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COVID-19 and occupation

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COVID-19 and occupation
SUMMARY

Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), was first identified at the end of December 2019 in China as the cause of an outbreak of cases of 'atypical viral pneumonia', Coronavirus disease 2019 (COVID-19). The first case of COVID-19 documented in the UK was on 31 January 2020. The UK experienced a first wave of infection between March and July 2020 with a second beginning in late August 2020. Over 75,000 deaths from COVID-19 had occurred by the end of December 2020. Knowledge of many aspects of SARS-CoV-2 and COVID-19, including detection, transmission, diagnosis, treatment and disease progression, has gradually accumulated during 2020. The Industrial Injuries Advisory Council (IIAC), therefore considered it timely and necessary to review the evidence for the relationship between occupation and COVID-19 during 2020 whilst acknowledging that, as yet, there may not be sufficient good quality information to make definitive recommendations.

The health effects arising from workplace exposure to SARS-COV-2 cannot be distinguished from infection transmitted in non-occupational circumstances. The Council thus looks for robust research evidence that the risk of developing the disease is more likely than not to have arisen from occupational exposure i.e. is more than doubled.

This interim position paper reports an evaluation of the available evidence with a focus on occupational mortality data based on death certificates, together with information on infection and hospitalisation rates by occupation and data on patterns of occupational exposure to SARS-COV-2.

There is evidence from several large outbreaks that working in close proximity to others in workplaces increases the risk of infection in workers, as does close proximity to infected individuals in health and social care settings and transport. The risk of suffering severe COVID-19 is also increased in social care and transport workers in the UK. There is, however, limited scientific evidence on the exact modes of transmission of COVID-19 in both workplaces and community settings and scarce data on dose, exposure frequency and length of exposure in the workplace.

Analyses of UK death certificates between March and December 2020 show more than a two-fold risk in several occupations especially for males, including social care, nursing, bus and taxi driving, food processing, retail work, local and national administration and security. The number of occurrences of cases and deaths from COVID-19 reported through RIDDOR (Reporting of Injuries Diseases and Dangerous Regulations) for these occupations mirror the death data; RIDDOR also provides evidence of the relatively high numbers of cases in other occupations such as education.

The Council concludes that there is a clear association between several occupations and increased risk of death from COVID-19 but acknowledges that the consistency. and extent of the mortality data, and the lack of adjustment for factors such as deprivation, means that the evidence is currently too limited in quality and quantity to justify prescription at this stage. Information regarding any link between occupation and risk of disability following SARS-CoV-2 infection is also currently scarce. The

Council therefore concludes, overall, that the evidence is not at present sufficient for recommending prescription. However, the evidence of a doubling of risk in several occupations indicates a pathway to potential prescription and the Council expects that future data will enable a better understanding of the effect that Post-COVID-19 syndrome may have on loss of function. The Council will recommend prescription if and when there is strong enough evidence that occupational exposures cause disabling disease on the 'balance of probabilities.'

The Council is aware of several ongoing studies and will continue to monitor the literature closely. It is particularly interested in large good quality studies of workers and workplaces and also community-based studies regarding both death and long-term effects of infection with SARS-CoV-2.

This report contains some technical terms, the meanings of which are explained in a concluding glossary.

INTRODUCTION

1. At the end of December 2019, a cluster of cases of “atypical viral pneumonia” was reported in Wuhan, Hubei province, People’s Republic of China. A novel coronavirus, severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), was identified as the cause of this outbreak and its genetic code was reported in early January 2020. Evidence of human-to-human transmission was also reported during January 2020. The disease state caused by SARS-CoV-2 was specified as Coronavirus disease 2019 (COVID-19) and by 30 January 2020, the World Health Organisation declared the epidemic a Public Health Emergency of International Concern (PHEIC). The first case of COVID-19 documented in the UK was on 31 January 2020. The World Health Organisation declared COVID-19 a global pandemic in early March 2020. The UK went into national lockdown in late March 2020 after a dramatic rise in cases, particularly in London, started to put pressure on the National Health Service (NHS).

2. The UK experienced a first wave of infection between March and July 2020 with 285,262 confirmed cases of COVID-19 and 40,673 deaths. A second wave of infection began in late August 2020 with a further 2,372,013 confirmed cases and 35,530 deaths up to the end of December. Evidence about the virus has accumulated rapidly. Although there is considerably more analysis to do, the Industrial Injuries Advisory Council (IIAC) considered it timely and necessary to review the evidence for occupation and COVID-19 during 2020 whilst acknowledging that, as yet, there may not be sufficient good quality information to make definitive recommendations.

3. Industrial Injury Disablement Benefit (IIDB) is currently prescribed for 15 biological agents. These include several infections (tuberculosis, hepatitis A, B and C) which can be acquired through occupational exposure.

4. There has been increasing evidence from several countries that workers in some occupational sectors are at increased risk of both being infected with SARS-CoV-2 and dying from it. These sectors include health and community social care, security, transportation, retail, food production and construction. In addition, several countries have now recognised COVID-19 as a work-related disease and a few, such as Belgium and Norway, consider it to be a compensatable occupational disease.

The Industrial Injuries Disablement Benefit Scheme

5. The IIDB Scheme provides non-contributory, ‘no-fault’ benefits for disablement because of accidents or prescribed diseases which arise during the course of employed earners’ work. The benefit is paid in addition to other incapacity and disability benefits. It is tax-free and administered by the Department for Work and Pensions.

6. It is possible to make a posthumous claim for IIDB in respect of someone who was entitled to IIDB, but who dies before being able to make a claim. A person

wanting to make a posthumous claim on behalf of a deceased person must apply to be appointed to act on behalf of the deceased person. There is normally an absolute 12-month time limit from the date of the issue of a death certificate in which a person must apply to act for the deceased and/or be appointed to act; and also make a claim for benefit, after they have been appointed. A posthumous claim is treated as if it had been made by the deceased person on the day they died, with a maximum amount of back payment of 3 months.

7. The legal requirements for prescription are set out in The Social Security Contributions and Benefits Act 1992 which states that the Secretary of State may prescribe a disease where they are satisfied that the disease ought to be treated, having regard to its causes and incidence and any other relevant considerations, as a risk of the occupation and not as a risk common to all persons; and is such that, in the absence of special circumstances, the attribution of particular cases to the nature of the employment can be established or presumed with reasonable certainty.

8. Thus, a disease may only be prescribed if there is a recognised risk to workers in an occupation and the link between disease and occupation can be established or reasonably presumed in individual cases.

The Role of the Industrial Injuries Advisory Council

9. IIAC is an independent statutory body established in 1946 to advise the Secretary of State for Social Security on matters relating to the IIDB scheme. The major part of the Council's time is spent considering whether the list of prescribed diseases for which benefit may be paid should be enlarged or amended.

10. In considering the question of prescription the Council searches for a practical way to demonstrate in the individual case that the disease can be attributed to occupational exposure with reasonable confidence; for this purpose, 'reasonable confidence' is interpreted as being based on the balance of probabilities.

11. Some occupational diseases are relatively simple to verify, as the link with occupation is clear-cut. Some only occur due to particular work or are almost always associated with work or have specific medical tests that prove their link with work, or have a rapid link to exposure, or other clinical features that make it easy to confirm the work connection. However, many other diseases are not uniquely occupational, and when caused by occupation, are indistinguishable from the same disease occurring in someone who has not been exposed to a hazard at work. In these circumstances, attribution to occupation depends on research evidence that work in the prescribed job or with the prescribed occupational exposures causes the disease on the balance of probabilities. The Council thus looks for evidence that the risk of developing the disease associated with a particular occupational exposure or circumstance is more than doubled (previous reports of the Council explain why this threshold was chosen).

12. The health effects arising from workplace exposure to SARS-CoV-2 cannot be distinguished from infection transmitted in non-occupational circumstances, so the case for prescription rests on having robust research evidence on the causal probabilities.

13. For most individuals COVID-19 is a self-limiting illness but a minority experience persisting symptoms after infection. Current estimates indicate that the death rate for adult infections is about 1% and that several times this number may experience 'Post-COVID-19 syndrome' with symptoms lasting some months[1]. However, at this time it is not known what the longer-term effects are as there have been few studies of Post-COVID-19 syndrome; there is also no agreed case definition. Furthermore, there is no indication to date that COVID-19 due to occupational exposures is more or less likely to result in Post-COVID-19 syndrome than is the case for non-occupationally transmitted COVID-19.

14. The focus of this initial paper is on evidence relating to the pandemic during 2020. A major source of information is the data extracted from death certificates and reported by the UK Office of National Statistics (ONS). These data are presented and discussed together with supporting information from a wide range of sources including occupational studies investigating infection and hospitalisation rates.

15. The Council recognises that knowledge of many aspects of SARS-CoV-2 and COVID-19, including detection, transmission, diagnosis, treatment and disease progression, has developed and expanded over the first few months of the pandemic. In parallel, guidance on measures to reduce infection for both the general community and for workers has changed quite rapidly over the same period. The Council will therefore further evaluate evidence as it emerges for both mortality and morbidity related to occupation. This will be reported in future papers. Emerging data from a longer period of follow-up will allow a greater understanding of the effect that Post-COVID-19 syndrome may have on loss of function.

CHARACTERISTICS OF THE DISEASE

16. Coronaviruses are RNA viruses that are common causes of infection in animals and humans. Some cause mild illness such as the common cold. Others cause severe diseases such as Middle East Respiratory Syndrome (MERS) and Severe Acute Respiratory Syndrome (SARS).

Symptoms

17. Approximately one-third of those infected with SARS-CoV-2 never develop symptoms (Ward et al 2020). Those that do can experience a range of symptoms including cough, fever, muscle aches, headache, shortness of breath, sore throat, diarrhoea, nausea and vomiting, a loss of sense of taste

[1] https://www.nice.org.uk/guidance/ng188/chapter/common-symptoms-of-ongoing-symptomatic-covid-19-and-post-covid-19-syndrome

and smell, abdominal pain, nasal symptoms and skin rashes (Docherty et al 2020). Most patients recover within 2 weeks. According to current data, approximately 5% report ongoing symptoms after one month and 2% after 3 months (Nguyen et al 2020). This Post-COVID-19 syndrome is not necessarily closely related to the severity of the initial illness and currently remains poorly characterised (Yelin et al 2020).

18. A minority of patients develop respiratory failure or other complications of COVID-19 infection severe enough to require hospital admission. Data up to October 2020 indicate that approximately 1% of those infected die during the acute illness; however, the risk of complications and death is strongly influenced by age and the presence of comorbidities.

19. Although usually presenting with respiratory symptoms, COVID-19 is now recognised as a multi-system inflammatory condition with impacts on every system in the body. Pulmonary fibrosis, cardiac injury, thromboembolic disease including pulmonary emboli and strokes, and encephalopathy are all recognised. In addition, patients requiring periods of intense medical treatment are at risk of a post-ICU syndrome, comprising a range of physical, cognitive and psychological impairments which persist after discharge from Intensive Care. The proportion of patients affected and the course of any disability is currently unknown.

20. There is currently no curative treatment for COVID-19 but there is emerging evidence of the effectiveness of a number of therapeutic approaches.

Diagnosis

21. SARS-CoV-2 infection can be diagnosed by detecting the virus during the acute illness, or by the detection of antibodies in the convalescent phase.

22. Acute COVID-19 infection is most reliably diagnosed by detecting viral RNA in upper airway secretions using nucleic acid amplification tests and real-time reverse transcription polymerase chain reactions (RT-PCR). These tests are very specific but failed to identify the virus in about 20% of subjects with typical clinical and radiological features of COVID-19 in the period from March to June 2020 (Woloshin et al 2020). Inadequate sampling and the timing of the test contributed to the false negative results. The test does not distinguish between dead and live viral RNA and in some cases is positive for weeks after the onset of symptoms, even though the individual is not necessarily infectious.

23. RT-PCR tests require sophisticated equipment and can take several hours to process. Several rapid tests have been developed for use at the point of care. They employ techniques such as simplified single-step or isothermal molecular amplification and lateral flow chromatography using surface-bound antibodies to detect viral antigen. The sensitivity and specificity of these tests is currently uncertain, particularly amongst individuals with low viral loads (Dinnes et al 2020).

24. Prior SARS-CoV-2 infection can be diagnosed by the presence of antibodies in the blood.

RISK FACTORS FOR INFECTION WITH SARS-COV-2 AND THE DEVELOPMENT OF COVID-19

25. There are rare reports of infection with SARS-CoV-2 from farmed animals (Oreshkova et al 2020) but infection is almost always caused by direct or indirect contact with another infected individual. The risk of infection is determined primarily by personal lifestyle and individual factors (including occupational) that increase contact with others who are already infected.

26. In the earlier stages of the pandemic COVID-19 testing was largely confined to more severely symptomatic individuals (particularly those who were hospitalised), making it difficult to distinguish risks of infection from risks of developing severe disease and death. Three large population-based studies have helped clarify the issues. The UK Office for National Statistics (ONS) infection survey (ONS, 2020a) and REACT-1 (Riley et al 2020) carried out tests for active infection using RT-PCR. REACT-2 (Ward et al 2020) investigated prior infection using antibody tests. The ONS conducted weekly surveys from April 2020 with a total of 1,116,988 tests up to November 2020, 7,595 (0.7%) of which were positive. REACT-1 involved 7 rounds of tests between May and November 2020. 1,197,387 tests were carried out, and 5,582 (0.5%) of these were positive. REACT-2 involved 365,104 antibody tests carried out in 3 rounds between June and September 2020. 17,576 (4.8%) of these were positive.

27. Over the periods in which these studies were carried out, those who reported definite contact with an infected individual were up to 30 times more likely than others to have evidence of infection themselves (Riley et al 2020). Infection rates were approximately twice as high in young adults as in older age groups; in round 1 of REACT-2, for example, the prevalence of positive antibodies fell from 7.9% in the 18-24 age group to 3.3% in those aged 75 or older. Infection was marginally more common in men compared with women: 0.13% vs 0.12% in REACT-1 and 6.2% vs 5.7% in REACT-2.

28. Living in a large household with five or more individuals or in a care home was associated with approximately a doubled risk of infection compared with living alone (ONS 2020a, Ward et al 2020). Those in the most deprived quartile of social deprivation were approximately 50% more likely to be infected compared with the least deprived (REACT-2). These associations are likely to reflect increased risks of contact with infected individuals. The ONS and REACT studies showed that those of a non-white ethnic background were 2-3 times more likely to have a positive test for SARS-CoV-2 compared with white ethnic background subjects (ONS 2020a, Riley et al 2020, Ward et al 2020). The openSAFELY Collaborative studied the primary care records of 17.5 million adults in England between February and August 2020 (Mahur et al 2020). After adjusting for age, sex, deprivation quintile, clinical co-morbidities, household

size and care home residency the results showed that South Asian, Black and mixed ethnic groups were marginally more likely to be tested for SARS-CoV-2, and substantially more likely to test positive compared with white adults (South Asian Hazard Ratio (HR) 2.02, Black HR 1.68, mixed HR 1.46).

29. Unlike the risk of acquiring infection, the risks of hospitalisation or death with COVID-19 are determined primarily by age, sex and the presence of co-morbidities. The risk of being admitted to ICU for COVID-19 was substantially increased in the openSafely study in all ethnic minority groups compared with white adults (South Asian HR 2.22, 95% CI 1.96-2.52; Black HR 3.07, 95% CI 2.61-3.61; Mixed HR 2.86, 95% CI 2.19-3.75, Other HR 2.86, 95% CI 2.31-3.63) (Williamson et al, 2020). However, the hazard ratios for COVID-19 mortality were less elevated (South Asian HR 1.27, Black HR 1.55, mixed HR 1.40). Similar findings were found in a study in Leicester of all individuals assessed for COVID-19 with polymerase chain reaction (PCR) testing at University Hospitals of Leicester NHS Trust between 1 March and 28 April 2020. (Martin et al, 2020) and in a systematic review and meta-analysis by the same Leicester research group (Sze et al, 2020).

30. These findings probably largely reflect socio-economic factors (including occupational exposures) that increase the risk of infection; ethnic differences in susceptibility are currently uncertain (Public Health England 2020a). The study by Martin et al, found that South Asian and Black participants were significantly younger, more likely to have diabetes and live in a larger household than those of white ethnicity and were more likely to live in a deprived area.

31. Age is the strongest predictor of death and other severe outcomes. Overall, those aged over 80 are approximately 70 times more likely to die following infection compared with those under 40 (PHE 2020). After adjustment for comorbidities (which increase with age) those over 80 remain approximately 14 times more likely to die compared with those under 50 (Docherty et al 2020, Williamson et al 2020).

32. Although men are only marginally more likely to be infected with SARS-CoV-2 than women, they are substantially more likely to die of COVID-19. PHE data indicate an adjusted hazard ratio (aHR) of 1.54 (95% CI 1.50 - 1.57) for male deaths vs female; UK Biobank an odds ratio (OR) of 1.52 (1.28 to 1.81) and openSAFELY an aHR of 1.93 (1.80-2.06). There is some evidence from the PHE data that the gender disparity is greater in working-aged men with an aHR of 1.99 (1.85 - 2.14) compared with an aHR of 1.47 (1.44 - 1.51) in those aged above 64 years.

33. A number of comorbid conditions are associated with severe outcomes and an increased risk of death following COVID-19 infection. Obesity is consistently associated with poorer outcomes. An openSAFELY collaborative paper (Williamson et al, 2020) found that those with BMI ≥ 40 kg/m^2 were more than twice as likely to die as the non-obese (aHR 2.27: 95% CI 1.99-2.58). Other associations have been demonstrated with diabetes, immunosuppression, respiratory disease, neurological disease and malignancy.

34. Those of a non-white ethnic background are 2-4 times more likely to die of COVID-19 compared with white ethnic background individuals (PHE 2020). The differences are reduced when social factors and comorbidities are taken into account but some differences in outcome appear to persist (Zakeri et al 2020).

35. ONS has also produced a report on ethnic differences in COVID-19 deaths up until 28 July 2020 (ONS 2020b). It found that males of Black African ethnic background had 2.7 times the risk of COVID-19 death compared with males of White ethnic background; females of Black Caribbean ethnic background had death rates higher than females of white ethnic background. Taking into account region, socio-economic characteristics and pre-existing conditions, males of Black African background still had 2.5 times the COVID-19 death rate of White males; for females, the corresponding estimate was 2.1. All ethnic minority groups other than Chinese had higher COVID-19 death rates than the White ethnic population. The Report concluded that 'ethnic differences in mortality involving COVID-19 are most strongly associated with demographic and socio-economic factors such as place of residence and occupational exposures and cannot be explained by pre-existing health conditions using hospital data or self-reported health status'.

POTENTIAL FOR EXPOSURE AND PATTERNS OF EXPOSURE WITHIN KEY OCCUPATIONS, PPE USE AND EFFECTIVENESS

36. Modes of transmission of SARS-CoV-2 are not fully understood. It seems that transmission may occur from close contact with an infected person (droplet or aerosol transmission), or indirectly from touching surfaces contaminated with the virus. The risk of viral infection depends on the level of exposure which, in turn, depends on the number, frequency, and proximity of infection sources (both social and occupational).

37. The ONS has created an estimate of exposure to generic disease, and physical proximity to others, for UK occupations based on US analysis of these factors.[2] Occupations involving both regular exposure to disease plus close contact with people will have higher risk of infection, while those with close proximity yet lower exposure to disease will have lower risk. For example, health and social care workers who have a greater chance of being in close proximity to infected people will be at greater risk than someone working from home.

38. The available information shows that there is widespread contamination of the air and surfaces in hospitals, although not all of the studies found the virus, and most of the positive studies showed relatively low concentrations[3]. Studies involving measuring SARS-CoV-2 on surfaces on public transportation showed that low-level contamination was possible. The extent of virus contamination in other workplaces is unknown since there have been no studies. While clusters of infection have been reported in numerous workplaces and occupations, it is

[2] https://www.ons.gov.uk/employmentandlabourmarket/peopleinwork/employmentandemployeetypes/articles/whichoccupationshavethehighestpotentialexposuretothecoronaviruscovid19/2020-05-11
[3] https://www.medrxiv.org/content/10.1101/2021.01.25.21250233v1

uncertain whether these resulted from local contamination or person-to-person spread, though the latter seems more likely.

39. The British Occupational Hygiene Society (BOHS) has developed a Risk Matrix (see Appendix Table 1) to synthesise the science into a set of practical guidance on the types of control measures that should be adopted to protect workers. This is based on the likelihood and duration of exposure. The highest risk ratings are for care workers, and then 'public facing' workers with a high chance of face-to-face contact. The BOHS Matrix also provides best practice advice on the control measures that should be used to protect workers in the various exposure categories. In line with the guidance from the Health and Safety Executive (HSE), these focus on control at the source of the potential infection, e.g. isolation of infected people, restricted staff access, physical distancing, regular surface disinfection, use of personal protective equipment (PPE).

40. PPE can never completely protect the wearer: the effectiveness of respirators and face coverings, for example, depends on factors such as mask type/material, fit to the face, and consistency of wearing. While good PPE practice may be feasible in a hospital environment, it is not necessarily as feasible in many other workplaces where workers are at potential risk. Other controls such as plastic screens, simple visors, and cloth face coverings are likely to offer suboptimal protection, particularly as there is growing concern that airborne transmission may be a significant infection mechanism in some workplace outbreaks. Furthermore, there are both compliance and feasibility issues that can limit the effectiveness of control measures. Patchy implementation of control measures will be compounded by the presence within workforces of an unknown proportion of asymptomatic yet infectious workers (particularly among the young). Effective control of risk of infection within the workplace is likely to remain a challenge, as indeed will controlling the risk of the virus entering the workplace from shared travel to work or from the wider community.

41. In summary, the scientific evidence on exposure is limited, both in quality and quantity, so our understanding is likely to develop further as new data on the transmission modes of SARS-CoV-2 emerges, Thus, there remains uncertainty over the relative importance of the primary modes of transmission of SARS-CoV-2, along with uncertainty over exposure times, proximity, infective dose, and the relative likelihood of SARS-CoV-2 originating in the workplace or the community. Nevertheless, it is reasonable to assume (and there is preliminary evidence) that some workplaces/workers will be at higher risk of infection due to higher levels of exposure related to job and workplace characteristics, and that this risk varies by age, sex, country, and labour market position.

OCCUPATION and MORTALITY FROM COVID-19

ONS DATA

42. The Office for National Statistics (ONS) has published three bulletins reporting analyses of deaths for England and Wales involving COVID-19 by occupation, the first for 2494 deaths aged 20-64 up to 20 April 2020, the second for 4761 deaths aged 20-64 registered (rather than based on the date of death), between 9 March and 25 May 2020 and the most recent for 7961 deaths aged 20-64 from 9 March to 28 December 2020 (ONS 2020c,d,e). Information from the third publication is presented and discussed here.

43. Population counts for occupations were obtained from the Annual Population Survey (APS), using data collected in 2019. The APS is the largest ongoing household survey in the UK, based on interviews with members of randomly selected households. The survey covers a range of diverse topics, including information on occupation, which is then coded using the SOC2010 Manual (SOC 2010). The population counts were restricted to those aged 20 to 64 years and were weighted to be representative of those living in England and Wales. Mortality rates for the broader population of all usual residents in England and Wales were based on the mid-year population estimates for 2018.

44. Cause of death on death certificates is coded using the International Classification of Diseases, 10th Revision (ICD-10). Deaths involving the SARS-CoV-2 virus (COVID-19) include those with an underlying cause, or any mention, of ICD-10 codes U07.1 (COVID-19, virus identified) or U07.2 (COVID-19, virus not identified). ONS applied an age restriction, selecting deaths among those aged 20 to 64 years, because of limitations of occupational mortality data for those outside these ranges; within these only those deaths with an occupation recorded on the death certificate at the time of death registration by the informant were included. This information was then coded using the Standard Occupational Classification 2010 (SOC 2010). This is a hierarchical coding system in which jobs are classified in terms of their skill level and skill content; ‘skill’ is defined in terms of the nature and duration of the qualifications, training and work experience required to become competent to perform the associated tasks in a particular job. There are nine Major job groups (see Table 2 below) ranging from Managerial jobs through to ‘Elementary occupations’; these are numbered 1 to 9 (SOC 1-digit codes). These are then subdivided into Sub-major groups (SOC 2-digit), Minor groups (SOC 3-digit) and Unit groups (SOC 4-digit).

45. The analyses are presented as age standardised death rates (ASDRs) per 100,000 (with 95% Confidence Intervals (CI)); the 2013 European Standard Population was used for age standardisation. Occupation was analysed by 9 major SOC groups (SOC 1-digit), 25 sub-major (SOC 2-digit), 90 minor (SOC 3-digit) and >350 individual (SOC 4-digit) groups of occupations.

46. Of the 7961 deaths that included information on occupation involving COVID-19 in people aged between 20 and 64 between March and the end of

December 2020, 60% (4761) occurred between March 2020 and the end of May 2020 with 40% occurring after that. Nearly two-thirds of the 7961 deaths were among men, with 5128 (64.4%) deaths compared with 35.6% (2833 deaths) among women. Men had a statistically higher rate of death involving COVID-19, with 31.4 deaths per 100,000 men of the working population, compared with 16.8 deaths per 100,000 women (Table 1).

Table 1: ONS data: Deaths and death rates/100,000 (95% Confidence Intervals) involving COVID-19 and all causes by sex (those aged 20 to 64 years), England and Wales, deaths registered between 9th March and 28th December 2020.

	Men		Women	
Cause of death	**Number of Deaths**	**Death Rate / 100,000 (95% CI)**	**Number of Deaths**	**Death Rate / 100,000 (95% CI)**
Involving COVID-19	5,128	31.4 (30.6, 32.3)	2,833	16.8 (16.2, 17.5)
All causes of death	42,082	256.0 (253.5, 258.4)	26,675	158.3 (156.4, 160.2)

47. Of the death certificates of men of working age (20-64 years), 80.6% deaths overall and 82.4% (4225) of those involving COVID-19 included information on occupation. Fewer women's death certificates included occupational information: 69.0 % overall and 61.5% (1742) involving COVID-19 (Appendix Table 2). The relatively small number of deaths limit the interpretation of the results for some of SOC 4-digit occupations particularly for women.

48. Table 2 shows the findings by the 9 major occupational groups separately for men, and women.

Table 2: Numbers of Deaths and Death Rates per 100,000 (95% Confidence Intervals) involving COVID-19 among major occupation groups by sex (those aged 20 to 64 years), England and Wales, deaths registered between 9th March and 28th December 2020.

			Men			Women	
SOC Major Groups	**Description**		**Number of Deaths**	**Death Rate/100,000 (95% CI)**		**Number of Deaths**	**Death Rate/100,000 (95% CI)**
1	Managers, directors and senior officials		472	25.1 (22.8, 27.5)		139	13.5 (11.1, 15.8)
2	Professional occupations		419	17.6 (15.9, 19.3)		279	12.8 (11.2, 14.4)
3	Associate professional and technical occupations		360	21.8 (19.5, 24.1)		103	8.2 (6.5, 9.9)

4	Administrative and secretarial occupations		186	39.0 (33.4, 44.7)		250	12.3 (10.7, 13.8)
5	Skilled trades occupations		848	40.4 (37.6, 43.1)		54	18.8 (14.1, 24.6)
6	Caring, leisure and other service occupations		258	64.1 (56.2, 71.9)		460	27.3 (24.7, 29.8)
7	Sales and customer service occupations		156	40.3 (33.8, 46.8)		173	18.6 (15.8, 21.4)
8	Process, plant and machine operatives		827	52.8 (49.2, 56.4)		57	33.7 (25.1, 44.2)
9	Elementary occupations		699	66.3 (61.3, 71.2)		227	21.1 (18.4, 23.9)

49. For men, the highest death rates were for elementary occupations, caring, leisure and other service occupations and process, plant and machine operatives compared with men of the same age in the general population. For women, the highest death rates were for process, plant and machine operatives, and caring, leisure and other services, compared with women of the same age in the general population.

4-digit SOC code occupational groups

50. Appendix Table 3 presents the findings from ONS for selected individual occupations coded to 4-digit SOC code for men, and Appendix Table 4 gives the corresponding findings for women.

51. Tables 3 and 4 below summarize the key findings from Appendix Tables 3 and 4, for males and females respectively and include selected 4-digit SOC coded occupations. The number of deaths and the death rate per 100,000 (and 95% confidence interval) are given for each occupational group defined by a SOC 2010 4-digit code. The Relative Risk (RR) for each occupational group has been estimated by dividing the death rate/100,000 for the specific occupation by the overall death rate per 100,000 (31.4 deaths per 100,000 men of the working population; 16.8 deaths per 100,000 women of the working population). Occupations are presented where the RR is:
    a. More than double and with 20 or more registered deaths
    b. Slightly less than doubled but with 20 or more registered deaths
    c. More than double but based on <20 registered deaths

    .

Table 3: Numbers of deaths and Death Rates per 100,000 (95% Confidence Intervals) involving COVID-19 from selected 4 digit SOC codes: men aged 20-64, England and Wales, deaths registered between 9th March and 28th December 2020.

SOC 2010 4-digit code	Occupations with 20 or more deaths and Relative Risk doubled	Number of Deaths	Death Rate/100,000 (95% CI)	Relative Risk
1223	Restaurant & caring establishment managers & proprietors	26	119.3 (71.2, 183.8)	3.8
6145	Care workers and home carers	107	109.9 (88.6, 131.3)	3.5
8125	Metal working machine operatives	40	106.1 (74.5, 146.0)	3.4
8111	Food, drink and tobacco process operatives	52	103.7 (77.5, 136.4)	3.3
5434	Chefs	82	103.1 (79.9, 130.5)	3.3
8214	Taxi & cab drivers & chauffeurs	209	101.4 (87.5, 115.2)	3.2
9241	Security guards & related occupations	140	100.7 (83.8, 117.6)	3.2
6141	Nursing auxiliaries and assistants	45	87.2 (63.3, 117.1)	2.8
9120	Elementary construction occupations	70	82.1 (63.9, 103.7)	2.6
2231	Nurses	47	79.1 (57.4, 106.1)	2.5
4113	Local government administrative occupations	23	72.1 (44.8, 109.4)	2.3
8213	Bus and coach drivers	83	70.3 (55.3, 88.0)	2.2
1254	Shop keepers & proprietors: wholesale & retail	54	69.0 (51.8, 90.1)	2.2
9233	Cleaners and domestics	58	66.6 (50.3, 86.5)	2.1
7112	Retail cashiers & check out operators	11	61.6 (27.9, 114.7)	2.0
	Occupations with 20 or more deaths but Relative Risk less than 2			
4112	National government administrative occupations	28	58 .5 (38.8, 84.7)	1.9
9211	Postal workers, mail sorter, messengers, couriers	64	58.2 (44.5, 74.6)	1.9

5231	Vehicle technicians, mechanics & electricians	48	58.0 (42.4, 77.4)	1.8
9272	Kitchen & catering assistants	29	57.0 (38.0, 81.9)	1.8
7111	Sales & retail assistants	69	56.5 (43.7, 71.9)	1.8
9260	Elementary storage occupations	111	54.0 (43.4, 64.6)	1.7
	Occupations with < 20 deaths and Relative Risk doubled			
5432	Bakers & flour confectioners	15	715.6 (331, 1282.8)	22.8
1224	Publicans & managers of licensed premises	19	219.9 (124.7, 354.2)	7.0
5431	Butchers	15	207 (112.2, 346.8)	6.6
3312	Police officers (sergeant and below)	19	194.1 (93.3, 333.3)	6.2
9236	Vehicle valets & cleaners	10	142.9 (60.7, 275.5)	4.6
6221	Hairdressers & barbers	12	112.5 (49.6, 209.8)	3.6
4123	Bank & post office clerks	11	105.5 (49.6, 193.7)	3.4
5313	Roofers, roof tilers & slaters	19	100.5 (55.8, 163.6)	3.2
9273	Waiters and waitresses	14	95.7 (46.6, 169.1)	3.0
6142	Ambulance staff (excluding paramedics)	15	95.2 (38.7, 178.5)	3.0
5436	Catering & bar managers	13	86.8 (41.6, 155.4)	2.8
9271	Hospital porters	18	86.7 (47.7, 142.3)	2.8
5235	Aircraft maintenance & related trades	11	70.8 (34.4, 128.2)	2.3

Table 4: Numbers of deaths and Death Rates per 100,000 (95% Confidence Intervals) involving COVID-19 from selected 4 digit SOC codes: women aged 20-64, England and Wales, deaths registered between 9th March and 28th December 2020.

SOC 2010 4-digit code	Occupations with 20 or more deaths and Relative Risk doubled	Deaths	Death Rate/100,000 (95% CI)	Relative Risk
6145	Care workers and home carers	240	47.1 (41.1, 53.1)	2.8
	Occupations with 20 or more deaths but Relative Risk < 2			
2442	Social workers	25	32.4 (20.7, 48.3)	1.9
4112	National government administrative occupations	26	27.9 (18.1, 41.2)	1.7
7111	Sales and retail assistants	111	26.9 (21.8, 31.9)	1.6
6141	Nursing auxiliaries and assistants	54	25.3 (18.9, 33.1)	1.5
2231	Nurses	110	24.5 (19.7, 29.4)	1.5
	Occupations with < 20 deaths and Relative Risk doubled			
8137	Sewing machinists	14	64.8 (34.6, 110.1)	3.9
6221	Hairdressers and barbers	18	44.0 (24.2, 72.2)	2.6
5434	Chefs	13	40.2 (20.5, 70.0)	2.4
6144	House-parents & residential wardens	13	37.4 (18.8, 65.7)	2.2
1254	Shopkeepers & proprietors, wholesale & retail	12	36.0 (18.0, 63.8)	2.1

52. The RRs are more than 3 for the first 7 4-digit occupations for males (Table 3) and a further 8 are more than doubled. The care workers/home carers category is the only 4-digit category with large numbers of deaths with a RR that is more than doubled for women; however, there are several other categories with small numbers of deaths including hairdressers, sewing machinists, chefs, house-parents and shopkeepers.

53. The findings for male transport workers are of particular interest because they involve workers in the same industry who have varying degrees of contact with the public. Nearly a third (28%) of the total deaths (739) among taxi and cab drivers and nearly a quarter (23%) of the total deaths (367) among bus and coach drivers between March and December 2020 were from Covid-19. There were high death rates and RRs for these groups. These are occupations which involve frequent contact with the public. However, the death rate for male van drivers (limited contact with the public) and large goods vehicle drivers (LGV lorries) (little or no contact with the public) were both 39.7/100,000 population, only a little above the overall death rate. This supports the hypothesis that occupations with high levels of public contact (in this case taxi and cab drivers and bus and coach drivers) have high risks of Covid-19 death compared to similar occupations that have little contact with the public (e.g. van drivers, large goods vehicle drivers).

54. The ONS deaths rates have been adjusted for age and sex and not for other factors such as deprivation, region and ethnicity. Whilst the rates amongst cab/taxi drivers appear considerably elevated relative to the other driving groups, there are currently no data amongst drivers which take ethnicity into account (see paragraphs 34 and 35). According to Department of Transport data from 2019/20, 52% of taxi drivers were of white ethnicity and 37% Asian or Asian British (Department of Transport, 2020). Likewise, a high proportion of London bus and coach drivers are male (93%) and of non-white ethnicity (79%). (Goldblatt & Morrison). Initial analysis of deaths amongst London bus drivers identified 27 deaths from COVID-19, 20 of which occurred amongst drivers of black (41%) or Asian (33%) ethnicity; 22% were of White ethnicity. Moreover, 18% of the deaths occurred amongst drivers aged > 65 years even though they accounted for only 4% of the workforce.

55. The potentially high risk of exposure to SARS-CoV-2 amongst those working in the care and personal services occupations has been highlighted above. The death rates for this sector overall (SOC 3-digit code 614) were 91/100,000 for males and 38.3/100,000 for females giving RRs of 2.9 and 2.3 respectively. The largest 4-digit SOC code sub-group is care workers and home care workers. There were 204 deaths in care workers and home carers between March and the end of May 2020 and a further 143 up to the end of December. More than three times the risk of death was found for males and nearly three times for females. Elevated risks were also found for other 4-digit subgroups including both male and female nursing auxiliaries and male ambulance men although risks were not always doubled.

56. In the health care sector, a RR of more than double was found for male nurses with a smaller increase for female nurses (Tables 3 and 4). ONS carried out specific analyses for two large categories of workers grouping together various SOC2010 codes; health care workers (including doctors, nurses and midwives, nurse assistants, paramedics and ambulance staff, and hospital porters), and social care workers (including care workers and home carers, social workers, managers of residential care institutions, and care escorts). Rates of death involving COVID-19 among men (79.1/100,00, 150 deaths) and women (35.9/100,000, 319 deaths) social care workers were more than doubled compared with the general population (adjusted for age and sex) in England and Wales. The rates of death involving COVID-19 were lower for health care workers and not more than doubled- 44.9/100,000 for men (190 deaths) and 17.3/100,000 for women (224 deaths). However, combining such a diverse group of workers who may have different risks may have obscured true associations for some types of workers. As shown in Tables 3 and 4, elevated death rates were found among some of the individual health care professions such as nurses and nursing auxiliaries and assistants.

57. Food preparation and the hospitality trade have also been highlighted as workplaces where increased exposure to SARS-CoV-2 may occur, as has retail work. As shown in Table 3, increased RRs have been found in several occupations within these industries in both males and females. Other areas of concern include security, cleaning, local and national administration, postal work and hairdressing.

DISCUSSION OF STRENGTHS AND LIMITATIONS

58. As acknowledged by the ONS (ONS 2020d) the data used may suffer from various biases. One potential problem is for numerator-denominator bias to occur because the deaths and the population denominators were classified (by occupation) at different times and in different data systems. The numerator data comes from the death certificates and occupation was missing for a relatively high proportion of men (18%) and very high proportion of women (40%). Numerator-denominator bias may occur if the non-recording of occupation is systematically biased. In general, this problem is likely to be minor, but there may be exceptions, e.g. if health care workers were more likely to have their occupations recorded on death certificates by informants, whereas some other occupations were less likely to be recorded, or if the accuracy of the recording differs by occupation (e.g. if a mid-level office worker is recorded as a ‘Manager’). ONS point out that the occupation recorded on the death certificate may reflect the deceased’s main lifetime occupation rather than their job at the time of death. ONS comment that the occupations found to have higher rates of death involving COVID-19 are generally consistent with other evidence on occupations where exposure is more likely to occur.

59. The denominator data comes from the Annual Population Survey (APS), using data collected in 2019. The APS is the largest ongoing household survey in the UK, based on interviews with members of randomly selected households. The

survey covers a range of diverse topics, including information on occupation, which is then coded to SOC 2010. The population counts are also restricted to those aged 20 to 64 years and are weighted to be representative of those living in England and Wales. Such surveys can never be fully comprehensive and are always subject to some responder bias.

60. A further potential problem is that of negative numerator bias i.e. under-counting of deaths involving COVID-19 and attributed to occupation. The Chief Coroner (England and Wales) has re-asserted that such cases of deaths which might be attributed to employment must be notified to the coroner using a "low threshold test; [which is] lower even than a prima facie case and requiring only grounds for surmise." (Lucraft 2020). This bias may be substantial (Agius 2020a). If the coroner decides to proceed to an inquest, then usually only a (non-registrable) Certificate of Fact of Death (CFD) is issued i.e. one where neither the cause nor the occupation are recorded. This would mean that these deaths are unlikely to be registered for at least one year (Agius 2020a) and would not be available for inclusion in the ONS data until then.

61. The causes of death recorded on death certificates may also be subject to uncertainties and inaccuracies. ONS included all deaths 'involving' COVID-19, i.e. whether they were the underlying cause in Part 1 of the Medical Certificate of Cause of Death or in Part II (contributory). This might introduce bias if there were to be an association between comorbidity and occupation (for example if workers in the security sector were pursuing a second career for health reasons). In addition, ONS included deaths for which the SARS-CoV-2 virus was identified e.g. through testing (ICD code U07.1) but also those where the virus had not been formally identified (ICD U07.2).

62. ONS were unable to calculate age-standardised mortality rates for some 4-digit occupations when the population data for those occupations was deemed to be unreliable. Most of these occupations had very small numbers of deaths. However, for 4-digit SOC code 9139, 'elementary process plant occupations not elsewhere classified', there were 100 male deaths and 25 female deaths. Occupations in 9139 include engineering factory hands and labourers, fitter/electrician mates, and machinery and work area cleaners. The death rate for the overall 3-digit category, 'elementary process plant occupations', (3-digit code 913) was more than doubled for men 143.2/100,000 based on 120 deaths, (RR=3.7) and for women 49.9/100,000 (RR=3.0), based on 33 deaths.

63. The interpretation of ONS results regarding the risk of COVID-19 and the likelihood of exposure to SARS-CoV-2 thus partly depends on the level of aggregation within the SOC codes from 9 broadly defined 1-digit Major groups of occupations that include a wide range of jobs through to occupations coded to 4-digits which are more specifically defined in terms of the tasks and jobs performed. The downside of more specificity is that the numbers of deaths in specific occupations coded at the 4-digit level may be fairly small and this has indeed occurred in the data for women. This is illustrated in the seemingly disparate results for health care workers described above. The ONS analysis

of a large group of health care occupations with wide ranging jobs and potential exposures to SARS-CoV-19 did not show any increased risk of death from COVID-19. However, for men, the 4-digit group ‘nurses’ and the 4-digit group ‘nursing auxiliaries and assistants’ had more than double the risk. For women, although the risks were elevated for these two categories they were not double but were based on much smaller numbers of deaths.

64. More than double the risk for women was found at the 3-digit SOC code level for managers and proprietors in hospitality and leisure services (3-digit SOC code 122, 26 deaths, death rate 35.1100,000), hairdressers and related services (3-digit SOC code 622, 26 deaths, death rate 39.8/100,000) and assemblers and routine operators (3-digit SOC code 813, 21 deaths, death rate 39.2/100,000). For men the 3-digit SOC code 331, protective service occupations (Officers in the police, fire and prison services, police community support officer and other community protective professionals) showed double the risk of death from COVID-19, 67 deaths, death rate 71.2/100,000.

65. The ONS death rates are age-adjusted but have not been adjusted for any other variables including deprivation, ethnicity and region. These adjustments may reduce the difference in ASDRs. However, the significant (more than) doubling of some of the ASDRs shown above is unlikely to be eliminated by such adjustment. On the other hand, it cannot be ruled out that some of the elevated risks in tables 3 and 4 may be reduced (and may be less than doubled) once these adjustments have been done. This particularly applies to transport workers where it is possible to make a comparison within the same broad occupational category. It is also possible that the high COVID-19 death rates found in certain ethnic groups or areas may be due to occupational exposures (rather than the high death rates in certain occupations being due to ethnicity or area of deprivation). Currently, these questions are unresolved. The ONS report on ethnic differences in COVID-19 deaths up to the end of July 2020 also noted that ‘an imbalance across ethnic groups working in at-risk occupations, such as front-facing occupations, could be a determining factor’.

RIDDOR

66. Another source of information on occurrences of and deaths from COVID-19 is the Reporting of Injuries Diseases and Dangerous Regulations (RIDDOR) 2013 data which is collected by the Health and Safety Executive (HSE). RIDDOR places a legal duty on employers to make reports to the enforcing authorities (i.e. to HSE or to Local Authorities) about work-related accidents which cause death or serious injury, diagnosed cases of certain industrial diseases and ‘dangerous occurrences’ i.e. incidents with the potential to cause serious harm. Accurate disease reporting depends on the reliable attribution of a case of disease to an occupational exposure. This is particularly difficult in the case of COVID-19 because the infection is prevalent in the general community.

67. The HSE guidance (HSE 2020a) relating to COVID-19 and SARS-CoV-2 is complex but could be summarised as follows:

A report under RIDDOR should be made when:

- a person at work (a worker) has been diagnosed as having COVID-19 attributed to an occupational exposure to coronavirus (reported as a 'case of disease')
- a worker dies as a result of occupational exposure to SARS-CoV-2. (reported as a work-related death)
- an accident or incident at work has, or could have, led to the release or escape of SARS-CoV-2, reported as a dangerous occurrence.

68. To determine whether there is reasonable evidence linking the nature of the person's work with an increased risk of becoming exposed to SARS-CoV-2 the HSE guidance indicates that account should be taken of whether or not work activities increased the risk of SARS-CoV-2 exposure, there was any specific, identifiable incident leading to an increased risk of exposure, or the person's work directly brought them into contact with a known SARS-CoV-2 hazard without effective control measures. Cases where a registered medical practitioner has highlighted the significance of work-related factors in relation to a diagnosis of COVID-19 would also be reportable.

69. The HSE guidance states that for an occupational exposure to be judged as the likely cause of the disease, it should be more likely than not that the person's work was the source of exposure to SARS-CoV-2 as opposed to general societal exposure. In this context, work with the general public, as opposed to work with persons known to be infected, would not in itself be considered sufficient to indicate that a COVID-19 diagnosis is likely to be attributable to occupational exposure. Unlike for the usual diagnoses of occupational disease, for pragmatic reasons the HSE accept that cases of COVID-19 can be reported without a registered medical practitioner's written diagnosis, for example, on the basis of laboratory test results (HSE 2020a).

70. National Statistics relating to RIDDOR published by HSE do not routinely include disease notifications due to data limitations, particularly the underreporting of cases. However, the HSE has published technical summaries of the RIDDOR data for COVID-19. These are published as 'Management Information' rather than as more rigorously validated National Statistics. The latest technical summary considered for the purposes of this IIAC report collated reports notified to the enforcing authorities over the period 10 April – 12 December 2020 (HSE 2020b). The data show that there were 17,895 of cases of COVID-19 (including 223 deaths) in workers where there was 'reasonable' evidence to suggest it was caused by occupational exposure in Great Britain (GB) i.e. excluding Northern Ireland (HSE 2020b).

71. The weekly number of RIDDOR (GB) notifications for COVID-19 peaked at 1183 (including 23 deaths) in the week ending 2 May 2020, two weeks later than the peak of deaths among the general population, as reported by the ONS (ONS 2020e) (Agius et al. 2020). The number of RIDDOR notifications began to rise again at the end of August, similarly shadowing the general population trend although the second wave in RIDDOR has not exceeded the weekly first wave RIDDOR peak at least from the data shown in the HSE December 2020 summary. The pattern of reporting differed over 2020. The proportion of reports

recorded against health and social work activities was higher in the first wave of reporting (10 April through August) than the second wave (September to 12 December) - 78% compared with 53%. In contrast, education and manufacturing combined accounted for less than 2% of all first wave reports, but around 17% of all reports made in the second wave. This could be attributed in part to the re-opening of the economy in July with more reports thence coming through from other sectors. It may also reflect increased awareness of risks in the workplace.

72. Table 5 shows the numbers of notifications from the HSE's December 2020 technical summary by industry sectors defined by Standard Industry Classification (SIC). These are not directly comparable with the SOC codes used by ONS and tend to be broader groups. For example, the industry section of ‘human health and social work activities’ could include occupations as diverse as nurses, cleaners, administrators and computer programmers. Over 70% of the notifications and deaths reported in Table 5 were for this industry section. Comparable numbers were reported for the 2 main divisions of this sector, ’human health activities’ and ’residential care activities’. There were also large numbers of reports from ‘personal service activities’ (includes hairdressing and beauty treatment, physical wellbeing activities, laundering and dry cleaning, portering etc) accommodation (hotels and other accommodation) and manufacturing, particularly of food products (not beverages).

Table 5: Worker COVID-19 disease reports made by employers to HSE and Local Authorities by disease severity and industry sector, 10 April to 12 December 2020
(Industry sectors with 20 or more total notifications)

SIC[2] Industry level	SIC Code	Industry sector (as reported by employer)[1]	Total COVID-19 notifications	Fatal notification	Non-fatal notification
All	**All (01-99)**	**All industry**	**17895**	**223**	**17672**
	B (05-09)	**Mining and quarrying**	**37**	**-**	**37**
	09	*Mining support service activities*	*20*	*-*	*20*
Section	**C (10-33)**	**Manufacturing**	**666**	**7**	**659**
Division	*10*	*Manufacture of food products*	*182*	*1*	*181*
	17	*Manufacture of paper and paper products*	*49*	*1*	*48*
	18	*Printing and reproduction of recorded media*	*26*	*-*	*26*
	20	*Manufacture of chemicals and chemical products*	*24*	*-*	*24*
	22	*Manufacture of rubber and plastic products*	*35*	*-*	*35*
	24	*Manufacture of basic metals*	*29*	*1*	*28*
	28	*Manufacture of machinery and equipment n.e.c.*	*46*	*-*	*46*
	30	*Manufacture of other transport equipment*	*24*	*-*	*24*
	32	*Other manufacturing*	*153*	*3*	*150*
Section	**D (35)**	**Electricity, gas, steam and air conditioning supply**	**23**	-	**23**
Section	**E (36-39)**	**Water supply; sewerage, waste management and remediation activities**	**41**	-	**41**
Division	*38*	*Waste collection, treatment and disposal activities; materials recovery*	*32*	*-*	*32*
Section	**F (41-43)**	**Construction**	**108**	**2**	**106**
Division	*41,43*	*Construction of buildings; Specialised construction activities*	*95*	*2*	*93*
Section	**G (45-47)**	**Wholesale and retail trade; repair of motor vehicles and motorcycles**	**291**	**-**	**291**
Division	*45*	*Wholesale and retail trade and repair of motor vehicles and motorcycles*	*118*	*-*	*118*

Division	*47*	*Retail trade, except of motor vehicles and motorcycles*	*142*	*-*	*142*
Section	**H (49-53)**	**Transportation and storage**	**270**	**3**	**267**
Division	*49*	*Land transport & transport via pipeline*	*52*	*1*	*51*
Division	*52*	*Warehousing and support activities for transportation*	*204*	*1*	*203*
Section	**I (55-56)**	**Accommodation and food service activities**	**901**	**6**	**895**
Division	*55*	*Accommodation*	*825*	*6*	*819*
Division	*56*	*Food and beverage service activities*	*76*	*-*	*76*
Section	**J-N (58-82)**	**Information and communication; financial and insurance activities; real estate activities; professional, scientific and technical activities; administrative and support service activities**	**324**	**4**	**320**
Division	*64*	*Financial service activities, except insurance and pension funding*	*86*	*-*	*86*
Division	*75*	*Veterinary activities*	*33*	*2*	*31*
Division	*82*	*Office administrative, office support and other business support activities*	*87*	*2*	*85*
Section	***O (84)***	**Public administration and defence; compulsory social security**	***458***	***3***	***455***
Section	**P (85)**	**Education**	**960**	**4**	**956**
Section	**Q (86-88)**	**Human health and social work activities**	**11710**	**169**	**11541**
Division	*86*	*Human health activities*	*5989*	*93*	*5896*
Division	*87*	*Residential care activities*	*5345*	*70*	*5275*
Division	*88*	*Social work activities without accommodation*	*376*	*6*	*370*
Section	**R-U (90-99)**	**Arts, entertainment and recreation; other service activities; activities of households as employers; undifferentiated goods-and services-producing activities of households for own use; activities of extraterritorial organisations and bodies**	**2098**	**25**	**2073**
Division	*93*	*Sports activities and amusement and recreation activities*	*26*	*-*	*26*
Division	*94*	*Activities of membership organisations*	*51*	*-*	*51*
Division	*96*	*Other personal service activities*	*1934*	*24*	*1910*

Division	*97*	*Activities of households as employers of domestic personnel*	*42*	*-*	*42*
Division	*99*	*Activities of extraterritorial organisations and bodies*	*30*	*-*	*30*

[1] Industry as reported by employers. A review of a sample of reports coded to SIC 96, 55 and 84 show that many of these are mis-allocation of reports that should have been recorded under residential care or social care activities (SIC 87 or 88)

[2] Standard Industrial Classification (SIC); there were no notifications for agriculture, energy supplies or water supplies/management and sewerage

73. In Northern Ireland RIDDOR is reported to, and collected by, the HSE in Northern Ireland (HSENI 2020). According to a communication from HSENI (Ref: FOI/111/2020) within the date range 18 March to 12 August 2020 the total number of RIDDOR reports for COVID-19 (or synonyms) received by HSENI was 814 (including one death). Of the 814 Reports, 811 related to the health and social work sector, 2 related to the fire and rescue sector and 1 related to manufacturing. However, because of the variation in guidance and in data collation it is not feasible to combine the datasets or to make reliable comparisons for example by sector.

74. The HSE acknowledges various shortcomings in the RIDDOR data including widespread under-reporting of cases and some misallocation in the coding of the industry in which the worker is employed. In particular, workers in residential and social care are often incorrectly recorded as working in the accommodation sector or in personal service (HSE 2020b). In addition, the HSE technical summaries omit data notified before the 10 April 2020 (HSE2020a) (Agius 2020b). The summaries may tend to exclude COVID-19 cases due to work in jobs that do not entail dealing with people known to be infected but with the general public, e.g. the transport sector. (HSE2020a). Nevertheless, acceptance of cases where a registered medical practitioner has highlighted the significance of work-related factors may have led to the numbers reported in industries such as food manufacture (Agius 2020a). The RIDDOR data provide useful additional information of occupations where COVID-19 cases occur but the data need to be interpreted in the light of the above limitations (Agius 2020a, Agius 2020b) including potential underreporting in many and perhaps all occupations.

OCCUPATION AND INFECTION RATES FROM SARS-CoV-2

SARS-CoV-2 infection rates and occupation

75. Information on the risks of infection by SARS-CoV-2 is becoming increasingly available for both the general population and by occupational sector. Access to testing in the UK and other countries was limited in the early months of the pandemic with sectors such as healthcare being prioritised. Many studies were thus opportunistic and focused on infection rates in healthcare settings. Interpretation is often limited by biases introduced by test availability and by the potential for inclusion and recall biases, small sample sizes or unclear participation rates, lack of comparator populations, imprecise exposure estimates, absence of control for confounders, and insufficient information about outcomes.

Healthcare workers

76. Chou et al identified 85 studies of infection rates in healthcare workers up to October 2020 (Chou et al 2020). The incidence of SARS-CoV-2 ranged from 0.6% to 50% based on RT-PCR testing, and the prevalence ranged from 1.6% to 32% based on antibody testing. Galanis et al carried out a systematic review and meta-analysis of 49 studies of SARS-CoV-2 antibodies involving 127,480 subjects. 7 of the studies were from the UK. The overall seroprevalence of SARS-CoV-2 antibodies was 8.7% (95% CI 6.7,10.9%). The UK studies reported prevalence rates ranging from 6% to 44%. These differences in infection rates in health care staff are likely to reflect varying prevalence rates in the local communities, staff roles and the extent to which these involved contact with infected patients, the extent to which the normal capacity of the service was strained, the availability and use of protective equipment, and possibly other factors.

77. Houlihan and colleagues recruited 200 high-risk frontline healthcare workers in a London hospital between March 26 and April 8, 2020 (Houlihan et al 2020). 23% had evidence of SARS-CoV-2 antibodies at recruitment, and 45% of 181 subjects who were retested one month later were positive. 21% had positive RT-PCR tests. Infection rates varied from 37% amongst those working in the intensive care unit to 51% amongst those on the acute admission unit. The infection was asymptomatic in about half of the cases.

78. A similar study in another London teaching hospital reported virology and staff sickness results from screening of 1045 staff (about 11% of the total) for SARS-CoV-2 between March 18 and May 3 2020 (Zheng et al 2020). SARS-CoV-2 infection rates in the healthcare workers largely rose and declined in parallel with the number of community cases. White and non-White ethnic groups had similar rates of infection. Clinical staff had a higher rate of laboratory-confirmed infection (7.3%) than non-clinical staff (2.8%), but total sickness rates were similar. Rates of infection varied from 17.3% in those working in emergency medicine and 10.4% in acute medicine to 1.9% amongst pharmacy workers and 2.4% in women's services. Rates in the emergency department declined when all staff were advised to use PPE. The authors conclude that much of the staff infection was caused by community transmission; however, they acknowledge that department-specific data showing localized clusters of infection indicates that some patient transmission may have occurred.

79. Pallett et al (2020) measured SARS-CoV-2 antibodies in previously symptomatic staff and a sample of asymptomatic staff of two London hospitals between April 8 and June 12 2020. 22% of the 6400 staff had experienced symptoms consistent with COVID-19 infection, and 47% of those tested (622/1391) had positive antibody tests. 10.6% of the 405 asymptomatic staff also had positive antibody tests. The overall prevalence of antibody test positivity amongst the workforce was

estimated at 18%. The authors compared that to a figure of 7.1% for the general London population.

80. Grant et al (2020) studied approximately half of the staff of another London hospital (2167 subjects) who self-referred for SARS-CoV-2 antibody tests between May 15 and June 5 2020. Antibodies were detected in 32%, approximately twice the rate in the general London population. 67% of the subjects reported having prolonged direct patient contact and they were more likely to have a positive test (35%; $p<0.005$) than others. Infection rates were higher amongst those working on COVID-19 wards (41.3-42.0%) compared with those undertaking non-clinical work (22.6%). The rates in intensive care staff were relatively low at 25.0%. However, account was not taken of control measures to prevent exposure.

81. Eyre et al (2020) reported the results of a volunteer survey of 77% of the staff (10,610 of 13,800) working in 4 hospitals in Oxford, mainly in the first three weeks of May 2020. Overall, 11.2% of subjects had evidence of infection either from RT-PCR (2.9%), antibody tests (10.7%), or both. The overall UK seroprevalence was 6.8% around the same time (28th May 2020).

82. Risk factors for a positive test included: household contact with a confirmed case (38.5% vs 10.7%); contact with an infected patient without using PPE (17.0% vs 9.6%) and work on wards caring for COVID-19 patients (22.6% vs 8.6%). Porters and cleaners had the highest rates (18.6%), followed by physiotherapy, occupational and speech and language therapists (14.9%) and nurses/healthcare-assistants (14.2%). Rates also varied by self-described ethnicity: White 9.5%; Asian 16.8%; Black 18.0%; Chinese 7.5%; Mixed 11.6%. Multivariate analysis showed increased risks associated with household contact with a known case (adjusted OR 4.82, 95% CI 3.45, 6.72), working in a COVID-19 facing area (adjusted OR 2.47, 95% CI 1.99, 3.08), and workplace exposure to a suspected or known COVID-19-positive patient without PPE (adjusted OR 1.44, 95% CI 1.24,1.67).

83. A cohort of all Scottish healthcare workers employed by the NHS on 1 March 2020 was linked to the Community Health Index (CHI) database, a registry of all patients registered to receive care from the NHS in Scotland, to obtain the unique CHI number for each individual (Shah et al. 2020). The CHI number was used to create a cohort linking these data on healthcare workers to several Scotland-wide datasets containing individual level clinical information for virology testing for SARS CoV-2, general hospital admission data, community prescribing, critical care admissions, and the national register for deaths. The CHI database also enabled identification of all individuals who were not themselves healthcare workers but shared a household with a healthcare worker.

84. The cohort consisted of 158,445 healthcare workers, 57% patient-facing, and 229,905 household members. 17.2% (360/2097) of hospital admissions in the 18-65 age range were in healthcare workers or their households. After adjustment for age, sex, ethnicity, socioeconomic deprivation, and comorbidity, the risk of admission due to COVID-19 in non-patient facing healthcare workers and their households was similar to the risk in the general population. Patient-facing healthcare workers were at higher risk of hospital admission compared with non-patient facing healthcare workers, (hazard ratio (HR)= 3.30, 95% CI 2.13, 5.13), as were household members of patient facing healthcare workers (HR =1.79, 95% CI 1.10, 2.91). After sub-division of patient-facing healthcare workers into those who worked in "front door," intensive care, and non-intensive care aerosol generating settings and other, those in front door roles were at higher risk (HR = 2.09, 95% CI 1.49, 2.94). The authors comment that healthcare workers may potentially present earlier, improving their survival for a given severity of COVID-19, and/or they may have a lower threshold for admission.

85. Iversen et al (2020) carried out SARS-CoV-2 antibody tests on 29,884 Danish health care workers (97% participation rate) and in 4672 randomly selected blood donors aged 18–64. The seroprevalence was significantly higher in the health care workers than in the blood donors (4.04% vs 3.04%, RR=1·33, 95% CI 1·12,1·58). Frontline hospital workers had a significantly higher seroprevalence compared with the remaining health-care workers (4.55% vs 3.29%, RR=1·38, 95% CI 1·22,1·56); as had those working on a dedicated COVID-19 ward (7.19% vs 4·35% for other frontline staff; RR=1·65, 95% CI 1·34, 2·03).

86. Jespersen et al (2020) carried out a similar antibody study on 17,987 (69% of the total) healthcare workers and administrative staff in central Denmark, and on 360 blood donors. The overall prevalence of positive antibodies was 3.4% in the healthcare workers and 0.6-1.2% in the blood donors. There were marked regional differences with test positivity ranging from 1.2%-11.9%. Test positivity was higher in younger workers. In the higher prevalence area, there were associations with type of work: aHRs compared with secretaries were 7.3 (95% CI, 3.5, 14.9) for nurses; 4.0 (95% CI, 1.8, 8.9) for doctors; and 5.0 (95% CI, 2.1, 11.6) for laboratory staff (who carried out phlebotomy and thus had close patient contact). There was a close association with previous SARS-CoV-2 PCR positivity in 4364 workers who had undergone both tests.

87. Sims et al (2020) carried out antibody tests on 20,614 of 43,000 staff at 8 Michigan hospitals. 8.1% were positive. There were associations with age, ethnicity, and job category. Those doing direct patient care had a higher seropositivity rate (9.5%, 95% CI 9.1%, 10.0%) than those who did not (7.0%, 95% CI 6.3%, 7.6%). Those with the greatest contact (phlebotomy, respiratory therapy, and nursing staff) had a significantly higher rate (11.0%, 95% CI 10.4%, 11.7%) than those with most direct patient contact (physicians or clinical support (7.4%, 95% CI

6.7%, 8.0%). The use of face masks was associated with lower rates of seropositivity.

COMMUNITY STUDIES INCLUDING HEALTH AND SOCIAL CARE WORKERS

88. The records of participants in the UK Biobank cohort, resident in England, alive and aged less than 65 years in 2020 and employed or self-employed at baseline data collection (2006-2008) were linked to SARS-CoV-2 test results from Public Health England (16 March to 26 July 2020) (Mutambudzi et al. 2020). A comparison was made between the occupation data collected at baseline and that collected for a subsample of the cohort (n=12,306) who participated in further data collection when attending a clinic visit to participate in the UK Biobank Imaging between 30 April 2014 and 7 March 2019 (median August 2017). A high correlation (r=0.71, p<0.001) was found between job at baseline and follow-up indicating a high likelihood that participants had continued working in the same profession. The analyses adjusted for baseline demographic, socioeconomic, work-related, health, and lifestyle-related risk factors. Of 120,075 participants, 271 were defined as having severe COVID-19, defined as a positive test taken in a hospital setting.

89. After adjustment for age, sex, ethnicity and country of birth, relative to non-essential workers, healthcare workers (RR=7.43, 95% CI 5.52,10.00), social and education workers (RR=1.84, 95% CI:1.21,2.82) and other essential workers (RR=1.60, 95% CI 1.05,2.45) had a higher risk of severe COVID-19. Medical support staff had particularly high risks (RR=8.70, 95% CI 4.87,15.55),

90. Nguyen et al (2020) reported the findings from a prospective cohort study of the UK and USA general communities, including frontline health care workers, who voluntarily reported information through the COVID Symptom Study smartphone application (developed by Zoe Global Ltd). 4.7% of the 2.1 million users self-identified as health care workers. There were 5545 reports of a positive SARS-CoV-2 test between March 23 and April 23 2020. Front-line health-care workers were 11.6 times more likely than others to report a positive test (adjusted HR 11·61, 95% CI 10·93, 12·33). The association was more marked in the UK (adjusted HR =12·52, 95% CI 11·77, 13·31) compared with the USA (adjusted HR 2·80, 2·09, 3·75).

91. Health care workers were 4-5 times more likely than others to have a SARS-CoV-2 test suggesting that the higher rate of test positivity could have been in part related to eligibility for testing. A further analysis with weighting for predictors of testing also showed a greater risk of infection among front-line health-care workers (adjusted HR=3·40, 95% CI 3·37, 3·43), which was higher in the UK (3·43, 95% CI 3·18, 3·69) than in the USA (1·97, 95% CI 1·36, 2·85). The authors also noted that the

development of combinations of symptoms that were predictive of SARS-CoV-2 infection were more common in health-care workers (adjusted HR= 2·05, 95% CI 1·99–2·10). Amongst health care workers there were increased risks for those reporting caring for patients with documented COVID-19 (adjusted HR=4·83, 95% CI 3·99, 5·85), suspected COVID-19 (adjusted HR=2·39, 95% CI 1·90–3·00), and using inadequate personal protective equipment (adjusted HR=5·91, 95% CI 4·53, 7·71).

92. ONS carried out a series of community surveys of SARS-CoV-2 infection using RT-PCR between 26 April and 27 June 2020. 1.58% (95% CI 0.99-2.38%) of individuals who reported working in patient-facing healthcare or resident-facing social care roles had a positive test compared with 0.27% (95% CI 0.22, 0.34%) in those not working in these roles[4]. A later analysis carried out between 2 September and 16 October 2020 found no cases in resident-facing care home workers, and no significant difference between infection rates in patient-facing health care workers (0.37%, 95% CI 0.25, 0.54%) and rates in other professions (0.44%, 95% CI 0.39, 0.49%).

93. The REACT-1 RT-PCR study carried out between May and November 2020 demonstrated differences in infection rates by age, sex, ethnicity, household size, COVID-19 contact history, symptoms, and employment type. In the first round of testing carried out in May 2020 health care and care home workers had higher infection rates (0.50%, 95% CI 033%, 0.76%) compared with other workers (0.09%, 95% CI 0.06, 0.13%). In the second round of testing carried out between 19 May and 7 July 2020 there were no significant differences in infection rates between health care/ care home workers (0.09%, 95% CI 0.04, 0.18%) and other workers (0.08%, 95% CI 0.06, 0.11%). There have been no significant differences between occupational groups in any subsequent rounds up to November 2020.

94. The REACT-2 antibody study also identified higher rates of infection in health and social care workers. In the first round of testing carried out between 20 June and 13 July 2020 antibody tests were positive in 12.91% (95% CI 11.61, 14.32%) of self-reported patient-facing health care workers and 19.56% (95% CI 16.42, 23.10%) of self-reported client-facing care home workers. That compared with 6.50% (95% CI 6.20, 6.82%) of other workers. The proportion of positive tests in 'other workers' had declined to 4.35% (95% CI 4.1, 4.56%) by the time of the third round of testing (15-23 September), and had declined to 11.09% (95% CI 8.96, 13.59%) in client-facing care home workers. It had increased slightly to 13.37% (95% CI 12.33, 14.47%) in patient-facing health care workers. That suggests an ongoing greater risk of infection

[4] https://www.ons.gov.uk/peoplepopulationandcommunity/healthandsocialcare/conditionsanddiseases/bulletins/coronaviruscovid19infectionsurveypilot/2july2020.

in health care workers than in other groups but that cannot be quantified as it is superimposed on declining levels of antibodies in those with earlier infection.

Other workers

95. Compared with health and social care workers, much less information has been published so far about risks of infection in other groups of workers.

96. The ONS infection survey demonstrated higher rates of COVID-19 infection in those who reported working outside their home between 26 April and 27 June (0.56%, 95% CI 0.59, 0.77%) compared with those who reported working at home (0.15%, 95% CI 0.07, 0.28%). The figures are not adjusted to take account of potential covariates such as ethnicity and socio-economic status.

97. The UK Biobank study (Mutambudzi et al. 2020) demonstrated higher rates of severe COVID-19 in social and education workers (RR=1.84, 95% CI 1.21, 2.82) and other essential workers (RR=1.60, 95% CI 1.05, 2.45) compared with non-essential workers. Occupation coded to 4-digit SOC code was classified into five broad groups (non-essential workers, healthcare workers, social and education workers, police and protective service and 'other' essential workers and within these into eight more precise categories of essential workers: healthcare professionals (e.g. doctors, pharmacists); health associated professionals (e.g. nurses, paramedics); medical support staff (nursing assistants, hospital porters); social care workers, education workers, food workers, transport workers, and police and protective services (including sanitary service workers). Social care (RR=2.46, 95% CI 1.47, 4.14) and transport workers (RR=2.20, 95% CI 1.21, 4.00) had the highest risks within the broader groups. Compared to white non-essential workers, non-white non-essential workers had a higher risk (RR=3.27, 95% CI 1.90, 5.62) and non-white essential workers had the highest risk (RR=8.34, 95% CI 5.17,1 3.47). Using SOC2000 major groups, associate professional and technical occupations, personal service occupations and plant and machine operatives had higher risks, compared to managers and senior officials. (Note: the authors carried out several analyses using different models that adjust for the above co-variates with several others including socioeconomic status, lifestyle factors co-morbidity etc). It should be noted however that there are small numbers of participants with severe COVID-19 in some job categories in this study e.g. only 7 food workers.

98. A study of the entire population of Norway included approximately 3.5 million residents aged 20-70 and investigated whether employees in occupations that typically involve close contact with other people (including pupils/students/patients/customers), coded to the International Standard Classification of Occupations (ISCO-08) codes were at higher risk of COVID-19 and related hospitalization, for the first

(February to July) and second (July to October) wave of infection in Norway (Magnusson et al 2020). Nurses, physicians, dentists, and bus and tram drivers had more than doubled risk of COVID-19 during the first wave of infection when compared to everyone in their working age. Excess risks for these occupations were not found in the second wave of the epidemic. Bartenders, waiters, food service counter attendants, taxi drivers and travel stewards had 1.5-4 times the odds of COVID-19 when compared to everyone in their working age. Teachers had no increased or only a moderately increased risk of COVID-19 in either wave. None of the included occupations had any particularly increased risk of severe COVID-19, indicated by hospitalization, when compared with all infected in their working age apart from dentists, who had an OR of 7.66 (95% CI 3.17,18.5) and pre-school teachers, child-care workers and taxi, bus and tram drivers who had a 1-2 times increased OR. The authors note that there were no hospitalizations for several occupations, and that for many occupations there were small numbers of cases with wide confidence intervals.

Comments

99. Many of the studies of health care workers have shown high rates of COVID-19 infection. The rates are generally higher than those reported in general population surveys but few studies have made any direct comparison with a control population. More readily available access to testing amongst health care workers might have contributed to the high risks demonstrated in some studies. This potential bias could also have occurred in some of the community-based studies reviewed e.g. the Biobank and Nguygen studies and participation bias is a risk in these studies. Other studies that attempted to obtain random population samples are less likely to have been subject to that bias.

100. The community studies do generally point to a higher rate of infection in health and social care workers compared with others in the earlier phases of the epidemic. They also provide some evidence that the risks reduced from May 2020 onwards.

CLUSTERS AND OUTBREAKS IN WORKPLACES

101. There have been numerous reports of outbreaks and clusters of COVID-19 in a variety of occupational settings. A report from fifteen countries from the European Union, the European Economic Area (EU/EEA) and the United Kingdom (UK) described 1376 clusters of COVID-19 which occurred between March and early July 2020 (COVID-19 clusters and outbreaks in occupational settings in the EU/EEA and the UK. Stockholm: ECDC; 2020). The majority of occupational COVID-19 clusters reported were from the health sector, with large numbers of clusters also reported from the food packaging and processing sectors, in factories and manufacturing and in office settings.

102. The UK clusters were in food processing and also in retail and sales. For example, a cluster was identified in a chicken processing plant in Anglesey where there were 58 confirmed cases of COVID-19 among staff on site, out of a workforce of 560 people. Another cluster was seen in a meat factory in Yorkshire where 165 workers tested positive for COVID-19[5].

DISCUSSION

103. This paper reports on evidence concerning the impact of the COVID-19 pandemic on the health of workers in the UK during 2020. In evaluating the evidence, the Council notes that the health effects of infection with SARS-CoV-2 in the workplace are indistinguishable from those resulting from non-occupational infection.

104. Much of the focus of this interim report is on occupational mortality data based on death certificates, in particular the reports made by ONS throughout 2020 and early 2021. These data were amongst the first occupational data to emerge in the UK, and up to the time of preparing this report it remains the most comprehensive source of information about occupational risks. Other information on infection and hospitalisation rates by occupation have also been evaluated, together with information on patterns of exposure to SARS-CoV-2.

105. Although this report deals primarily with deaths associated with SARS-CoV-2 infection the Council recognises that morbidity associated with the Post-COVID-19 syndrome is likely to cause a substantial health burden and potential long-term disability. At present there is insufficient information about the characteristics of post-COVID-19 syndrome and its association with occupation for that to be considered further in the current report. The Council will address this issue as additional information becomes available

106. The risk of infection has been shown to increase with direct contact with an infected individual, living in a care home or living in a household with five or more individuals. There is evidence from several large outbreaks that physical close proximity in workplaces increases the risk of infection in workers, as does close proximity to infected individuals in health and social care settings. There is, however, limited scientific evidence on the exact modes of transmission of COVID-19 in both workplaces and community settings and scarce data on dose, exposure frequency and length of exposure. Moreover, there is limited evidence about the extent to which workplace measures such as distancing, the use of physical

[5] European Federation of Food Agriculture and Tourism Trade Unions (EFFAT). COVID-19 outbreaks in slaughterhouses and meat processing plants [Internet]. Brussels: EFFAT; 2020. Available from: https://effat.org/wp-content/uploads/2020/06/EFFAT-Report-COVID-19-outbreaks-in-slaughterhouses-and-meat-packing-plants-State-of-affairs-and-proposals-for-policy-action-at-EU-level-30.06.2020.pdf

barriers, and personal protective equipment reduce the likelihood of infection and lessen any occupational risks.

107. The mortality data published by ONS demonstrate that the occupations that show increased risks are largely those where there is regular contact with the public and/or patients. For men, fifteen occupations (SOC 4-digit) with more than 20 deaths had at least a two-fold risk of death from COVID-19 with the highest rates found in food processing, care work, transport, security, nursing, local, national and local government administration and retail work. For women there were large numbers of deaths and a high death rate for care work. Food processing, and retail work were also of concern although with small numbers of deaths, as were nursing, sewing machining and hairdressing.

108. The findings were adjusted for age, but not other factors such as ethnic group, place of residence and deprivation. The distribution of ethnic groups among workers in some occupations differs from that of the general population, for example in the transport industry, as does the distribution of other factors such as area of residence, type of housing etc. Adjustment for these factors might potentially result in reduced estimates of risks associated with occupation but is unlikely to substantially affect the high risk identified in the ONS data.

109. The ONS mortality data do not always provide a consistent pattern of the risks, with some being increased in males but not females or in different subgroups of the same industry, such as food processing. Many of these inconsistencies are due to small numbers in the more specific occupations coded to SOC 2010 4-digits. It is unlikely that the risks for males and females in the same jobs will be substantially different although worker practices may differ.

110. There are also seemingly disparate results in risk between different levels of aggregation of occupations. For example, an analysis of a large category of health care occupations grouped together did not show any increased risk whereas the specific jobs, nurses and nursing assistants, showed a doubling of risk for men and a smaller but still increased risk for women. The risk of exposure to SARS-CoV-2 in analyses of larger groups may be diluted due to the wide-ranging nature of the jobs included as compared with analyses of the more specific occupations.

111. The Council notes that the available mortality data may suffer from a number of limitations. Occupation is under-reported on death certificates particularly for women and may be inaccurate, for example, the usual or longest-held job may be reported rather than that immediately prior to death. The ONS data include cases with and without confirmation of a positive test, although it is likely to be largely accurate for those who received hospital treatment. A high rate of Coroner referrals and delayed reporting of deaths in health care

workers, or redeployment of staff away from their usual role may also have impacted on the results. In addition, the risk of death is likely to be modified by the provision of PPE but this information cannot be directly inferred from death certificates.

112. The occupational classification used for RIDDOR is not directly comparable to that used for the ONS mortality data. However, occupations with large numbers of notifications overall and fatal notifications tend to mirror those with high rates of death in the ONS data; these include human health and social work activities, transportation and storage, education, and personal service activities. The RIDDOR scheme depends on awareness by employers of the requirement for notification and it is acknowledged that there is general underreporting; There were also marked differences for some occupations between numbers reported at different phases of the pandemic suggesting changes in patterns of in reporting behaviour. However, the RIDDOR data provide useful additional indication of occupations where COVID-19 cases and deaths occur.

113. Many of the initial studies of the risk of infection in workplaces were opportunistic and small and carried out predominantly in health care settings where testing was more readily available. The studies generally found high rates of infection in health care workers. Community studies involving testing for the SARS-CoV-2 virus or antibodies also indicate a higher rate of infection (several with more than two-fold risk) in health care workers, particularly 'frontline workers', and social care workers compared with others. The UK Biobank also showed more than a two-fold increased risk in transport workers. The results from these studies appear to have been partly influenced by the date at which they were carried out and the phase of the pandemic with respect to the use of prevention measures. For example, the REACT studies tend to show increased rates in the earlier phases of the epidemic; they also provide some evidence that the risks reduced in the summer of 2020.

114. The Council's evaluation of the evidence on the impact of the COVID-19 pandemic on the health of workers has highlighted the inadequacy of available information on occupation. In addition to problems of using death certificate data, highlighted above, the Council notes that most of the studies of infection and hospitalisation rates were unable to include analyses by occupation or adjust for this; occupational information is rarely routinely collected in many healthcare data systems.

115. These problems may have contributed to perceived disparities in occupationally-related risks in different subgroups. For example, the gender disparity observed in the ONS analyses of deaths by occupation may partly reflect the smaller numbers of death certificates with occupational information for women and/or the imprecision and

inaccuracies in the occupational information. There are also disparities in risk of infection, hospitalisation and death in people of non-white ethnicity backgrounds compared with those of white ethnicity background; individuals from ethnic minority backgrounds may be more likely to live in larger (multigenerational) households, are often employed as essential workers, less likely to be able to work from home and have jobs that involve more contact with other workers and/or the general public. Assessing the influence of these related characteristics remains challenging. In their evaluations, IIAC does not generally take account of confounders other than those that are clearly established competing causes of the disease of interest. In addition, it should be noted that the available data used for many of the current prescriptions is often limited; for example, only studies of men may be available but this does not preclude women in the relevant occupations from claiming IIDB.

CONCLUSIONS

116. In this interim report, IIAC has reviewed the evidence relating to the health risks of infection by SARS-COV-2 and has discussed the strengths and weaknesses of the information. The Council has found evidence that:

    a. Some workplaces and thus workers are at higher risk of COVID-19 due to higher levels of exposure related to job and workplace characteristics.
    b. Higher infection rates are found in workers in healthcare, social care, and transport, particularly in the first wave of the pandemic. The risk of suffering severe COVID-19 is also increased in social care and transport workers in the UK.
    c. Analyses of UK death certificates between March and December 2020 showed more than doubled risk in several occupations especially for males, including social care, nursing, bus and taxi driving, food processing, retail work, local and national administration and security.
    d. The large number of RIDDOR disease (including death) reports for COVID-19 for these occupations mirror the death data; RIDDOR also provides evidence of high numbers of cases in other occupations such as education.

117. The Council concludes that there is a clear association between several occupations and increased risk of death from COVID-19 but acknowledges that the consistency and extent of the mortality data, and the lack of adjustment for factors such as deprivation, means that the evidence is currently too limited and of varying quality to justify prescription at this stage. Information regarding any link between occupation and risk of disability following COVID-19 is currently scarce The Council therefore concludes overall that the evidence is not at

present sufficient for prescription. However, the evidence of a doubling of risk in several occupations indicates a pathway to potential prescription and the Council expects that future data will inform this. The Council will recommend prescription if and when there is strong enough evidence that occupational exposures cause disabling disease on the 'balance of probabilities.'

118. The Council will continue to monitor the literature for future published papers and reports. The Council is aware of several ongoing studies. They are particularly interested in large good quality studies of workers and workplaces and also community-based studies regarding both death and long term effects of infection with SARS-CoV-2.

PREVENTION

119. Development of COVID-19 requires human-to-human transmission of the virus, SARS-CoV-2, so the only way to prevent the disease is to stop the virus being transferred from an infectious person to the nose or mouth of an uninfected individual. Preventive measures seek to reduce exposure by minimising emission of virus from the infected person, e.g. by wearing a face covering and maintaining physical distance between people, reducing transmission through the environment, e.g. by providing good air ventilation and by protecting the person at risk of infection, e.g. by requiring the wearing of a visor and respirator. However, because transmission may occur by multiple routes, i.e. by inhaling aerosol, intercepting large droplets or hand contact with contaminated surfaces, complete prevention for workers is not feasible. While exposure levels vary in different workplaces, exposure is difficult to quantify and people can be infective even when asymptomatic. So, it is prudent to apply as much control as is practicable for the workplace concerned, with a variety of control measures likely being required.

120. This includes carrying out a COVID-19 risk assessment, maintaining adequate physical distance where possible, use of physical barriers, e.g. screens, and appropriate PPE, providing good ventilation, and maintaining regular sanitisation of hands and touch-points. In high-risk jobs, particularly where there is close contact with potentially infected persons, such as in healthcare, public transport and retail, the level of intervention will need to be proportionally higher to achieve optimal control. The BOHS Risk matrix (see Appendix Table 1) provides general advice on control strategies. Official government advice on workplace prevention is available from the Gov.uk website (www.gov.uk/coronavirus) and the HSE website (https://www.hse.gov.uk/coronavirus/working-safely/index.htm).

121. Pharmacological prevention is also developing, with vaccination being the most obvious strategy. As yet, the overall preventive potential of these strategies remains unknown, and it will be considerable time

before herd protection can be envisaged. As we learn more about the virus and its transmission, our understanding of the best approaches to prevention will evolve further.

Bibliography

Agius RM, Robertson JFR, Kendrick D et al. Editorial: COVID-19 in the workplace. BMJ 2020;370:m3577.

Agius RM. (a) Editorial: Disease and death from work: RIDDOR and covid-19, Occup Med 2020;70(7),470–472.

Agius RM. (b) Covid-19: statutory means of scrutinizing workers' deaths and disease, Occup Med 2020;70(7):515–522.

Chou R, Dana T, Buckley DI, et al. Update Alert 6: Epidemiology of and Risk Factors for Coronavirus Infection in Health Care Workers [Ann Intern Med. 2020;174(1):w19

Department of Transport. Taxi and Private Hire Vehicle Statistics, England: 2020. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/944680/taxi-and-private-hire-vehicle-statistics-2020.pdf

Dinnes J, Deeks JJ, Adriano A et al. Cochrane COVID-19 Diagnostic Test Accuracy Group. Rapid, point-of-care antigen and molecular-based tests for diagnosis of SARS-CoV-2 infection. Cochrane Database Syst Rev. 2020;26(8):CD013705.

Docherty AB, Harrison EM, Green CA et al. Features of 20133 UK patients in hospital with Covid-19 using the ISARIC WHO Clinical Characterisation Protocol: prospective observational cohort study BMJ 2020;369:m1985

Eyre DW, Lumley SF, O'Donnell D et al. Differential occupational risks to healthcare workers from SARS-CoV-2 observed during a prospective observational study. eLife 2020;9:e60675 .

Galanis P, Vraka I, Fragkou D et al. Seroprevalence of SARS-CoV-2 antibodies and associated factors in health care workers: a systematic review and meta-analysis. J Hosp Infect. 2020;108:120–34.

Goldblatt P, Morrison J. Initial assessment of London bus driver mortality from Covid-19. UCL. Institute of Health Equity, 2020

Grant J, Wilmore S, McCann N, et al. Seroprevalence of SARS-CoV-2 antibodies in healthcare workers at a London NHS Trust. Infect Control Hosp Epidemiol 2020:1-12. Epub 3. 2020/08/05. doi: 10.1017/ice.2020.402.

Houlihan CF, Vora N, Byrne T, et al. Pandemic peak SARS-CoV-2 infection and
seroconversion rates in London frontline health-care workers. Lancet 2020;396: e6-e7.

HSE (2020a) Health and Safety Executive (UK). Further guidance on RIDDOR reporting of COVID-19 (2020) https://www.hse.gov.uk/coronavirus/riddor/riddor-reporting-further-guidance.htm

HSE (2020b) Health and Safety Executive. Management information: Coronavirus (COVID-19) disease reports. Made by employers to HSE and Local Authorities since 10 April 2020. https://www.hse.gov.uk/statistics/coronavirus/index.htm

Iversen K, Bundgaard H, Hasselbalch RB et al. Risk of COVID-19 in health-care workers in Denmark: an observational cohort study. Lancet Infect Dis. 2020;20(12):1401-1408.

Jespersen S, Mikkelsen S, Greve T, et al. SARS-CoV-2 seroprevalence survey among 17,971 healthcare and administrative personnel at hospitals, pre-hospital services, and specialist practitioners in the Central Denmark Region. Clin Infect Dis. 2020:ciaa1471.

Lucraft M. COVID-19 Deaths and Possible Exposure in the Workplace. Chief Coroner's Guidance No. 37 (Amended) (2020) https://www.judiciary.uk/wp-content/uploads/2020/07/Chief-Coroners-Guidance-No-37-AMENDED-01.07.20.pdf

Magnusson K, Nygård K, Methi F et al SARS-CoV-2 seroprevalence survey among 17,971 healthcare and administrative personnel at hospitals. medRxiv 2020.10.29.20220426; doi: https://doi.org/10.1101/2020.10.29.20220426

Martin CA, Jenkins DR, Minhas JS et al. Socio-demographic heterogeneity in the prevalence of COVID-19 during lockdown is associated with ethnicity and household size: Results from an observational cohort study. EClinicalMedicine 2020:25;10046

Mathur R et al. Ethnic differences in COVID-19 infection, hospitalisation, and mortality: an OpenSAFELY analysis of 17 million adults in England. medRxiv preprint doi: https://doi.org/10.1101/2020.09.22.20198754

Mutambudzi M, Niedwiedz C, Macdonald EB*, et al* Occupation and risk of severe COVID-19: prospective cohort study of 120 075 UK Biobank participants
Occup Environ Med 2020 **0**:1–8. doi:10.1136/oemed-2020-106731.

Nguyen, L. H., Drew, D. A., Joshi, A. D. et al . Risk of COVID-19 among frontline healthcare workers and the general community: a prospective cohort study. Lancet Public Health 2020;5:e475–83

ONS 2020(a) Office for National Statistics. Coronavirus (COVID-19) Infection Survey, UK: 07 July 2020

ONS 2020(b) Office of National Statistics: Updating ethnic contrasts in deaths involving the coronavirus (COVID-19), England and Wales: deaths occurring 2 March to 28 July 2020. https://www.ons.gov.uk/peoplepopulationandcommunity/birthsdeathsandmarriages/deaths/articles/updatingethniccontrastsindeathsinvolvingthecoronaviruscovid19englandandwales/deathsoccurring2marchto28july2020

ONS 2020(c) Office for National Statistics. Coronavirus (COVID-19) related deaths by occupation, England and Wales: deaths registered up to and including 20 April 2020. (Release date 11 May 2020) https://www.ons.gov.uk/peoplepopulationandcommunity/healthandsocialcare/causesofdeath/bulletins/coronaviruscovid19relateddeathsbyoccupationenglandandwales/deathsregistereduptoandincluding20april2020 (Last accessed 3 July 2020)

ONS 2020(d) Office for National Statistics. Coronavirus (COVID-19) related deaths by occupation, England and Wales: deaths registered between 9 March and 25 May 2020. (Release date 26 June 2020) https://www.ons.gov.uk/peoplepopulationandcommunity/healthandsocialcare/causesofdeath/bulletins/coronaviruscovid19relateddeathsbyoccupationenglandandwales/deathsregisteredbetween9marchand25may2020

ONS 2020€ Office for National Statistics. Coronavirus (COVID-19) related deaths by occupation, England and Wales: deaths registered between 9 March and 28 December 2020. (Release date 25 January 2021) https://www.ons.gov.uk/releases/coronaviruscovid19relateddeathsbyoccupationenglandandwalesdeathsregisteredbetween9marchand28december2020

Oreshkova N, Molenaar RJ, Vreman S, et al. SARS-CoV-2 infection in farmed minks, the Netherlands, April and May 2020. Euro Surveill. 2020;25(23):2001005.

Pallett SJC, Rayment M, Patel A, et al. Point-of-care serological assays for delayed SARS-CoV-2 case identification among health-care workers in the UK: a prospective multicentre cohort study. Lancet Respir Med. 2020;8(9):885-894.

Public Health England (2020b). Disparities in the risk and outcomes of covid-19. Jun 2020. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/890258/disparities_review.pdf.

Riley SA, Eales O, Walters CE et al. REACT-1 round 7 interim report: fall in prevalence of swab-positivity in England during national lockdown. Available from: https://www.imperial.ac.uk/media/imperial-college/institute-of-global-healthinnovation/imperial_react1_r7_interim.pdf

Shah ASV et al. Risk of hospital admission with coronavirus disease 2019 in healthcare workers and their households: nationwide linkage cohort study. BMJ 2020;371:m3582 http://dx.doi.org/10.1136/bmj.m3582

Sims MD, Maine GN, Childers KL et al. Coronavirus disease 2019 (COVID-19) Seropositivity and asymptomatic rates in healthcare workers are associated with job function and masking. Clin Infect Dis 2020:ciaa1684, https://doi.org/10.1093/cid/ciaa1684

SOC 2010 Office for National Statistics. Standard Occupational Classification 2000. http://www.ons.gov.uk/aboutstatistics/classifications/archived/SOC2000/index.html.

Sze S, Daniel P, Nevill PR et al. Ethnicity and clinical outcomes in COVID-19: A systematic review and meta-analysis. EClinicalMedicine 29_30 (2020) 100630

Ward H, Cooke G, Atchison C, et al for the REACT-2 team. Declining prevalence of antibody positivity to SARS-CoV-2: a community study of 365 000 adults. [Preprint]2020. *https://www.imperial.ac.uk/media/imperial-college/institute-of-global-health-innovation/MEDRXIV-2020-219725v1-Elliott.pdf doi:10.1101/2020.10.26.20219725*

Williamson EJ, Walker AJ, Bhaskaran K et al. Factors associated with COVID-19-related death using OpenSAFELY. Nature. 2020:584(7821):430-436.

Woloshin S, Patel N, Kesselheim AS. False Negative Tests for SARS-CoV-2 Infection - Challenges and Implications. N Engl J Med. 2020;383(6):e38.

Yelin D, Wirtheim E, Vetter P, et al. Long-term consequences of COVID-19: research needs. Lancet Infect Dis. 2020;20(10):1115-1117.

Zakeri R, Bendayan R, Ashworth M, et al. A case-control and cohort study to determine the relationship between ethnic background and severe COVID-19 EClinicalMedicine. 2020;100574. doi:10.1016/j.eclinm.2020.100574

Zheng C et al. Characteristics and transmission dynamics of COVID-19 in healthcare workers at a London teaching hospital. J Hosp Infection 2020:106;325-329.

Glossary

CFD: Certificates of Fact of Death (also known as Coroners' interim death certificates) which can be used to notify asset holders and other organisations of the death and to make an application for probate.

MCCD: Medical Certificate of Cause of Death - issued by a doctor after someone has died. It details the cause of death and is required to register the death.

PPE: Personal protective equipment - equipment which will protect the user against health or safety risks at work. Examples might include facemasks, visors (eye protection), gloves, aprons etc.

Measures of association

Statistical significance and P values: Statistical significance refers to the probability that a result as large as that observed, or more extreme still, could have arisen simply by chance. The smaller the probability, the less likely it is that the findings arise by chance alone and the more likely they are to be 'true'. A 'statistically significant' result is one for which the chance alone probability is suitably small, as judged by reference to a pre-defined cut-point. (Conventionally, this is often less than 5% ($p<0.05$)).

Relative Risk (RR): A measure of the strength of association between exposure and disease. RR is the ratio of the risk of disease in one group to that in another. Often the first group is exposed and the second unexposed or less exposed. A value greater than 1.0 indicates a positive association between exposure and disease. (This may be causal, or have other explanations, such as bias, chance or confounding.) RR is measured or approximated by other measures in this glossary, such as the Odds Ratio, Standardised Incidence Ratio and Standardised

Mortality Ratio.

Odds Ratio (OR): A measure of the strength of association between exposure and disease. It is the odds of exposure in those with disease relative to the odds of exposure in those without disease, expressed as a ratio. For rare exposures, odds and risks are numerically very similar, so the OR can be thought of as a Relative Risk. A value greater than 1.0 indicates a positive association between exposure and disease. (This may be causal, or have other explanations, such as bias, chance or confounding.)

Standardised Mortality Ratio (SMR): A measure of the strength of association between exposure and mortality; a form of Relative Risk in which the outcome is death. The SMR is the ratio of the number of deaths (due to a given disease arising from exposure to a specific risk factor) that occurs within the study population to the number of deaths that would be expected if the study population had the same rate of mortality as the general population (the standard).

By convention, SMRs (and proportional mortality ratios, as described below) are usually multiplied by 100. Thus, an SMR (or PMR) of 200 corresponds to a RR of 2.0. For ease of understanding in this report, SMRs (or PMRs) are quoted as if RRs, and are not multiplied by 100. Thus, a value greater than 1.0 indicates a positive association between exposure and disease. (This may be causal, or have other explanations, such as bias, chance or confounding.)

ASDR: age standardised death rate - the death rate of a population adjusted to a standard age distribution. It is calculated as a weighted average of the age-specific death rates of a given population; the weights are the age distribution of that population.

Hazard ratio: A measure of how often a particular event happens in one group compared to how often it happens in another group, over time. In cancer research, hazard ratios are often used in clinical trials to measure survival at any point in time in a group of patients who have been given a specific treatment compared to a control group given another treatment or a placebo. A hazard ratio of one means that there is no difference in survival between the two groups. A hazard ratio of greater than one or less than one means that survival was better in one of the groups.

Other epidemiological terms

Prevalence: the proportion of a particular population found to be affected by a medical condition (typically a disease or a risk factor such as smoking). It is derived by comparing the number of people found to have the condition with the total number of people studied, and is usually expressed as a fraction, as a percentage, or as the number of cases per 10,000 or 100,000 people. It is the total number of cases of a disease in a given area during a given time period.

Seroprevalence: the number of persons in a population who test positive for a specific disease based on serology (blood serum) specimens; often presented as a percent of the total specimens tested or as a proportion per 100,000 persons tested.

Systematic review: a complex piece of research which aims to identify, select and synthesise all research published on a particular question or topic. Systematic reviews adhere to a strict scientific design based on pre-specified and reproducible methods. They provide reliable estimates about the effects of interventions.

Meta-analysis: a statistical procedure for combining data from multiple studies. When the treatment effect (or effect size) is consistent from one study to the next, meta-analysis can be used to identify this common effect. The effect may be summarised as a meta-estimate of relative risk (meta-RR).

Risk: the probability that an event will occur (e.g., that an individual will develop disease within a stated period of time or by a certain age).

Incidence rate or incidence: the rate of occurrence of a new event of interest (e.g. cancer) in a given population over a given time period. (The rate is often expressed in terms of cases per year of ‘person-time’, and so incorporates the

numbers at risk of the event, the time for which they are at risk and the numbers that go on to develop that event.)

Confidence Interval (CI): the Relative Risk reported in a study is only an estimate of the true value of relative risk in the underlying population; a different sample may give a somewhat different estimate. The CI defines a plausible range in which the true population value lies, given the extent of statistical uncertainty in the data. The commonly chosen 95% CIs give a range in which there is a 95% chance that the true value will be found (in the absence of bias and confounding). Small studies generate much uncertainty and a wide range, whereas very large studies provide a narrower band of compatible values.

Bias: a systematic tendency to over- or under-estimate the size of a measure of interest in a study.

Numerator-denominator bias: a systematic distortion due to a denominator which does not match the numerator, or vice versa. For example, when calculating the mortality rate of a population, a numerator-denominator bias will occur if the numerator does not relate to the population in the denominator. This would be the case if the numerator contained all deaths that occurred within a particular country, whereas the denominator contained only the resident population.

Confounding: arises when the association between exposure and disease is explained in whole or part by a third factor (confounder), itself a cause of the disease that occurs to a different extent in the groups being compared.

Comorbidity: is the presence of two or more conditions occurring in a person, either at the same time, or successively (one condition which occurs right after the other).

Appendix:
Table 1: British Occupational Hygiene Society

Occupation Risk Rating and Control Options According to Exposure Rank

	Generic Occupational Description	Examples of Occupational Groups	Comments	Exposure Rank	Control Band	Control Options		
						Source	Pathway	Receptor
1	Care workers in the vicinity of AGPs involving infected patients:	ICU staff, doctors, nurses, dentists, surgical staff	AGP= Aerosol Generating Procedures. General ventilation requirements will require special considerations pertaining to clinical environment	E4	D	Isolation of patient, restricted staff access, regular surface disinfection. Visor or facecovering on patient	LEV, General ventilation, regular surface disinfection	Preferably PAPR, otherwise minimum FFP3 and visor, gown, gloves and/or hygiene - hand washing/hand sanitizing.
2	Care workers not in the vicinity of AGPs involving infected patients:	Doctors, nurses, dentists, surgical staff, social care staff		E4	D	Isolation of patient, restricted staff access, regular surface disinfection. Visor or facecovering on patient	Barrier / enclosure, General ventilation, regular surface disinfection	Minimum FFP3 and visor, gown, gloves and/or hygiene - hand washing/hand sanitizing.
3	Care workers where infected patients may be present	OP clinic, GP practice, generic A & E, Ambulance staff, care home staff, Therapists (eg; counsellors psychologists), nurses, physiotherpists, midwives, pharmacists, optometrists, ICU auxiliary workers and assistants	First aiders may not be health care professionals but need to adopt measures describe here	E4	D	Isolation of patient, restricted staff access, regular surface disinfection	Barrier / enclosure, General ventilation, regular surface disinfection	Minimum FFP3 and visor, gown, gloves and/or hygiene - hand washing/hand sanitizing.
4	Public facing workers - high risk face to face contact (distancing cannot be assured)	Police officers, Police community support officers, Traffic officers, Firefighters, Social services, Therapists (eg; counsellors, psychologists), Prison officers and other staff, legal professionals, school teachers, nursery nurses, child care staff, education support staff, public transport staff (eg; train stewards, air line stewards), first aiders, ministers of religion, nail bar workers, hairdressers, taxi cab drivers, chauffeurs, security guard and related work, bus and coach drivers, sales and retail, chefs, supermarket cleaning hygiene staff, Police community support officers, Traffic officers,	Reasonable to anticipate regular close distance (<2m) or extended duration of contact in enclosed spaces (eg; interview room).	E3	C	Require distancing and hand washing / sanitisation by public as far as practicable, implement government advice on face coverings	Barriers, regular surface disinfection of frequent touch points, one way systems as far as reasonably practicable, general ventilation, avoid retail cash payments,	FFP2 should be considered for prolonged contact, otherwise fluid resistant masks, visor, gloves and/or hygiene - hand washing/hand sanitizing.
5	Public-facing workers - low risk face to face contact (distancing is practicable)	Civilian police staff, probation service staff, bus drivers or supermarket employees, hospitality, restaurant / café, gyms, lecturers, personal advisors (financial, law etc.), Fire safety engineers, Retail staff, Railways maintenance staff, Railway freight staff, Delivery drivers, Environmental Health officers, postal services, essential civil service (benefits, boder control, etc.), Occupational hygienists, some Ministry of defence personnel, health and safety advisors, local authority planners, charity staff (eg; foodbanks), funereal staff, journalist and broadcasting, , telecommunication engineers, waste collection, veterinary services,	Presuming that distancing can be enhanced by barriers and other workplace arrangements such as one-way routes and staggered shift patterns.	E2	B	Distancing, frequent hand washing / sanitisation by public as far as practicable	Barriers, regular surface disinfection of frequent touch points, one way systems as far as reasonably practicable, general ventilation	Visor / safety spectacles & fluid resistant mask and/or hygiene - hand washing/hand sanitizing.
6	Non public facing services where distancing may not be practicable	Food production staff, Enginering maintenance, financial services, energy (eg; nuclear, oil and gas, electricity), telecommunications, utilities (eg water), call centre staff, agriculture	Presuming control of workplace arrangements is more consistent, ie; public not present, screening of staff, cohorting and quarantine arrangements etc.	E2	A	Distancing, frequent hand washing / sanitisation	Regular surface disinfection of frequent touch points, one way systems as far as reasonably practicable, general ventilation	Visor / safety spectacles & fluid resistant mask and/or hygiene - hand washing/hand sanitizing.
7	Non public facing services where distancing is practicable	Financial services, energy (eg; nuclear, oil, gas, electricity), telecommunications, utilities (eg; water, sewerage), Food distribution, cleaning hygiene staff	Presuming control of workplace arrangements is more consistent, ie; public not present, screening of staff, cohorting and quarantine arrangements etc. Very low risk band	E1	A	Normal social distancing as advised for general population.	Regular surface disinfection of frequent touch points, one way systems as far as reasonably practicable, general ventilation	Hand washing/sanitizing as advised for general population.
8	Ability to work exclusively from home in isolation or within household 'bubble'	Possibly personal advisors, some civil service and administration staff	Exposure more likely to come from non-occupational sources.	E0	N	Normal social distancing as advised for general population.	Nil	Hand washing/sanitizing as advised for general population.

Appendix Table 2: Male deaths involving COVID-19 and all causes that included information on occupation by sex (those aged 20 to 64 years), England and Wales, deaths registered between 9 March and 28 December 2020.

	Men		
Cause of death	**Deaths**	**Number with information on occupation**	**Proportion (%) of deaths with information on occupation**
Involving COVID-19	5,128	4,225	82.4
All causes of death	42,082	33,904	80.6

	Women		
Cause of death	**Deaths**	**Number with information on occupation**	**Proportion (%) of deaths with information on occupation**
Involving COVID-19	2,833	1,742	61.5
All causes of death	33,904	18,419	69.0

Appendix Table 3:
Numbers of deaths and Death Rates per 100,000 (95% Confidence Intervals) involving COVID-19 for 4 digit SOC codes: men aged 20-64, England and Wales, deaths registered between 9 March and 28 December 2020.

		Deaths involving COVID-19				
SOC individual occupation	**Description**	**Deaths**	**Rate**	**Lower CI**	**Upper CI**	
1115	Chief executives and senior officials	11				p
1116	Elected officers and representatives	1	:	:	:	
1121	Production managers and directors in manufacturing	44	16.3	11.7	22.1	
1122	Production managers and directors in construction	33	20.7	14.1	29.4	
1123	Production managers and directors in mining and energy	4	:	:	:	
1131	Financial managers and directors	17	10	5.7	16.2	u
1132	Marketing and sales directors	13	8.2	4.2	14.1	u
1133	Purchasing managers and directors	9	:	:	:	
1134	Advertising and public relations directors	0	:	:	:	
1135	Human resource managers and directors	7	:	:	:	
1136	Information technology and telecommunications directors	6	:	:	:	
1139	Functional managers and directors n.e.c.	10	16.7	7.8	31.1	u
1150	Financial institution managers and directors	7	:	:	:	
1161	Managers and directors in transport and distribution	30	51.6	33.8	74.9	
1162	Managers and directors in storage and warehousing	24	49.9	30.1	76.7	
1171	Officers in armed forces	2	:	:	:	
1172	Senior police officers	0	:	:	:	

1173	Senior officers in fire, ambulance, prison and related services	2	:	:	:	
1181	Health services and public health managers and directors	3	:	:	:	
1184	Social services managers and directors	2	:	:	:	
1190	Managers and directors in retail and wholesale	42	28.3	20	38.8	
1211	Managers and proprietors in agriculture and horticulture	0	:	:	:	
1213	Managers and proprietors in forestry, fishing and related services	2	:	:	:	
1221	Hotel and accommodation managers and proprietors	6	:	:	:	
1223	Restaurant and catering establishment managers and proprietors	26	119.3	71.2	183.8	
1224	Publicans and managers of licensed premises	19	219.9	124.7	354.2	u
1225	Leisure and sports managers	5	:	:	:	
1226	Travel agency managers and proprietors	2	:	:	:	
1241	Health care practice managers	0	:	:	:	
1242	Residential, day and domiciliary care managers and proprietors	5	:	:	:	
1251	Property, housing and estate managers	28	31.1	20.4	45.4	
1252	Garage managers and proprietors	7	:	:	:	
1253	Hairdressing and beauty salon managers and proprietors	1	:	:	:	
1254	Shopkeepers and proprietors: wholesale and retail	54	69	51.8	90.1	
1255	Waste disposal and environmental services managers	6	:	:	:	
1259	Managers and proprietors in other services n.e.c.	44	40.6	28.9	55.2	
2111	Chemical scientists	3	:	:	:	
2112	Biological scientists and biochemists	6	:	:	:	
2113	Physical scientists	2	:	:	:	
2114	Social and humanities scientists	1	:	:	:	

2119	Natural and social science professionals n.e.c.	3	:	:	:	
2121	Civil engineers	5	:	:	:	
2122	Mechanical engineers	8	:	:	:	
2123	Electrical engineers	2	:	:	:	
2124	Electronics engineers	1	:	:	:	
2126	Design and development engineers	4	:	:	:	
2127	Production and process engineers	6	:	:	:	
2129	Engineering professionals n.e.c.	8	:	:	:	
2133	IT specialist managers	20	21.9	12	35.7	
2134	IT project and programme managers	6	:	:	:	
2135	IT business analysts, architects and systems designers	8	:	:	:	
2136	Programmers and software development professionals	15	8	3.9	14	u
2137	Web design and development professionals	5	:	:	:	
2139	Information technology and telecommunications professionals n.e.c.	22	20	11.9	31.1	
2141	Conservation professionals	0	:	:	:	
2142	Environment professionals	1	:	:	:	
2150	Research and development managers	0	:	:	:	
2211	Medical practitioners	30	27.6	18.6	39.5	
2212	Psychologists	0	:	:	:	
2213	Pharmacists	4	:	:	:	
2214	Ophthalmic opticians	1	:	:	:	
2215	Dental practitioners	2	:	:	:	
2216	Veterinarians	0	:	:	:	
2217	Medical radiographers	2	:	:	:	
2218	Podiatrists	1	:	:	:	
2219	Health professionals n.e.c.	0	:	:	:	
2221	Physiotherapists	1	:	:	:	
2222	Occupational therapists	1	:	:	:	

2223	Speech and language therapists	0	:	:	:	
2229	Therapy professionals n.e.c.	1	:	:	:	
2231	Nurses	47	79.1	57.4	106.1	
2232	Midwives	0	:	:	:	
2311	Higher education teaching professionals	10	11.5	5.2	21.7	u
2312	Further education teaching professionals	10	24.7	11.1	46.6	u
2314	Secondary education teaching professionals	29	39.2	24.3	58.6	
2315	Primary and nursery education teaching professionals	4	:	:	:	
2316	Special needs education teaching professionals	1	:	:	:	
2317	Senior professionals of educational establishments	3	:	:	:	
2318	Education advisers and school inspectors	1	:	:	:	
2319	Teaching and other educational professionals n.e.c.	8	:	:	:	
2412	Barristers and judges	2	:	:	:	
2413	Solicitors	5	:	:	:	
2419	Legal professionals n.e.c.	9	:	:	:	
2421	Chartered and certified accountants	19	21.9	13	34.4	u
2423	Management consultants and business analysts	6	:	:	:	
2424	Business and financial project management professionals	17	20.1	10.7	33.7	u
2425	Actuaries, economists and statisticians	1	:	:	:	
2426	Business and related research professionals	2	:	:	:	
2429	Business, research and administrative professionals n.e.c.	0	:	:	:	
2431	Architects	4	:	:	:	
2432	Town planning officers	0	:	:	:	
2433	Quantity surveyors	3	:	:	:	
2434	Chartered surveyors	10	21.6	10.3	39.9	u
2435	Chartered architectural technologists	1	:	:	:	
2436	Construction project managers and related professionals	2	:	:	:	

2442	Social workers	11				p
2443	Probation officers	1	:	:	:	
2444	Clergy	21				p
2449	Welfare professionals n.e.c.	0	:	:	:	
2451	Librarians	1	:	:	:	
2452	Archivists and curators	1	:	:	:	
2461	Quality control and planning engineers	6	:	:	:	
2462	Quality assurance and regulatory professionals	5	:	:	:	
2463	Environmental health professionals	0	:	:	:	
2471	Journalists, newspaper and periodical editors	8	:	:	:	
2472	Public relations professionals	1	:	:	:	
2473	Advertising accounts managers and creative directors	1	:	:	:	
3111	Laboratory technicians	4	:	:	:	
3112	Electrical and electronics technicians	3	:	:	:	
3113	Engineering technicians	1	:	:	:	
3114	Building and civil engineering technicians	2	:	:	:	
3115	Quality assurance technicians	1	:	:	:	
3116	Planning, process and production technicians	1	:	:	:	
3119	Science, engineering and production technicians n.e.c.	7	:	:	:	
3121	Architectural and town planning technicians	0	:	:	:	
3122	Draughtspersons	5	:	:	:	
3131	IT operations technicians	12	32.2	15.3	58.3	u
3132	IT user support technicians	9	:	:	:	
3213	Paramedics	9	:	:	:	
3216	Dispensing opticians	0	:	:	:	
3217	Pharmaceutical technicians	1	:	:	:	
3218	Medical and dental technicians	4	:	:	:	
3219	Health associate professionals n.e.c.	3	:	:	:	
3231	Youth and community workers	5	:	:	:	

3233	Child and early years officers	1	:	:	:	
3234	Housing officers	2	:	:	:	
3235	Counsellors	1	:	:	:	
3239	Welfare and housing associate professionals n.e.c.	9	:	:	:	
3311	NCOs and other ranks	24				p
3312	Police officers (sergeant and below)	19	194.1	93.3	336.3	u
3313	Fire service officers (watch manager and below)	3	:	:	:	
3314	Prison service officers (below principal officer)	6	:	:	:	
3315	Police community support officers	2	:	:	:	
3319	Protective service associate professionals n.e.c.	13	39.3	20.1	68.3	u
3411	Artists	6	:	:	:	
3412	Authors, writers and translators	5	:	:	:	
3413	Actors, entertainers and presenters	9	:	:	:	
3414	Dancers and choreographers	0	:	:	:	
3415	Musicians	6	:	:	:	
3416	Arts officers, producers and directors	3	:	:	:	
3417	Photographers, audio-visual and broadcasting equipment operators	12	31.9	15.6	57.1	u
3421	Graphic designers	6	:	:	:	
3422	Product, clothing and related designers	2	:	:	:	
3441	Sports players	2	:	:	:	
3442	Sports coaches, instructors and officials	3	:	:	:	
3443	Fitness instructors	2	:	:	:	
3511	Air traffic controllers	2	:	:	:	
3512	Aircraft pilots and flight engineers	1	:	:	:	
3513	Ship and hovercraft officers	3	:	:	:	
3520	Legal associate professionals	2	:	:	:	
3531	Estimators, valuers and assessors	4	:	:	:	
3532	Brokers	5	:	:	:	

3533	Insurance underwriters	0	:	:	:	
3534	Finance and investment analysts and advisers	9	:	:	:	
3535	Taxation experts	4	:	:	:	
3536	Importers and exporters	2	:	:	:	
3537	Financial and accounting technicians	1	:	:	:	
3538	Financial accounts managers	8	:	:	:	
3539	Business and related associate professionals n.e.c.	11	20.3	9.7	37	u
3541	Buyers and procurement officers	4	:	:	:	
3542	Business sales executives	25	47.2	29.8	70.6	
3543	Marketing associate professionals	4	:	:	:	
3544	Estate agents and auctioneers	5	:	:	:	
3545	Sales accounts and business development managers	30	15.8	10.4	22.9	
3546	Conference and exhibition managers and organisers	3	:	:	:	
3550	Conservation and environmental associate professionals	0	:	:	:	
3561	Public services associate professionals	8	:	:	:	
3562	Human resources and industrial relations officers	8	:	:	:	
3563	Vocational and industrial trainers and instructors	9	:	:	:	
3564	Careers advisers and vocational guidance specialists	1	:	:	:	
3565	Inspectors of standards and regulations	2	:	:	:	
3567	Health and safety officers	6	:	:	:	
4112	National government administrative occupations	28	58.5	38.8	84.7	
4113	Local government administrative occupations	23	72.1	44.8	109.4	
4114	Officers of non-governmental organisations	1	:	:	:	
4121	Credit controllers	2	:	:	:	
4122	Book-keepers, payroll managers and wages clerks	37	48.4	33.7	67.2	
4123	Bank and post office clerks	11	105.5	49.6	193.7	u
4124	Finance officers	2	:	:	:	
4129	Financial administrative occupations n.e.c.	6	:	:	:	
4131	Records clerks and assistants	8	:	:	:	

4132	Pensions and insurance clerks and assistants	3	:	:	:	
4133	Stock control clerks and assistants	6	:	:	:	
4134	Transport and distribution clerks and assistants	15	51.4	27.2	87.1	u
4135	Library clerks and assistants	1	:	:	:	
4138	Human resources administrative occupations	0	:	:	:	
4151	Sales administrators	1	:	:	:	
4159	Other administrative occupations n.e.c.	26	26.8	17.4	39.4	
4161	Office managers	7	:	:	:	
4162	Office supervisors	1	:	:	:	
4211	Medical secretaries	1	:	:	:	
4212	Legal secretaries	1	:	:	:	
4213	School secretaries	0	:	:	:	
4214	Company secretaries	1	:	:	:	
4215	Personal assistants and other secretaries	0	:	:	:	
4216	Receptionists	2	:	:	:	
4217	Typists and related keyboard occupations	3	:	:	:	
5111	Farmers	13	17	8.8	29.4	u
5112	Horticultural trades	3	:	:	:	
5113	Gardeners and landscape gardeners	28	22.2	14.6	32.3	
5114	Groundsmen and greenkeepers	6	:	:	:	
5119	Agricultural and fishing trades n.e.c.	2	:	:	:	
5211	Smiths and forge workers	1	:	:	:	
5212	Moulders, core makers and die casters	0	:	:	:	
5213	Sheet metal workers	6	:	:	:	
5214	Metal plate workers, and riveters	1	:	:	:	
5215	Welding trades	26	54.7	33.1	83.5	
5216	Pipe fitters	2	:	:	:	
5221	Metal machining setters and setter-operators	5	:	:	:	
5222	Tool makers, tool fitters and markers-out	8	:	:	:	

5223	Metal working production and maintenance fitters	62	36.4	27.8	46.8	
5224	Precision instrument makers and repairers	4	:	:	:	
5225	Air-conditioning and refrigeration engineers	2	:	:	:	
5231	Vehicle technicians, mechanics and electricians	48	58	42.4	77.4	
5232	Vehicle body builders and repairers	9	:	:	:	
5234	Vehicle paint technicians	9	:	:	:	
5235	Aircraft maintenance and related trades	11	70.8	34.4	128.2	u
5236	Boat and ship builders and repairers	1	:	:	:	
5237	Rail and rolling stock builders and repairers	3	:	:	:	
5241	Electricians and electrical fitters	54	33.3	25	43.5	
5242	Telecommunications engineers	16	56.4	30.8	93.7	u
5244	TV, video and audio engineers	2	:	:	:	
5245	IT engineers	12	51.9	25.9	92	u
5249	Electrical and electronic trades n.e.c.	22	38	23.6	57.9	
5250	Skilled metal, electrical and electronic trades supervisors	5	:	:	:	
5311	Steel erectors	2	:	:	:	
5312	Bricklayers and masons	18	32.4	18.9	51.6	u
5313	Roofers, roof tilers and slaters	19	100.5	55.8	163.6	u
5314	Plumbers and heating and ventilating engineers	31	24.3	16.3	34.6	
5315	Carpenters and joiners	60	43.1	32.8	55.6	
5316	Glaziers, window fabricators and fitters	9	:	:	:	
5319	Construction and building trades n.e.c.	85	40.1	32	49.7	
5321	Plasterers	11	38.5	18.9	69.2	u
5322	Floorers and wall tilers	8	:	:	:	
5323	Painters and decorators	56	47	34.9	61.8	
5330	Construction and building trades supervisors	6	:	:	:	
5411	Weavers and knitters	1	:	:	:	
5412	Upholsterers	7	:	:	:	
5413	Footwear and leather working trades	4	:	:	:	

5414	Tailors and dressmakers	5	:	:	:	
5419	Textiles, garments and related trades n.e.c.	1	:	:	:	
5421	Pre-press technicians	0	:	:	:	
5422	Printers	12				p
5423	Print finishing and binding workers	1	:	:	:	
5431	Butchers	15	207	112.2	346.8	u
5432	Bakers and flour confectioners	15	715.6	331	1282.8	u
5433	Fishmongers and poultry dressers	1	:	:	:	
5434	Chefs	82	103.1	79.9	130.5	
5435	Cooks	2	:	:	:	
5436	Catering and bar managers	13	86.8	41.6	155.4	u
5441	Glass and ceramics makers, decorators and finishers	6	:	:	:	
5442	Furniture makers and other craft woodworkers	6	:	:	:	
5443	Florists	2	:	:	:	
5449	Other skilled trades n.e.c.	9	:	:	:	
6121	Nursery nurses and assistants	0	:	:	:	
6122	Childminders and related occupations	0	:	:	:	
6123	Playworkers	1	:	:	:	
6125	Teaching assistants	5	:	:	:	
6126	Educational support assistants	1	:	:	:	
6131	Veterinary nurses	0	:	:	:	
6132	Pest control officers	3	:	:	:	
6139	Animal care services occupations n.e.c.	0	:	:	:	
6141	Nursing auxiliaries and assistants	45	87.2	63.3	117.1	
6142	Ambulance staff (excluding paramedics)	15	95.2	38.7	178.5	u
6143	Dental nurses	0	:	:	:	
6144	Houseparents and residential wardens	6	:	:	:	
6145	Care workers and home carers	107	109.9	88.6	131.3	
6146	Senior care workers	7	:	:	:	

6147	Care escorts	2	:	:	:	
6148	Undertakers, mortuary and crematorium assistants	2	:	:	:	
6211	Sports and leisure assistants	5	:	:	:	
6212	Travel agents	3	:	:	:	
6214	Air travel assistants	2	:	:	:	
6215	Rail travel assistants	8	:	:	:	
6219	Leisure and travel service occupations n.e.c.	2	:	:	:	
6221	Hairdressers and barbers	12	112.5	49.6	209.8	u
6222	Beauticians and related occupations	1	:	:	:	
6231	Housekeepers and related occupations	0	:	:	:	
6232	Caretakers	25	30.1	19.4	44.4	
6240	Cleaning and housekeeping managers and supervisors	6	:	:	:	
7111	Sales and retail assistants	69	56.5	43.7	71.9	
7112	Retail cashiers and check-out operators	11	61.6	27.9	114.7	u
7113	Telephone salespersons	1	:	:	:	
7114	Pharmacy and other dispensing assistants	1	:	:	:	
7115	Vehicle and parts salespersons and advisers	11	42.1	20.3	76.6	u
7121	Collector salespersons and credit agents	0	:	:	:	
7122	Debt, rent and other cash collectors	3	:	:	:	
7123	Roundspersons and van salespersons	6	:	:	:	
7124	Market and street traders and assistants	14				p
7125	Merchandisers and window dressers	0	:	:	:	
7129	Sales related occupations n.e.c.	2	:	:	:	
7130	Sales supervisors	8	:	:	:	
7211	Call and contact centre occupations	9	:	:	:	
7213	Telephonists	2	:	:	:	
7214	Communication operators	2	:	:	:	
7215	Market research interviewers	0	:	:	:	
7219	Customer service occupations n.e.c.	16	41.8	23.2	68.8	u

7220	Customer service managers and supervisors	1	:	:	:	
8111	Food, drink and tobacco process operatives	52	103.7	77.2	136.4	
8112	Glass and ceramics process operatives	5	:	:	:	
8113	Textile process operatives	5	:	:	:	
8114	Chemical and related process operatives	8	:	:	:	
8115	Rubber process operatives	0	:	:	:	
8116	Plastics process operatives	4	:	:	:	
8117	Metal making and treating process operatives	0	:	:	:	
8118	Electroplaters	1	:	:	:	
8119	Process operatives n.e.c.	0	:	:	:	
8121	Paper and wood machine operatives	2	:	:	:	
8122	Coal mine operatives	13				p
8123	Quarry workers and related operatives	3	:	:	:	
8124	Energy plant operatives	3	:	:	:	
8125	Metal working machine operatives	40	106.1	74.5	146	
8126	Water and sewerage plant operatives	2	:	:	:	
8127	Printing machine assistants	3	:	:	:	
8129	Plant and machine operatives n.e.c.	9	:	:	:	
8131	Assemblers (electrical and electronic products)	8	:	:	:	
8132	Assemblers (vehicles and metal goods)	8	:	:	:	
8133	Routine inspectors and testers	14	29	15.8	48.7	u
8134	Weighers, graders and sorters	1	:	:	:	
8135	Tyre, exhaust and windscreen fitters	4	:	:	:	
8137	Sewing machinists	1	:	:	:	
8139	Assemblers and routine operatives n.e.c.	4	:	:	:	
8141	Scaffolders, stagers and riggers	8	:	:	:	
8142	Road construction operatives	6	:	:	:	
8143	Rail construction and maintenance operatives	4	:	:	:	
8149	Construction operatives n.e.c.	22	23.7	14.6	36.3	

8211	Large goods vehicle drivers	118	39.7	32.4	47.1	
8212	Van drivers	97	39.7	32.1	48.5	
8213	Bus and coach drivers	83	70.3	55.3	88	
8214	Taxi and cab drivers and chauffeurs	209	101.4	87.5	115.2	
8215	Driving instructors	18				p
8221	Crane drivers	4	:	:	:	
8222	Fork-lift truck drivers	22	34.8	21.4	53.1	
8223	Agricultural machinery drivers	0	:	:	:	
8229	Mobile machine drivers and operatives n.e.c.	16	44.2	24.9	72.3	u
8231	Train and tram drivers	4	:	:	:	
8232	Marine and waterways transport operatives	3	:	:	:	
8233	Air transport operatives	7	:	:	:	
8234	Rail transport operatives	13				p
8239	Other drivers and transport operatives n.e.c.	3	:	:	:	
9111	Farm workers	6	:	:	:	
9112	Forestry workers	0	:	:	:	
9119	Fishing and other elementary agriculture occupations n.e.c.	4	:	:	:	
9120	Elementary construction occupations	70	82.1	63.9	103.7	
9132	Industrial cleaning process occupations	6	:	:	:	
9134	Packers, bottlers, canners and fillers	14	51.6	24.9	91.4	u
9139	Elementary process plant occupations n.e.c.	100				p
9211	Postal workers, mail sorters, messengers and couriers	64	58.2	44.5	74.6	
9219	Elementary administration occupations n.e.c.	2	:	:	:	
9231	Window cleaners	3	:	:	:	
9232	Street cleaners	6	:	:	:	
9233	Cleaners and domestics	58	66.6	50.3	86.5	
9234	Launderers, dry cleaners and pressers	5	:	:	:	
9235	Refuse and salvage occupations	13	45.8	23.9	79.2	u

9236	Vehicle valeters and cleaners	10	142.9	60.7	275.5	u
9239	Elementary cleaning occupations n.e.c.	1	:	:	:	
9241	Security guards and related occupations	140	100.7	83.8	117.6	
9242	Parking and civil enforcement occupations	7	:	:	:	
9244	School midday and crossing patrol occupations	2	:	:	:	
9249	Elementary security occupations n.e.c.	4	:	:	:	
9251	Shelf fillers	2	:	:	:	
9259	Elementary sales occupations n.e.c.	2	:	:	:	
9260	Elementary storage occupations	111	54	43.4	64.6	
9271	Hospital porters	18	86.7	47.7	142.3	u
9272	Kitchen and catering assistants	29	57	38	81.9	
9273	Waiters and waitresses	14	95.7	46.6	169.1	u
9274	Bar staff	4	:	:	:	
9275	Leisure and theme park attendants	0	:	:	:	
9279	Other elementary services occupations n.e.c.	4	:	:	:	

Statistics based on a small number of deaths (10 to 19) may not be reliable and are therefore marked by **'u**'.
Analysis is not provided when numbers of deaths are below 10 and have been marked **':'**
Age-standardised mortality rates were not calculated when the population for an individual occupation was found to be unreliable and have been marked as **‘p’**

Appendix Table 4:
Numbers of deaths and Death Rates per 100,000 (95% Confidence Intervals) involving COVID-19 for 4 digit SOC codes: women aged 20-64, England and Wales, deaths registered between 9 March and 28 December 2020.

			Deaths involving COVID-19				
SOC individual occupation	Description		Deaths	Rate	Lower CI	Upper CI	
1115	Chief executives and senior officials		2	:	:	:	
1116	Elected officers and representatives		2	:	:	:	
1121	Production managers and directors in manufacturing		4	:	:	:	
1122	Production managers and directors in construction		0	:	:	:	
1123	Production managers and directors in mining and energy		0	:	:	:	
1131	Financial managers and directors		4	:	:	:	
1132	Marketing and sales directors		1	:	:	:	
1133	Purchasing managers and directors		1	:	:	:	
1134	Advertising and public relations directors		0	:	:	:	
1135	Human resource managers and directors		7	:	:	:	
1136	Information technology and telecommunications directors		1	:	:	:	
1139	Functional managers and directors n.e.c.		4	:	:	:	
1150	Financial institution managers and directors		2	:	:	:	
1161	Managers and directors in transport and distribution		1	:	:	:	
1162	Managers and directors in storage and warehousing		4	:	:	:	
1171	Officers in armed forces		0	:	:	:	
1172	Senior police officers		1	:	:	:	

1173	Senior officers in fire, ambulance, prison and related services		1	:	:	:	
1181	Health services and public health managers and directors		4	:	:	:	
1184	Social services managers and directors		1	:	:	:	
1190	Managers and directors in retail and wholesale		24	26.7	16.7	40.2	
1211	Managers and proprietors in agriculture and horticulture		1	:	:	:	
1213	Managers and proprietors in forestry, fishing and related services		0	:	:	:	
1221	Hotel and accommodation managers and proprietors		6	:	:	:	
1223	Restaurant and catering establishment managers and proprietors		9	:	:	:	
1224	Publicans and managers of licensed premises		8	:	:	:	
1225	Leisure and sports managers		3	:	:	:	
1226	Travel agency managers and proprietors		0	:	:	:	
1241	Health care practice managers		3	:	:	:	
1242	Residential, day and domiciliary care managers and proprietors		16	31.5	17.9	51.3	u
1251	Property, housing and estate managers		5	:	:	:	
1252	Garage managers and proprietors		0	:	:	:	
1253	Hairdressing and beauty salon managers and proprietors		3	:	:	:	
1254	Shopkeepers and proprietors: wholesale and retail		12	36	18	63.8	u
1255	Waste disposal and environmental services managers		0	:	:	:	
1259	Managers and proprietors in other services n.e.c.		9	:	:	:	
2111	Chemical scientists		0	:	:	:	
2112	Biological scientists and biochemists		0	:	:	:	
2113	Physical scientists		0	:	:	:	

2114	Social and humanities scientists		0	:	:	:	
2119	Natural and social science professionals n.e.c.		2	:	:	:	
2121	Civil engineers		0	:	:	:	
2122	Mechanical engineers		0	:	:	:	
2123	Electrical engineers		0	:	:	:	
2124	Electronics engineers		0	:	:	:	
2126	Design and development engineers		0	:	:	:	
2127	Production and process engineers		0	:	:	:	
2129	Engineering professionals n.e.c.		0	:	:	:	
2133	IT specialist managers		1	:	:	:	
2134	IT project and programme managers		1	:	:	:	
2135	IT business analysts, architects and systems designers		1	:	:	:	
2136	Programmers and software development professionals		2	:	:	:	
2137	Web design and development professionals		0	:	:	:	
2139	Information technology and telecommunications professionals n.e.c.		2	:	:	:	
2141	Conservation professionals		0	:	:	:	
2142	Environment professionals		1	:	:	:	
2150	Research and development managers		0	:	:	:	
2211	Medical practitioners		5	:	:	:	
2212	Psychologists		2	:	:	:	
2213	Pharmacists		2	:	:	:	
2214	Ophthalmic opticians		0	:	:	:	
2215	Dental practitioners		0	:	:	:	
2216	Veterinarians		0	:	:	:	
2217	Medical radiographers		3	:	:	:	

2218	Podiatrists		0	:	:	:	
2219	Health professionals n.e.c.		4	:	:	:	
2221	Physiotherapists		1	:	:	:	
2222	Occupational therapists		1	:	:	:	
2223	Speech and language therapists		0	:	:	:	
2229	Therapy professionals n.e.c.		1	:	:	:	
2231	Nurses		110	24.5	19.7	29.4	
2232	Midwives		9	:	:	:	
2311	Higher education teaching professionals		3	:	:	:	
2312	Further education teaching professionals		4	:	:	:	
2314	Secondary education teaching professionals		23	21.2	12.4	33.2	
2315	Primary and nursery education teaching professionals		19	10	5.4	16.5	u
2316	Special needs education teaching professionals		3	:	:	:	
2317	Senior professionals of educational establishments		12	25.2	10.7	47.6	u
2318	Education advisers and school inspectors		2	:	:	:	
2319	Teaching and other educational professionals n.e.c.		7	:	:	:	
2412	Barristers and judges		0	:	:	:	
2413	Solicitors		0	:	:	:	
2419	Legal professionals n.e.c.		2	:	:	:	
2421	Chartered and certified accountants		4	:	:	:	
2423	Management consultants and business analysts		5	:	:	:	
2424	Business and financial project management professionals		3	:	:	:	
2425	Actuaries, economists and statisticians		0	:	:	:	
2426	Business and related research professionals		2	:	:	:	
2429	Business, research and administrative professionals n.e.c.		1	:	:	:	
2431	Architects		0	:	:	:	

2432	Town planning officers		0	:	:	:	
2433	Quantity surveyors		0	:	:	:	
2434	Chartered surveyors		0	:	:	:	
2435	Chartered architectural technologists		0	:	:	:	
2436	Construction project managers and related professionals		0	:	:	:	
2442	Social workers		25	32.4	20.7	48.3	
2443	Probation officers		1	:	:	:	
2444	Clergy		1	:	:	:	
2449	Welfare professionals n.e.c.		1	:	:	:	
2451	Librarians		3	:	:	:	
2452	Archivists and curators		1	:	:	:	
2461	Quality control and planning engineers		1	:	:	:	
2462	Quality assurance and regulatory professionals		4	:	:	:	
2463	Environmental health professionals		0	:	:	:	
2471	Journalists, newspaper and periodical editors		2	:	:	:	
2472	Public relations professionals		1	:	:	:	
2473	Advertising accounts managers and creative directors		1	:	:	:	
3111	Laboratory technicians		1	:	:	:	
3112	Electrical and electronics technicians		1	:	:	:	
3113	Engineering technicians		0	:	:	:	
3114	Building and civil engineering technicians		0	:	:	:	
3115	Quality assurance technicians		0	:	:	:	
3116	Planning, process and production technicians		0	:	:	:	
3119	Science, engineering and production technicians n.e.c.		1	:	:	:	
3121	Architectural and town planning technicians		0	:	:	:	

3122	Draughtspersons		2	:	:	:	
3131	IT operations technicians		2	:	:	:	
3132	IT user support technicians		1	:	:	:	
3213	Paramedics		1	:	:	:	
3216	Dispensing opticians		0	:	:	:	
3217	Pharmaceutical technicians		3	:	:	:	
3218	Medical and dental technicians		1	:	:	:	
3219	Health associate professionals n.e.c.		4	:	:	:	
3231	Youth and community workers		4	:	:	:	
3233	Child and early years officers		2	:	:	:	
3234	Housing officers		2	:	:	:	
3235	Counsellors		3	:	:	:	
3239	Welfare and housing associate professionals n.e.c.		9	:	:	:	
3311	NCOs and other ranks		1	:	:	:	
3312	Police officers (sergeant and below)		1	:	:	:	
3313	Fire service officers (watch manager and below)		0	:	:	:	
3314	Prison service officers (below principal officer)		2	:	:	:	
3315	Police community support officers		0	:	:	:	
3319	Protective service associate professionals n.e.c.		0	:	:	:	
3411	Artists		1	:	:	:	
3412	Authors, writers and translators		2	:	:	:	
3413	Actors, entertainers and presenters		2	:	:	:	
3414	Dancers and choreographers		0	:	:	:	
3415	Musicians		2	:	:	:	
3416	Arts officers, producers and directors		1	:	:	:	

3417	Photographers, audio-visual and broadcasting equipment operators		0	:	:	:	
3421	Graphic designers		0	:	:	:	
3422	Product, clothing and related designers		2	:	:	:	
3441	Sports players		0	:	:	:	
3442	Sports coaches, instructors and officials		2	:	:	:	
3443	Fitness instructors		1	:	:	:	
3511	Air traffic controllers		0	:	:	:	
3512	Aircraft pilots and flight engineers		0	:	:	:	
3513	Ship and hovercraft officers		0	:	:	:	
3520	Legal associate professionals		2	:	:	:	
3531	Estimators, valuers and assessors		1	:	:	:	
3532	Brokers		3	:	:	:	
3533	Insurance underwriters		0	:	:	:	
3534	Finance and investment analysts and advisers		2	:	:	:	
3535	Taxation experts		2	:	:	:	
3536	Importers and exporters		0	:	:	:	
3537	Financial and accounting technicians		0	:	:	:	
3538	Financial accounts managers		3	:	:	:	
3539	Business and related associate professionals n.e.c.		3	:	:	:	
3541	Buyers and procurement officers		1	:	:	:	
3542	Business sales executives		5	:	:	:	
3543	Marketing associate professionals		2	:	:	:	
3544	Estate agents and auctioneers		2	:	:	:	

3545	Sales accounts and business development managers	2	:	:	:	
3546	Conference and exhibition managers and organisers	3	:	:	:	
3550	Conservation and environmental associate professionals	1	:	:	:	
3561	Public services associate professionals	3	:	:	:	
3562	Human resources and industrial relations officers	7	:	:	:	
3563	Vocational and industrial trainers and instructors	5	:	:	:	
3564	Careers advisers and vocational guidance specialists	2	:	:	:	
3565	Inspectors of standards and regulations	0	:	:	:	
3567	Health and safety officers	0	:	:	:	
4112	National government administrative occupations	26	27.9	18.1	41.2	
4113	Local government administrative occupations	10	10.5	4.9	19.5	u
4114	Officers of non-governmental organisations	4	:	:	:	
4121	Credit controllers	2	:	:	:	
4122	Book-keepers, payroll managers and wages clerks	26	11.9	7.7	17.6	
4123	Bank and post office clerks	15	24.1	13.4	39.9	u
4124	Finance officers	2	:	:	:	
4129	Financial administrative occupations n.e.c.	9	:	:	:	
4131	Records clerks and assistants	6	:	:	:	
4132	Pensions and insurance clerks and assistants	5	:	:	:	
4133	Stock control clerks and assistants	1	:	:	:	
4134	Transport and distribution clerks and assistants	3	:	:	:	
4135	Library clerks and assistants	3	:	:	:	
4138	Human resources administrative occupations	1	:	:	:	
4151	Sales administrators	3	:	:	:	
4159	Other administrative occupations n.e.c.	58	12.3	9.3	15.9	

4161	Office managers		11	8.7	4.2	15.9	u
4162	Office supervisors		1	:	:	:	
4211	Medical secretaries		4	:	:	:	
4212	Legal secretaries		3	:	:	:	
4213	School secretaries		4	:	:	:	
4214	Company secretaries		1	:	:	:	
4215	Personal assistants and other secretaries		30	19.1	12.7	27.4	
4216	Receptionists		18	9.5	5.3	15.6	u
4217	Typists and related keyboard occupations		4	:	:	:	
5111	Farmers		0	:	:	:	
5112	Horticultural trades		0	:	:	:	
5113	Gardeners and landscape gardeners		2	:	:	:	
5114	Groundsmen and greenkeepers		0	:	:	:	
5119	Agricultural and fishing trades n.e.c.		0	:	:	:	
5211	Smiths and forge workers		0	:	:	:	
5212	Moulders, core makers and die casters		0	:	:	:	
5213	Sheet metal workers		0	:	:	:	
5214	Metal plate workers, and riveters		0	:	:	:	
5215	Welding trades		1	:	:	:	
5216	Pipe fitters		0	:	:	:	
5221	Metal machining setters and setter-operators		0	:	:	:	
5222	Tool makers, tool fitters and markers-out		0	:	:	:	

5223	Metal working production and maintenance fitters	2	:	:	:	
5224	Precision instrument makers and repairers	1	:	:	:	
5225	Air-conditioning and refrigeration engineers	0	:	:	:	
5231	Vehicle technicians, mechanics and electricians	0	:	:	:	
5232	Vehicle body builders and repairers	0	:	:	:	
5234	Vehicle paint technicians	0	:	:	:	
5235	Aircraft maintenance and related trades	0	:	:	:	
5236	Boat and ship builders and repairers	0	:	:	:	
5237	Rail and rolling stock builders and repairers	0	:	:	:	
5241	Electricians and electrical fitters	2	:	:	:	
5242	Telecommunications engineers	0	:	:	:	
5244	TV, video and audio engineers	0	:	:	:	
5245	IT engineers	0	:	:	:	
5249	Electrical and electronic trades n.e.c.	1	:	:	:	
5250	Skilled metal, electrical and electronic trades supervisors	0	:	:	:	
5311	Steel erectors	0	:	:	:	
5312	Bricklayers and masons	0	:	:	:	
5313	Roofers, roof tilers and slaters	0	:	:	:	
5314	Plumbers and heating and ventilating engineers	0	:	:	:	
5315	Carpenters and joiners	0	:	:	:	
5316	Glaziers, window fabricators and fitters	0	:	:	:	
5319	Construction and building trades n.e.c.	0	:	:	:	
5321	Plasterers	0	:	:	:	
5322	Floorers and wall tilers	0	:	:	:	
5323	Painters and decorators	0	:	:	:	
5330	Construction and building trades supervisors	0	:	:	:	
5411	Weavers and knitters	0	:	:	:	
5412	Upholsterers	0	:	:	:	

5413	Footwear and leather working trades		1	:	:	:	
5414	Tailors and dressmakers		2	:	:	:	
5419	Textiles, garments and related trades n.e.c.		0	:	:	:	
5421	Pre-press technicians		0	:	:	:	
5422	Printers		0	:	:	:	
5423	Print finishing and binding workers		0	:	:	:	
5431	Butchers		0	:	:	:	
5432	Bakers and flour confectioners		4	:	:	:	
5433	Fishmongers and poultry dressers		0	:	:	:	
5434	Chefs		13	40.2	20.5	70	u
5435	Cooks		10				p
5436	Catering and bar managers		9	:	:	:	
5441	Glass and ceramics makers, decorators and finishers		1	:	:	:	
5442	Furniture makers and other craft woodworkers		1	:	:	:	
5443	Florists		4	:	:	:	
5449	Other skilled trades n.e.c.		0	:	:	:	
6121	Nursery nurses and assistants		12	11.8	5.3	22	u
6122	Childminders and related occupations		18	27.8	15.9	44.8	u
6123	Playworkers		1	:	:	:	
6125	Teaching assistants		37	15	10.2	21	
6126	Educational support assistants		3	:	:	:	
6131	Veterinary nurses		1	:	:	:	
6132	Pest control officers		0	:	:	:	
6139	Animal care services occupations n.e.c.		2	:	:	:	
6141	Nursing auxiliaries and assistants		54	25.3	18.9	33.1	

6142	Ambulance staff (excluding paramedics)		0	:	:	:	
6143	Dental nurses		6	:	:	:	
6144	Houseparents and residential wardens		13	37.4	18.8	65.7	u
6145	Care workers and home carers		240	47.1	41.1	53.1	
6146	Senior care workers		9	:	:	:	
6147	Care escorts		3	:	:	:	
6148	Undertakers, mortuary and crematorium assistants		1	:	:	:	
6211	Sports and leisure assistants		3	:	:	:	
6212	Travel agents		2	:	:	:	
6214	Air travel assistants		1	:	:	:	
6215	Rail travel assistants		2	:	:	:	
6219	Leisure and travel service occupations n.e.c.		0	:	:	:	
6221	Hairdressers and barbers		18	44	24.2	72.2	u
6222	Beauticians and related occupations		8	:	:	:	
6231	Housekeepers and related occupations		14	26.4	14	45	u
6232	Caretakers		1	:	:	:	
6240	Cleaning and housekeeping managers and supervisors		11	26.1	12.8	47.1	u
7111	Sales and retail assistants		111	26.9	21.8	31.9	
7112	Retail cashiers and check-out operators		15	15.7	8.4	26.4	u
7113	Telephone salespersons		2	:	:	:	
7114	Pharmacy and other dispensing assistants		6	:	:	:	
7115	Vehicle and parts salespersons and advisers		1	:	:	:	
7121	Collector salespersons and credit agents		0	:	:	:	
7122	Debt, rent and other cash collectors		0	:	:	:	
7123	Roundspersons and van salespersons		0	:	:	:	
7124	Market and street traders and assistants		1	:	:	:	

7125	Merchandisers and window dressers	0	:	:	:	
7129	Sales related occupations n.e.c.	1	:	:	:	
7130	Sales supervisors	6	:	:	:	
7211	Call and contact centre occupations	5	:	:	:	
7213	Telephonists	2	:	:	:	
7214	Communication operators	2	:	:	:	
7215	Market research interviewers	0	:	:	:	
7219	Customer service occupations n.e.c.	17	12.6	7	20.8	u
7220	Customer service managers and supervisors	4	:	:	:	
8111	Food, drink and tobacco process operatives	11	28.2	14	50.6	u
8112	Glass and ceramics process operatives	1	:	:	:	
8113	Textile process operatives	6	:	:	:	
8114	Chemical and related process operatives	0	:	:	:	
8115	Rubber process operatives	0	:	:	:	
8116	Plastics process operatives	1	:	:	:	
8117	Metal making and treating process operatives	0	:	:	:	
8118	Electroplaters	0	:	:	:	
8119	Process operatives n.e.c.	0	:	:	:	
8121	Paper and wood machine operatives	0	:	:	:	
8122	Coal mine operatives	0	:	:	:	
8123	Quarry workers and related operatives	0	:	:	:	
8124	Energy plant operatives	0	:	:	:	
8125	Metal working machine operatives	1	:	:	:	
8126	Water and sewerage plant operatives	0	:	:	:	
8127	Printing machine assistants	1	:	:	:	
8129	Plant and machine operatives n.e.c.	4	:	:	:	
8131	Assemblers (electrical and electronic products)	3	:	:	:	

8132	Assemblers (vehicles and metal goods)		2	:	:	:	
8133	Routine inspectors and testers		1	:	:	:	
8134	Weighers, graders and sorters		0	:	:	:	
8135	Tyre, exhaust and windscreen fitters		0	:	:	:	
8137	Sewing machinists		14	64.8	34.6	110.1	u
8139	Assemblers and routine operatives n.e.c.		1	:	:	:	
8141	Scaffolders, stagers and riggers		0	:	:	:	
8142	Road construction operatives		0	:	:	:	
8143	Rail construction and maintenance operatives		0	:	:	:	
8149	Construction operatives n.e.c.		0	:	:	:	
8211	Large goods vehicle drivers		0	:	:	:	
8212	Van drivers		2	:	:	:	
8213	Bus and coach drivers		2	:	:	:	
8214	Taxi and cab drivers and chauffeurs		4	:	:	:	
8215	Driving instructors		1	:	:	:	
8221	Crane drivers		0	:	:	:	
8222	Fork-lift truck drivers		1	:	:	:	
8223	Agricultural machinery drivers		0	:	:	:	
8229	Mobile machine drivers and operatives n.e.c.		0	:	:	:	
8231	Train and tram drivers		0	:	:	:	
8232	Marine and waterways transport operatives		0	:	:	:	
8233	Air transport operatives		0	:	:	:	
8234	Rail transport operatives		0	:	:	:	
8239	Other drivers and transport operatives n.e.c.		1	:	:	:	
9111	Farm workers		1	:	:	:	

9112	Forestry workers		0	:	:	:	
9119	Fishing and other elementary agriculture occupations n.e.c.		0	:	:	:	
9120	Elementary construction occupations		0	:	:	:	
9132	Industrial cleaning process occupations		1	:	:	:	
9134	Packers, bottlers, canners and fillers		7	:	:	:	
9139	Elementary process plant occupations n.e.c.		25				p
9211	Postal workers, mail sorters, messengers and couriers		4	:	:	:	
9219	Elementary administration occupations n.e.c.		6	:	:	:	
9231	Window cleaners		1	:	:	:	
9232	Street cleaners		0	:	:	:	
9233	Cleaners and domestics		95	21.5	17.4	26.3	
9234	Launderers, dry cleaners and pressers		1	:	:	:	
9235	Refuse and salvage occupations		0	:	:	:	
9236	Vehicle valeters and cleaners		0	:	:	:	
9239	Elementary cleaning occupations n.e.c.		0	:	:	:	
9241	Security guards and related occupations		3	:	:	:	
9242	Parking and civil enforcement occupations		0	:	:	:	
9244	School midday and crossing patrol occupations		18	19.2	11.3	30.3	u
9249	Elementary security occupations n.e.c.		1	:	:	:	
9251	Shelf fillers		1	:	:	:	
9259	Elementary sales occupations n.e.c.		0	:	:	:	
9260	Elementary storage occupations		9	:	:	:	
9271	Hospital porters		0	:	:	:	
9272	Kitchen and catering assistants		36	18.8	13.1	26.1	
9273	Waiters and waitresses		8	:	:	:	

9274	Bar staff		9	:	:	:	
9275	Leisure and theme park attendants		1	:	:	:	
9279	Other elementary services occupations n.e.c.		0	:	:	:	

Statistics based on a small number of deaths (10 to 19) may not be reliable and are therefore marked by **'u**'.
Analysis is not provided when numbers of deaths are below 10 and have been marked **':'**
Age-standardised mortality rates were not calculated when the population for an individual occupation was found to be unreliable and have been marked as **‘p’**

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