**Comparison of reported relative risks for health care, transport, and food processing workers – methods, description of studies and references to accompany EPICOH conference slides**

**Introduction**

Risk of SARS-CoV-2 infection has been strongly linked to occupation, with specific occupational sectors such as health care, social care food production, and transport, particularly affected. To better understand the potential risks by occupational sector we investigated the reported risks of Covid-19 infection and mortality for employees in three employment sectors.

**Methods**

We performed a rapid review of observational studies reporting Covid-19 risk for employees in health care, social care, food manufacturing, and transport sectors. All studies published in the peer-review and pre-print literature between March 2020 and Oct 2021 were considered. This was a rapid literature review and synthesis of available evidence to guide current and future research rather than a systematic review performed according to a pre-specified protocol.

**Research questions**

**Primary**

Is there an increased risk of Covid-19 infection and/or mortality for workers in the Healthcare, Transport, Food Production, Social Care and Construction sectors compared to other workers or the general population?

**Secondary**

How do any increased risks vary by stage of pandemic?

How do any increased risks vary for subgroups within each sector?

**Inclusion criteria**

We included any study that met the following criteria in terms of population, exposure, comparator and outcome;

Population: Any population that includes adults of working age from any country. This could be from a longitudinal cohort (e.g. UK Biobank) or national routine population data (e.g. Norwegian population registry) or other type of study (e.g. cross sectional survey)

Exposure: Working within any of the following sectors; Healthcare, Transport and Food Production. We accepted any definition of these sectors as defined by study authors. Where a study reported data on multiple different job titles within at least one of the sectors of interest, we included it and looked for all relevant job titles. Where sector groupings were combined with other sectors (e.g. food production and agriculture) we included the study and recorded the definition of the grouping used.

Comparator: Any relevant comparator that allows an assessment as to whether or not working in the occupational sector elevates the risk of Covid-19 outcomes. This included other occupational groups, the general population, or the same occupational group prior to the Covid-19 pandemic.

Outcome: Covid-19 infection (using any degree of severity or definition as defined by study authors), death relating to Covid-19 (including measures of excess mortality), or hospitalisation due to Covid-19. We included only studies that reported the likelihood of a Covid-19 outcome relative to another occupational group using either an odds ratio, relative risk or hazard ratio (i.e. relative risks).

Type of study: Any observational study suitable in answering our research question (e.g. case-control study, cohort study, cross-sectional)

**Search strategy**

We searched the following sources for relevant studies

1. Studies listed in the UK SAGE report on ‘COVID-19 Risk by Occupation and Workplace’(1)
2. Studies collected in a repository of research relating to COVID-19 and occupation by researchers working on the PROTECT project
3. Studies included in systematic reviews of the risk of Covid-19 amongst health workers(2, 3)

**Data extraction**

For each included study, we extracted data on the design, definition of sector groupings, definition of the outcome measure, reference category and adjustment variables. We also extracted data on the number of participants per group and any relevant sector specific relative effect measure with either a 95% confidence interval and/or standard error. Where relative risks were adjusted for multiple different sets of adjustment factors we extracted the one that adjusted for the greatest number of variables. Where necessary, relative risks and confidence intervals were estimated from graphical displays. All plots were produced using the *metan* function in STATA 14.0. Where studies reported relative estimates separately for different sub-groups or time periods we extracted all relevant effect measures.

**Statistical Methods**

We present relative risks and 95% confidence intervals on a forest plot. Due to differences in outcome definition, comparator, population, stage of the pandemic and sector definition we did not combine results. We did not convert effect measures to the same scale (e.g. odds ratios to relative risks) due to uncertainties in estimates of control group risk. We produced a separate plot for each of the five sectors, and grouped results by type of outcome and summary measure to enable comparison and triangulation.

**Description of included studies**

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| --- | --- | --- | --- | --- | --- | --- |
| **Study**  **Data source** | **Type of publication**  **Period of outcome data collection** | **Design** | **Description of sectors included** | **Outcome measure** | **Reference category** | **Adjustment factors** |
| Nafilyan 2021(4)  UK mortality data | Preprint  January 24 2020 to  December 28 2020 | Retrospective cohort of 14,295,900 people aged 40-64 years who were alive on 24 January 2020, living in private households in England in 2019, were employed in 2011, and completed the 2011 census. | 4 digit SOC codes used to derive occupational groups  **Healthcare-** Healthcare professionals, healthcare associates  **Food production-** meat packers  **Transport-** Taxi drivers, van drivers, bus drivers, other transport workers | Confirmed or suspected COVID-19 death as derived from the medical certificate of cause of death. | Non-essential workers | Region, population density,  urban/rural, ethnicity, socio-economic characteristics,  household size, multigenerational household, household with children), body mass index, chronic kidney  disease, learning disability, cancer or immunosuppression, other conditions |
| Billingsley 2020  Sweden Mortality | Published Oct 2021  March 5 2020 to Feb 23 2021 | Retrospective cohort of 4 620 395; individuals using Swedish administrative and population registers. Restricted to participants aged 20-66 with occupation recorded in Dec 2018. | Swedish Standard Classification of Occupations (SSYK 2012) used to derive occupational groups  **Care** workers -  Includes mixture of workers in healthcare and social care  **Food production**-  Meat packers  **Transport-**  Taxi and bus drivers | Death associated with COVID-19 | IT, Economics and admin | Age, sex, country of birth, living in Stockholm, highest achieved educational degree, and individual net income. |
| Beale 2021(5)  UK Virus Watch | Preprint  February 1 2021 to April 28 2021 | Prospective cohort of 3761 adults (≥18) tested for SARS-CoV-2 antinucleocapsid antibodies 1 and responded to a questionnaire about work during the pandemic as part of the Virus Watch study. | SOC-2020 codes.  **Healthcare-** Healthcare  **Transport-**  Transport & Mobile Machine operatives | SARS-CoV-2 infection | Other professionals and associate occupations (professional and associate professional occupations excluding healthcare, teaching, and social care/community protective services) | Age, sex, geographic region, deprivation based on annual household income. |
| Hiironen 2020(6)  Public Health England | Preprint  August 2020 to October 2020 | Three retrospective, frequency-matched case-control studies using case data from NHS Test and Trace and Controls through Market Research Panels. Total of 12,338 recruited, 6000 of which were cases. Restricted to adults over 18 years. | Unclear  **Healthcare-** Working in healthcare – including hospitals, GPs, drop-in clinics and other healthcare settings  **Food production-** Working in food production – including farming and agriculture, any food manufacturing and food production  **Transport-** Working in public transport including underground, trains, buses, and logistics and storage | SARS-CoV-2 infection | Unclear | age, sex, ethnicity, socioeconomic deprivation (using index for multiple deprivation (IMD)), geographical region, and non-work community and leisure activities |
| Iverson 2020 (7)  Danish cohort | Published Aug 2020  April 15 2020 to April 23 2020 | Observational cohort study, screening health-care workers in the Capital Region of Denmark. A total of 28792 participants provided antibody results. | Unclear  **Healthcare-** | positive antibody test for SARS-CoV-2 | Blood donors | Unclear |
| Magnusson 2021(8, 9)  Norwegian registry | Published Oct 2021  First wave (Feb 26 2020 to July 17 2020)  Second wave (July 18 2020 to December 18 2020) | Data from the BEREDT C19 register which included all Norwegian residents in their working age, here defined as age between 20 and 70 years on January 1st 2020 (3,559,694 included participants). | Standard Classification of Occupations (ISCO-08 using 4-digit codes, i.e. corresponding to the Norwegian STYRK-08)  **Healthcare-**  Physician  **Transport-**  Bus and tram driver  **Note: all data estimated from graphs** | Positive PCR test | Everyone else aged 20-70 years | Age, sex, continent of birth, testing |
| Mudumbudzi 2020(10)  UK Biobank | Published December 2020  March 16 2020 to July 26 2020 | Prospective cohort study. UK Biobank data linked with SARS-CoV-2 test results from Public Health England. Sample included 120,075 working participants aged 49 to 64 years. | Three types of definitions: Broad occupational groups of essential workers, detailed occupational groups of essential workers and SOC 2000 major occupation group.  **Healthcare-**  Healthcare professionals  **Social Care-**  Social care workers  **Food production-**  Food workers  **Transport-**  Transport workers | Severe COVID-19 defined by positive test result in a hospital setting or death with primary/ contributory cause. | Non-essential workers | Model adjusted for age group, sex, ethnicity & country of birth |
| Shah 2020 (11)  NHS Scotland | Published September 2020  March 1 2020 to June 6 2020 | Healthcare workers aged 18-65 years, their households, and other members of the general population. Cohort study comprising of 158445 healthcare workers and 229905 household members. | Occupation was obtained from the healthcare worker database.  **Healthcare-**  Patient facing and non-patient facing | COVID-19 hospital admission | General population | Age, sex, socioeconomic deprivation, ethnicity, comorbidity |
| Nguyen 2020(12)  UK and USA COVID Zoe data | Published July 2020  March 24 2020 to April 23 2020 | Prospective, observational cohort study using the COVID Symptom Study app. Study comprised of 2,135,190 participants. | Occupation either frontline health-care or general pop.  **Healthcare**- Frontline healthcare workers | COVID-19 infection | General population | All models were stratified by age, date and country. Multivariate risk factor models were adjusted for sex, history of diabetes, heart disease, lung disease, kidney disease, smoking, ethnicity and BMI. |
| Rowlands 2021(13)  UK Biobank | Published April 2021  March 16 2020 to August 31 2020 | Prospective, observational cohort study using the UK Biobank. Study comprised of 235,685 participants | Occupation from baseline taken 2006-2010  **Healthcare**- healthcare workers | Severe COVID-19 defined as a composite of a positive test result for SARS-CoV-2 from a hospital setting or death related to the disease | Workers who worked neither in health care or on shifts | BMI, sex, ethnicity, deprivation, cancer, co-morbidities and smoking status |

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