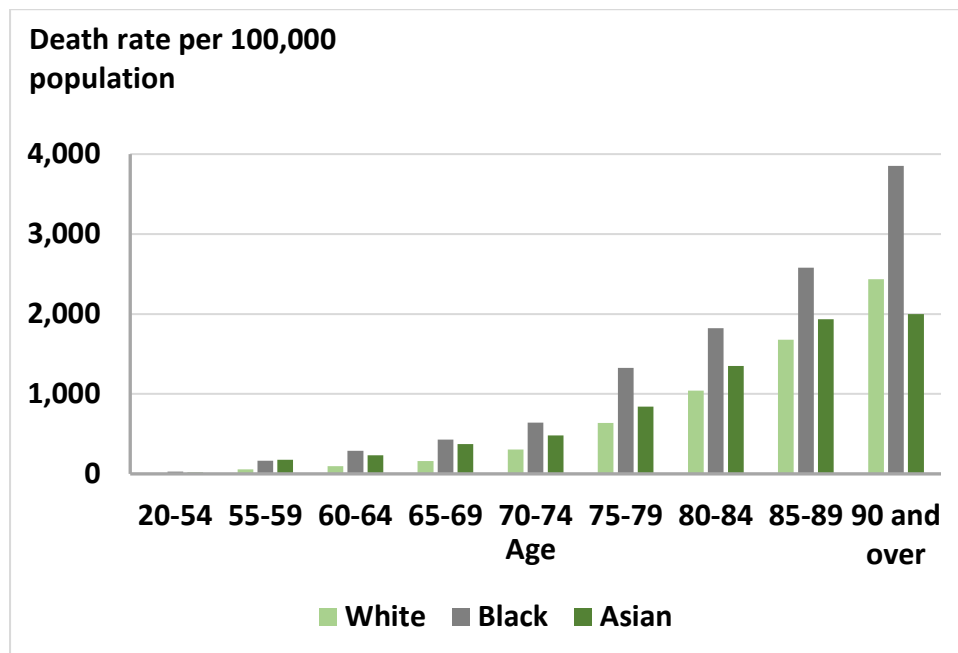
Notes: Results obtained from Cox-regression models adjusted for age, population density, area and household deprivation, socio-economic status (SES), household composition, occupational exposure, self-reported health, with baseline hazards specific to local-authority district (LAD). Details of the covariates can be found in the source article. Numerical results can be found in supplementary tables to the source article (14).

Error bars represent limits of 95% confidence intervals of the hazard ratio.

When hazard ratios for males in Figure 3.8 were split into the pre- and post- lockdown periods, using the same 21-day lag time between infection and death shown in Figure 3.7, the hazard ratios for each BAME group (except the mixed group) were significantly high compared to White men before lockdown. All those that were significantly high before lockdown decreased after lockdown and only those for Black, Indian and “Other” men remained statistically significant compared to White men. For females hazard ratios were significantly elevated before lockdown only for the Bangladeshi/Pakistani and Black groups, when compared with White women. After the lockdown, all the hazard ratios decreased and none were significantly high compared to White women. (14).

The analysis of bus driver mortality by ethnicity in Sections 3.2 and 3.3 relied on death rates provided by ONS. These were obtained from the same database as used in Figure 3.7 and 3.8. These death rates are shown in Figure 3.9, illustrating the higher rates for Black men at each age and the increase with age for all ethnicities shown.

Figure 3.9 London death rates among men by ethnicity recorded at Census, March to July 2020



Source: Ayoubkhani et al. (14) Tingay (23)

3.5 UPDATE ON DEATHS SINCE MAY 2020

Limited analyses are currently available from ONS for more recent deaths from COVID-19. Table 3.2 compares the deaths of bus drivers so far reported to TfL with those deaths in the population as a whole that occurred up to 29 January and had so far been registered (24). Clearly all the figures for January in that ONS bulletin were provisional, as more deaths are notified. As noted above, on average deaths occur around 21 days after infection. Therefore, most of the deaths to those infected in January or later will not occur until February or later. This suggests that, for infections contracted between mid-May and the end of December, deaths of London bus drivers, as a proportion of those in the regions in which they live, have fallen by around 45 percent compared to March to May, consistent with the evidence presented here and

in the interim report that most of the excess mortality in London bus drivers was due to infections contracted before lockdown on 23 March 2020 (see Section 4.1 for an explanation of the timeline supporting this argument). These comparisons suggest that the 15 London bus driver deaths in June to January are unlikely to be statistically greater than what would be expected on the basis of regional and ethnic death rates. However, in the absence of relevant detailed data from ONS, this is pure speculation.

Table 3.2 Deaths involving COVID-19 occurring from 1 March to 29 January to (a) London bus drivers (b) residents of England by selected regions

	1 March to 5 June 20	6 June to 4 Dec 20	5 Dec to 31 Dec 20	1 Jan to 29 Jan 21	1 March 20 to 29 Jan 21
London bus driver deaths	27	3	3	9	42
ONS regional mortality figures:					
East	4,750	1,440	1,654	4,274	12,118
London	8,371	1,387	1,808	4,738	16,304
South East	6,820	2,045	2,481	5,689	17,035
England	46,167	21,404	13,411	27,401	108,383

Source: London bus driver deaths from bus operators, Regional mortality figures from ONS (24)

One piece of analysis that ONS have published is to look at occupational mortality to the 28 December (19). Table 3.3 shows occupations which can be identified from ONS figures as having higher rates of mortality for men than bus and coach drivers nationally at ages 20 to 64, either in the period 9 March to 25 May or for the whole period 9 March to 28 December. It can be seen that bus and coach drivers had the 16th highest mortality rate in the early periods, but 25th highest for the whole period. Most of the occupations in the table were those for which the men could not work from home, with a predominance of key front-line workers and those whose jobs required them to work in close proximity to others or their customers/clients. Where death rates are available for both periods, for each occupation group in the table death rates were lower in June to December than in March to May.

For the period March to May, this analysis by ONS confirms the preliminary analysis of London bus driver mortality in the interim report (see Section 3.1) and the more detailed analysis in Section 3.2. For the period June to December, when six London bus driver COVID-19 deaths occurred, it suggests that the death rate would be expected to be lower than in the earlier period based on national experience of bus and coach drivers and similarly exposed occupations.

Table 3.3 ONS figures on deaths involving COVID-19 and all causes among selected individual occupations (males aged 20 to 64 years shown here), England and Wales, deaths registered between 9th March and 28th December 2020

SOC	Description	Deaths 9 March to 25 May	Deaths 26 May to 28 December	Monthly Death rate 9 March to 25 May	Rank 9 March to 25 May	Monthly Death rate 9 March to 28 December	Rank 9 March to 28 December
Occupations with death rates above those of bus and coach drivers in March to May 2020							
5432	Bakers and flour confectioners	11	4	182.3	1	117.0	1
3312	Police officers (sergeant and below)	15	4	52.7	2	31.7	4
6142	Ambulance staff (excluding paramedics)	12	3	32.5	3	15.6	17
9241	Security guards and related occupations	104	36	29.2	4	16.5	14
6145	Care workers and home carers	70	37	28.1	5	18.0	8
9273	Waiters and waitresses	11	3	27.5	6	15.6	16
8214	Taxi and cab drivers and chauffeurs	134	75	25.8	7	16.6	13
8111	Food, drink and tobacco process operatives	32	20	25.4	8	17.0	11
1223	Restaurant and catering establishment managers and proprietors	16	10	25.2	9	19.5	6

6141	Nursing auxiliaries and assistants		30	15	23.3	10	14.3	18
5434	Chefs		49	33	22.4	11	16.9	12
8125	Metal working machine operatives		19	21	20.1	12	17.4	9
2231	Nurses		31	16	19.9	13	12.9	22
4113	Local government administrative occupations		16	7	19.7	14	11.8	23
5231	Vehicle technicians, mechanics and electricians		36	12	17.5	15	9.5	31
8213	Bus and coach drivers		53	30	17.5	16	11.5	25
Occupations with death rates above those of bus and coach drivers in March to December 2020, but not identified as such by ONS in March to May 2020								
9120	Elementary construction occupations		36	34	16.6	17	13.4	21
1224	Publicans and managers of licensed premises		8	11	n/a	n/a	36.0	2
5431	Butchers		9	6	n/a	n/a	33.9	3
9236	Vehicle valeters and cleaners		6	4	n/a	n/a	23.4	5
622	Hairdressers and Related Services		8	5	n/a	n/a	13.9	7
4123	Bank and post office clerks		6	5	n/a	n/a	17.3	10
5313	Roofers, roof tilers and slaters		n/a	n/a	n/a	n/a	16.4	15
5436	Catering and bar managers		9	4	n/a	n/a	14.2	19
9271	Hospital porters		9	9	n/a	n/a	14.2	20
5235	Aircraft maintenance and related trades		8	3	n/a	n/a	11.6	24

Source: ONS (19)

4. SURVEY OF BUS DRIVERS – VIEWS ON MEASURES TAKEN BY TFL AND BUS OPERATORS

4.1 SUMMARY OF FINDINGS IN THE INTERIM REPORT ON SAFETY MEASURES INTRODUCED BEFORE AND AFTER LOCKDOWN ON 23 MARCH 2020

In terms of actions to prevent infection, in the interim report we analysed 14 of the actions that were identified by bus operators and TfL as potentially reducing COVID-19 transmission and were initiated in the period March to early June by operators (1). These actions comprised those related to vehicles (daily antiviral cleaning, enhanced cleaning, closing holes on assault screens, restricted access to front seats and middle door boarding), to drivers (communications, HR policies and advice, hand sanitiser, wipes and masks) and to premises (access to toilets, enhanced cleaning, adapted premises/social distancing, health and safety/union reps stood down and cleaning inspections).

On average, bus companies had completed 13.3 out of the 14 by early June. Timing of actions varied across companies – between four and eight actions were initiated by companies before lockdown on 23 March – an average of 5.3 per company. A number of companies also initiated actions shortly after lockdown – an average of 2.6 per company were initiated between 23 March and 3 April. Companies also initiated a number of actions after 3 April, by which time most (80 percent) of those who later died had stopped working (an average of 5.4 actions per company after this date), with some companies initiating the majority of their actions before lockdown and others initiated the majority after 3 April.

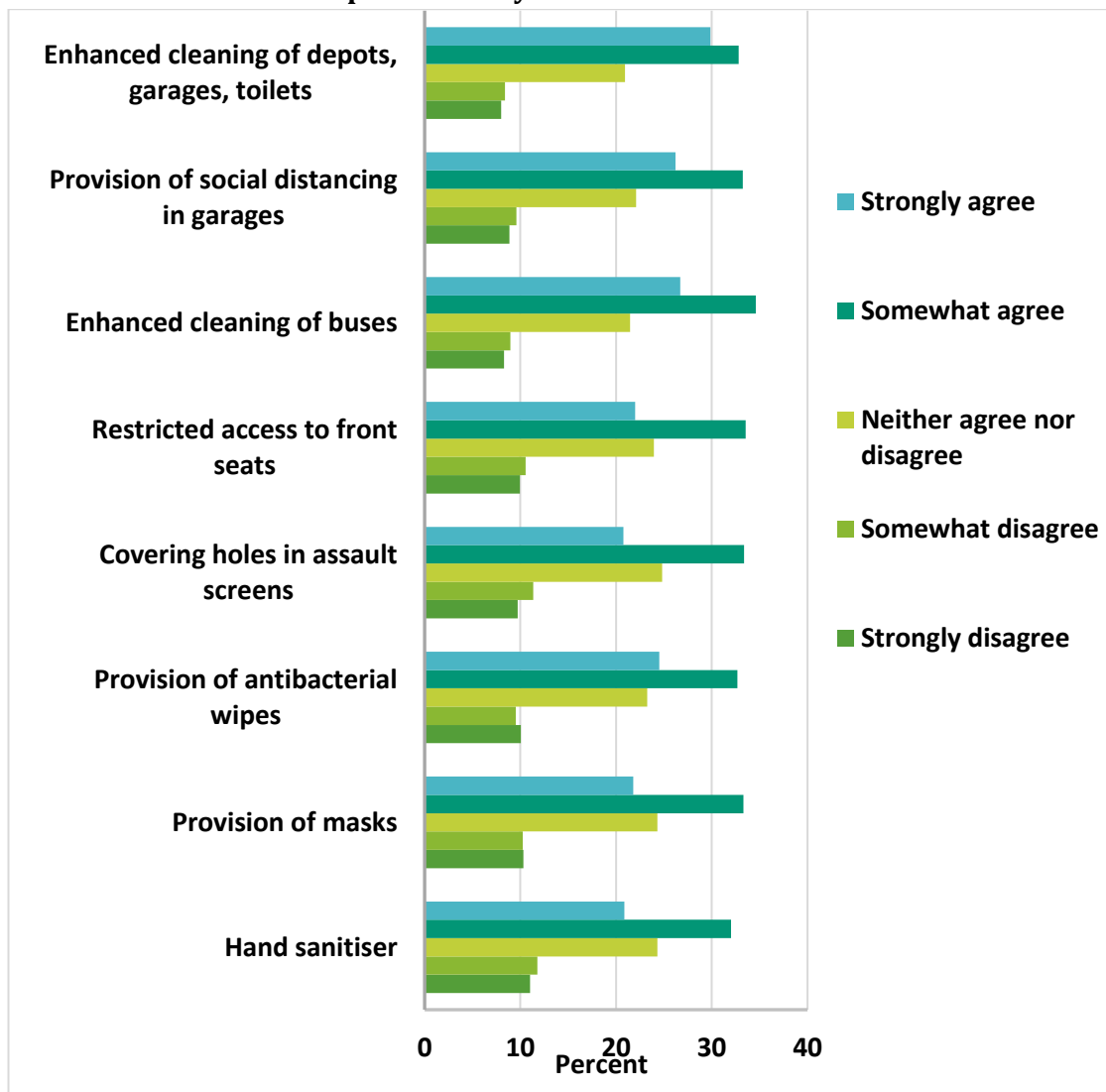
The majority, 59 percent, of the London bus drivers who died of COVID-19 by May 2020 had ceased work during the week ending on the 27 March, which was the week during which lockdown took place (23 March), and the following week. In this context, the incubation period (the time from exposure to development of symptoms) is believed to be between two and 14 days, with the average being five days. Since over 80 percent of drivers who subsequently died had ceased work by 3 April, this suggests that most of those who died had become infected in March. This timing makes it unlikely that the actions taken by bus operators affected the majority of infections leading to death.

4.2 BUS DRIVERS' VIEWS ON SAFETY MEASURES INTRODUCED BEFORE 23 MARCH 2020

For the safety measures listed in Section 4.1, bus drivers were asked in the survey, which took place in October and November 2020, to indicate, for those that they could remember, whether they made them feel safer from getting COVID-19 before and after lockdown on 23 March 2020 (see Annex 1). They were asked to record their answer on a five-point scale, from strongly disagree to strongly agree. At the end of the questionnaire, bus drivers were also invited to add any comments, as free text, on how the COVID-19 pandemic has affected their work as a bus driver. We use these comments to shed light on their thinking when answering the preceding structured questions.

Figure 4.1 shows that for most safety measures introduced before the 23 March the majority of bus drivers responding agreed that the new measures improved their safety at work.

Figure 4.1 Bus drivers’ assessment of whether safety measures introduced before lockdown on 23 March improved safety



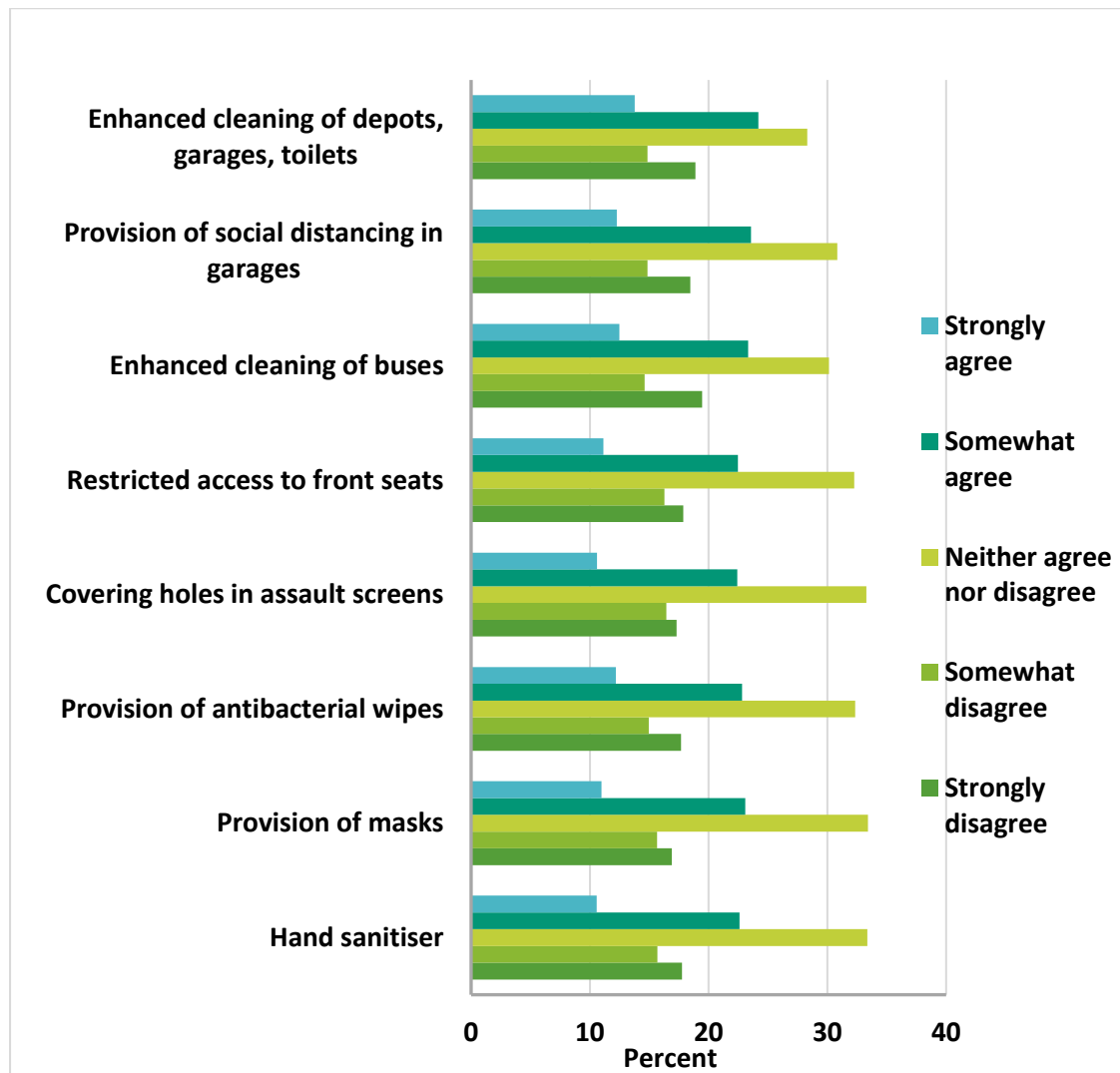
Source: authors’ analysis of the London bus drivers’ survey data, 2021

There was a small difference by ethnic background in how bus drivers assessed whether the COVID-19 safety measures introduced before the first lockdown in 2020 increased their safety. Those identifying as Black were more likely than others to agree that safety measures had increased safety. Although levels of agreement were generally lowest among employees of one operator, this was not one of those indicated in Table 3.1 as having a significantly raised level of mortality. Responses among employees of the operators with high levels of mortality did not differ markedly from the other seven operators.

In their comments at the end of the survey, which do not necessarily distinguish what happened before or since lockdown (unless indicated by the tense used by the bus driver) they referred to the slow and late introduction of hand sanitiser and social distancing measures, as well as the lack of enhanced cab cleaning between shifts. For example, they used phrases such as “the company was slow to react”, “the government was too slow”, “poorly carried out”, “lack of enforcement”. They also referred to the need to include more time in their shift as they need to spend more time cleaning the cab or ensuring that the cab was cleaned between shifts.

These comments also point to the inconvenience to some drivers of measures not being fully implemented as well as the safety aspects. The survey also included a structured question on whether the implementation of safety measures created inconvenience for bus drivers. As shown in Figure 4.2, views were mixed among bus drivers as to whether the measures introduced were inconvenient and varied little between the type of measure – around a third agreed that they were inconvenient and a third disagreed with that statement.

Figure 4.2 Bus drivers’ assessment of whether safety measures introduced before lockdown on 23 March were inconvenient



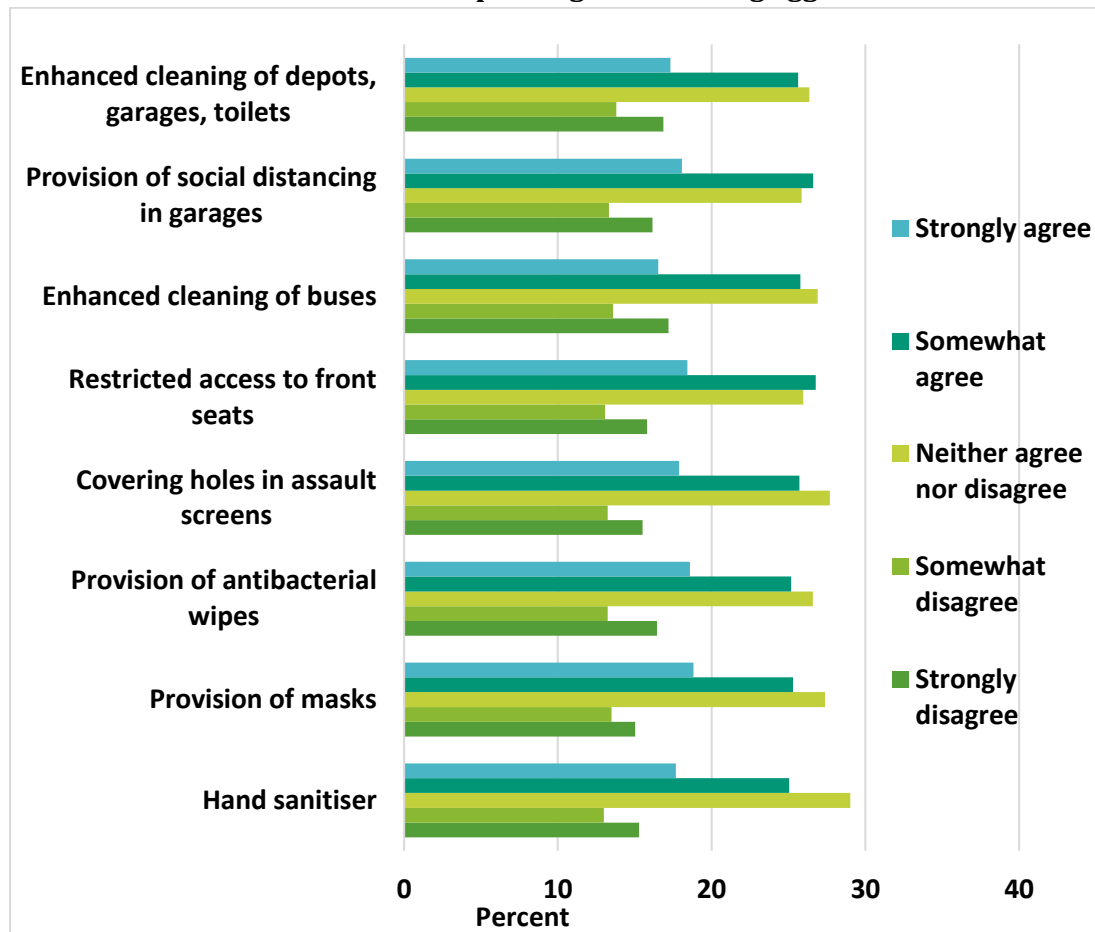
Source: authors’ analysis of the London bus drivers’ survey data, 2021

Bus drivers who identify as White were less likely than others to agree the statement that safety measures were inconvenient. While employees of some operators were slightly more likely to agree that the measures were inconvenient, this was again not related to mortality levels in those operators.

Regarding bus drivers’ views on whether the COVID-19 safety measures introduced before the first lockdown on the 23 March 2020, resulted in passengers becoming aggressive, responses were fairly similar for most of the measures taken – Figure 4.3. More drivers agreed with the statement (over 40 percent in each case) than disagreed (around 30 percent in each case). Given that some of these measures were unlikely to have affected passengers, it may be that these

responses reflected a general impression of whether or not passengers were more aggressive. In their free text comments, several bus drivers referred to the difficulty in hearing and being heard by passengers due to the covering up of holes on the assault screen (which started to happen soon after lockdown on 23 March) and the wearing of masks, having had to open the cab door to answer passengers' questions and trying to enforce rules brought in with the COVID-19 restrictions. Some bus drivers alluded to the need for microphones in order to communicate with passengers outside the cab screen.

Figure 4.3 Bus drivers' assessment of whether safety measures introduced before lockdown on 23 March resulted in passengers becoming aggressive



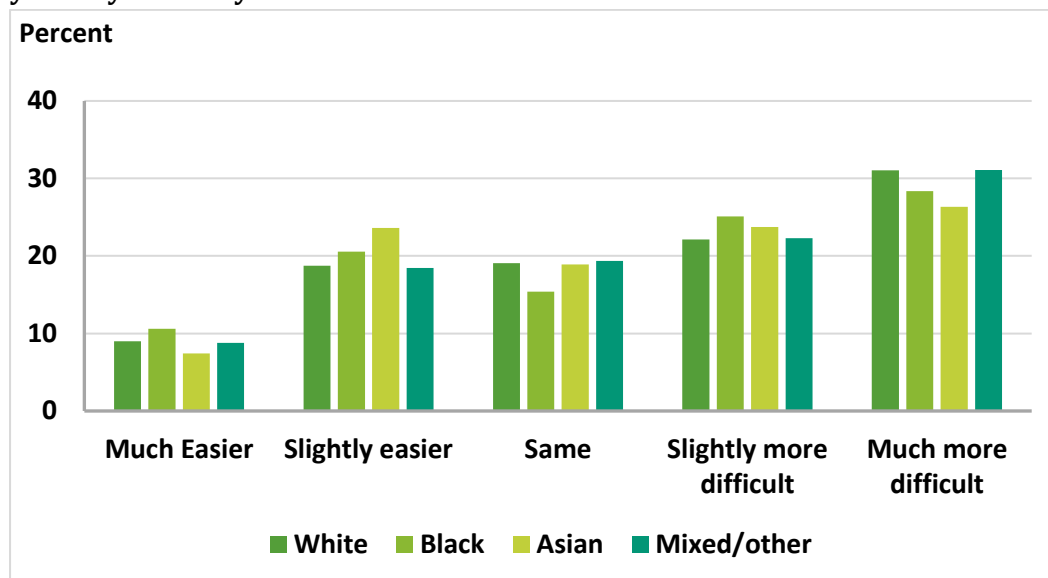
Source: authors' analysis of the London bus drivers' survey data, 2021

Black bus drivers were less likely than other ethnicities to agree with the statement that passengers had become more aggressive towards drivers with the introduction of each of the COVID-19 safety measures introduced before 23 March. The proportions of Black drivers agreeing and disagreeing tended to be very similar, while among other ethnicities, more tended to agree that passengers were more aggressive as a result of the measures – but, as above, this finding should be interpreted in terms of overall impressions about passenger aggressiveness. Views on passenger aggressiveness also varied between drivers employed by the different bus operators – possibly reflecting differences in the characteristics of the areas in which they operated – but did not appear to be related to mortality levels.

4.3 BUS DRIVERS' VIEWS ON CHANGES IN THEIR WORK ENVIRONMENT

Figure 4.4 suggests that a slight majority of bus drivers of all ethnicities reported finding managing traffic congestion more difficult than in previous years (around 53 percent for most ethnicities), with no consistent differences in the pattern of responses between ethnic groups. Despite reductions in overall traffic levels after lockdown on 23 March 2020, one explanation may be related to the design of those street space schemes that have made some locations more difficult to access. In their free text comments, drivers referred to worsened traffic conditions linked to traffic calming measures and widening of bicycle lanes during the first lockdown in London. These conditions caused localised traffic delays and congestion, according to some bus drivers' accounts. The effect on working conditions was summed up by some drivers as "all drivers are forced onto the main roads which[are] now heavily congested. My work as a bus driver has been affected", "Congestion on the road is becoming more intolerable".

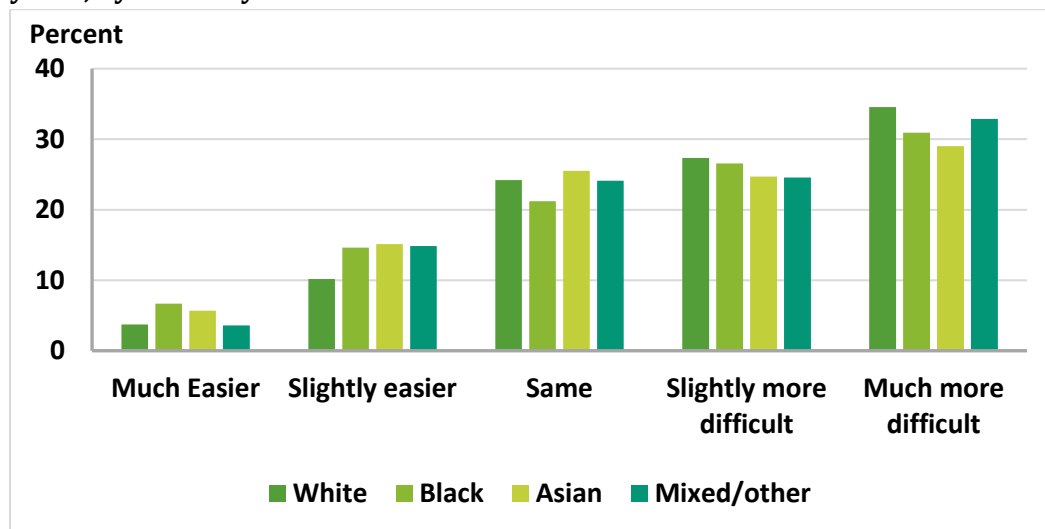
Figure 4.4 Bus drivers' assessment of managing traffic congestion compared to previous years by ethnicity



Source: authors' analysis of the London bus drivers' survey data, 2021

Not surprisingly, given the free text comments quoted above, there was a stronger view, shown in Figure 4.5 that managing traffic hazards had become more difficult compared to previous years, with more White drivers agreeing with the statement (62 percent) and fewer Asian drivers doing so (54 percent).

Figure 4.5 Bus drivers' assessment of managing traffic hazards compared to previous years, by ethnicity



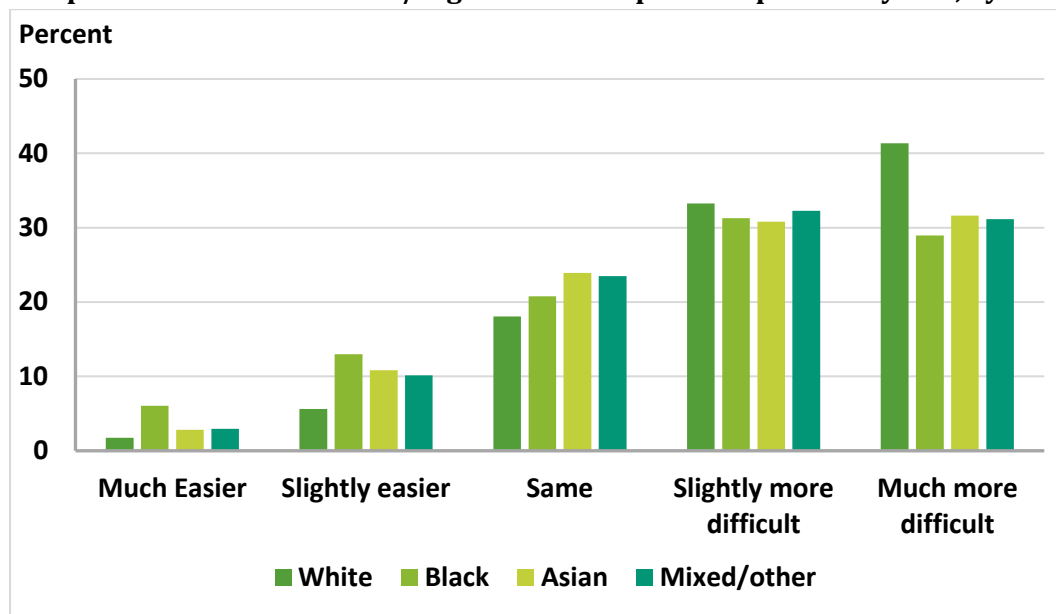
Source: authors' analysis of the London bus drivers' survey data, 2021

Managing adult passenger behaviour and compliance with instructions/regulations compared to previous years was seen as more difficult by most drivers (Figure 4.6), with 75 percent of White drivers agreeing with this statement compared to around 60 percent for other ethnicities. Many of the bus drivers' free text comments related to the actions of TfL and bus operators after 23 March -either during lockdown or subsequently. Bus drivers responded that some of the measures such as wearing masks made passengers more aggressive. According to at least 74 bus drivers' accounts, there was a lack of compliance with COVID-19 restrictions by passengers and bus drivers encountered aggression and no response from passengers when trying to enforce COVID-19 measures. Bus drivers have also stated that enforcing social distancing regulations on buses was very difficult and that passengers did not comply with these. One of the explanations is that the 30-passenger limit and other restrictions resulted in passengers experiencing longer than normal delays and waiting times before being able to board a bus.

Many bus drivers indicated that some passengers were not compliant with mask wearing rules since the first COVID-19 lockdown and were not compliant when drivers tried to enforce these. These were illustrated by some drivers using phrases such as "social distancing and regulations on a bus are good ideas on paper but enforcing them day to day in the real world is virtually impossible", "they take it out on us in the form of verbal abuse", "more arguing between passengers, and no exemption cards shown".

Drivers referred to feeling being left alone to enforce these rules and the need for police officers to implement COVID-19 measures - such as "Need to insist and make orders on posters", "there has to be more enforcement officers around implementing the rules."

Figure 4.6 Bus drivers' assessment of managing adult passenger behaviour and compliance with instructions/regulations compared to previous years, by ethnicity

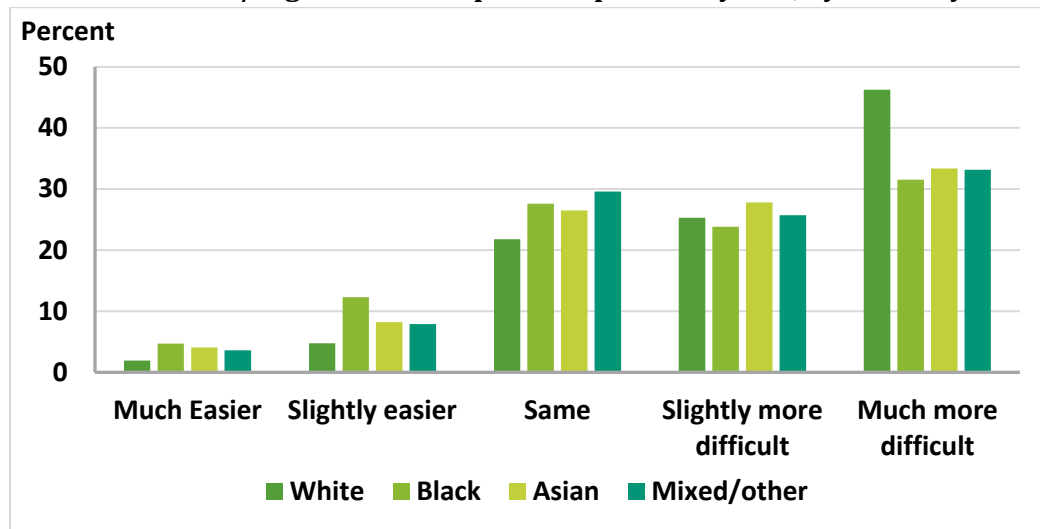


Source: authors' analysis of the London bus drivers' survey data, 2021

Responses to the question on the difficulty of managing school age children and their compliance with instructions/regulations were similar to those for adult compliance (Figure 4.7), except that drivers of all ethnicities were slightly more likely to agree strongly with the statement and less likely to only agree slightly with it. Again, White drivers were more likely than others to agree with the statement.

A specific issue that arose in the free text comments related to adults and children ignoring the distinction between school and non-school services, as passengers did not tend to comply with this and boarded the wrong buses. Comments included the following phrases from some bus drivers "passengers not bothered about school service and non-school service", "It's no good designating some services for school children only but then telling you must still pick adults up", "Kids get on any bus so you are leaving the non-school service people behind", "We service the school run but adult passengers are getting aggressive when I tell them that it is a school service".

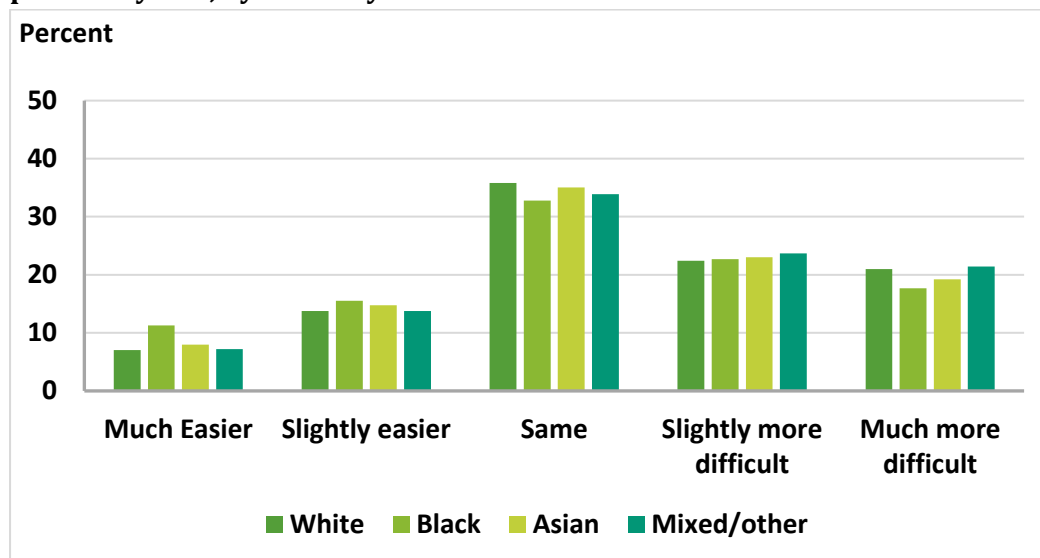
Figure 4.7 Bus drivers' assessment of managing school age children and their compliance with instructions/regulations compared to previous years, by ethnicity



Source: authors' analysis of the London bus drivers' survey data, 2021

Drivers were more likely to indicate that meeting demands of bus timetables had become more difficult than to say it had become easier (Figure 4.8). Around 40 to 45 percent of each ethnic group thought it had become more difficult, with the smallest of these percentages being among Black drivers. Around 21 to 25 percent thought it had become easier, with the smallest percentage being among White drivers and those of mixed/other ethnic origins.

Figure 4.8 Bus drivers' assessment of meeting demands of bus timetables compared to previous years, by ethnicity

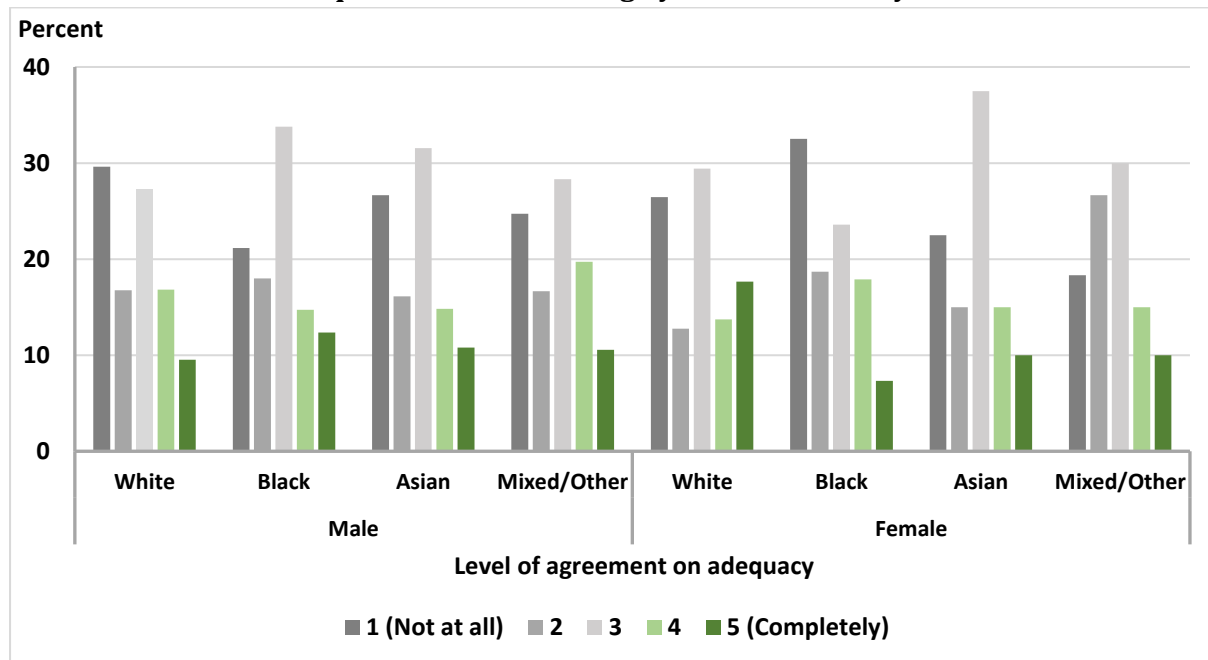


Source: authors' analysis of the London bus drivers' survey data, 2021

In commenting on the arrangements for bus changeover and transfer, over twice as many bus drivers indicated that the arrangements did not ensure social distancing (27 percent) compared to the proportion who thought they were completely adequate (11 percent). Figure 4.9 indicates the different attitudes to the adequacy of social distancing by ethnicity and sex. White men and Black women expressed the greatest level of concern about the adequacy of

arrangements (around 30 percent indicated that they are not at all adequate) while the proportion thinking they are completely adequate was greatest among White women drivers (18 percent).

Figure 4.9 Bus drivers’ assessment of how much the arrangements for bus changeover and transit ensures adequate social distancing by sex and ethnicity

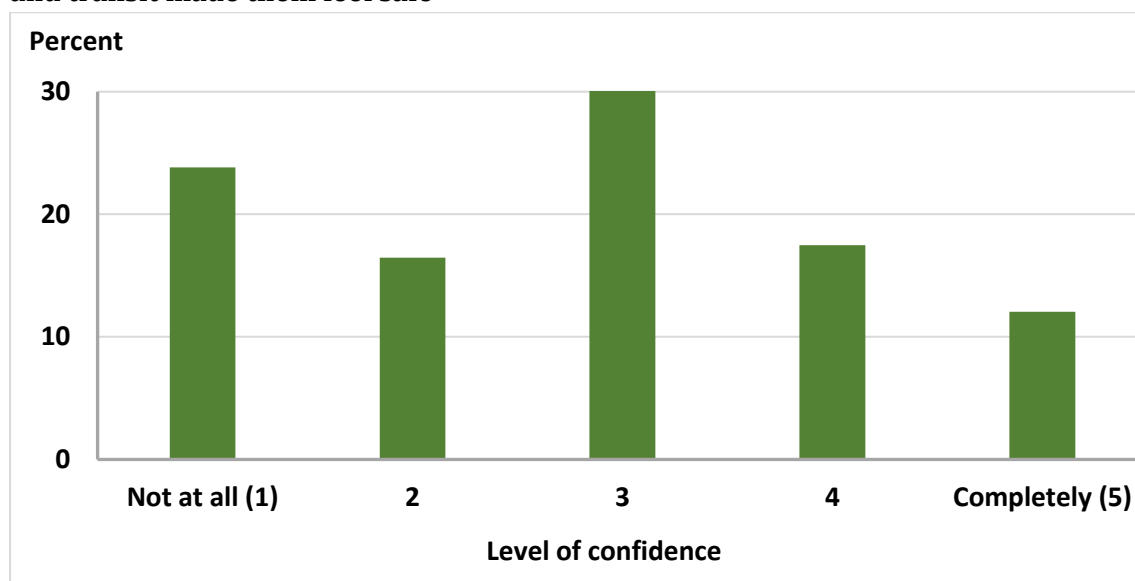


Source: authors’ analysis of the London bus drivers’ survey data, 2021

In their free text comments, bus drivers referred to lack of social distancing and lack of compliance in wearing masks by other fellow passengers during transfers – “on ferry buses most drivers don’t follow guidelines”, “Our journeys to and from the depot are in cramped ferry vehicles and the depot has plenty of notices but no enforcement of the social distance rules”, “not adhered to in ferry buses”, “no social distancing whatsoever in the shuttle buses”.

Figure 4.10 summarises bus drivers’ assessments of how much the arrangements for bus changeover and transfers made them feel safe. As with their assessment of social distancing, twice as many bus drivers considered the arrangements were not at all safe than were completely satisfied.

Figure 4.10 Bus drivers’ assessment of how much the arrangements for bus changeover and transit made them feel safe



Source: authors’ analysis of the London bus drivers’ survey data, 2021

Table 4.7 shows that the views of bus drivers on the adequacy of social distancing and the safety of transfers does not vary markedly between bus operators, with no relationship to excess mortality in Table 3.1.

Table 4.7 Percent of bus drivers indicating that the arrangements for bus changeover and transit ensured adequate social distancing or safety were (a) not at all adequate or (b) completely adequate, by bus operator

Bus operator	Not at all adequate		Completely adequate	
	Social distancing	Safety	Social distancing	Safety
Abellio	28	24	10	14
Arriva London	26	19	11	13
Go Ahead	24	22	10	11
HCT	30	27	12	15
Metroline	30	27	9	10
RATP Dev	26	25	12	14
Stagecoach London	31	28	10	11
Tower Transit	27	22	18	19
All operators	27	24	11	12

Source: authors’ analysis of the London bus drivers’ survey data, 2021

Some free text comments also provided a critique of the survey itself, in omitting explicit questions on mental health conditions and help point to the rationale behind some of the responses to safety measures taken. For example, “Mental health and emotional states are not mentioned in your survey - perhaps it should be included”.

5. SURVEY OF LONDON BUS DRIVERS – SOCIODEMOGRAPHIC CHARACTERISTICS

5.1 SUMMARY OF FINDINGS IN THE INTERIM REPORT CONCERNING THE DEMOGRAPHIC CHARACTERISTICS OF BUS DRIVERS

As indicated in Sections 2 and 3, the information available on the demographic characteristics of bus drivers focused on the distribution of deaths - a high proportion from BAME backgrounds, living in areas of above average deprivation and in the quarter of London Boroughs with the highest COVID-19 death rates in April 2020. In this section we examine the extent to which these findings aligned with the sociodemographic characteristics of all bus drivers.

5.2 AGE DISTRIBUTION

As indicated in Section 2, this report uses two sources of information about the basic characteristics of bus drivers – tables from bus operators and similar questions included in the survey of bus drivers. In this section we describe the information from both sources and, as far as possible, reconcile them recognising that (a) the drivers who responded to the questionnaire may not be fully representative of all drivers (b) the administrative information held by bus operators may not always be complete or up-to-date c) bus drivers may decline to provide some information either in the survey or to bus operators or both.

As Table 5.1 shows, the age estimates from the sample are reasonably representative of the wider bus driver population – the greater variation in sampling fractions by age among women drivers is, in part, a reflection of smaller numbers of female bus drivers.

Table 5.1: Observed and estimated numbers of bus drivers by age and sex

	Total in sample with either positive test or COVID symptoms with age information		Number in sample who answered age question later		Estimated age distribution in full sample		All bus operator employees		Estimated sampling fractions	
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
Under 20	*	*	*	*	*	*	19	*	*	*
20-44	237	24	112	9	1043.2	127.1	8805	1129	11.8	11.3
45-49	80	13	46	6	411.1	81.7	3470	329	11.8	24.8
50-54	76	18	77	3	630.2	52.4	4027	405	15.7	12.9
55-59	73	9	65	9	540.9	112.1	3718	356	14.5	31.5
60-64	50	6	69	5	546.7	63.3	2562	168	21.3	37.7
65-69	*	*	*	*	103.8	11.5	858	27	12.1	42.4
70-74	*	*	*	*	60.6	*	187	*	32.4	*
75 or over	*	*	*	*	*	*	37	*	19.5	*
Total	522	70	394	33	3358	448	23684	2422	14.2	18.5

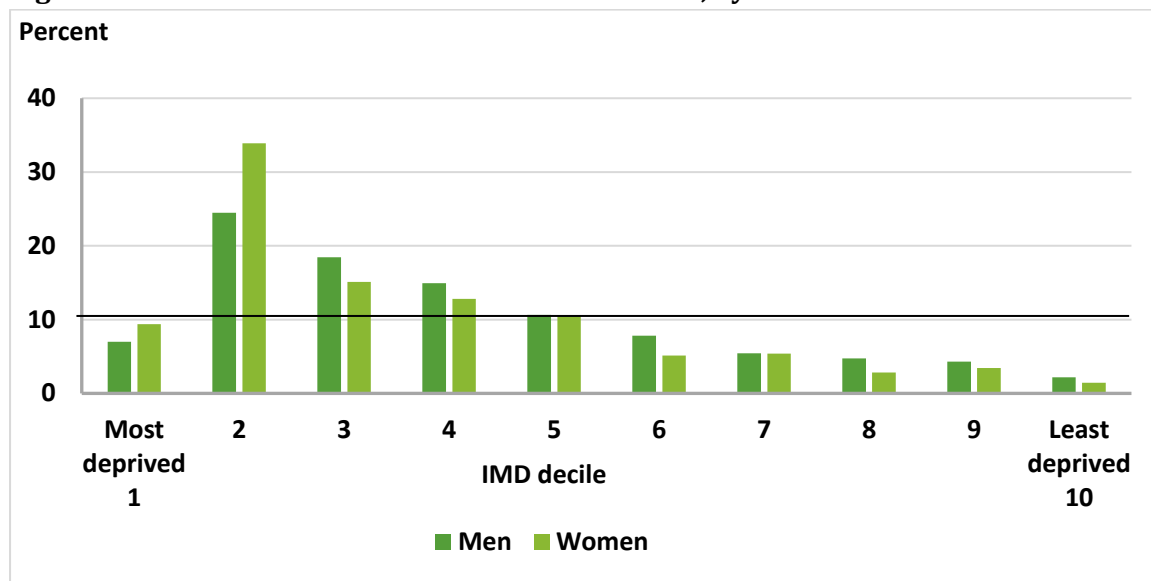
Sources: Populations of London bus drivers provided by bus operators, sample data collected by NATCen

Note: * Number suppressed to avoid disclosure of small numbers of drivers

5.3 AREA DEPRIVATION

The bus driver survey included a question on the postcode where drivers lived. This enabled NATCen to provide us with both the local authority of residence of the driver and the deprivation decile of the neighbourhood in which they lived, using the Index of Multiple Deprivation (IMD2015) (25). As shown in Figure 5.1, drivers who participated in the survey and provided information on where they lived, were more likely than the general population to live in the relatively deprived deciles 2 to 4 and less likely to live in the most deprived decile or in the 50 percent of more affluent areas (deciles 6 to 10). Female drivers were more likely to live in the 20 percent of most deprived neighbourhoods (deciles 1 and 2) than their male colleagues.

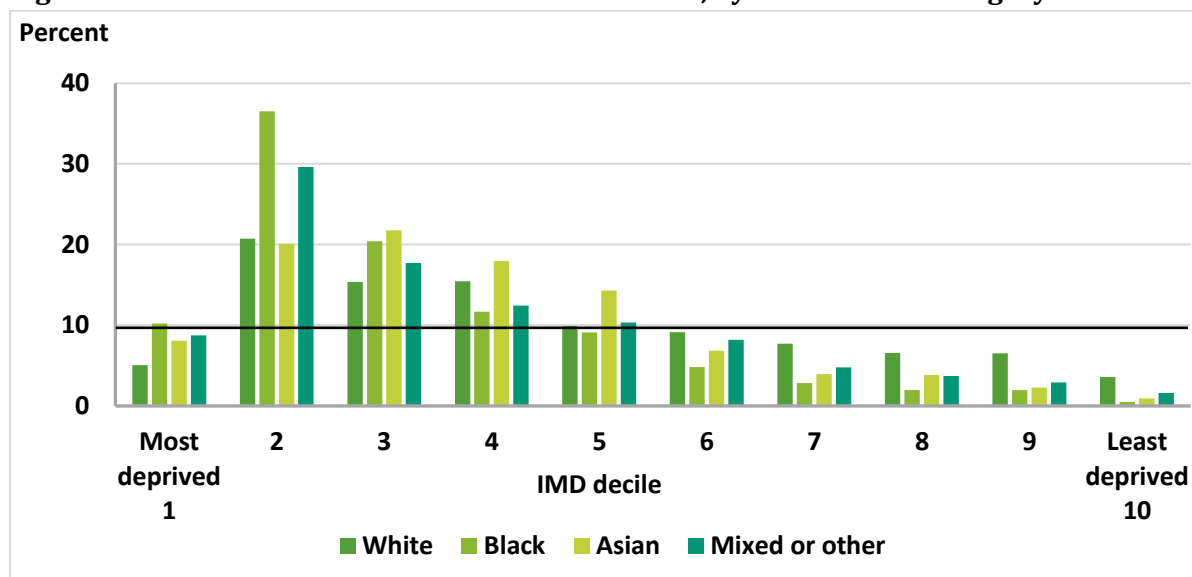
Figure 5.1 Percent of bus drivers in each IMD decile, by sex



Sources: authors' analysis of the London bus drivers' survey data and MHCLG (25)

Figure 5.2 provides comparable information by ethnicity to that in the previous figure. It can be seen that White drivers were less likely to live in the three most deprived neighbourhoods than drivers from any other ethnic group and more likely to live in the five most affluent deciles (although less likely to do so than the general population). While drivers from Black and mixed/other backgrounds were more likely than other drivers to live in the two most deprived neighbourhoods, Asian drivers were more likely than others to live in deciles three to five. These patterns broadly reflect the social and geographic position of many key worker populations within society and the ethnic divisions among key workers (7). It points to the value of using neighbourhood deprivation as a proxy indicator of individual socio-economic position (26) (27).

Figure 5.2 Percent of bus drivers in each IMD decile, by broad ethnic category

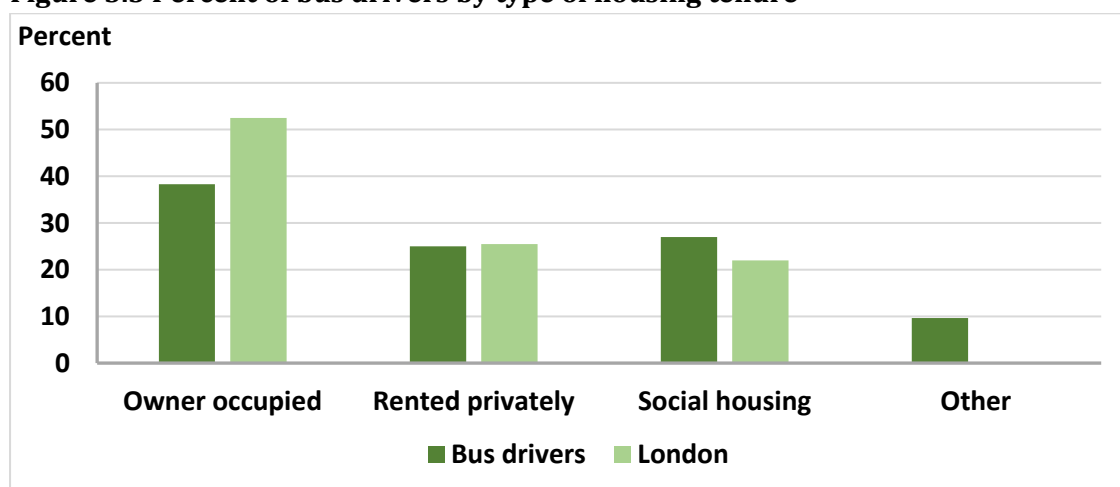


Sources: authors' analysis of the London bus drivers' survey data and MHCLG (25)

5.2 HOUSING AND HOUSEHOLD CONDITIONS

Housing tenure has long been recognised as a way of distinguishing between the socio-economic positions of those within an occupational group in a way that is more personal than the neighbourhood in which they live. In view of the sharp differences in the quality of housing stock in different sectors, it also has a direct bearing on the conditions in which people are likely to live. Figure 5.3 shows that 41 percent of drivers live in owner occupied or shared ownership dwellings, with 26 percent in social housing and 25 percent in privately rented housing. This compares with figures in the Mayor's Housing in London document of 52 percent owner occupied, 27 percent privately rented and 22 percent social housing in 2018 (28). The lower figure for ownership among drivers may, in part, reflect the age structure of drivers shown in Figure 5.1, as around 40 percent of drivers are aged 20 to 44 and in London, home ownership is restricted to only 28 percent of those aged 25 to 34 and 49 percent of those aged 35 to 44 (28).

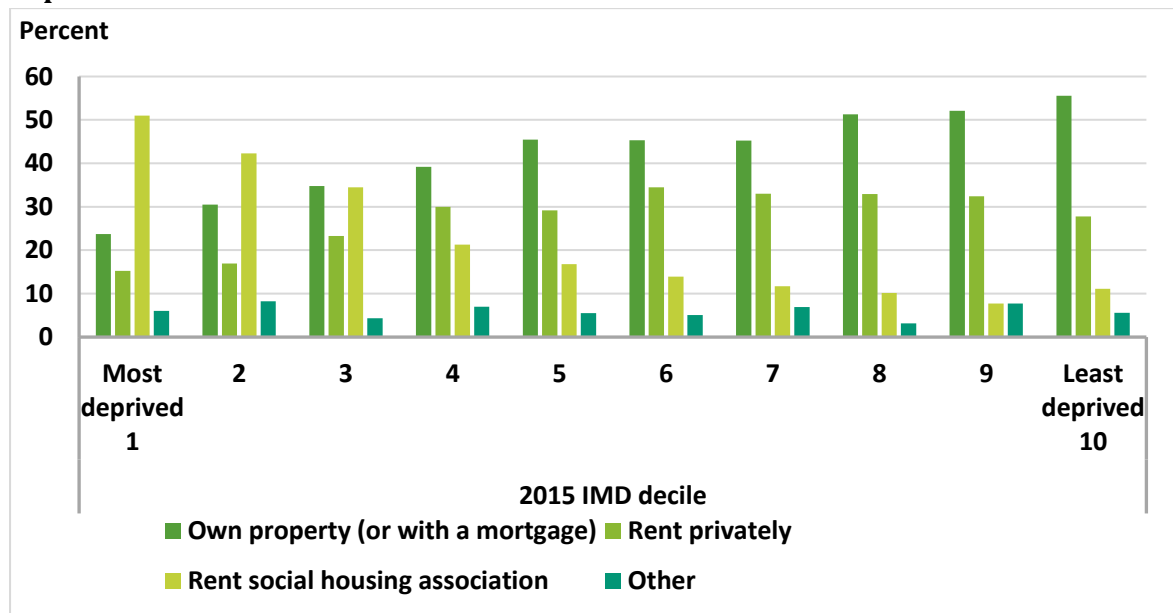
Figure 5.3 Percent of bus drivers by type of housing tenure



Source: authors' analysis of the London bus drivers' survey data, 2021 and Mayor of London (28)

In terms of the relationship between housing characteristics and neighbourhood deprivation, Figure 5.4 shows the unsurprising fact that the proportion of drivers living in owner occupied housing increases sharply with the affluence of neighbourhoods, while living in social housing predominates in more deprived neighbourhoods. Private renting is least common in the 30 percent of more deprived neighbourhoods but is used by around 30 percent of drivers in every other deprivation decile.

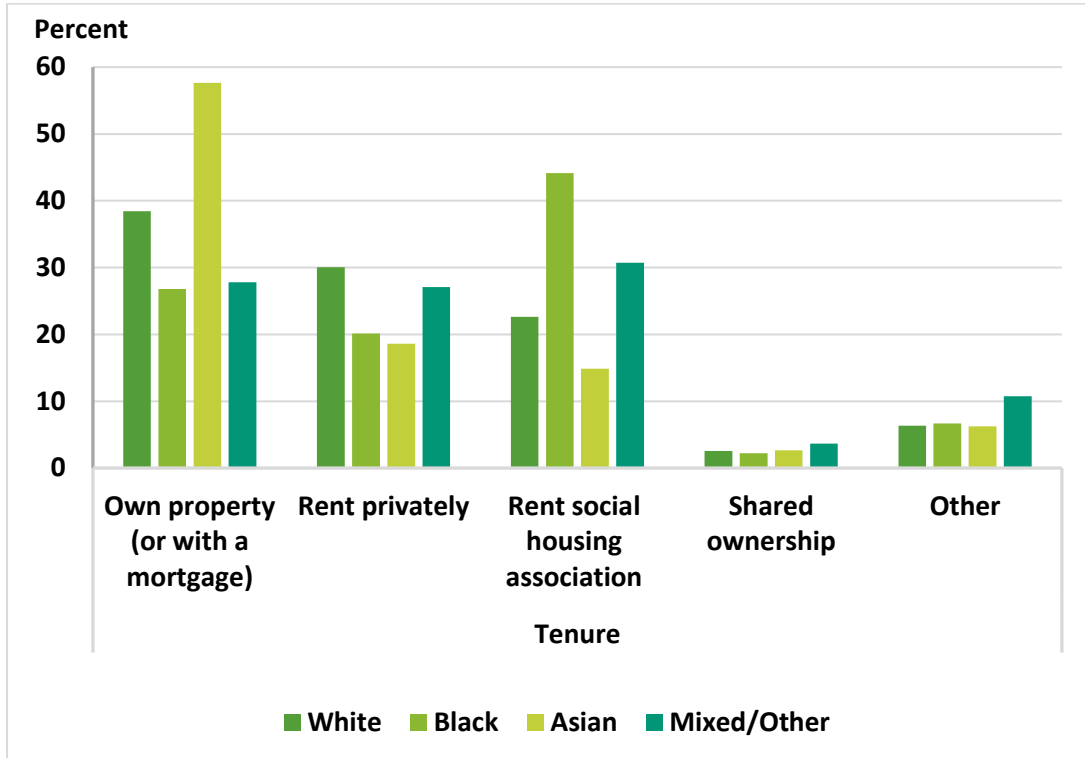
Figure 5.4 Distribution of bus drivers by housing tenure within each neighbourhood deprivation decile



Sources: authors' analysis of the London bus drivers' survey data and MHCLG (25)

Those who identify as Asian are the most likely to live in owner occupied property, while those who identify as Black, are more likely to be in property rented from a social housing association than in any other type of accommodation – Figure 5.5. Taken together these figures point to Black drivers being more likely than others to be living in social housing located in more deprived areas.

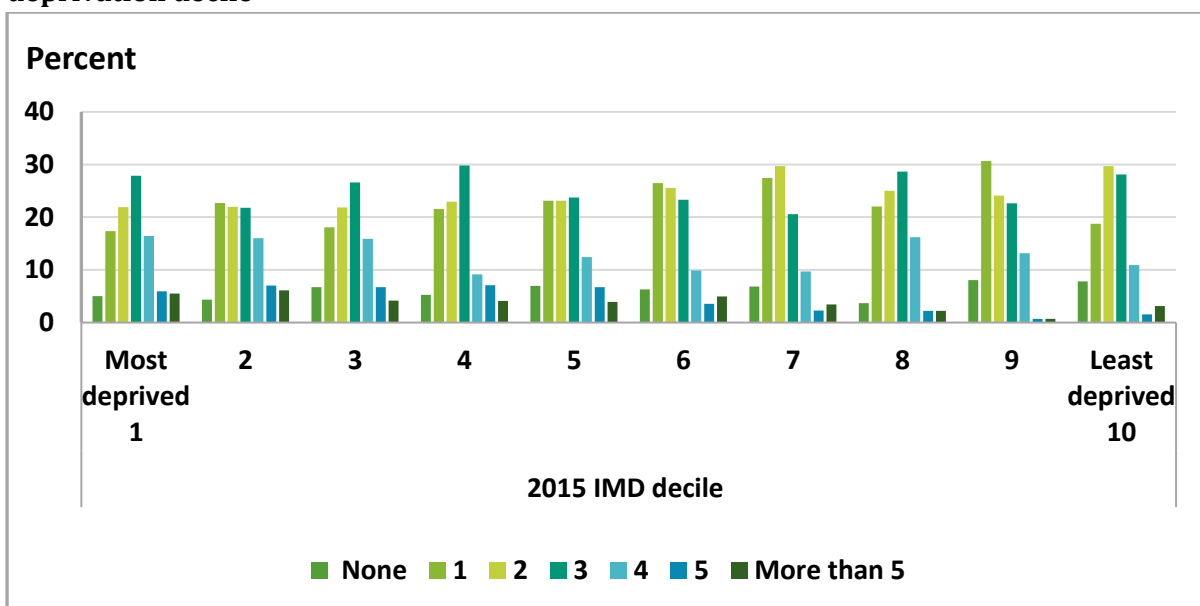
Figure 5.5 Percent of bus drivers in each broad ethnic category by type of tenure



Source: authors' analysis of the London bus drivers' survey data

Figure 5.6 shows the distribution, within each neighbourhood deprivation decile, of the number of other people living in the same household as the bus driver. In all deciles, households with between two and four other people predominated – with equal proportions in decile two, which includes more drivers than other deciles, while in deciles one, three and four the most common household size is three other persons.

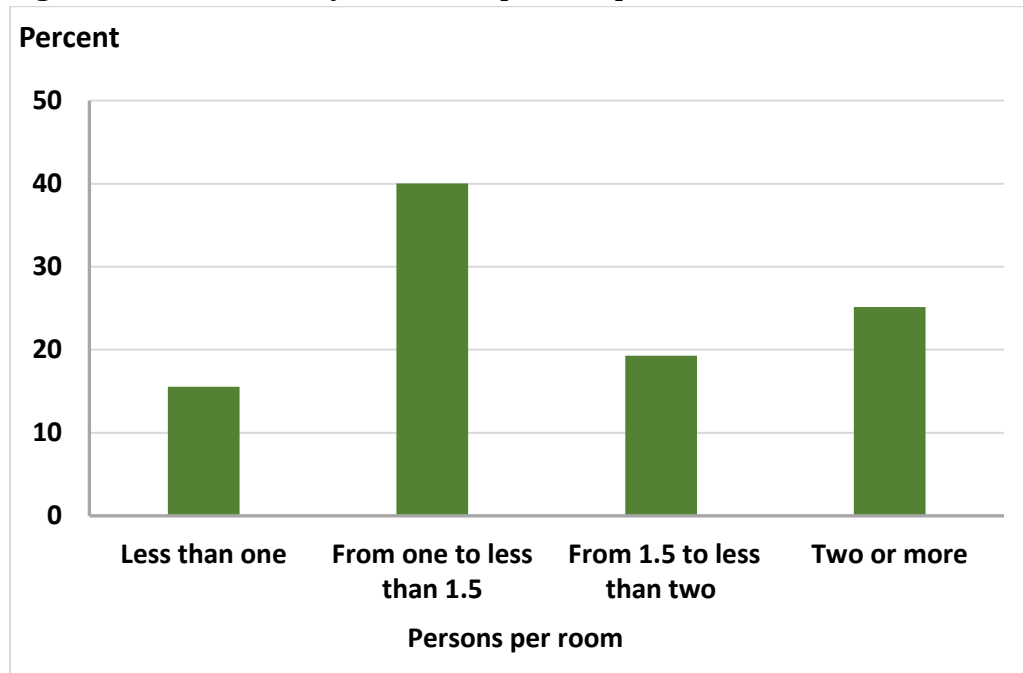
Figure 5.6 Number of family members living in the same household as the bus driver by deprivation decile



Sources: authors' analysis of the London bus drivers' survey data and MHCLG (25)

Household accommodation has been shown to be a factor in mortality from COVID-19 through the extent of mixing that goes on in the home and the lack of scope for social distancing (29). The measure used by the Ministry of Housing Communities and Local Government to assess overcrowding is the “bedroom standard” (30). However, this requires detailed information on the age structure of the household. An approximate measure is obtained by dividing the number of people in the household by the number of available rooms. Figure 5.7 shows that while it is most common for drivers to live in households with between one and 1.5 persons per room (40 percent), 25 percent live in households with two or more persons per room.

Figure 5.7 Bus drivers by number of persons per room in drivers’ households



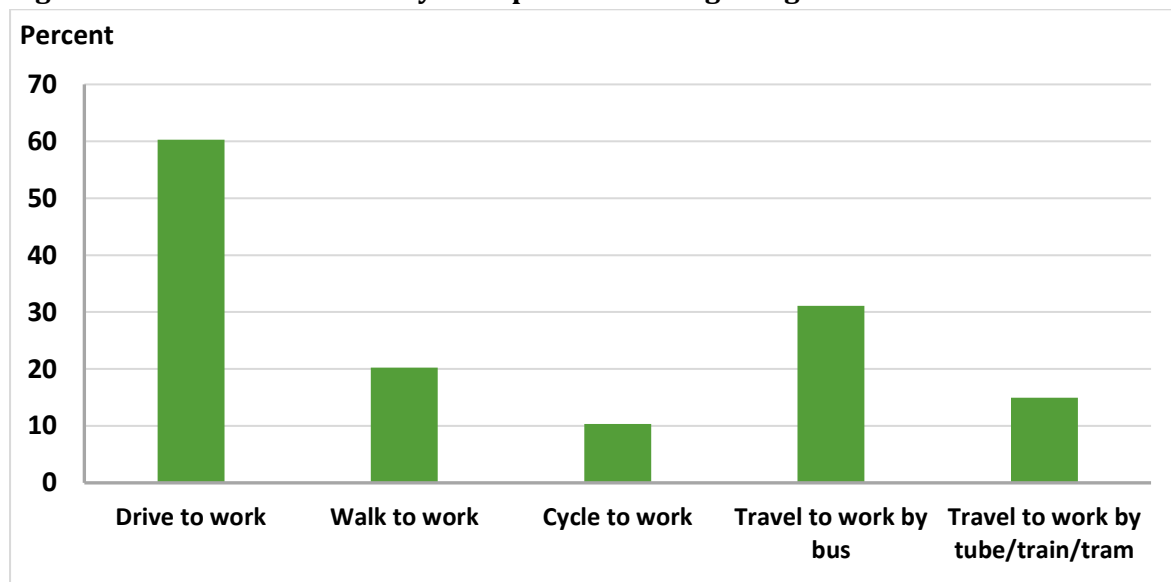
Sources: authors’ analysis of the London bus drivers’ survey data

6. SURVEY OF LONDON BUS DRIVERS – TRAVEL TO AND FROM WORK AND SHIFT PATTERNS

6.1 TRAVEL TO AND FROM WORK

Figure 6.1 shows that most drivers (60 percent) drive to and from work and are therefore less likely to be exposed to COVID-19 in the journey to and from work than others. Cycling was least common among bus drivers (10 per cent). For comparison, among adults of all ages in London, five percent cycled for travel purposes (rather than leisure) at least three times a week in 2018/19 – although this figure is likely to underestimate the proportion at working ages (31). Other means of transport are likely to be used in combination by many bus drivers and therefore total percentages exceeded 100 percent. Use of buses was second only to driving (30 percent) followed by walking some or all of the journey (20 percent). While all forms of commuting are work-related activities, rather than for leisure, driving to and from work adds to the length of bus drivers' time at the wheel each day.

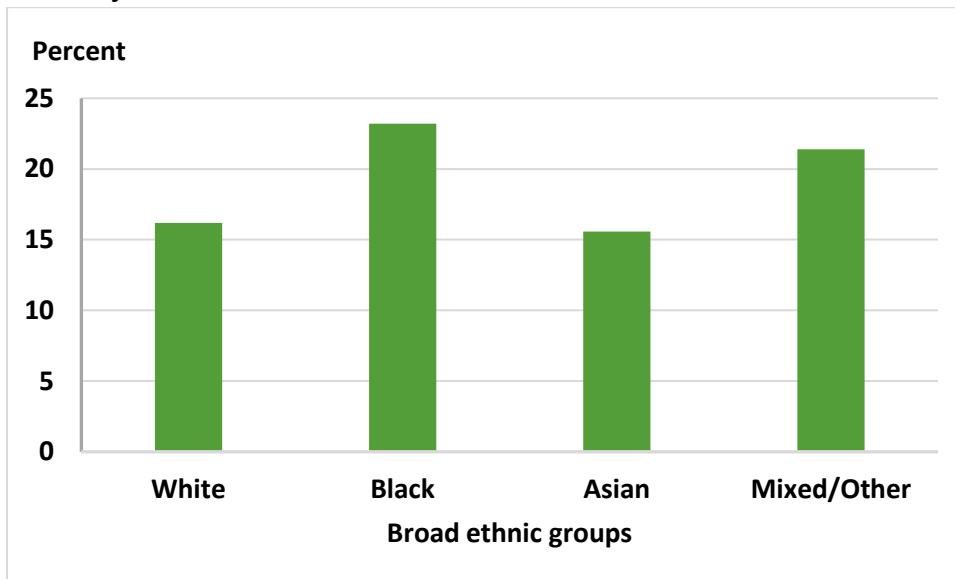
Figure 6.1 Percent of drivers by transport means in getting to and from work



Source: authors' analysis of the London bus drivers' survey data, 2021

Figure 6.2 shows the use of public transport (bus, train, tube or tram) by ethnic group and hence potential exposure to other passengers in enclosed spaces on their journey to and from work. While such exposure is minimised if others adhere to social distancing and mask wearing, these measures were not in place prior to lockdown on 23 March when most of those London bus drivers (and other key workers) who died in March to May 2020 were likely to have been infected. Black bus drivers made most use of public transport (23 percent) followed by those with mixed or other ethnicity (21 percent). White and Asian drivers had similar lower levels of use of public transport (16 percent).

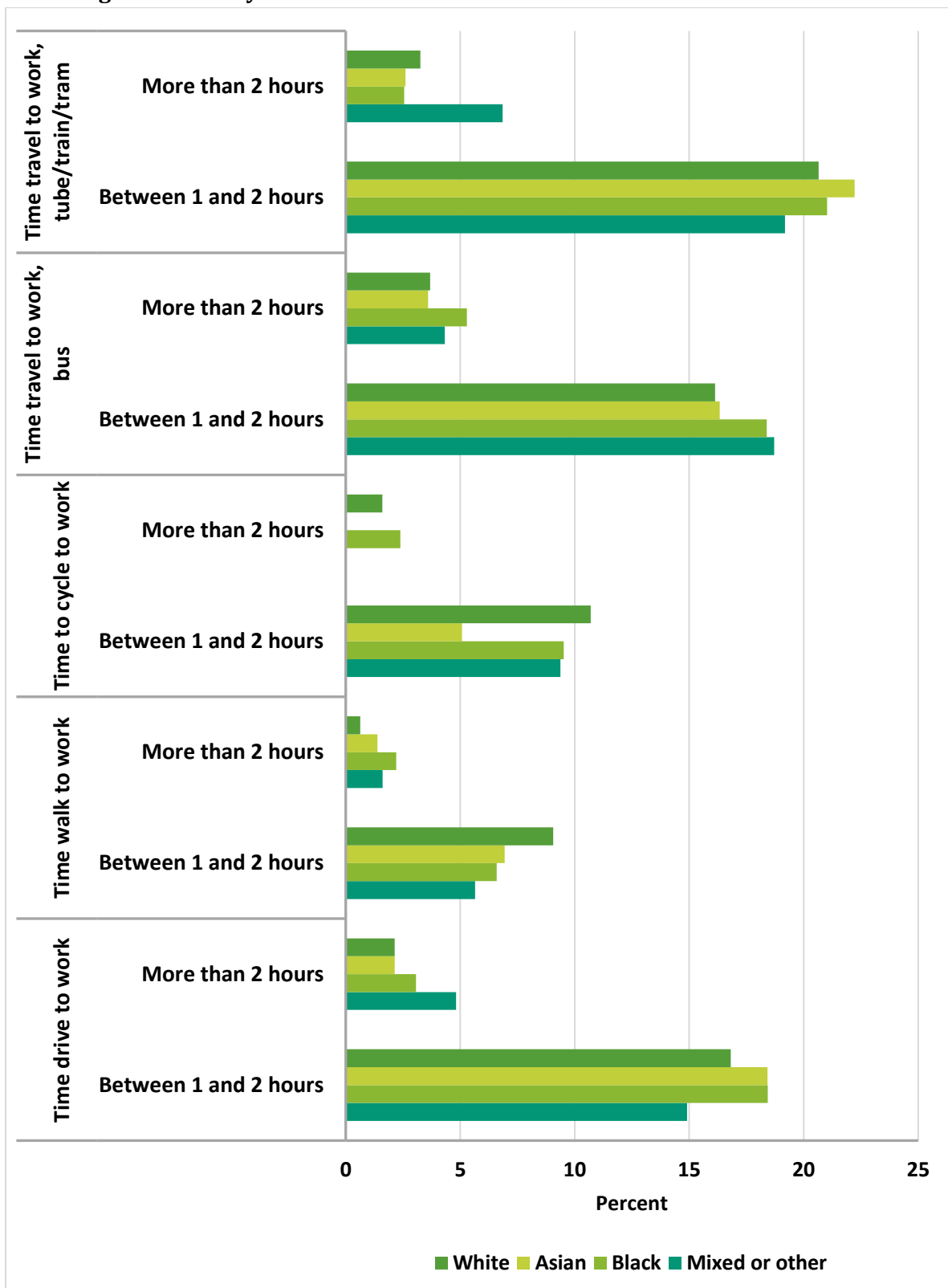
Figure 6.2 Percent of bus drivers take the bus/train/tube/tram to and from work by ethnicity



Source: authors' analysis of the London bus drivers' survey data, 2021

Figure 6.3 shows, for each mode of travel and ethnic group, the proportion of drivers who spent between one and two hours travelling to and from work and those who spent more than two hours commuting. Among those who drove to and from work, BAME bus drivers were slightly more likely to have journeys totalling over an hour. While Black drivers were most likely to spend an hour or more getting to and from work by car (22 percent), those of mixed and other ethnic origin were more likely than others to spend two or more hours doing so (5 percent). In terms of public transport, while a similar proportion of most ethnic groups spent a total of more than an hour in train, tube or trams (around 25 percent of those using these forms of transport), those of mixed or other ethnic origins were again more likely than others to spend two or more hours doing so (7 percent). Those of Black and mixed or other ethnic origins were more likely to spend an hour or more in total on bus journeys to work (24 and 23 percent, respectively). In terms of active travel, if they walked or cycled, both White and Black groups were more likely than others to spend more than an hour in total on the journey (10 and nine percent, respectively, among those walking, and 12 percent of both ethnic groups who cycled).

Figure 6.3 Percent of bus drivers by means of getting to and from work and time spent travelling and ethnicity

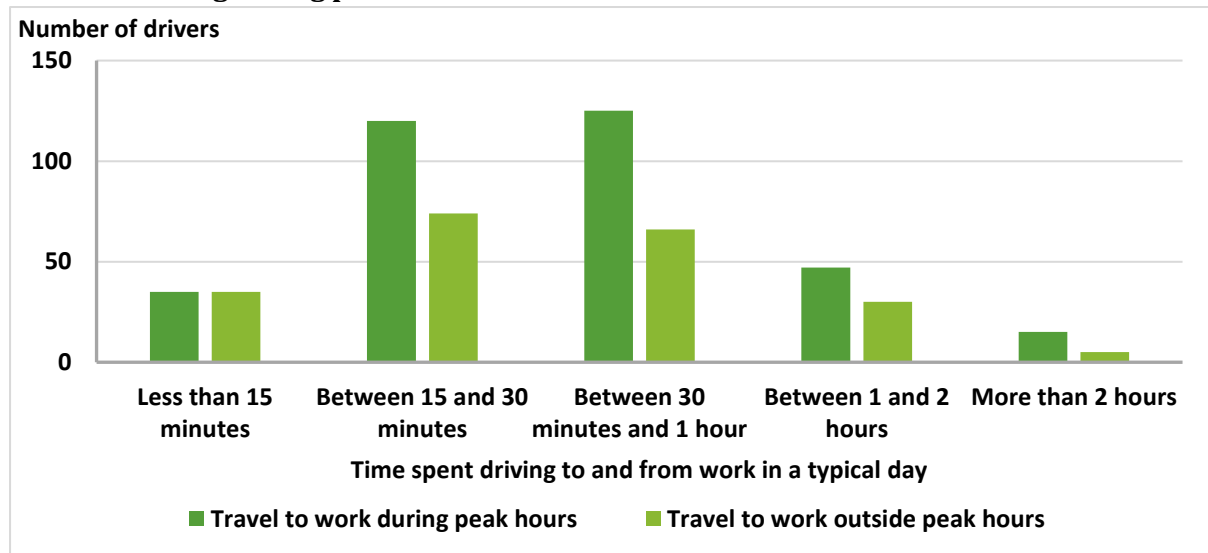


Source: authors' analysis of the London bus drivers' survey data, 2021

While total duration of commuting is an important addition to the length of the working day, the conditions in which driving to and from work is undertaken may affect the impact of doing so.

As shown in Figure 6.4, most of the drivers who drive their private vehicle to and from work spend either between 15 and 30 minutes or between 30 minutes and an hour to get to and from work. However, for all journey times of over 15 minutes, higher numbers of drivers undertake these journeys during peak hours.

Figure 6.4 Number of drivers who drive to and from work by time spent driving and whether driving during peak hours

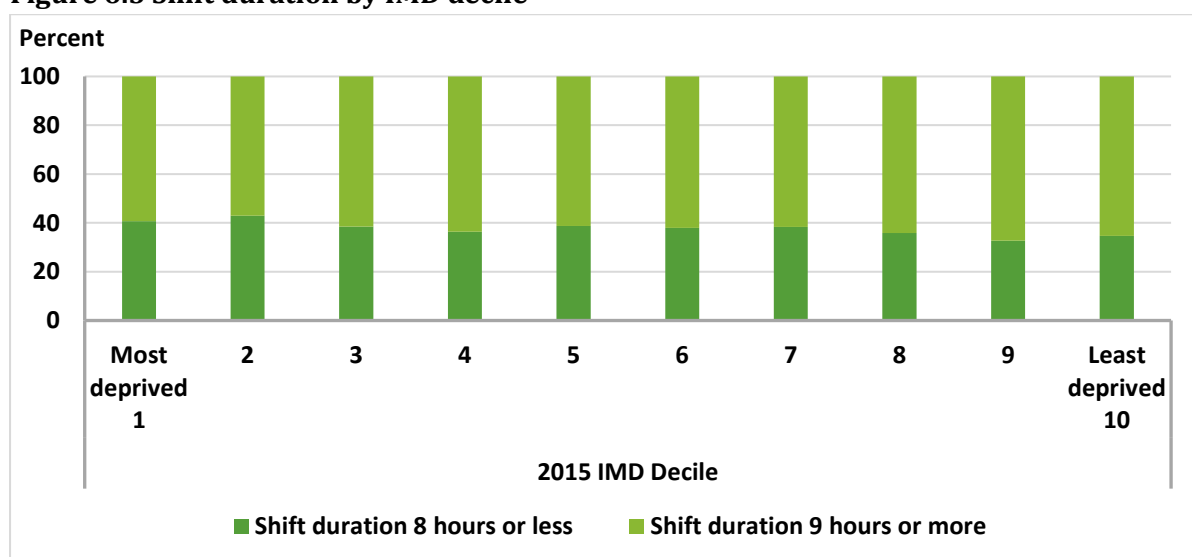


Source: authors' analysis of the London bus drivers' survey data, 2021

6.2 DURATION OF SHIFTS

Figure 6.5 shows that, in every neighbourhood deprivation decile, the majority of bus drivers had shifts of 9 hours or more, with the proportion varying from 57 percent in decile two to 67 percent in decile nine. Overall, there was a significant trend for shift time to increase with living in an affluent area (R squared = 0.69). In their free text comments, some bus drivers indicated that they were working longer hours – for example “We as bus drivers have been told to do lots of extra things, do longer hours and enforce things with no help”.

Figure 6.5 Shift duration by IMD decile



Source: authors' analysis of the London bus drivers' survey data, 2021

7. UNDERLYING HEALTH CONDITIONS AFFECTING COVID 19 OUTCOMES

7.1 KEY HEALTH CONDITIONS THAT ARE RISK FACTORS FOR COVID-19

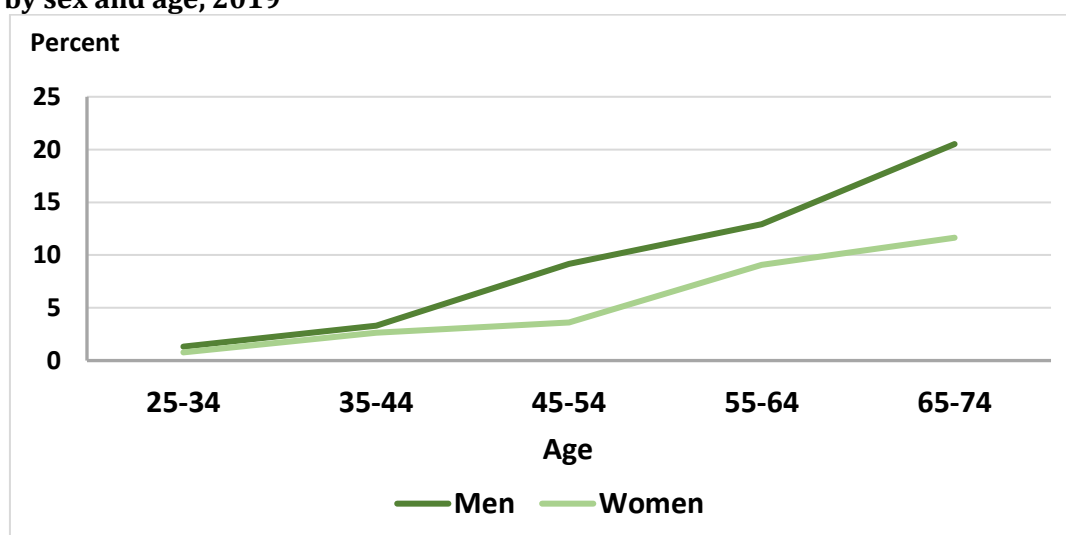
A number of underlying health conditions are risk factors for developing worse COVID-19 outcomes such as hospital admission, the need for intensive care and death. Among those aged 75 and under, particularly high risk pre-existing conditions include diabetes, hypertension, cardiovascular disease and other chronic diseases such as chronic obstructive pulmonary disease (COPD) and chronic kidney disease (5) (32) (33) (34). Obesity is also a risk factor for severity of symptoms and mortality from COVID-19 (35) (36).

Given the close relationship between health and sociodemographic factors such as sex, ethnicity and deprivation and that COVID-19 is particularly a risk for those with a range of underlying health conditions – COVID-19 mortality will reflect and exacerbate existing inequalities in health. For example, data from the Health Survey for England show that respiratory and heart and circulatory conditions are more prevalent in the most deprived areas (10 and 12 percent, respectively) than in the least deprived ones (six and nine percent, respectively) (37) .

7.2 DISTRIBUTION OF UNDERLYING HEALTH CONDITIONS IN THE GENERAL POPULATION

Diabetes mellitus is one of the common endocrine diseases affecting all age groups with nine percent of men and six percent of women aged 16 and over having the condition (37). Prevalence increases steeply with age to 21 and 12 percent, respectively for men and women aged 65 to 74 (Figure 5.1). The prevalence for those in the most deprived 2015 IMD neighbourhood quintile was 11 percent compared with seven percent in the least deprived one (38).

Figure 7.1 Percent of adults aged 25 to 74 in the Health Survey for England with diabetes by sex and age, 2019



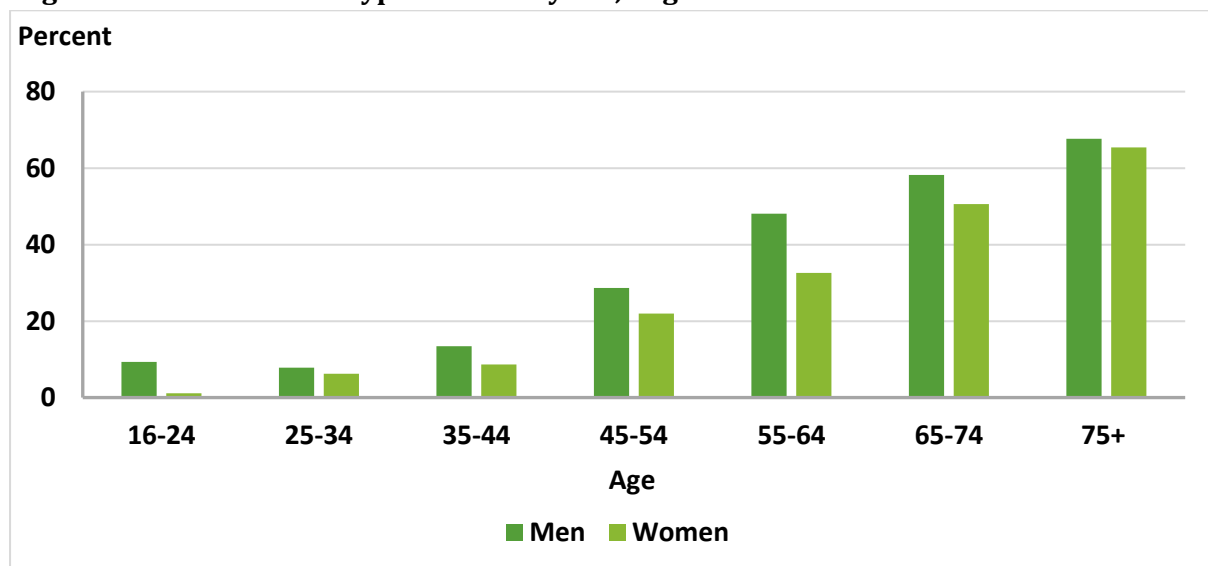
Source: Health Survey England 2019 (37)

The prevalence of people of all ages on the coronary heart disease (CHD) register was three percent in England in 2019 and did not show a clear pattern by IMD local authority decile (39).

Long-term respiratory conditions affect all age groups with seven percent of men and eight percent of women aged 16 and over having the condition (38). Prevalence increases steadily with age from five percent of men and six percent of women affected at ages 16 to 24 to 12 percent of both men and women at age 65 to 74. The prevalence for those in the most deprived 2015 IMD neighbourhood quintile was 10 percent compared with six percent in the least deprived one (38).

In the 2019 Health Survey for England, 28 percent of adults (30 percent of men and 25 percent of women) had hypertension (high blood pressure), 14 percent of men and 11 percent of women had untreated high blood pressure (37) - Figure 7.2. Among men, untreated hypertension was highest among those aged 55 to 64 (22 percent), among women, this proportion increased with age and was highest among those aged 65 and over (19 percent) (37). The prevalence of people of all ages on the hypertension register was three percent in England in 2019 and did not show a clear pattern by IMD local authority decile (40).

Figure 7.2. Percent with hypertension by sex, England 2019

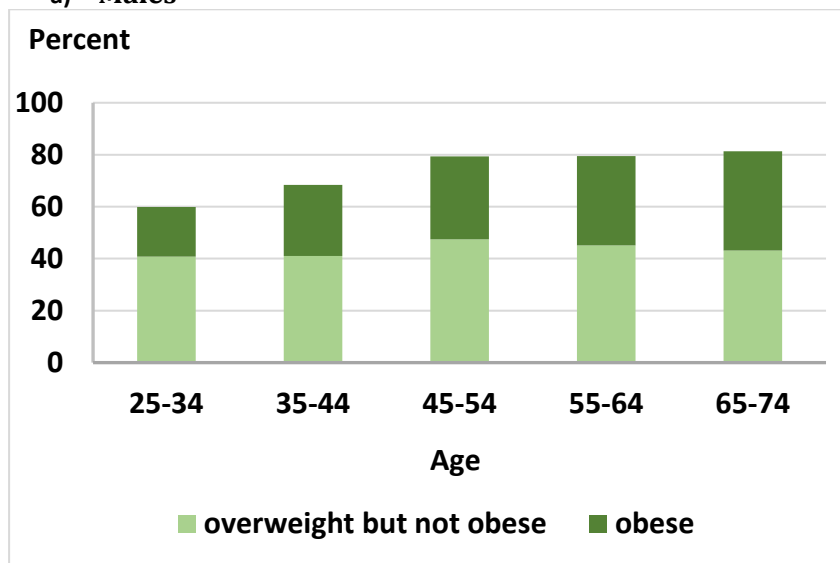


Source: Health Survey England 2019 (37)

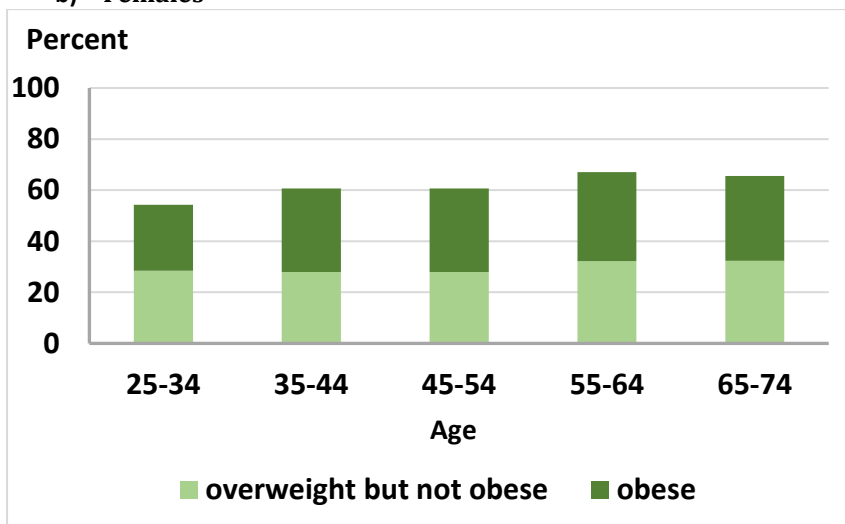
Figure 7.3 shows data on overweight and obesity from the 2019 Health Survey for England (37). The prevalence of overweight and obese men living in England increased with age from 60 percent at ages 25-34 to 80 percent at ages 45 to 74, with obesity doubling from 19 to 38 percent across this age range. Among women, overweight and obesity increased from 57 percent at ages 25 to 34 to peak at 67 percent at ages 55 to 64. Between ages 35 to 44 and 65 to 74, the proportion obese was fairly constant – around a third of all women in each age group (36).

Figure 7.3 Percent of adults aged 25 to 74 classified as overweight or obese by sex and age, England 2019

a) Males



b) Females



Source: Health Survey for England (37)

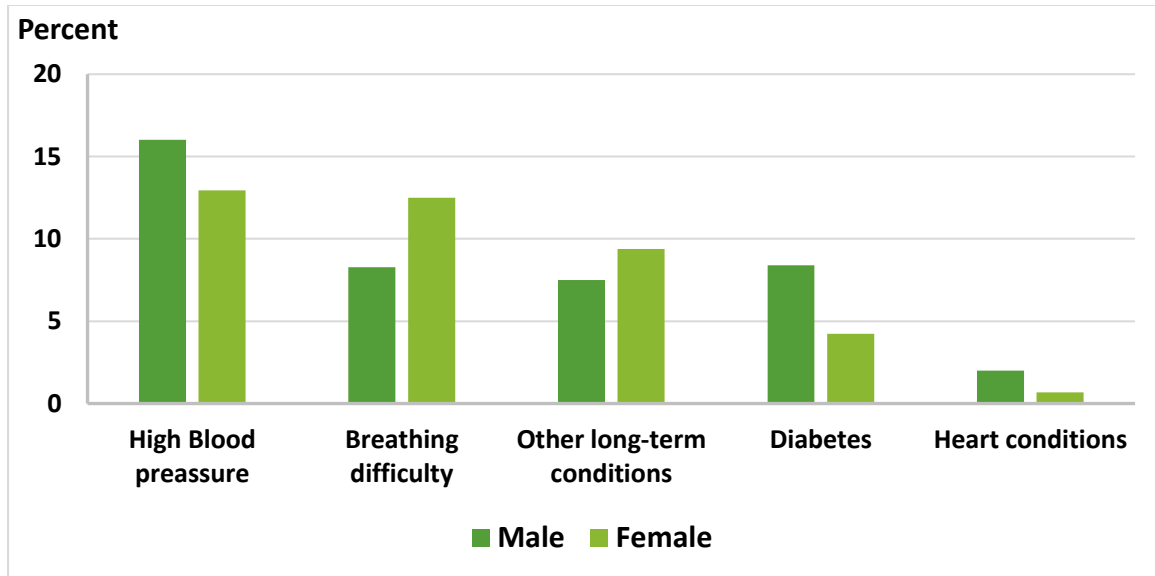
When Health Survey for England figures are disaggregated by ethnicity, the highest rates of overweight including obesity were among Black adults (74 percent), followed by White adults (63 percent). Asian adults had some of the lowest rates (56 percent) (36).

When comparing 2019 Health Survey for England figures across neighbourhood deprivation quintiles, rates of overweight including obesity among men in the most deprived quintile were 69 percent, compared with 66 percent in the least deprived. Inequalities were more pronounced for women - 69 and 53 percent, respectively, in the most and least deprived quintiles. Within this category of overweight and obese, differences in obesity were more pronounced among both men and women - 30 percent of men in the most deprived quintile were obese compared to 22 percent in the least deprived quintile while the rates for women were 39 and 22 percent, respectively (37).

7.3 DISTRIBUTION OF UNDERLYING HEALTH CONDITIONS AMONG BUS DRIVERS

Among bus drivers who responded to whether they had an underlying condition in the survey carried out for us by NATCen, 608 or 15.7 percent self-reported having high blood pressure- a higher rate than for any of the other health conditions – Figure 7.4. The second most prevalent underlying condition was breathing difficulties, with 8.8 percent of drivers having this condition, followed by diabetes (8 percent) and other health conditions (7.8 percent).

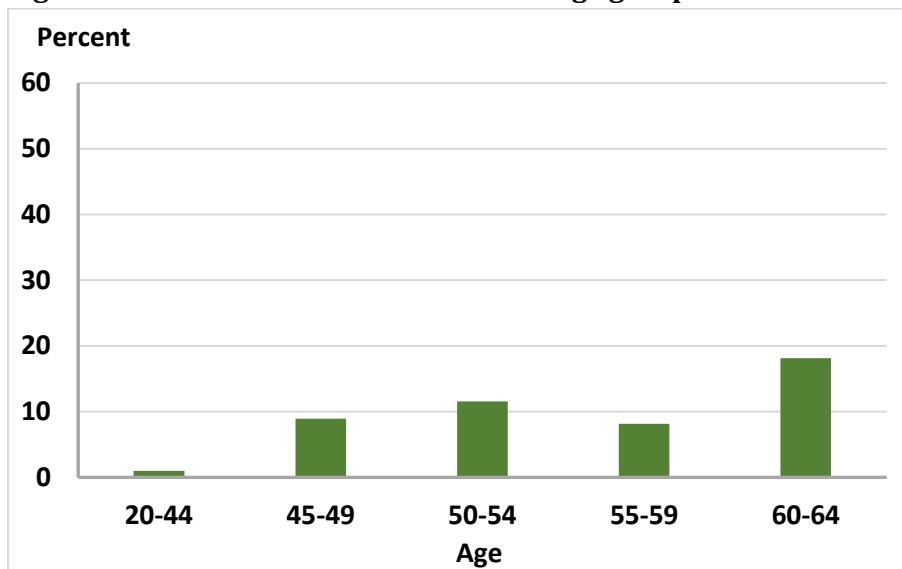
Figure 7.4 Percent of bus drivers with underlying health condition by sex



Source: authors’ analysis of the London bus drivers’ survey data, 2021

Although there was some variability in reporting of diabetes in some age groups, the overall pattern by age is consistent with levels in the general population shown in Figure 7.1– rising from 10 percent at ages 45-49 to 18 percent at ages 60 to 64 – Figure 7.5.

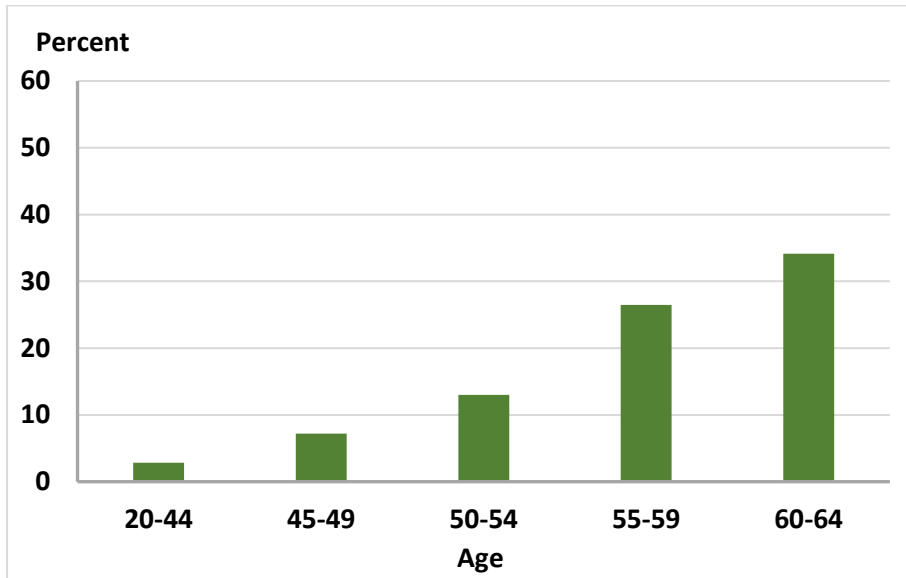
Figure 7.5 Percent of bus drivers in each age group with diabetes



Source: authors’ analysis of the London bus drivers’ survey data, 2021

Figure 7.6 shows the age distribution of bus drivers with high blood pressure, with the proportion increasing from four percent at ages 20 to 44 to 34 percent at ages 60 to 64. While the figure at younger ages is lower than in the general population, that at older working ages is similar (see Figure 7.2).

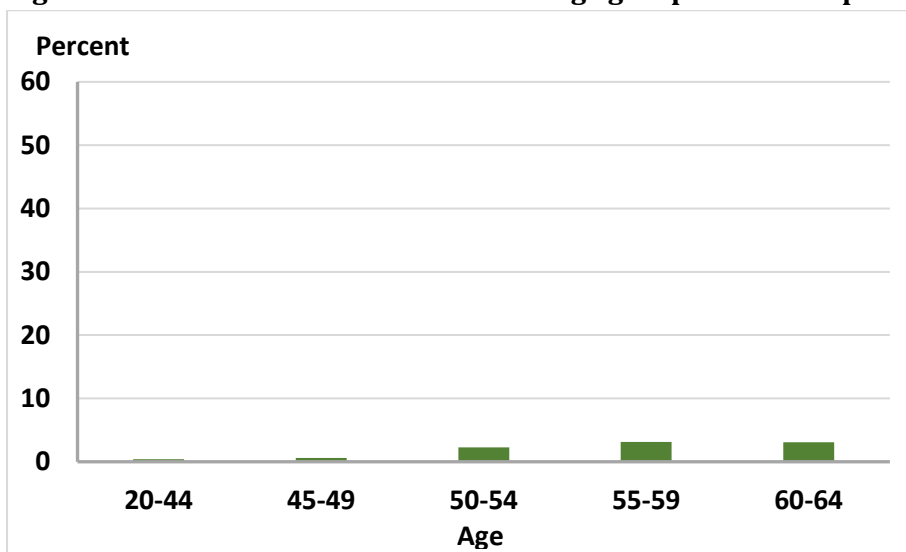
Figure 7.6 Percent of bus drivers with high blood pressure by age group



Source: authors' analysis of the London bus drivers' survey data, 2021

Figure 7.7 shows the age distribution of bus drivers with heart problems, increasing from well below one percent at ages 20 to 44 to three percent at ages 60 to 64. Vocational medical requirements for bus drivers mean that any conditions reported here, like heart problems, are likely to be at a level of severity that are considered safe in terms of the Government's minimum health standards.

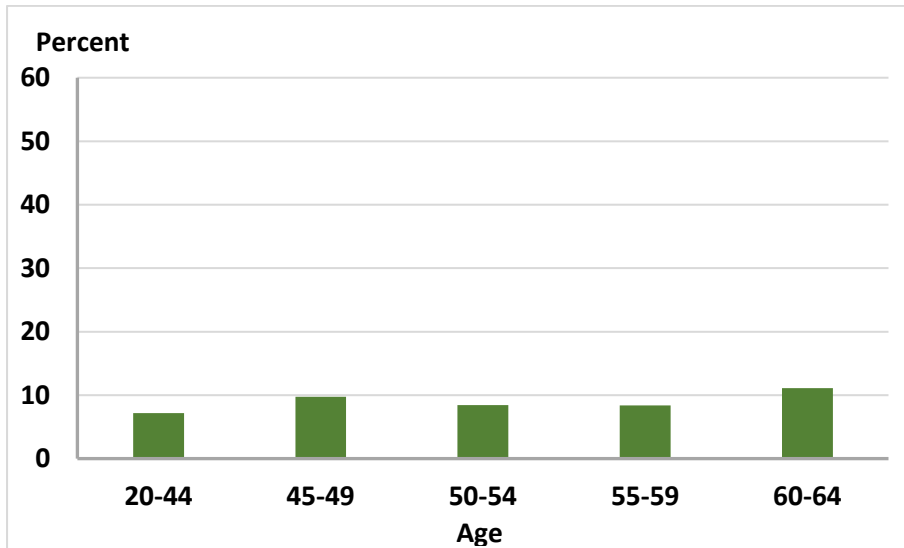
Figure 7.7 Percent of bus drivers in each age group with heart problems



Source: authors' analysis of the London bus drivers' survey data, 2021

Figure 7.8 shows the percentage of drivers in each age group with breathing problems, with a broadly steady increase in problems with age, from nine percent at ages 20 to 44 to 11 percent at ages 60 to 64.

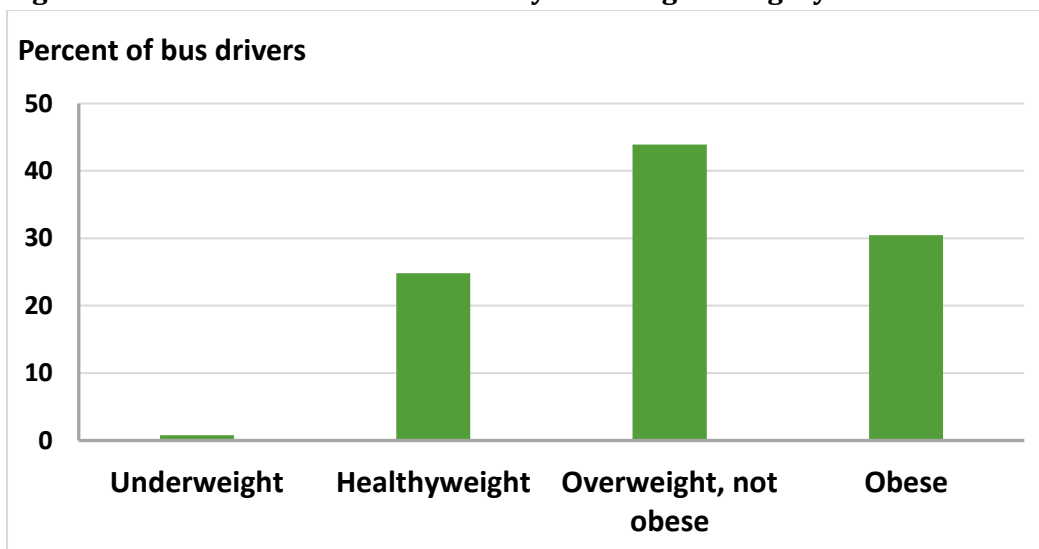
Figure 7.8 Percent of bus drivers in each age group with breathing problems



Source: authors' analysis of the London bus drivers' survey data, 2021

Among the bus drivers who responded to the survey around 44 percent were overweight but not obese (BMI of 25.0 to 29.99) and 30 percent were obese (BMI of 30.0 or higher) – Figure 7.9.

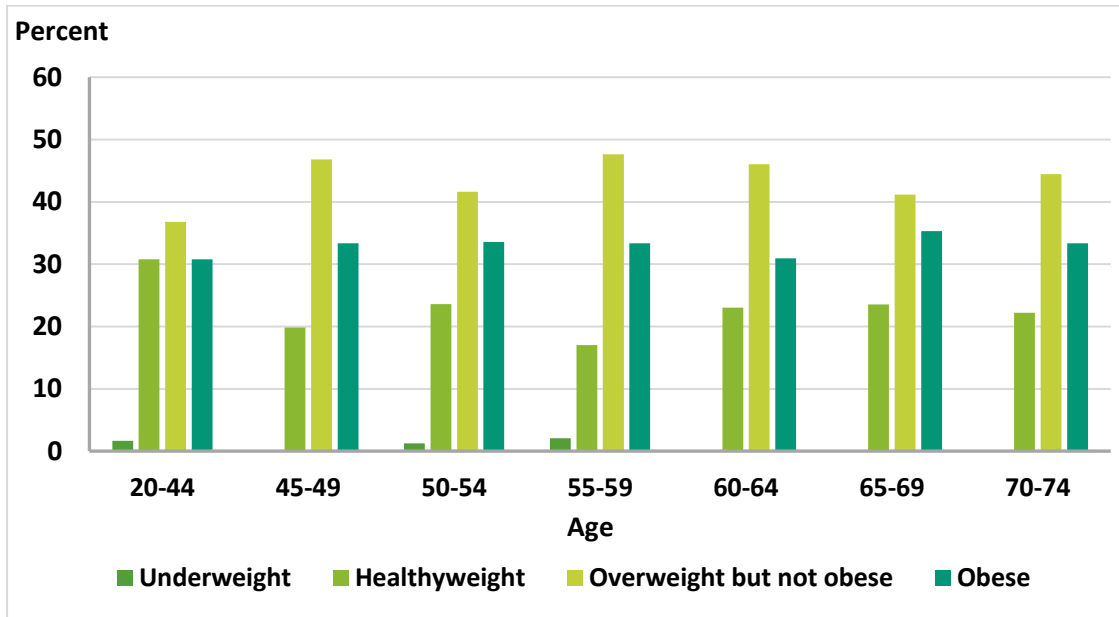
Figure 7.9 Distribution of bus drivers by BMI weight category



Source: authors' analysis of the London bus drivers' survey data, 2021

Figure 7.10 shows the percentage of bus drivers in each BMI weight category within each age group. The proportion overweight but not obese is similar to that of men in each age group in the general population in England (Figure 7.3), but the proportion obese at ages 20 to 44 (31 percent) is greater than the proportion for men of similar ages in the general population.

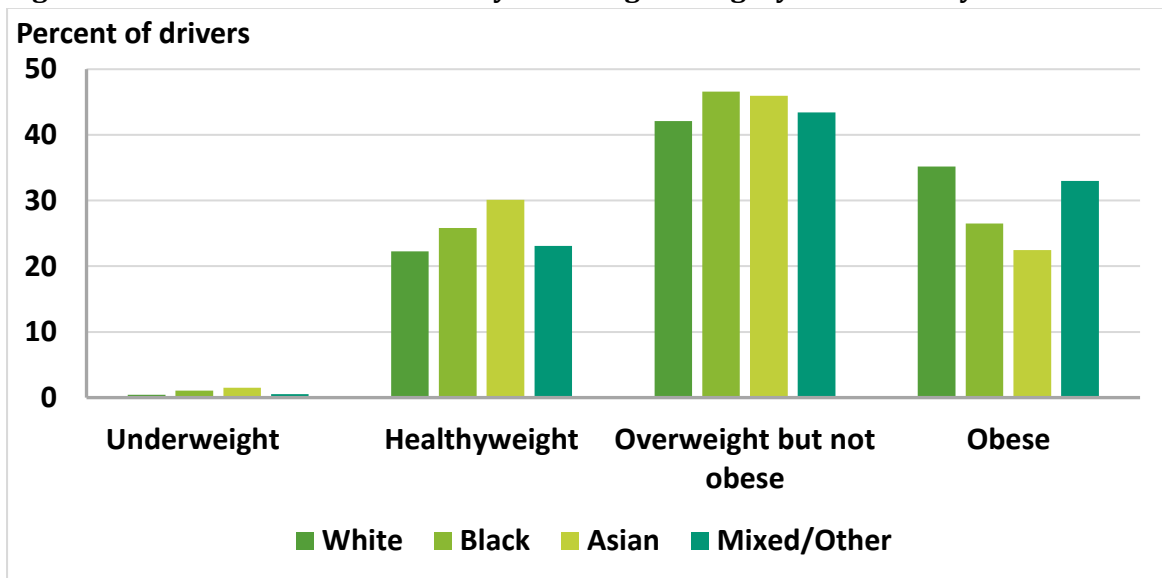
Figure 7.10 Percent of bus drivers by BMI weight category and age group



Source: authors' analysis of the London bus drivers' survey data, 2021

Figure 7.11 shows the percentage of bus drivers within each ethnicity group that are either underweight, have a healthy weight, are overweight but not obese or are obese. There are slightly higher rates of drivers who identify as Black and Asian who are overweight but not obese compared with those who identify as White or Mixed/Other, while there are higher rates of White drivers and those identifying as Mixed/Other who are obese than Black or Asian ones.

Figure 7.11 Distribution of drivers by BMI weight category and ethnicity



Source: authors' analysis of the London bus drivers' survey data, 2021

8. SURVEY OF BUS DRIVERS – CHARACTERISTICS OF THOSE WHO REPORTED EXPERIENCING COVID-19 SYMPTOMS OR A POSITIVE TEST

8.1 REPORTING OF COVID-19 BY SOCIODEMOGRAPHIC FACTORS AND THOSE RELATING TO LIVING CONDITIONS

Drivers were asked in the survey in October/November 2020 if they had experienced COVID-19 symptoms and 765 reported that they had ever had symptoms. Drivers were also asked if they had received a positive test for COVID-19. A total of 176 had a positive COVID-19 test, that is 5 percent of the 3,872 drivers who responded to this question. Among those testing positive, 49 reported having had no symptoms. This probably represents an underestimate of asymptomatic COVID-19, as testing of people without symptoms was very limited in the first wave of the pandemic.

Table 8.1 below presents the sociodemographic profile for the bus drivers who responded to the survey, with the respondents categorised according to whether they reported having experienced COVID-19 or not (either self-reported symptoms of having COVID-19 or a positive COVID-19 test). The profile summary shows that 24 percent of female drivers who responded to the survey reported experiencing COVID-19 symptoms or a positive test compared to 21 percent of males. In terms of ethnic background, Asian drivers were most likely to report having COVID-19 symptoms or a positive test (27 percent) while Black drivers were least likely to do so (17 percent). The proportion reporting symptoms or a positive test increased slightly with the level of crowding in the driver's household – from 18 percent in households with fewer than one person per room to 22 percent with two or more persons per room.

Table 8.1 Sociodemographic profile of bus drivers and whether they reported COVID-19 symptoms or a positive test

Socio-demographic characteristic	Percent of all drivers	COVID-19 symptoms or positive test	
		Number reporting COVID-19	Rate (percent)
Sex			
Male	88	689	21
Female	12	106	24
All respondents	100	795	21
Ethnicity			
White	45	355	21
Black	24	153	17
Asian	20	197	27
Mixed/other	12	88	20
All respondents	100	793	21
Index of multiple deprivation decile			
1 (most deprived)	7	56	23
2	25	166	19
3	18	149	24
4	15	83	16
5	11	74	20
6	8	44	17
7	5	46	24
8	5	35	22
9	4	34	24
10 (least deprived)	2	17	24
All respondents	100	704	21
Housing tenure			
Owner occupied	38	307	22
Privately rented	25	189	20
Social housing	27	218	22
Other	10	70	20
All respondents	100	784	21
Persons per room in house			
Less than one	16	90	18
From one to less than 1.5	40	258	20
From 1.5 to less than two	19	119	20
Two or more	25	173	22
All respondents	100	640	20

Source: authors' analysis of the London bus drivers' survey data, 2021

Note: Percentages may not sum to 100 due to rounding

Table 8.2 provides a summary of reporting of COVID-19 symptoms or a positive test in relation to existing health-related conditions. Bus drivers with a BMI classed as obese were more likely to have reported having COVID-19 symptoms (23 percent) compared to those with normal/low BMI (19 percent). Those with long-term health conditions were also marginally more likely to report symptoms than those without (22 compared to 20 percent).

Table 8.2 Health-related characteristics of bus drivers and whether they reported COVID-19 symptoms or a positive test

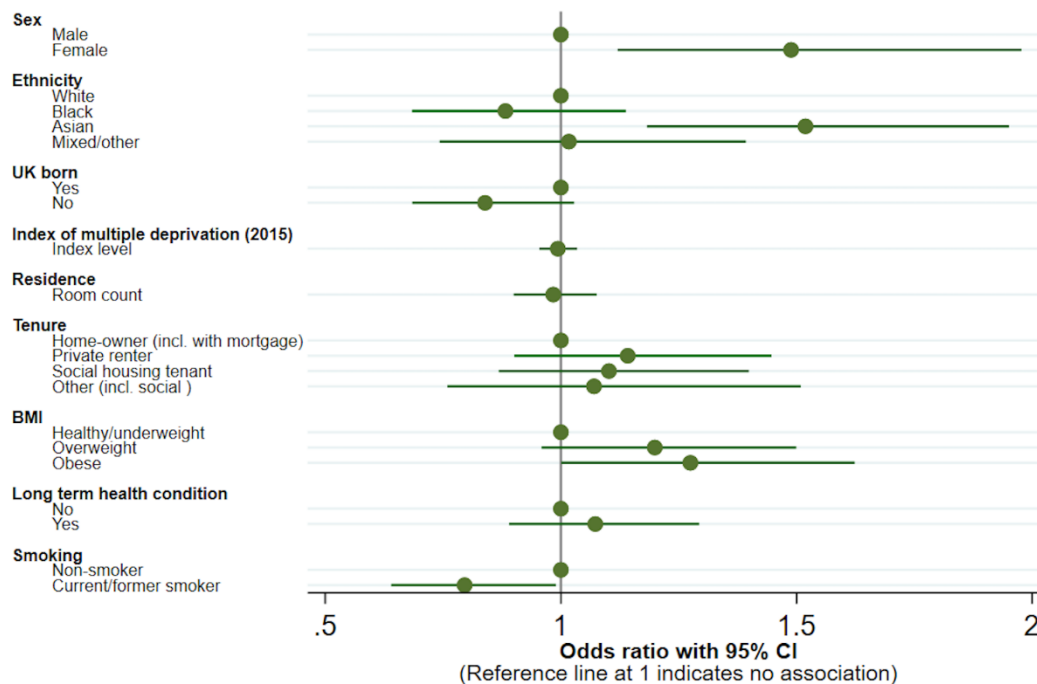
Health-related characteristics	Percent of all drivers	COVID-19 symptoms or positive test	
		Number reporting COVID-19	Rate (percent)
Body mass index			
Healthy/underweight	26	168	19
Overweight but not obese	44	328	22
Obese	31	239	23
All respondents	100	735	22
Any long-term health condition(s)			
No	68	531	20
Yes	32	272	22
All respondents	100	803	21
Smoking status			
Non-smoker	75	618	21
Current/former smoker	25	190	20
All respondents	100	808	21

Source: authors' analysis of the London bus drivers' survey data, 2021

Note: Percentages may not sum to 100 due to rounding

To provide a statistical interpretation of the pattern of results shown in Table 8.1, we undertook a logistic regression analysis. Figure 8.1 shows the probability of reporting COVID-19 symptoms or a positive test for each socio-demographic characteristic, while controlling for the others. The odds of reporting COVID-19 symptoms or a positive test were higher for women (Odds Ratio (OR) 1.5, 95 percent confidence interval (CI) 1.2-2.0) compared with men and higher for Asian bus drivers (OR 1.5, 95 percent CI 1.2-2.0) compared with White ones. Further analysis disaggregating within ethnic groups showed that the OR for drivers of Pakistani ethnic background was 1.8 and the OR for those of Bangladeshi identity was 1.6. This means that bus drivers of Pakistani ethnic background were 80 percent more likely to have reported COVID-19 than White drivers and Bangladeshi background drivers were 60 percent more likely than White drivers.

Figure 8.1 Association between socio-demographic characteristics and COVID-19 reporting and positive test (Odds Ratio)

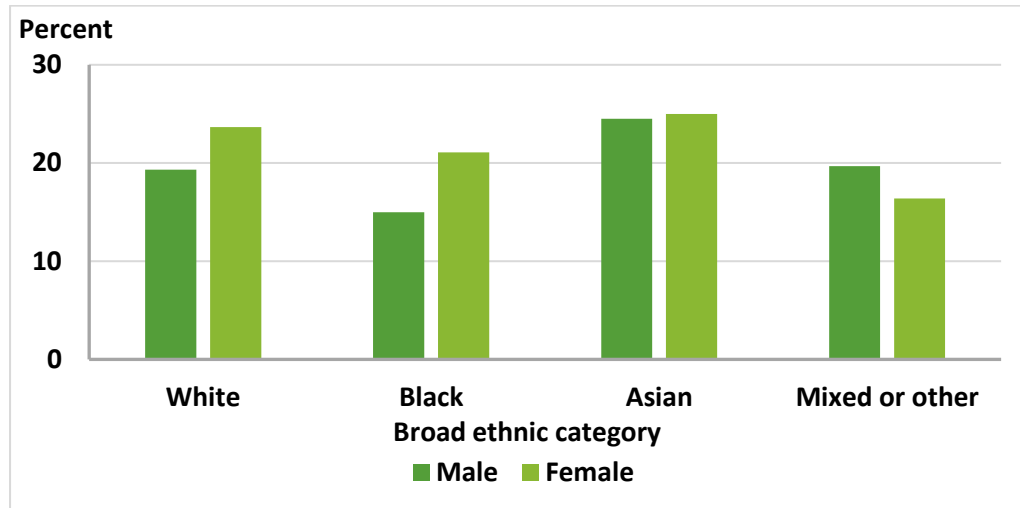


Source: authors' analysis of the London bus drivers' survey data, 2021

The above associations remained after controlling for other factors in Figure 8.1 - long term health conditions, BMI, and whether bus drivers smoked or not. The associations similarly held after controlling for socio-economic factors related to where people live in terms of neighbourhood area deprivation (IMD), type of tenure and number of rooms in their residence. These findings are aligned with those in the 'Build Back Fairer' report and other literature showing the disproportionate burden of COVID-19 on the population of Asian background. Our analytic modelling of the bus driver data however shows that being born outside the UK did not increase the probability of reporting COVID-19 symptoms or a positive test among the drivers who responded to the survey. Furthermore, there was no association in our findings between the other socioeconomic and deprivation factors shown in Figure 8.2, some of which have been shown to be risk factors for poorer outcomes related to COVID-19 elsewhere. Specifically, living in areas with higher levels of deprivation and higher concentration of overcrowded households have been shown to increase COVID-19 mortality risk, but no pattern of association with symptoms was evident for London bus drivers when other socio-demographic characteristics such as sex and ethnicity were taken into account.

In terms of how the experience of reported COVID-19 symptoms varied by sex and ethnicity, Figure 8.2 shows that Asian bus drivers of both sexes were more likely to have reported COVID-19 symptoms (25 percent among both males and females) than had other ethnic groups, while male Black bus drivers were least likely to report having done so (15 percent). Among female bus drivers, those with mixed or other ethnic origins were least likely to report experiencing symptoms (16 percent).

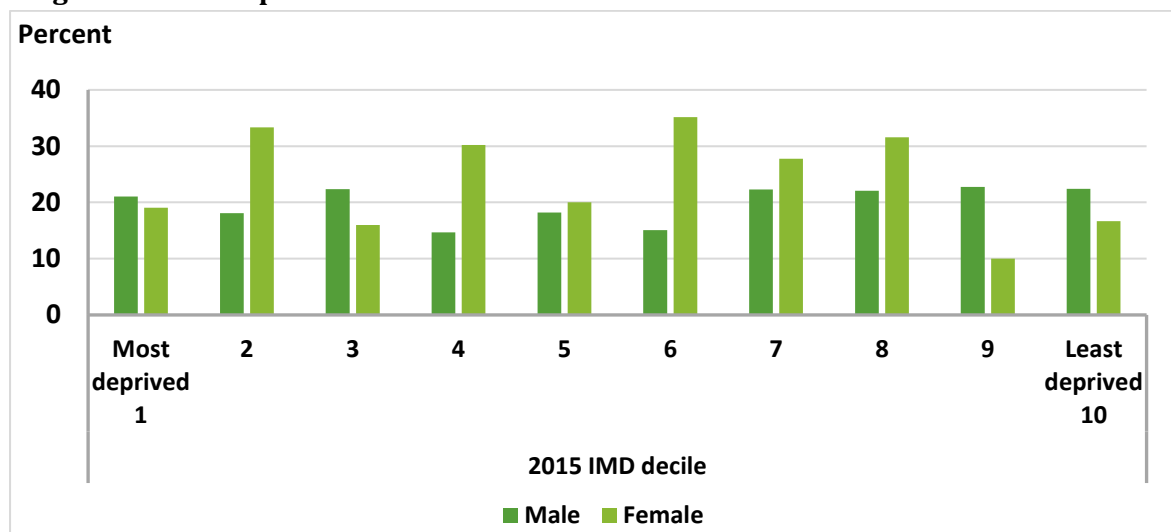
Figure 8.2 Percent of drivers reporting COVID-19 symptoms by sex and ethnicity



Source: authors' analysis of the London bus drivers' survey data, 2021

Figure 8.3 shows that there was no clear relationship between neighbourhood deprivation and reporting COVID-19 symptoms among either male or female bus driver (R squared test for trend 0.14 and 0.04, respectively).

Figure 8.3 Percent of drivers reporting COVID-19 symptoms by sex and IMD neighbourhood deprivation decile



Source: authors' analysis of the London bus drivers' survey data, 2021

8.2 REPORTING OF COVID-19 SYMPTOMS BY FACTORS RELATING TO TRAVEL TO AND FROM WORK

Table 8.3 shows that there were no systematic differences in reporting of COVID-19 symptoms by travel time to and from work within each mode of travel, except for a suggestion (based on small numbers) that among those cycling increased with the length of their journey to and from work. This may be a chance finding based on relatively small numbers of cases, or it may reflect sensitivity to mild symptoms for those doing more exercise or it may reflect greater exposure linked to longer journeys or be an indirect association with other aspects of the lives of those who undertake longer cycle rides.

Table 8.3 Percent of bus drivers by reported COVID-19 symptoms by time travelled to and from work

Time to and from work					
	Less than 15 minutes	Between 15 and 30 minutes	Between 30 minutes and 1 hour	Between 1 and 2 hours	More than 2 hours
Drive to and from work	24	19	21	20	16
Walk to and from work	10	20	18	24	10
Cycle to and from work	16	24	18	30	40
Travel to and from work by bus	25	21	21	21	10
Travel to and from work by train/tube/tram	17	24	19	21	16

Source: authors' analysis of the London bus drivers' survey data, 2021

Table 8.4 shows that reporting of COVID-19 symptoms was more common among those who worked shifts of five to six hours within each travel to and from work duration. Within this group, reporting of symptoms tended to increase with journey time. This may, of course reflect the fact that the survey asked drivers to retrospectively recall their experience of COVID-19 while asking about current travel patterns. Their reduced hours may reflect being part-time or on a reduced rota either reflecting the impact of COVID-19 on them and the difficulty of coping with a long commute following illness or a correlation with pre-existing health problems that had led to shorter hours prior to infection.

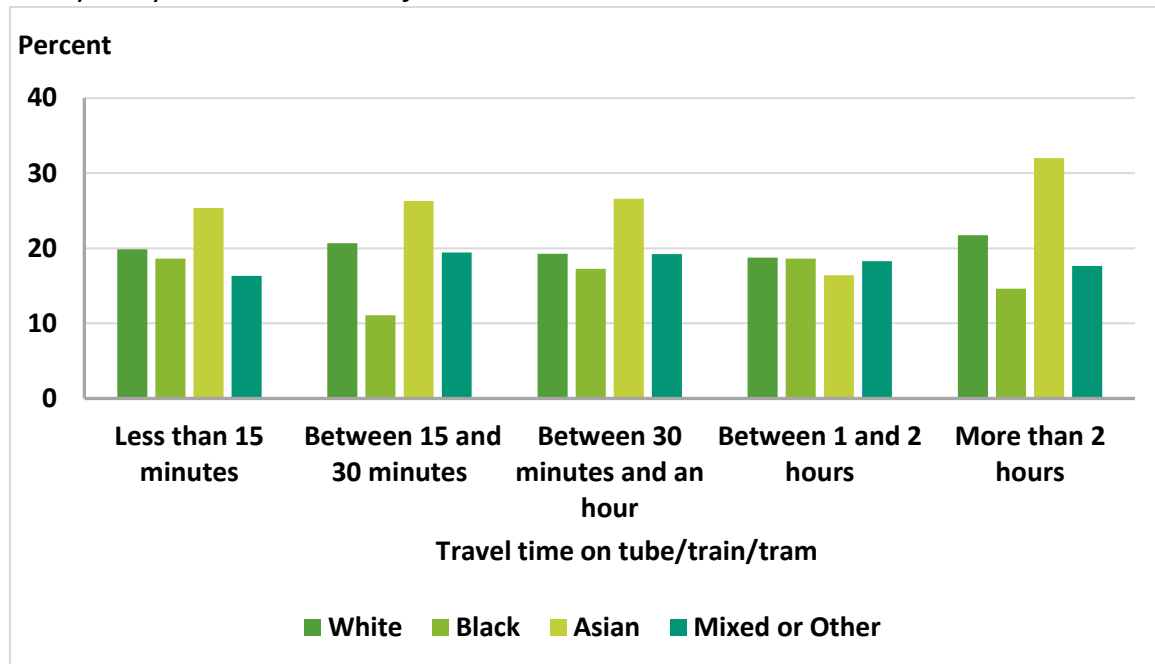
Table 8.4. Percent of bus drivers reporting COVID-19 symptoms by time spent travelling to and from work and shift duration

Shift duration					
Time spent going to and from work	4 hours or less	5-6 hours	7-8 hours	9-10 hours	More than 10 hours
Less than 15 minutes	0	29	14	27	20
Between 15 and 30 minutes	8	36	18	20	23
Between 30 minutes and 1 hour	22	29	14	23	29
Between 1 and 2 hours	0	40	17	19	25
More than 2 hours	0	50	19	21	40

Source: authors' analysis of the London bus drivers' survey data, 2021

Figure 8.4 shows that the higher rate of reporting COVID-19 symptoms among Asian bus drivers was seen in most travel to and from work durations, with no clear pattern related to duration of the journey.

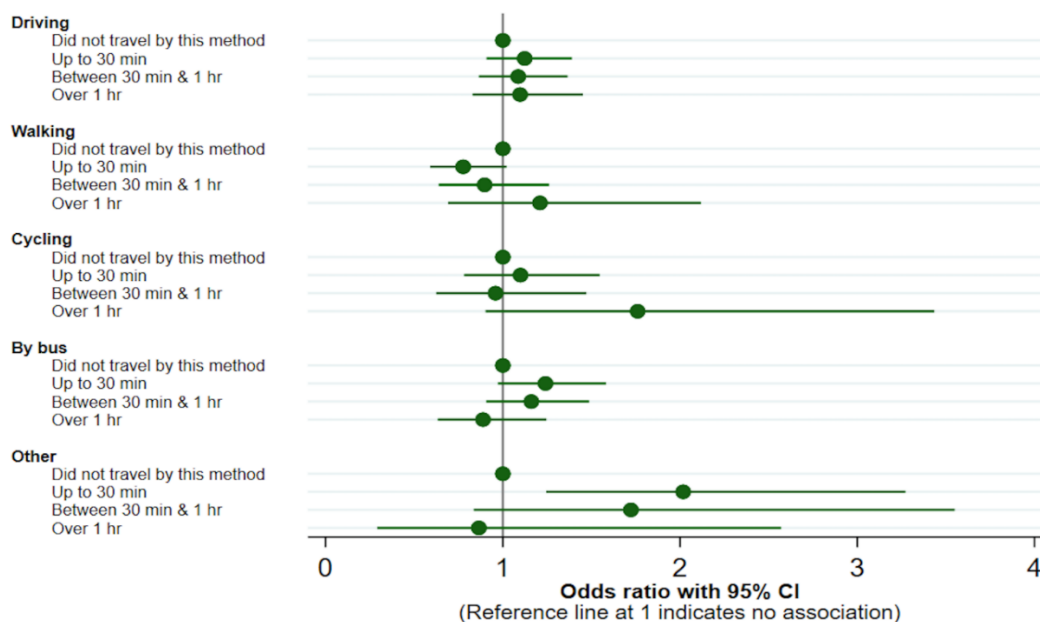
Figure 8.4 Percent of bus drivers reporting COVID-19 symptoms by time spent on the train/tube/tram and ethnicity



Source: authors' analysis of the London bus drivers' survey data, 2021

In Figure 8.5, we present the results of a logistic regression analysis of the associations between mode of travel, length of commute and reporting having had COVID-19 (either symptoms or a positive test). This confirms that for the most part, there is no link between reporting COVID-19 symptoms or a positive test and mode of travel and commute time among bus drivers. However, for those who used mixed methods of transport or other less common modes, shorter commutes (less than 30 minutes) were associated with twofold likelihood of reporting having COVID-19 (OR 2.0, 95 percent CI 1.2-3.3). We have not explored potential confounding factors in this relationship.

Figure 8.5 Association between time travelling and means of transport and reporting COVID-19 symptoms or a positive test (Odds Ratio)



Source: authors' analysis of the London bus drivers' survey data, 2021

8.3 REPORTING OF COVID-19 BY UNDERLYING HEALTH CONDITIONS

Table 8.5 suggests that reporting of long-term breathing difficulties and diabetes was greater among those who had COVID-19 symptoms and had received a positive test. While this might reflect the seriousness of COVID-19 symptoms on those with these pre-existing problems (during the peak of the first wave of the epidemic testing of those in the community mainly occurred on admission to hospital), it may also reflect the problem associated with asking these questions retrospectively- some drivers who reported COVID-19 symptoms were not necessarily reporting their long term condition prior to the COVID-19 pandemic but instead reporting, as long-term conditions, those which were sequelae of COVID-19 infection e.g. breathing difficulty.

Table 8.5 Percent of bus drivers reporting underlying health conditions by whether or not they reported COVID-19 symptoms or a positive test

	COVID-19 Symptoms		No COVID-19 symptoms		All Drivers
	Positive test	No positive test	Positive test	No positive test	
High blood pressure	13	17	18	16	16
Diabetes	11	6	*	8	8
Heart problems	*	2	*	23	2
Breathing difficulty	18	10	*	8	9
Other long-term conditions	9	10	12	7	8

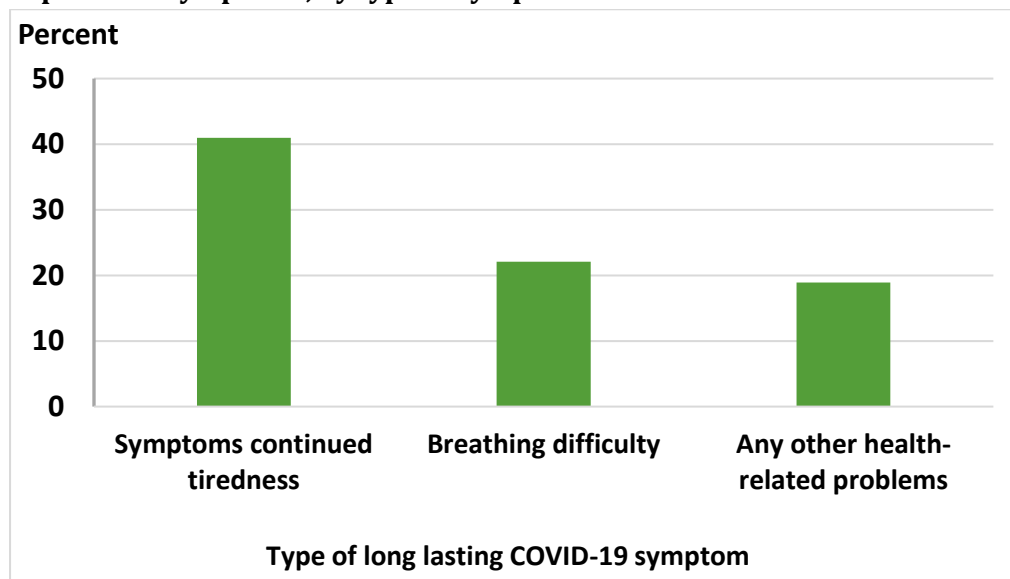
Source: authors' analysis of the London bus drivers' survey data, 2021

Note: * Number suppressed to avoid disclosure of small numbers of drivers

9. SURVEY OF LONDON BUS DRIVERS – REPORTING OF LONGTERM SIGNS AND SYMPTOMS AMONG THOSE REPORTING HAVING HAD COVID-19 SYMPTOMS AND/OR A POSITIVE TEST

Drivers that had either reported COVID-19 symptoms or a positive COVID-19 test, were asked if they continued to have lasting COVID-19 symptoms. As shown in Figure 9.1, among those reporting continuing symptoms, 40 percent had continued to experience tiredness, 22 percent had continued to experience breathing difficulties and 19 percent still had a health-related problem other than these.

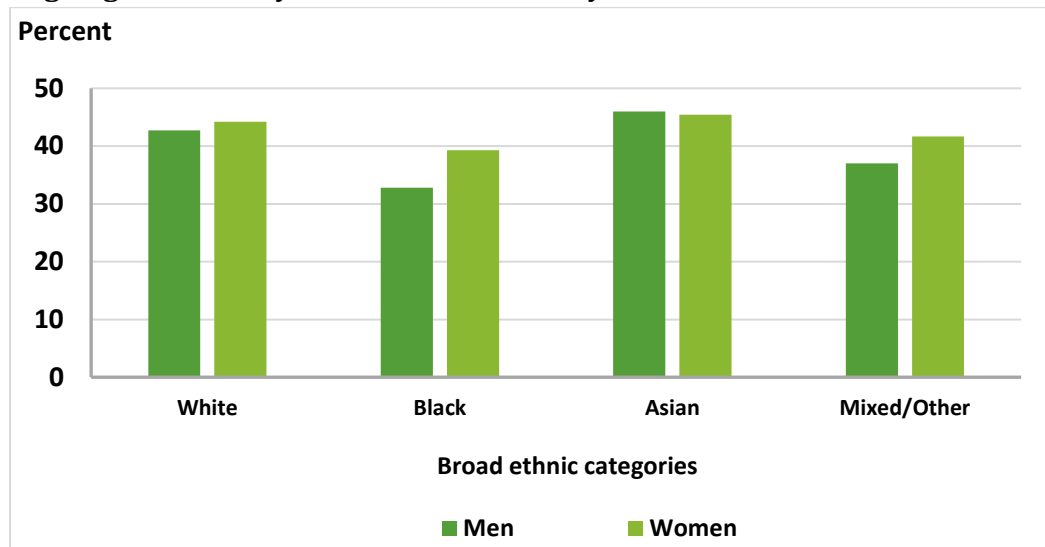
Figure 9.1 Percent of drivers who reported COVID-19 symptoms and continued to experience symptoms, by type of symptom



Source: authors' analysis of the London bus drivers' survey data, 2021

Figure 9.2 shows the rate of men and women in each ethnic group who reported COVID-19 symptoms and continued to experience tiredness. At least 30 percent continued to experience tiredness, with the highest rates found among bus drivers identifying as Asian and the lowest among those identifying as Black, for both men and women. The differences in rates of those experiencing tiredness by ethnicity are less steep for women than for men.

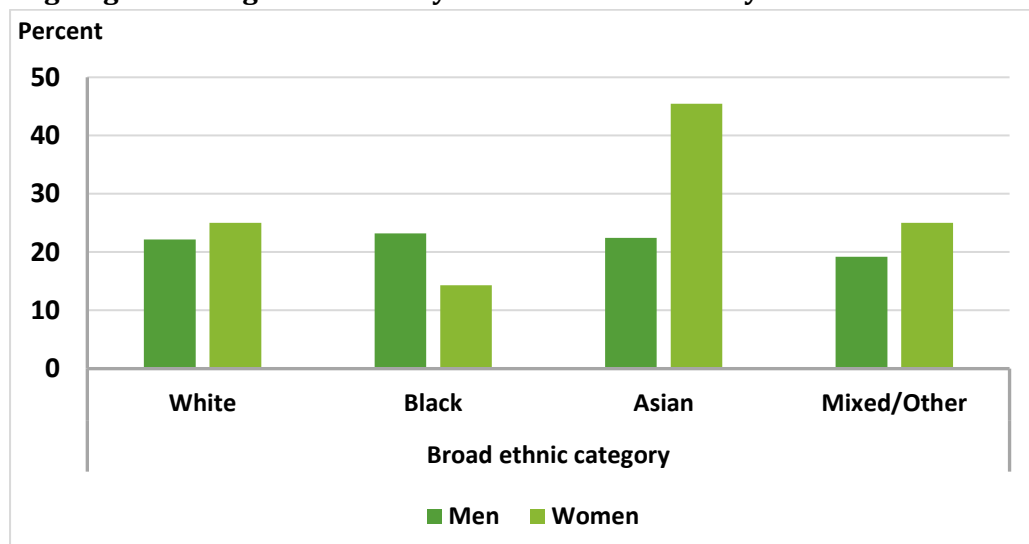
Figure 9.2 Percent of drivers who reported COVID-19 symptoms and have experienced ongoing tiredness by sex and ethnic identity



Source: authors' analysis of the London bus drivers' survey data, 2021

Figure 9.3 shows the rate of men and women in each ethnic group who reported COVID-19 symptoms and continued to experience ongoing breathing difficulties. Between 20 and 25 percent continued to experience breathing difficulties, varying slightly by sex and ethnicity. The exception to this is for female bus drivers identifying as Asian, 46 percent reported continuing to experience breathing problems as did 15 percent of female Black drivers.

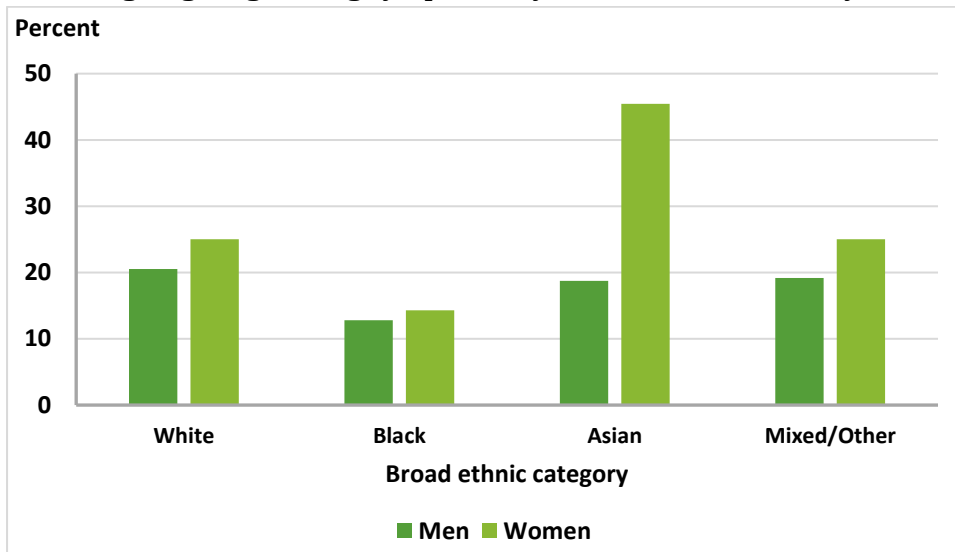
Figure 9.3 Percent of drivers who reported COVID-19 symptoms and have experienced ongoing breathing difficulties by sex and ethnic identity



Source: authors' analysis of the London bus drivers' survey data, 2021

Figure 9.4 shows the rate of men and women in each ethnic group who reported COVID-19 symptoms and continued to experience other long-lasting symptoms. Women bus drivers in each ethnic group were more likely to report COVID-19 symptoms than men, particularly those of Asian origin.

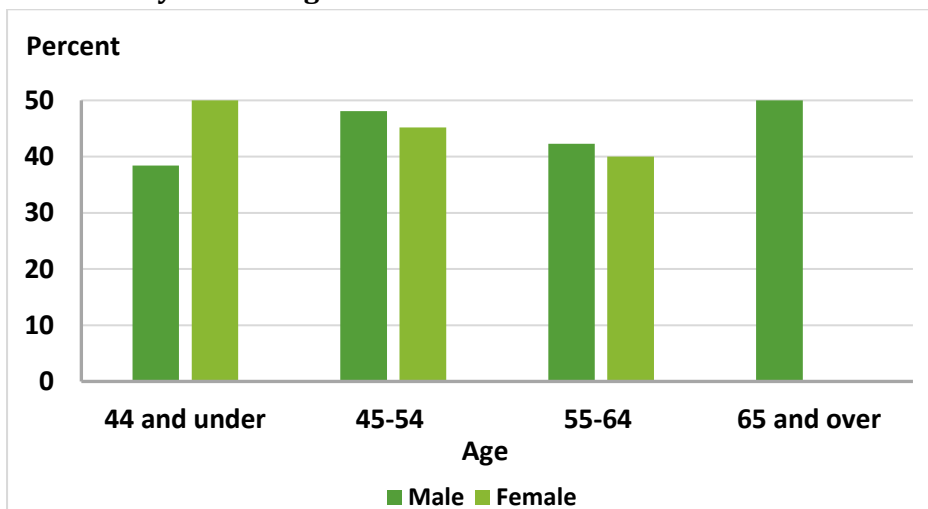
Figure 9.4 Percent of drivers who reported COVID-19 symptoms and have experienced other ongoing long-lasting symptoms by sex and ethnic identity



Source: authors' analysis of the London bus drivers' survey data, 2021

Figure 9.5 shows the rate of men and women in each age group who reported COVID-19 symptoms and continued to experience tiredness. Four age groups are used for these analyses due to small numbers in the under 20 and 65 and over age groups. Within those age under 45, women had higher rates by seven percentage points, while in the 65 and over there were no women bus drivers who had had COVID-19 symptoms in the survey.

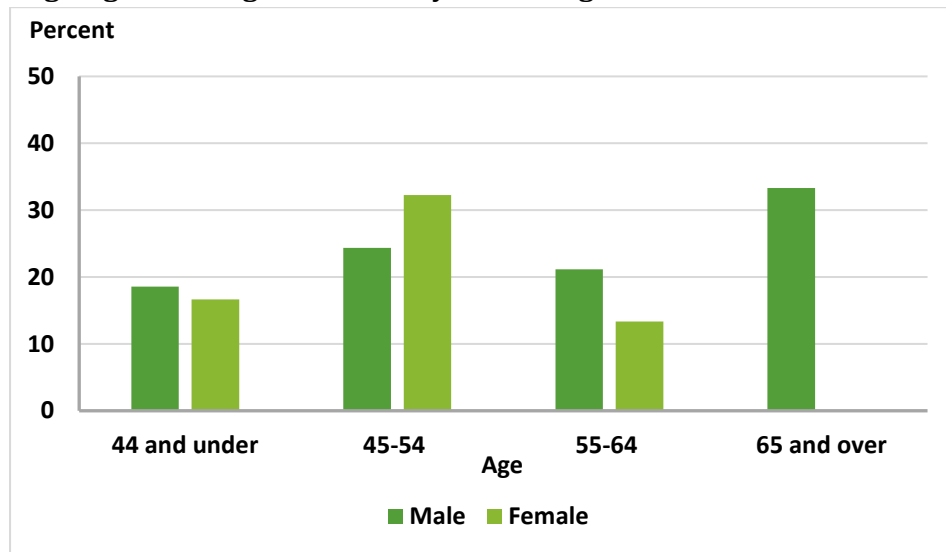
Figure 9.5 Percent of drivers who reported COVID-19 symptoms and experience ongoing tiredness by sex and age



Source: authors' analysis of the London bus drivers' survey data, 2021

Figure 9.6 shows the rate of men and women in each age group who reported COVID-19 symptoms and continued to experience ongoing breathing difficulties. Women in the 45-54 and men in the 65 and over had higher percentages compared with other age groups.

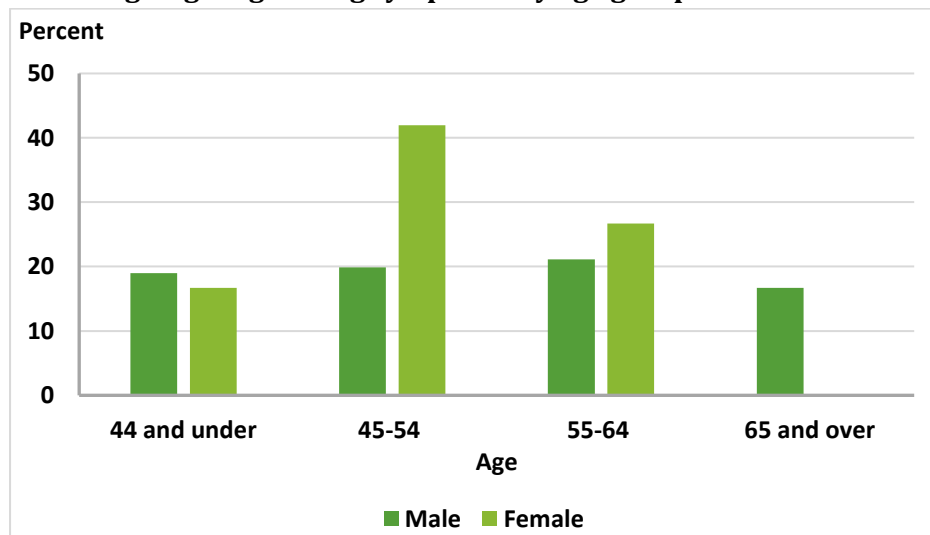
Figure 9.6 Percent of drivers who reported COVID-19 symptoms and have experienced ongoing breathing difficulties by sex and age



Source: authors' analysis of the London bus drivers' survey data, 2021

Figure 9.7 shows the rate of men and women in each age group who reported COVID-19 symptoms and have continued to experience other long-lasting symptoms. The highest proportion was in women aged 45 to 54.

Figure 9.7 Percent of drivers who reported COVID-19 symptoms and have experienced other ongoing long-lasting symptoms by age group and sex



Source: authors' analysis of the London bus drivers' survey data, 2021

10. CONCLUSIONS

This analysis, by using new data from bus operators and ONS, now provides a good indication of the extent of excess mortality in March to May 2020 among London bus drivers in the first wave of the COVID-19 pandemic in London. Two confirmatory analyses indicate a three-fold excess in age-standardised mortality compared to the population of the country as a whole in March to May 2020. Other studies suggest that a number of inter-related factors contributed to this excess, in particular a higher proportion of BAME staff than in the general population and living in disadvantaged urban settings with high rates of COVID-19 mortality. After taking account of these in complementary analyses, bus drivers had a statistically significant, two-fold excess in mortality in March to May 2020.

The majority of drivers who subsequently died - over 80 percent (22 out of 27) - had ceased work by 3 April. This observation led to the conclusion, in our earlier analysis, that the high rates of mortality in London bus drivers in March to May 2020 were largely a result of infections acquired before lockdown on 23 March. This conclusion is now supported by two recent national analyses. First that key worker mortality nationally was higher in cases likely to be infected before lockdown. Second that mortality in BAME groups was similarly higher in those early cases, even after accounting for a broad range of factors that are known to have contributed to higher BAME COVID-19 mortality – including living in more deprived urban environments, household living arrangements, occupational risk factors and some pre-existing health conditions.

In our first report, we indicated that around 70 percent of deaths to London bus drivers in March to May 2020 occurred to drivers working for three of the ten bus operators. Using new information on age, sex and region of residence of drivers working for each bus operator, there was a statistically significant excess of deaths. Taking account of the ethnic composition of the bus drivers working for these operators reduced, but did not remove, the statistically significant excesses. We have not been able to identify any factors that explain these excesses in this review.

In the survey we commissioned, undertaken in October/November 2020, London bus drivers were asked a broad range of questions relating to their work patterns and driving conditions, travel to and from work, their pre-existing health and health-related conditions, their experiences of COVID-19, their demographic characteristics and living conditions and their views on the safety actions taken by bus operators.

One set of questions specifically related to their views on the safety measures they could recall being introduced before the 23 March. The majority of bus drivers responding agreed that the new measures improved their safety at work. Views were more mixed on the inconvenience to drivers of the measures taken, with some indicating the extra efforts they felt it necessary to take. While the answers given to the questions on drivers' views of safety measures showed some variation across ethnic groups and bus operators, there was no clear pattern of association with variation in high mortality across bus operators. Similarly, in our first report we concluded that delays in taking action are unlikely to have contributed to the death rates from COVID-19. This does not mean that all the actions were ineffective – simply that so many were taken close to or after lockdown on 23 March and hence they were not really tested. Lockdown changed the environment both within buses (fewer passengers) and in the

community (more people staying at home, furloughed and implementing other preventative measures) and were effective at reducing mortality for bus drivers as well as other key worker occupations and the general population.

Government and WHO guidelines and the availability of materials limited implementation of some of the actions by bus operators in March 2020. These constraints have all changed since then. Similarly, scientific evidence about specific preventative measures for buses has improved. With the benefit of hindsight, some of the deaths to London bus drivers and other key workers who were infected in March 2020, would not have happened if lockdown had been introduced earlier and all the current measures and evidence described above were in place and achievable then.

As well as being asked questions about the measures implemented before and after 23 March 2020, drivers were asked about the current demands of driving a bus. Some drivers identified increased difficulties in dealing with passengers and increased aggression. First the difficult role of drivers in dealing with passenger non-compliance in mask-wearing and social distancing rules with limited support from enforcement staff. Second the difficulties associated with incomplete passenger compliance when some buses were classified as school services and others not - particularly when buses were full. Third the design of street space measures introduced by TfL and the boroughs had reduced traffic flow in some locations, leading to congestion at pinch points and access to bus stops more difficult in some locations, despite the overall reduction in traffic and passenger numbers. Fifth, there was an evident safety concern among some bus drivers about perceived lack of social distancing during transfers, bus changeovers and in bus depots. Of course, the views of those who commented do not necessarily reflect the views of those who did not.

In terms of socio-demographic characteristics, we confirmed that bus drivers are more likely to be in the upper half of the working age range than the general population, with a sizeable minority working at ages 65 and over. From the survey and partially confirmed by incomplete bus operator records, a slight majority of bus drivers are from BAME backgrounds – particularly from Black groups, well above the levels in London as a whole. While bus drivers were less likely than the general population to live in neighbourhoods comprising the most deprived decile of population, they were more likely than others to live in the second to fourth most deprived deciles- with clear differences by ethnic group in where they lived. The majority live in rented accommodation (more so than the general population), particularly so among those in more deprived areas and among Black bus drivers.

The information collected in the survey from bus drivers on their pre-existing health conditions shows that rates of diabetes, hypertension and overweight are broadly similar to those collected on the general population in the Health Survey for England, with exceptions in specific age groups. Among younger bus drivers, there seems to be more obesity than in the general population while in those in their seventies there was more high blood pressure than in the general population. Although we have no basis for comparison with the general population, the steep increase in heart problems in this older age group is worthy of note.

Bus drivers were asked in the survey to provide information on their recall of having COVID-19 symptoms or a positive test. As with all information in a self-completed survey, this cannot be clinically verified. Only a minority of those reporting symptoms also indicated that they had a

positive test, which may reflect reduced levels of community testing in the months that they had symptoms. We cannot however draw any inferences on what proportion of those without a positive test did not actually have COVID-19.

The odds of reporting COVID-19 symptoms or a positive test were higher for women and Asian bus drivers and for those travelling short distances to work using mixed modes of transport. While there were no systematic differences by deprivation decile, there was weak evidence of slightly greater rates of reporting among those overweight or obese.

Among those who reported COVID-19 symptoms or a positive test, the survey also asked about continuing symptoms. Breathing problems were reported most commonly, as was tiredness. While both of these have been reported in the literature as sequelae of COVID-19, it is also worth noting that bus drivers reporting pre-existing breathing problems and a high level of fatigue was reported in an earlier study of this population by Loughborough University. In view of the retrospective nature of the survey, we cannot be sure that these symptoms are solely due to COVID-19. However, we can conclude that there is an ongoing issue of breathing problems and fatigue among London bus drivers which may well have been exacerbated by COVID-19.

RECOMMENDATIONS

- 1) All bus drivers and particularly those with identified risk factors need continued protection by reducing exposure to COVID-19 as long as it persists in the community. Social distancing and mask wearing must continue to be observed consistently in all locations where bus drivers are out of their cabs including transfers, depots and canteens. Promotion and enforcement of compliance of these measures by all, to ensure consistent adherence, remains a priority, as it does for all passengers when travelling on public transport.
- 2) In the longer term, early interventions on ill-health prevention are needed to reduce obesity in the population as a whole, with responsible employers playing their part. In particular, measures are needed among younger London bus drivers who have higher rates than other young people of the same age.
- 3) Fatigue is a pre-existing issue for some bus drivers, with some evidence that COVID-19 infection and lockdown has contributed to this. Action, already being taken following previous research into factors contributing to tiredness, should be enhanced to address any new issues arising from the pandemic, following a short term review of shift lengths, patterns and rotas.
- 4) Drivers who have clinically verified ongoing symptoms of COVID-19 infection will continue to need financial, psychological and clinical support from the bus companies and the NHS, as will need to be the case for all those working for responsible employers.
- 5) Some bus drivers report several factors that have increased the demands on them despite reduced passenger and traffic numbers - passenger aggression and non-compliance and some new traffic measures. In anticipation of increased passenger and traffic numbers, TfL should support drivers in the short term through both ensuring communication of guidance to the public is clear on measures in force and those that change at any point in time, accompanied by enforcement action to support drivers.
- 6) Monitoring the health of London bus drivers is a priority following the ongoing presence of COVID-19 infection in the community. As well as the measures described above for other identified at-risk groups, more complete and consistent recording of the ethnicity of bus drivers is required. We recommend that in the coming months, bus operators ensure more complete recording of ethnicity. To ensure consistency across operators and with other organisations, TfL should issue similar guidance on harmonised ethnic recording to that currently being implemented across the NHS, based on the March 2021 Census ethnic classification.
- 7) Breathing problems appear to be a pre-existing issue reported by many London bus drivers, exacerbated in those self-reporting COVID-19 symptoms. In the longer term, air quality on London roads, to which bus drivers have particularly high levels of exposure, needs to be a priority for the Government and Mayor.

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ANNEX 1

BUS DRIVER QUESTIONNAIRE

Programming instructions

All questions to have hidden Don't Know (-8) and Not completed (-9) codes unless otherwise specified.

Work

{ASK ALL}

Jobpattern

"Do you drive buses..."

1. Full-time (5 days a week)
 2. Part-time (less than 5 days a week)
 3. Other
-

{ASK ALL}

Sparedriver

"Are you a spare driver?"

1. Yes
 2. No
-

{ASK ALL}

NBusroutes

"Which bus routes do you normally drive?"

{ASK ALL}

Travelmode [MULTICODE]

"How do you normally travel to work?"

1. Drive
 2. Walk
 3. Cycle
 4. By bus
 5. By train/tube/tram
 6. Other
-

{ASK ALL}

TravelTotal [SINGLE CODE]

"How much time per day do you normally spend travelling to and from work ** in total?"**

1. Less than 15 minutes
 2. Between 15 and 30 minutes
 3. Between 30 minutes and 1 hour
 4. Between 1 and 2 hours
 5. More than 2 hours.
-

{ASK IF TravelMode=1}

TimeDrive

“How much time do you spend driving to and from work in a typical day?”

1. Less than 15 minutes
 2. Between 15 and 30 minutes
 3. Between 30 minutes and 1 hour
 4. Between 1 and 2 hours
 5. More than 2 hours.
-

{ASK IF TravelMode=2}

TimeWalk

“How much time do you spend walking to and from work in a typical day?”

1. Less than 15 minutes
 2. Between 15 and 30 minutes
 3. Between 30 minutes and 1 hour
 4. Between 1 and 2 hours
 5. More than 2 hours.
-

{ASK IF TravelMode=3}

TimeCycle

“How much time do you spend cycling to and from work in a typical day?”

1. Less than 15 minutes
 2. Between 15 and 30 minutes
 3. Between 30 minutes and 1 hour
 4. Between 1 and 2 hours
 5. More than 2 hours.
-

{ASK IF TravelMode=4}

TimeBus

“How much time do you spend on a bus to and from work in a typical day?”

1. Less than 15 minutes
 2. Between 15 and 30 minutes
 3. Between 30 minutes and 1 hour
 4. Between 1 and 2 hours
 5. More than 2 hours.
-

{ASK IF TravelMode=5}

TimeTrain

“How much time do you spend on a train, tube or tram to and from work in a typical day?”

1. Less than 15 minutes
 2. Between 15 and 30 minutes
 3. Between 30 minutes and 1 hour
 4. Between 1 and 2 hours
 5. More than 2 hours.
-

{ASK IF TravelMode=6}

TimeOther

“How much time do you spend using another form of transport travelling to and from work in a typical day?”

1. Less than 15 minutes
 2. Between 15 and 30 minutes
 3. Between 30 minutes and 1 hour
 4. Between 1 and 2 hours
 5. More than 2 hours.
-

{ASK If TravelMode=4 or 5}

TravelPeak

“Do you normally travel to and from work during peak hours?”

1. Yes
 2. No
-

{ASK ALL}

Shiftduration

“How long does each of your shifts last on average?”

1. 4 hours or less
 2. 5-6 hours
 3. 7-8 hours
 4. 9-10 hours
 5. More than 10 hours
-

{ASK ALL}

Breakduration

“How much time in total do you spend on break during a typical shift?”

Hours 0...4 Minutes 0.....60

{ASK ALL}

Patternregular

“Do you have a regular work pattern?”

1. Yes
 2. No
-

{ASK IF Patternregular =1}

DaysWork

“How many days do you work between rest days?”

NUMERIC
RANGE 1...15

{ASK IF Patternregular=1}

DaysRest

“How many rest days do you have between working days?”

NUMERIC
RANGE 1...15

{ASK IF Patternregular=2}

Patterndescribe

“Please describe your work pattern”.

[FREE TEXT]

Interventions

ASK ALL}

Changesbef [MULTICODE]

“Your bus company may have taken some or all of the following actions to make it safer for drivers and passengers before lockdown on 23rd March. Please indicate those that you remember making you feel safer from getting COVID-19 before 23rd March.”

1. Provision of hand sanitiser
2. Provision of face masks
3. Provision of anti-bacterial wipes
4. Covering holes on assault screens on buses
5. Restricted access to front seats on buses
6. Enhanced cleaning of buses
7. Provision of social distancing in garages, depots, toilets and canteens
8. Enhanced cleaning of garages, depots, toilets and canteens
9. None of the above [EXCLUSIVE]

{ASK IF Changesbef = 1 to 8}

Feelbef [DISPLAY AS COLLAPSABLE GRID]

“Do you feel that that the measures introduced before lockdown on 23rd March...”

		1. Strongly disagree	2. Somewhat disagree	3. Neither agree or disagree	4. Somewhat agree	5. Strongly agree
Feelbefsafety	Increased your safety					
Feelbefinconvenient	Were inconvenient for you					
Feelbefaggressive	Resulted in passengers being more aggressive					

{ASK ALL}

Changesaft [MULTICODE]

“Your bus company may have taken some or all of the following actions to make it safer for drivers and passengers since lockdown on 23rd March. Please indicate those that make you feel safer from getting COVID-19.”

{ASK IF ANY Changesaft = 1 to 10}

Feelaft [MULTICODE]

“Do you feel the measures implemented since 23rd March 2020...”

G_Collapsible_Grid_II1

		1. Strongly disagree	2. Somewhat disagree	3. Neither agree or disagree	4. Somewhat agree	5. Strongly agree
Feelaftsafety	Increased your safety					
Feelaftinconvenient	Are inconvenient for you					
Feelaftaggressive	Have Resulted in passengers being more aggressive					

{ASK ALL}

Managedemands [DISPLAY AS COLLAPSABLE GRID]

“Compared to previous years, do you feel that the current demands of driving a bus have become easier or more difficult in relation to:..”

G_Collapsible_Grid_II1

		1. Much Easier	2. Slightly easier	3. Same	4. Slightly more difficult	5. Much more difficult
Congestionaft	Traffic congestion					
Hazardsaft	Traffic hazards (other drivers, pedestrians)					
Adultsaft	Adults passenger behaviour and compliance with instructions/regulations					
Childrenaft	School age children and compliance with instructions/regulations					
Timetablesaft	Meeting demands of bus timetables					

{ASK ALL}

Transfersocialdistance

“On a scale from 1 to 5, how much do the arrangements for bus changeover and transfers ensure adequate social distancing?”

1. 1 Not at all
 2. 2
 3. 3
 4. 4
 5. 5 Completely
-

{ASK ALL}

Transfersafe

“On a scale from 1 to 5 how much do the arrangements for bus changeover and transfers make you feel safe?”

G_ReadOut_II1

1. 1 Not at all
 2. 2
 3. 3
 4. 4
 5. 5 Completely
-

Biometric and recreational information

‘This section of the questionnaire asks for some personal details. This is only for us to get a better understanding of your potential vulnerability to serious health impacts from COVID-19 infection, and will only be used for this research.’

{ASK ALL}

Height

“What is your height?”

Firstly would you like to give your height in feet and inches or in centimetres?

1. Feet/inches
 2. Centimetres
-

{ASK IF Height=1}HeightFT

What is your height in feet and inches”

Range 1..7 feet 0...12 inches

{ASK IF Height=2}

Heightcm

What is your height in cms

Range 1...230 cm

{ASK ALL}

Weight

What is your weight?

Firstly would you like to give your weight in stones and pounds or in kilogrammes?

1. Stones and pounds
 2. Kilogrammes
-

{ASK IF Weight =1}

WeighthSt

What is your weight in stones and pounds

3...30 Stones 1...14 lbs

{Ask if Weight = 2}

WeightKg

What is your weight in kgs

25...220 Kg

{ASK ALL}

Healthcond

“Did you have any of the following pre-existing health conditions before March 2020?”

1. High Blood Pressure
 2. Diabetes
 3. Heart Problems
 4. Breathing difficulty (including asthma, chronic bronchitis, chronic obstructive pulmonary disease (COPD))
 5. Any other long-term conditions
 6. None of the above [EXCLUSIVE].
-

{ASK ALL}

Shield

“At any time since March, have you felt you needed to shield and self-isolate on account of your health status?”

1. Yes
 2. No
-

{ASK ALL}

Lettershield

“Did you get a letter from the NHS saying you needed to shield and self-isolate?”

1. Yes
 2. No
-

{ASK ALL}

Shieldothers

“Do you know if any member of your household thought they needed to shield and self-isolate on account of their health status?”

1. Yes
 2. No
-

{ASK ALL}

Lettershieldothers

“Did anyone else in your household get a letter to say they needed to shield and self-isolate?”

1. Yes
 2. No
-

{ASK ALL}

Advicevuln

“Did you get advice from your GP, or another doctor or nurse, saying you were vulnerable and should try to stay at home as much as possible?”

1. Yes
 2. No
-

{ASK ALL}

Advicehhvuln

“Did anyone else in your household get advice from their GP, other doctor or nurse to say that they were vulnerable and needed to stay at home as much as possible?”

1. Yes
 2. No
-

{ASK ALL}

CovidSymptoms

“Have you had COVID-19 Symptoms?”

1. Yes
 2. No
-

{ASK ALL}

PositiveTest

“Have you had a COVID-19 positive test?”

1. Yes
 2. No
-

{ASK IF CovidSymptoms = 1 OR PositiveTest =1}

Timeoff

“Did you have any time off work?”

1. Yes
 2. No
-

{ASK IF Timeoff = 1}

Datestopwork

“What date did you stop work?”

TU: DATE MUST BE IN 2020

Dd/mm/2020

{ASK IF CovidSymptoms = 1 OR PostiveTest =1}

Sympcontinued [MULTICODE]

“Since having COVID-19 [Textfill if CovidSymptoms=1 “symptoms”], have you continued to have any of the following [Textfill if Postivetest =1 “symptoms”]?”

1. Tiredness
 2. Breathing difficulty
 3. Any other health-related problems [free text]
 4. None [EXCLUSIVE]
-

{ASK ALL}

Smoke

“In March 2020, did you smoke cigarettes?”

Please select one option

1. Yes, and I am currently still a cigarette smoker
 2. Yes, I smoked cigarettes, but I have now quit
 3. No, but I have since started smoking
 4. No, I did not smoke cigarettes and I am currently not a smoker.
-

{ASK ALL}

TimeTV

“How much time per week do you typically spend sitting watching TV?”

None

Less than 30 minutes

Between 30 minutes and 1 hour

1-2 hours

2-5 hours

5-10 hours

More than 10 hours

{ASK ALL}

TimeReading

“How much time per week do you typically spend sitting and reading?”

None

Less than 30 minutes

Between 30 minutes and 1 hour

1-2 hours

2-5 hours

5-10 hours

More than 10 hours

{ASK ALL}

Timepcphone

“How much time per week do you typically spend sitting and using a computer and/or smartphone?”

None

Less than 30 minutes

Between 30 minutes and 1 hour

1-2 hours

2-5 hours

5-10 hours

More than 10 hours

{ASK ALL}

Timewalking

“How much time per week do you typically spend walking?”

G_IfNec_II1

None

Less than 30 minutes

Between 30 minutes and 1 hour

1-2 hours

2-5 hours

5-10 hours

More than 10 hours

{ASK ALL}

Timegardening

“How much time per week do you typically spend gardening?”

G_IfNec_II1

None

Less than 30 minutes

Between 30 minutes and 1 hour

1-2 hours

2-5 hours

5-10 hours

More than 10 hours

{ASK ALL}

Timeexercise

“How much time per week do you typically spend doing vigorous exercise (jogging, gym, swimming etc.)?”

G_IfNec_II1

None

Less than 30 minutes

Between 30 minutes and 1 hour

1-2 hours

2-5 hours

5-10 hours

More than 10 hours

Household information

{ASK ALL}

Postcode

“What is the FULL postcode where you live?”

[free text]

{ASK ALL}

Property

“In the property in which you live, does your household..”

G_ReadOut_II1

1. Own the property (or with a mortgage)
 2. Rent privately
 3. Rent from social housing association or local authority
 4. Shared ownership
 5. Other
-

{ASK ALL}

Nrooms

“How many bedrooms are available where you live?”

1. 1
 2. 2
 3. 3
 4. 4
 5. 5
 6. 6
 7. 7
 8. 8.
 9. 9
 10. 10 or more
-

{ASK ALL}

Livealone

“Do you live alone in the property in which you live?”

1. Yes
 2. No
-

{ASK IF Livealone=2}

Otherfamily

“Apart from yourself, how many immediate family members live with you (i.e. partner and/their unmarried children)?”

1. None
 2. 1
 3. 2
 4. 3
 5. 4
 6. 5
 7. More than 5
-

{ASK IF Livealone=2}

Otherrelatives

“How many other relatives of you or your partner live in your household?”

1. None
 2. 1
 3. 2
 4. 3
 5. 4
 6. 5
 7. More than 5
-

{ASK IF Livealone=2}

Otherunrelated

“How many other people unrelated to you live in your household?”

1. None
 2. 1
 3. 2
 4. 3
 5. 4
 6. 5
 7. More than 5
-

Demographic information

{ASK ALL}

Dob

“What is your date of birth?”

Dd/mm/yyyy

{ASK ALL}

Sex

“What is your sex?”

1. Male
 2. Female
 3. Other
-

{ASK ALL}

Ethnicity

“What is your ethnicity?”

White British

White Irish

White Gypsy or Irish Traveller

White Other

Black or Black British - African

Black or Black British - Caribbean

Black or Black British - Other

Asian or Asian British - Pakistani

Asian or Asian British - Bangladeshi

Asian or Asian British - Indian

Asian or Asian British - Chinese

Asian or Asian British - Other

Mixed - White & Black

Mixed - White & Asian

Mixed - Other

Other - Arab

Other - Any other ethnic group

{ASK ALL}

UKBorn

“Were you born in the UK?”

1. Yes

2. No

{ASK IF UKBorn=2}

UKentry

“What was your year of entry into the UK?”

NUMERIC 1940....2020

{ASK ALL}

FINALQ

Finally is there anything you would like to add about how the COVID-19 pandemic has affected your work as a bus driver, that we have not covered above?

OPEN

{ASK ALL}

HELP

If the issues discussed in this survey have caused you any distress or discomfort, we can sign-post you to an organisation that can provide support. Would you like details?

1. Yes

2. No

{IF HELP=1}

SUPLN

The following organisation can be of help

Supportline

A confidential telephone helpline offering emotional support to any individual on any issue.

0170 8765 200

www.supportline.org.uk

If you have any questions or concerns about the research, please visit www.natcen.ac.uk/busdrivers, email busdriversurvey@natcen.ac.uk or call us free on 0800 652 9296.