PROTECT
A COVID-19 National Core Study

Virus Watch Study Findings (Report 2)

Prepared for
The PROTECT COVID-19 National Core Study on transmission and environment

PROTECT (2022)
National Core Study Report

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The PROTECT COVID-19 National Core Study on transmission and environment is a UK-wide research programme improving our understanding of how SARS-CoV-2 (the virus that causes COVID-19) is transmitted from person to person, and how this varies in different settings and environments. This improved understanding is enabling more effective measures to reduce transmission – saving lives and getting society back towards 'normal'.

This report contains findings from Virus Watch analyses conducted within the remit of PROTECT between September 2021 – March 2022. As part of the PROTECT National Core Study, analyses of data from the Virus Watch cohort aim to understand drivers of occupational COVID-19 risk and inform work-related mitigations. The study addresses a series of research questions related to COVID-19 and the workplace.

Where the questions have already been satisfactorily answered in previous research, readers are directed to the relevant publications. Remaining questions were responded to in a variety of research methods. Researchers concluded that both the workplace and public transport – often used for commuting to and from work – as a significant location of COVID-19 transmission. They also identified substantial differences in occupational risk of SARS-CoV-2 infection beyond the impact of non-occupational demographic, health-related, and behavioural factors, with workers in healthcare, teaching, indoor trade and process/plant, and leisure and personal service occupations at elevated risk.

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Virus Watch Study Findings (Report 2)

Sarah Beale[1, 2], Robert Aldridge[2], and Andrew Hayward[1]

1 UCL Institute of Epidemiology and Health Care
1-19 Torrington Place, London, WC1E 7HB

2 UCL Institute of Health Informatics
222 Euston Rd, London, NW1 2DA

On behalf of the Virus Watch Study Team

PROTECT National Core Study (Theme 3): Virus Watch Study Findings (Report 2)

As part of the PROTECT National Core Study, analyses of data from the Virus Watch cohort aim to understand drivers of occupational COVID-19 risk and inform work-related mitigations. This document contains findings from Virus Watch analyses conducted within the remit of PROTECT between September 2021 – March 2022. Where findings are available as a preprint, we present a brief overview of the main findings and provide details of the preprint, in order to prevent duplication of results. Where findings have not yet been posted as a pre-print, we present detail in this document. Studies completed during September – December 2021 were presented in detail in our December 2021 interim report and are briefly reviewed here. During the study period, we have addressed the following research questions as planned:

A. *How much do socio-demographic circumstances explain occupational variations in COVID-19 risk?*

Update: This work was completed and described in detail in the December 2021 interim report. We identified systematic differences in SARS-CoV-2 infection risk across occupations after controlling for demographic, health-related, and non-work behavioural factors, particularly during the first and second waves of the COVID-19 pandemic. At-risk groups included nurses, carers, teachers, and warehouse/process/plant workers. Detailed findings have been posted as a preprint on MedRxiv:

> Beale S, Hoskins S, Byrne T, Fong EW, Fragaszy E, Geismar C, Kovar J, Navaratnam AM, Nguyen V, Patel P, Yavlinsky A, Johnson, AM, Aldridge, RW, Hayward, A. Differential Risk of SARS-CoV-2 Infection by Occupation: Evidence from the Virus Watch prospective cohort study in England and Wales. medRxiv. 2021.12.15. https://doi.org/10.1101/2021.12.14.21267460

B. *What characteristics of workplace contact best explain occupational differences in risk?*

Update: This work was completed and described in detail in the December 2021 interim report. We found variation in workplace contact patterns across occupations and time. Healthcare and education workers consistently demonstrated multiple elements of contact-related risk. Across all occupations, space sharing and close contact increased and usage of

face coverings decreased over time. Detailed findings have been accepted for publication in the Lancet Regional Health – Europe:

> Beale S, Hoskins SJ, Byrne TE, Fong EW, Fragaszy E, Geismar C, Kovar J, Navaratnam AM, Nguyen V, Patel P, Yavlinsky A, Johnson, AM, Aldridge, RW, Hayward, A. 2022. Workplace Contact Patterns in England during the COVID-19 Pandemic: Analysis of the Virus Watch prospective cohort study. The Lancet Regional Health – Europe, forthcoming.

C. *Does the recently developed COVID-19 Job Exposure Matrix accurately predict risk and can it be improved?*

Update: The Job Exposure Matrix (JEM) has been linked to data from Virus Watch and ONS Coronavirus Infection survey, to triangulate findings from these two datasets. We found that the majority of JEM dimensions predict infection risk early in the pandemic, with good agreement across both datasets. Full findings will be circulated separately by PROTECT Theme 3.

D. *Does public transport increase risk after accounting for occupational and sociodemographic risk?*

Update: We investigated the risk associated with using public transport using logistic regression adjusted for sociodemographic factors, vaccination status, workplace attendance, visiting retail venues, and other non-household contacts. Based on data from 10475 adult participants including 874 infections acquired outside the household during the second wave of the COVID-19 pandemic, we found that using public transport was associated with 82% higher odds of SARS-CoV-2 infection (adjusted odds ratio 1.82, 95% confidence interval 1.49–2.23) than not using public transport during the same period. Based on our regression estimates, we estimated that approximately 12.42% of SARS-CoV-2 infections were attributable to public transport use. Detailed findings have been posted as a preprint on MedRxiv:

> Hoskins SJ, Beale S, Aldridge RW, Navaratnam AMD, Smith C, French CE, Yavlinsky A, Nguyen V, Byrne T, Kovar J, Fragaszy E, Fong WLA, Geismar C, Patel P, Johnson A & Hayward AC. Relative contribution of leaving home for work or education, transport, shopping and other activities on risk of acquiring COVID-19 infection outside the household in the second wave of the pandemic in England and Wales. medRxiv. 2021.12.08. https://doi.org/10.1101/2021.12.08.21267458

E. *Do different occupational approaches to income loss affect presenteeism when symptomatic or following contact?*

Update: In the pre-print listed below, we have investigated access to paid sick leave by occupation, based on a survey sent to adults within the Virus Watch cohort in February 2021. We found that access to paid sick leave varied substantially across occupational groups, with the lowest access to sick pay amongst workers in outdoor trades (60% lacking sick pay), leisure and personal service (41%), transport and mobile machine (39%), and indoor trades and process/plant (37%) occupations. After adjusting for age, sex, region, ethnicity, and household income, we found that all of these groups had substantially lower access to sick pay than managerial occupations (19% lacking sick pay), with outdoor trades having 5x greater odds of lacking access to sick pay and other groups above at least 2x greater odds. Compared to other occupations, these at-risk groups were among the most likely to attend their workplace in-person (see Section B) and – for indoor trades and process/plant and leisure and personal service occupations – demonstrated elevated infection risk (see Section A). Detailed findings have been posted as a pre-print on MedRxiv and further investigations into presenteeism are underway:

> Patel P, Beale S, Nguyen V, Braithwaite I, Byrne TE, Fong WL, Fragaszy E, Geismar C, Hoskins S, Navaratnam AM, Shrotri M. Inequalities in access to paid sick leave among workers in England and Wales. medRxiv. 2022.01.21. https://doi.org/10.1101/2022.01.30.22270112

F. *How are workplace mitigation measures promoted, perceived and adhered to?*

Update: To address this research question, we developed a monthly survey investigating the implementation and perception of different workplace mitigation methods during key phases of pandemic-related national legislation since January 2021 (third national lockdown). We investigated responses to this questionnaire by occupational group, specifically aiming to:

1. To investigate how implementation and adherence to key work-related mitigations varied by occupation and, where relevant, by pandemic phase.
2. To investigate which COVID-19 mitigations methods were perceived as reasonable and worthwhile by workers in different occupations during the third national lockdown (January – March 2021) and around the removal of pandemic-related restrictions in February 2022.

Methods

Survey

We developed a monthly survey in collaboration with subject expert colleagues in infection disease epidemiology and occupational medicine from the Virus Watch Collaborative and PROTECT Theme 3, which drew from items in the Job Exposure Matrix (please see https://doi.org/10.1093/ije/dyab168.678) as well as key targets of national recommendations and regulations. The survey addressed the implementation and participant perceptions of key mitigation methods in the workplace since January 2021 (third national lockdown) up to the current phase of the pandemic. The survey was sent to participants on 22nd February 2022.

The first section of the survey comprised items regarding how key Covid-related mitigation methods were implemented and adhered to in the workplace. The items addressed the following mitigation methods: remote working, social distancing, ventilation, usage of face coverings, usage of rapid lateral flow tests (LFTs), surface cleaning, hand hygiene, and COVID-19 vaccination. Where items were liable to change substantially over time and were applicable across multiple pandemic phases, they were asked separately for the following periods: late December 2020 – March 2021 (third lockdown), July – December 2021 (most restrictions relaxed), Late December 2021 – January 2022 (Omicron/Phase 2 restrictions), or late February 2022 (restrictions lifted).

In the second section of the survey, participants rated how reasonable and worthwhile they believed key mitigation methods to be in their workplace during the third national lockdown (most stringent period of restrictions covered by the survey) and the current phase of the pandemic at the time of the survey (late February 2022).

Participants included in the analyses described below were 5279 survey respondents who indicated that they were employed or self-employed and not on full-time furlough during at least part of the survey period. If participants' employment status changed during the survey period, only relevant pandemic phases were displayed for questions that were asked separately over time.

We present the proportion of participants who endorsed each response by occupation for the survey items described below to investigate between-occupation differences; we did not include NA responses in the figures here. Occupational groups were defined based on the groupings outlined in earlier studies. We also performed logistic regression (ordinal or binomial as appropriate for the outcome) to investigate between-occupational differences in responses. For items measured across multiple time periods, we accounted for within-

individual clustering and investigated whether responses varied over time periods and whether there was any interaction between occupational group and time using Wald tests. We found interactions for all time-varying outcomes (p<0.001) except for frequency of hand hygiene (p=0.09) and surface cleaning (p=0.17), which demonstrated main effects for occupation and time. These interactions indicate that the frequency of the outcomes changed differently over time for different occupations. For models without an effect of time, we found between occupational differences (p<0.05) for all outcomes. We report trends in responses by time and occupation below.

Findings

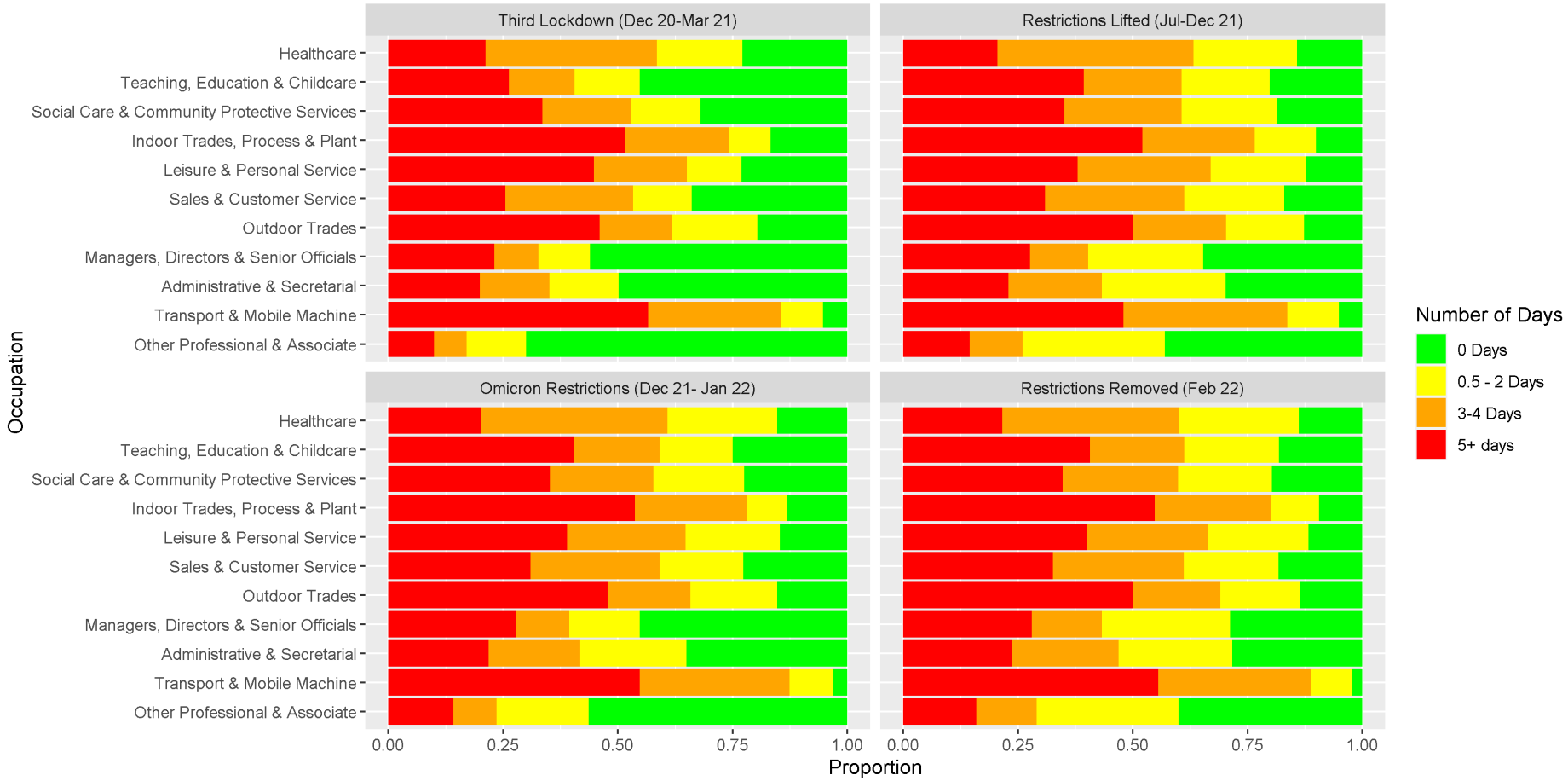
Remote versus In-Person Working

Across all participants, 48% reported working fully remotely during the third national lockdown and 23% attended their workplace 5+ days per week. In subsequent periods, 26-35% of participants (depending on period) reported working fully remotely and 27-28% working 5+ days per week in-person.

The average number of in-person workdays changed differentially over time between occupations (Figure F1). Similar to findings in Section B, trade and transport occupations had persistently high in-person workplace attendance across time, and professional occupations had low attendance. Across most other groups, there was a trend over time away from fully remote working.

All subsequent questions were only asked to participants who indicated that they did not work fully remotely in a given period.

Figure F1. Average Number of Days Worked Outside the Home, by Occupation and Time Period

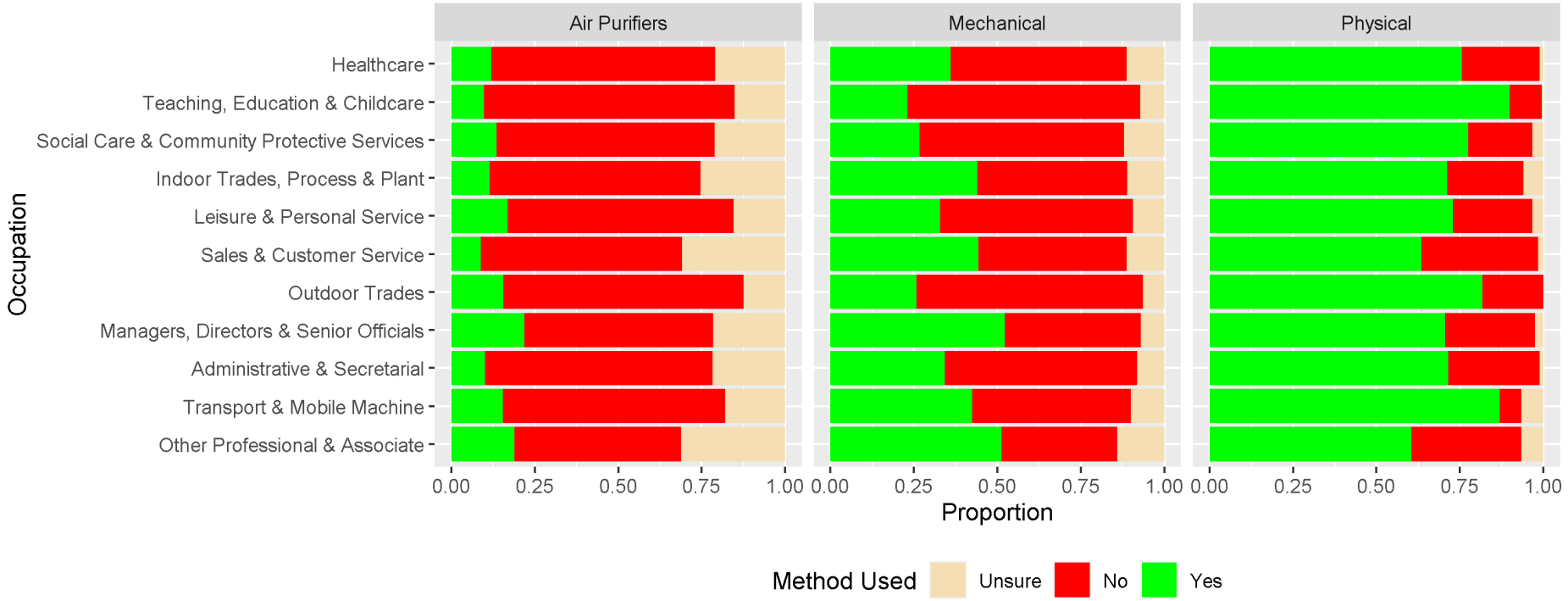


Ventilation

We asked participants who attended their workplace in person at any point whether their workplace used physical ventilation (e.g. doors and windows opened where possible), mechanical ventilation, or air purifiers (inc. HEPA filters). Physical ventilation was the most commonly reported method overall (68%), followed by mechanical ventilation (37%), and air purifiers (13%).

There were substantial differences between occupations beyond those expected by chance for all three outcomes (Figure F2). Over 50% of workers reported that their workplaces used physical ventilation across occupations, with the highest usage in teaching and transport occupations (>90%) and the lowest in professional occupations (65%). Mechanical ventilation was much less commonly reported overall; only for managerial and other professional occupations did over 50% of workers report its usage. Air purifiers were even less commonly reported, ranging from 12% in teaching, education and childcare occupations to 28% in managerial occupations.

Figure F2. Ventilation Methods Used in the Workplace



Workspace Sharing and Social Distancing

Workers who attended their workplace in person were asked the number of people with whom they shared their workspace across an average day. Across time periods, the most commonly reported number of work-related contacts was 1-9 people (47-52%), followed by 10-30 people (20-22%), then 30+ people (16-19%), and 0 people (8-12%). Results by occupation are reported in Figure F3. Teaching and sales occupations had persistently high numbers of workplace contacts, and outdoor trades persistently low. For many groups, there was a notable increase in the number of workplace contacts after restrictions were lifted in July 2021 which persisted in subsequent periods.

Across periods, participants most often reported that contact was 'mostly' (30-37%) or 'sometimes' (25-28%) socially distanced, followed by 'rarely' (16-22%). Similar proportions reported that contact was 'always' (9-13%) or 'never' (9-12%) socially distanced. Healthcare, teaching, and social care workers had the highest levels of non-socially-distanced contact during the third national lockdown, but this increased in many other occupations including transport and sales workers following the removal of restrictions in July 2021 (Figure F4). Relatively few workers across occupations reported always having socially distanced contact, even during the third national lockdown.

We asked workers whether their workplaces ever used a range of methods to promote social distancing and reduce contact-related risk. Across all respondents, methods were reported by frequency as follows: using posters/reminders (70%), limiting occupancy (68%), reconfiguring workspace to promote social distancing (64%), one-way systems (54%), screens/barriers (47%), workplace bubbles (39%), staggering breaks (35%), and staggering shifts (18%). We found substantial differences by occupation across outcomes (Figure F5). Across most occupational groups, environmental adaptations and reminders were more common than staggering shifts or breaks or using workplace bubbles and these strategies were reported by >50% of workers, excluding those in outdoor trades. With the exception of a relatively high usage of workplace bubbles, the proportion of workers reporting most risk-reduction strategies was lower in outdoor trade occupations.

Figure F3. Number of People with Whom Shared Workspace across Average Day

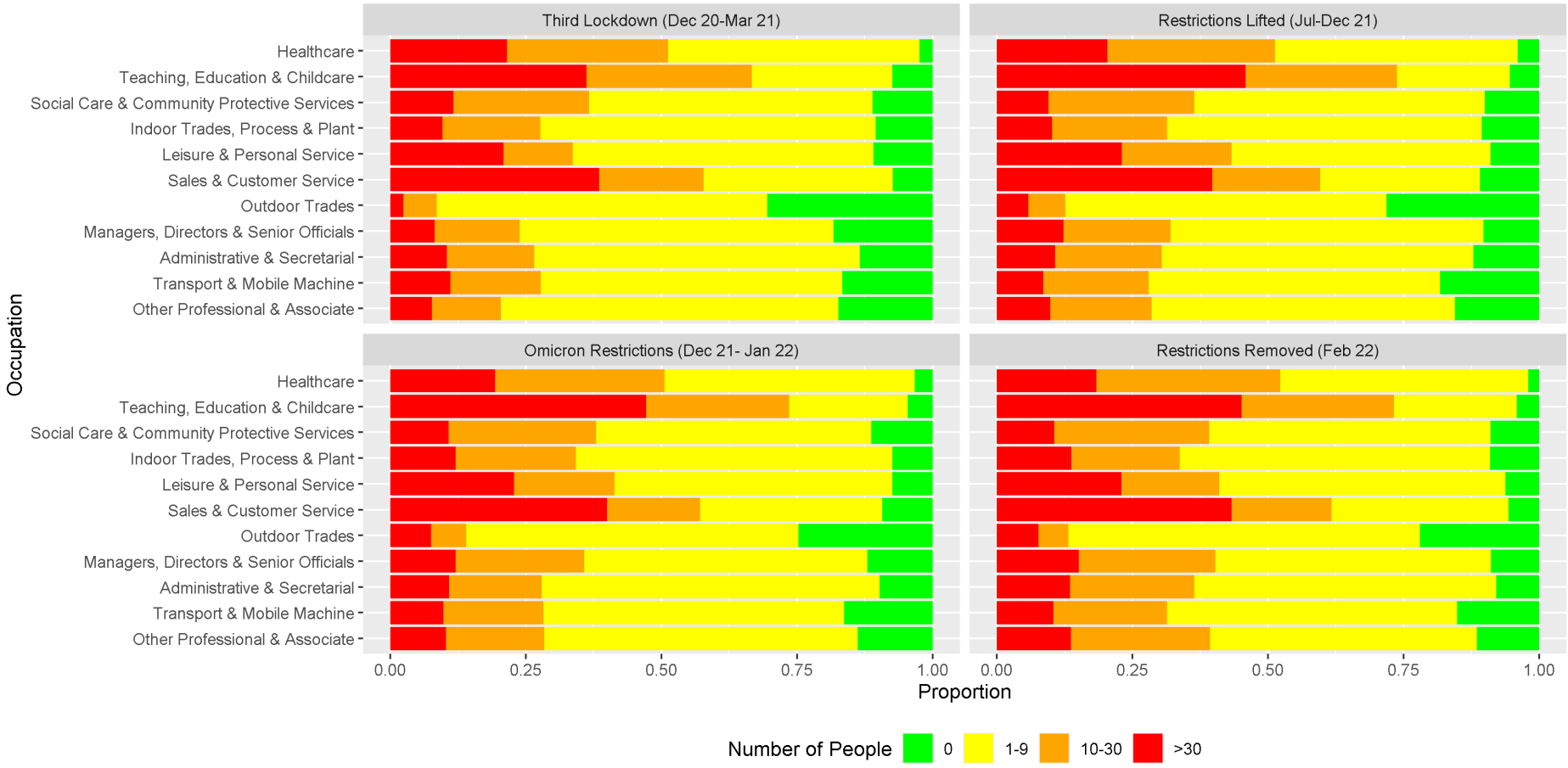


Figure F4. Extent to Which Social Distance Could be Maintained at Work

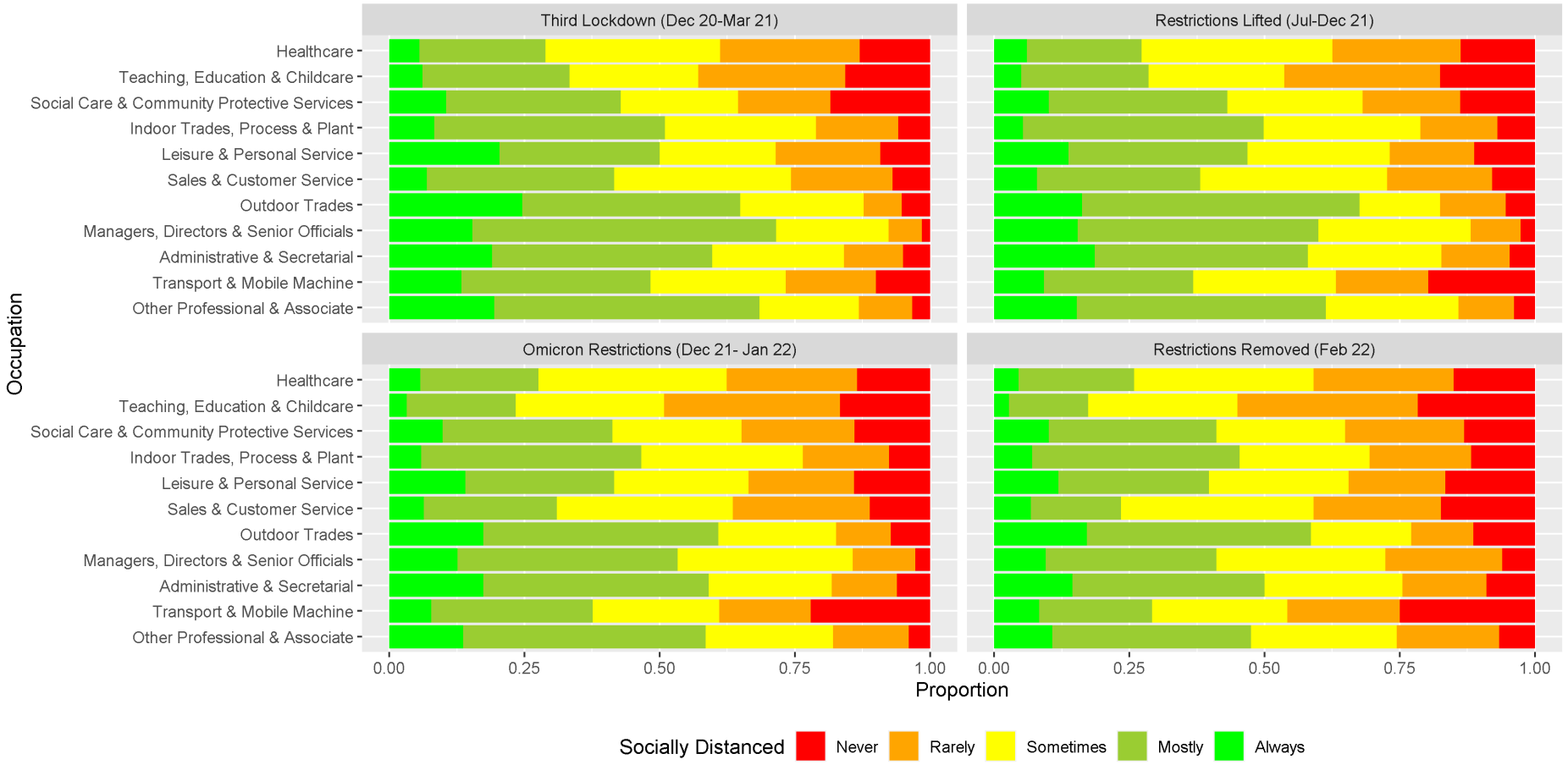
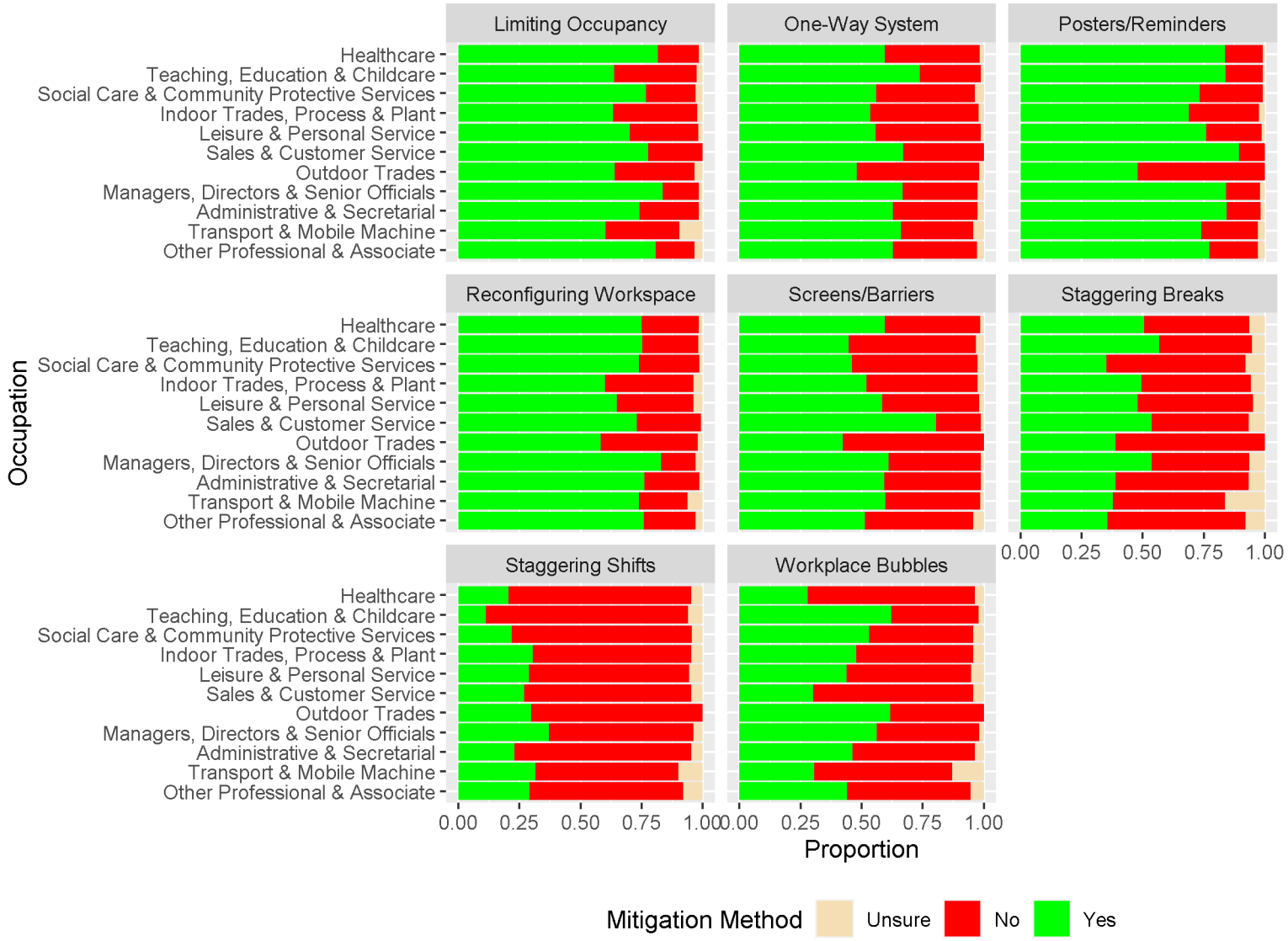


Figure F5. Strategies to Reduce Contact-Related Risk in the Workplace



Hand and Surface Hygiene

Across all respondents, 30% reported never or infrequently touching shared surfaces or objects at work, 42% frequently, and 27% very frequently, with about 1% unsure. Surface hygiene was relatively consistent by time period, with 20-25% reported that shared surfaces at their workplace were never or infrequently disinfected, 37-39% reported that they were sometimes disinfected, and 23-32% very frequently disinfected. The lowest estimate for very frequent disinfection occurred in February 2022 and the highest during the third national lockdown. 11-14% of participants were unsure. Differences in hand hygiene were more marked across periods. During the third national lockdown, 35% reported washing their hands 0-5 times per workday, 32% 6-10 times, and 33% >10 times. During the subsequent periods, 42-49% reported 0-5 times, 30-33% 6-10 times, and 21-26% >10 times.

Occupations differed in the frequency that they reported touching surfaces or items shared with other people (Figure F6). Teaching, sales, healthcare and service occupations reported the highest frequency of touching shared surfaces/objects (40-45% ‘very frequently’) and outdoor trades the lowest (58% ‘never’). Healthcare workers washed their hands most frequently and outdoor trades least frequently at all time points (Figure 7a). Proportions of workers washing their hands >10 times a day decreased over time across most occupations. Trade occupations had lower frequency of surface cleaning compared to most other groups, and across occupations levels of surface cleaning appeared to decrease over time (Figure 7b).

Figure F6. Frequency of Touching Shared Surfaces or Objects at Work

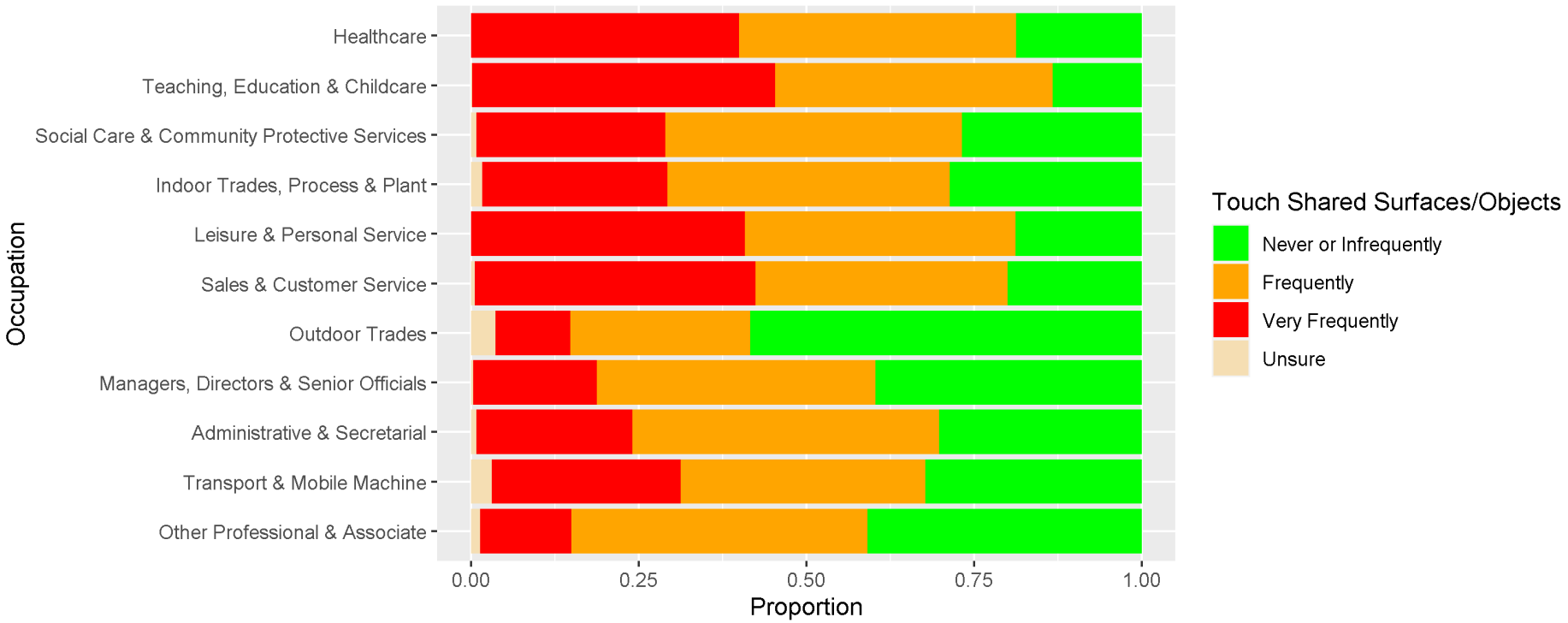


Figure F7a. Frequency of Handwashing at Work

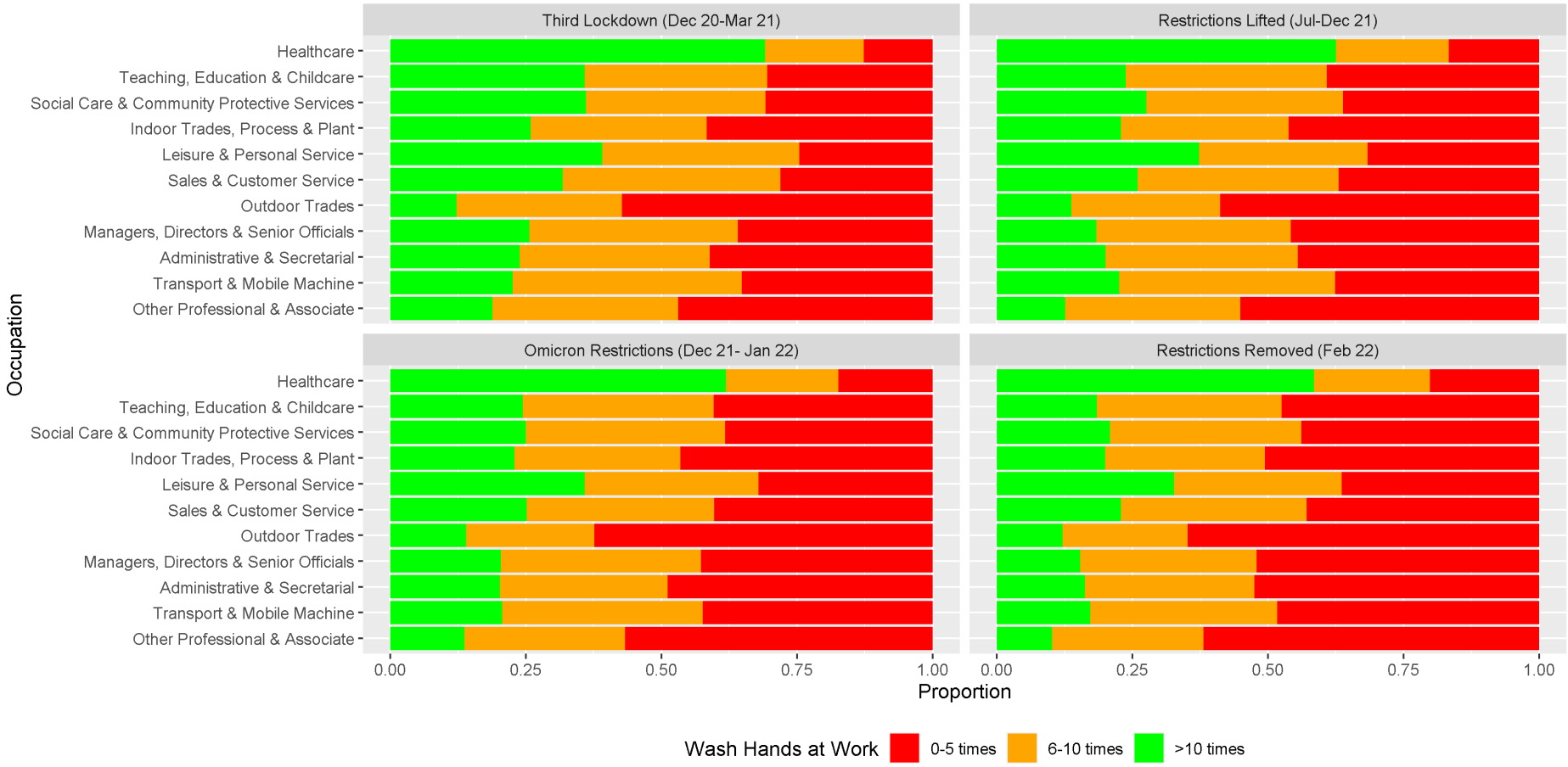
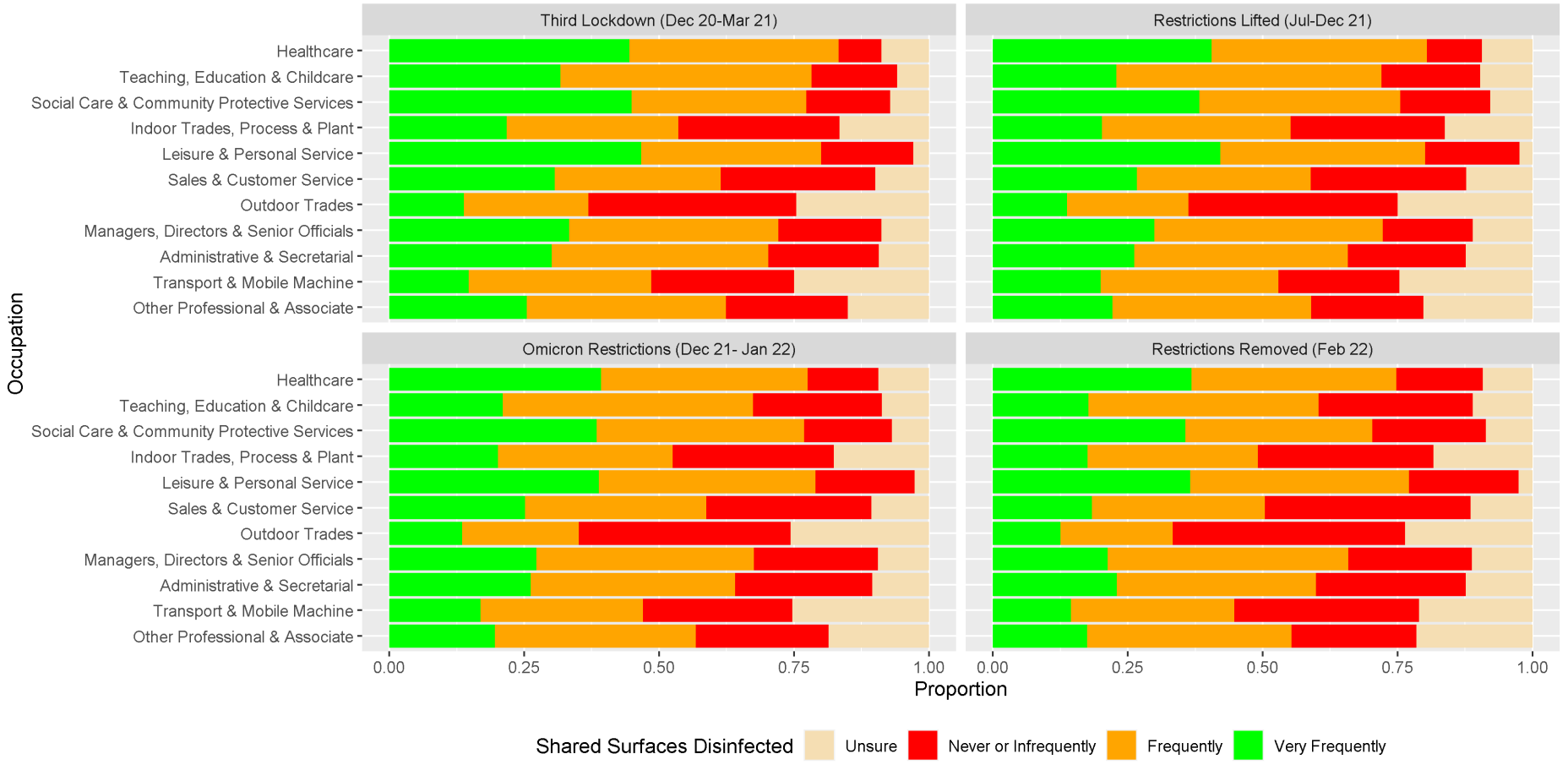


Figure F7b. Frequency of Disinfection of Shared Surfaces/Objects



Face Coverings

Across all respondents, differences emerged in the usage of face coverings over time. During the three earliest time periods, 37-43% of participants self-reported ‘always’ wearing a face covering, 26-27% mostly, 16-21% sometimes, 7-9% rarely, and 8-9% never. In late February 2022, 27% reported ‘always’ wearing a face covering, 20% mostly, 24% sometimes, 14% rarely, and 16% never. Similar patterns were observed for usage of face coverings by other people (e.g. colleagues, customers, clients, etc.), although fewer participants endorsed that others ‘always’ wore face coverings (25-32% in the initial three periods and 13% in February 2022) with responses distributed amongst the other categories.

There was a decrease in the frequency of self-reported face covering usage at work between the third national lockdown and current period (Fig F8a), though this declined less markedly for healthcare workers who had persistently high usage, and for outdoor trades who had persistently low usage. The proportion who self-reported never wearing a mask remained relatively low for many occupational groups. Patterns were similar for reported usage of face coverings by other people, although workers reported lower levels of usage by others than by themselves at all timepoints and the decrease over time was more marked (Figure F8b).

Across all respondents, 71% reported that their workplace provided face coverings for workers at some point during the study period, and 54% reported that their workplace also provided face coverings for others (customers, clients, patients etc.). With the exception of outdoor trades (44%), over 50% of workers in all occupational groups reported that their workplaces provided face coverings for workers at some point during the study period (Figure F9). Healthcare had the highest level of provision at 94%. Across occupations, face coverings tended to be provided less frequently to other people attending the workspace (range 31% in outdoor trades to 84% in healthcare).

Figure F8a. Usage of Face Coverings in the Workplace – Workers Self-Report

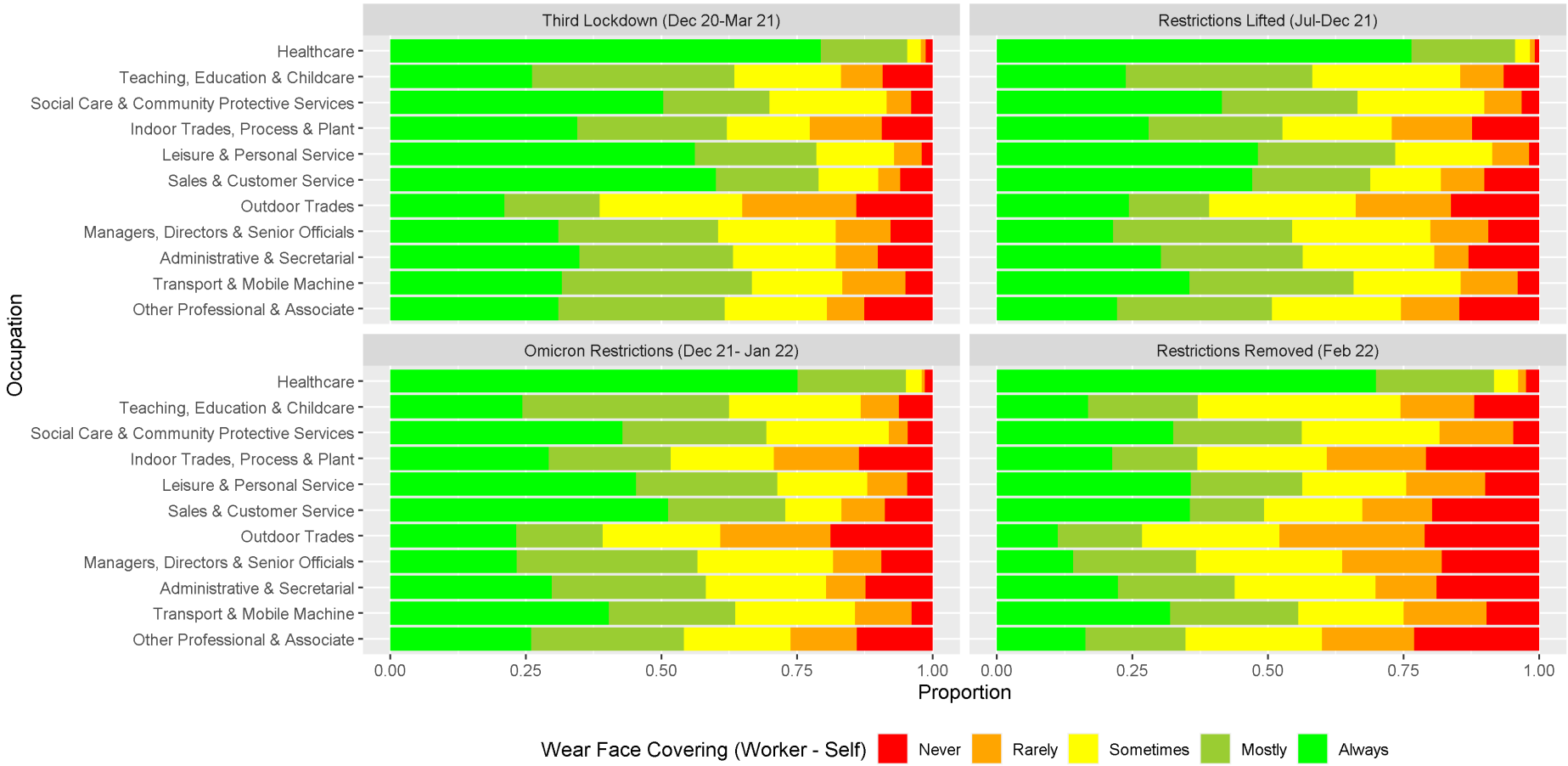
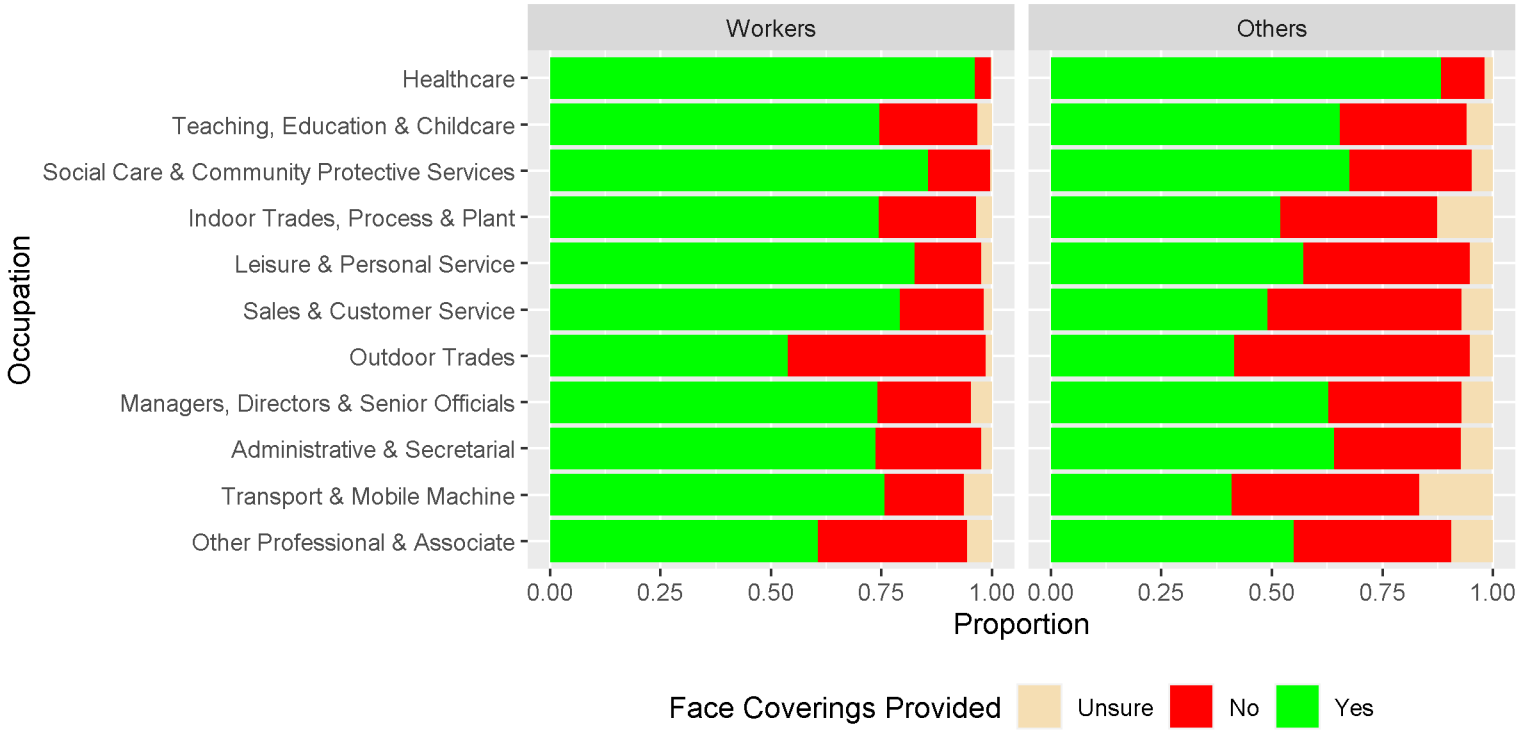


Figure F8b. Usage of Face Coverings in the Workplace - Others

Figure F9. Face Coverings Provided for People Attending the Worksite



Breaks and Work-Related Social Activities

Across occupations, respondents perceived that workers took fewer precautions during breaks over time, particularly in the current period compared to the third national lockdown. During the third national lockdown, 24% of participants believed that workers took fewer precautions during breaks. This rose to 33-34% in the subsequent two periods, and increased to 47% in February 2022. This increase over time was more marked for teaching and sales occupations (Figure F10).

Workers also reported increasing proportions of work-related social gatherings/parties across time, particularly in the current phase of the pandemic. During the third national lockdown, 84% of participants reported that work-related social gatherings/parties were never organised or allowed and only 2% reported that these occurred sometimes or frequently. In February 2022, 53% reported that these never occurred and 15% reported that they occurred sometimes or frequently. This increase over time was marked in February 2022 for managerial and other professional occupations (Figure F11), which tend to be office-based. Social gatherings were defined here as social events outside of working hours organised by the workplace, or social events on work premises including food and/or drinks (i.e. parties).

Figure F10. Fewer Precautions Taken during Breaks Compared to Active Work?

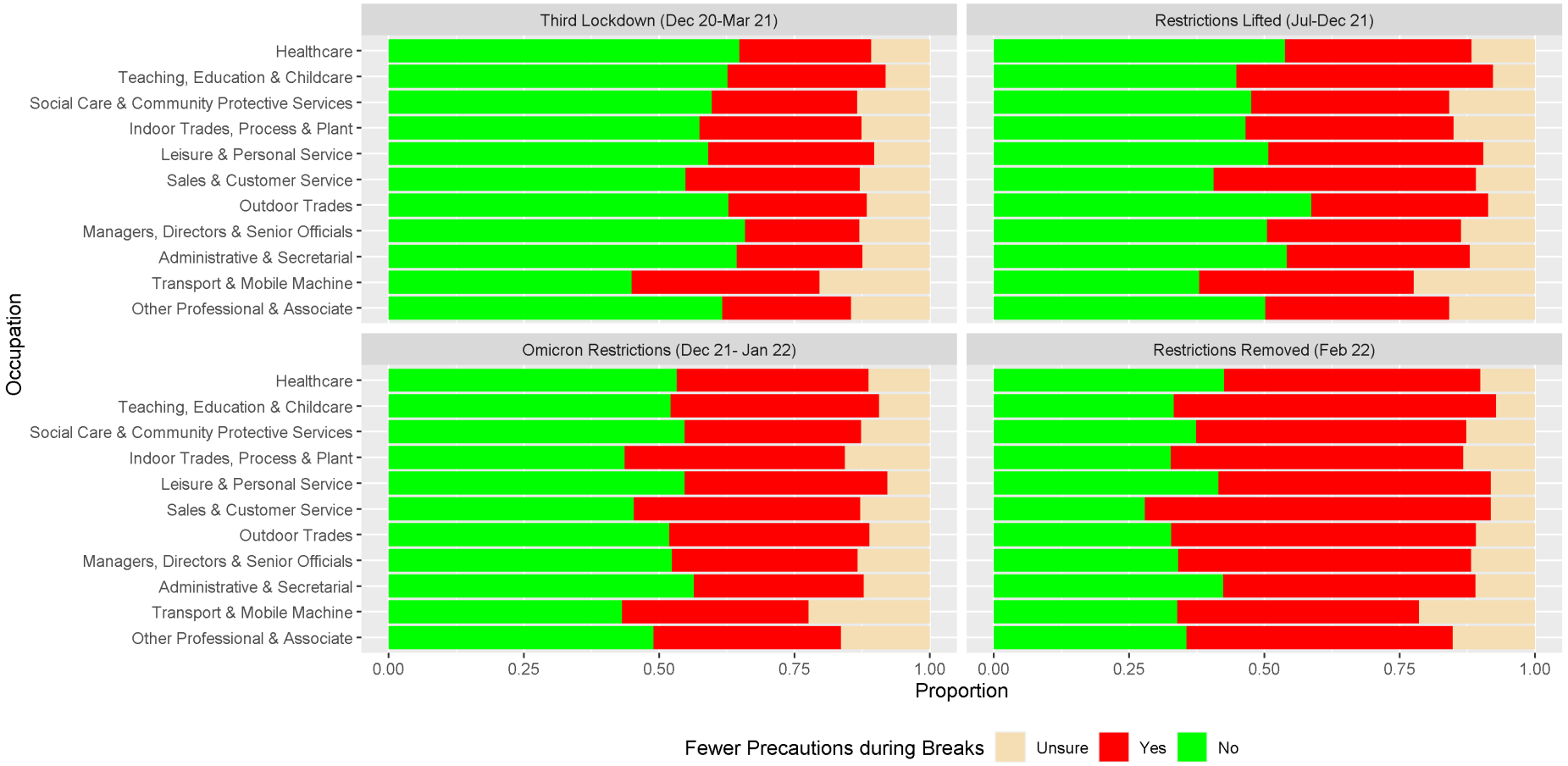
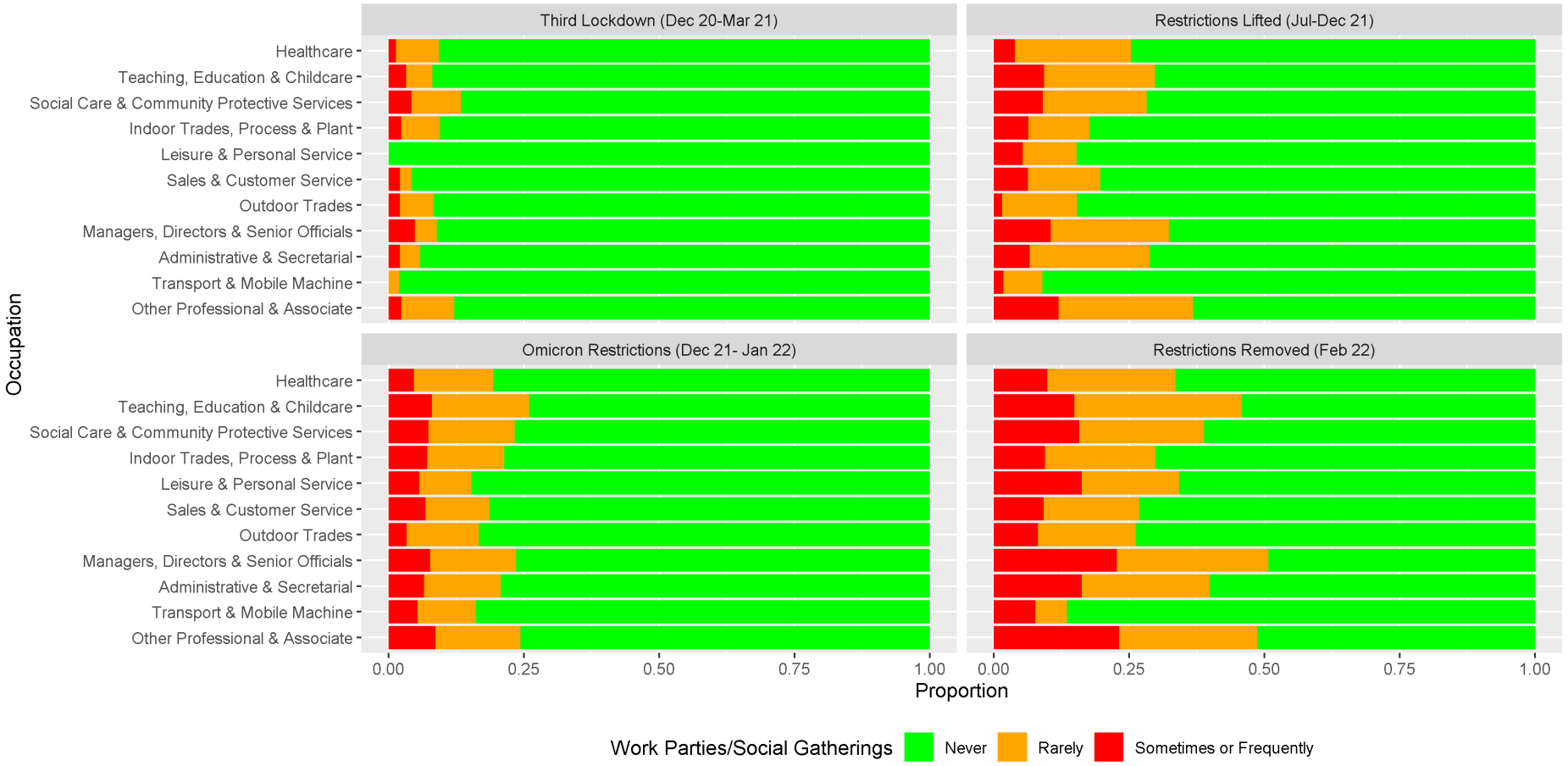


Figure F11. Frequency of Work-Related Social Gatherings/Parties



Lateral Flow Testing

Please see Section G below for detailed results regarding lateral flow testing.

COVID-19 Vaccination

We asked participants whether their workplace ever employed several strategies to promote COVID-19 vaccination. Across all respondents, time off work was the most commonly reported method (63%), followed by promotional materials (43%), mandatory vaccination (11%), and vouchers or incentives (3%). Differences emerged in strategies across occupations, most notably that health and social care workers more commonly reported vaccination mandates in their workplace compared to other groups (Figure F12).

Figure F12. Methods of Promoting COVID-19 Vaccination

Perception of Workplace Mitigation Methods

Respondents agreed or strongly agreed with the following measures in descending order: regular testing (88% during third national lockdown versus 84% in February 2022), requiring face coverings for workers (88% versus 84%), proof of vaccination for workers (86% versus 74%), ventilation (83% versus 62%), requiring face coverings for non-workers attending the worksite (83% versus 62%), screens/barriers (79% versus 60%), working from home (76% versus 58%), surface cleaning (68% versus 54%), proof of vaccination for non-workers attending the worksite (e.g., customers, clients, patients) (62% versus 55%), and social distancing (44% versus 39%). With the exception of social distancing, over 50% of respondents agreed or strongly agreed with each measure, with similar patterns of agreement across measures between both time periods and lower overall agreement in February 2022. The decline was markedly less substantial for regular testing and requiring face coverings for workers than for other measures.

The patterns were relatively consistent across occupational groups (Figure F13a and b). Reporting that mitigation methods were not possible/relevant varied across occupational groups in line with likely roles (e.g. difficulties with physical distancing in teaching and service occupations) and was relatively high across mitigation methods for trade occupations.

Figure F13a. Perceptions of Mitigation Methods in the Third National Lockdown (January-March 2021)

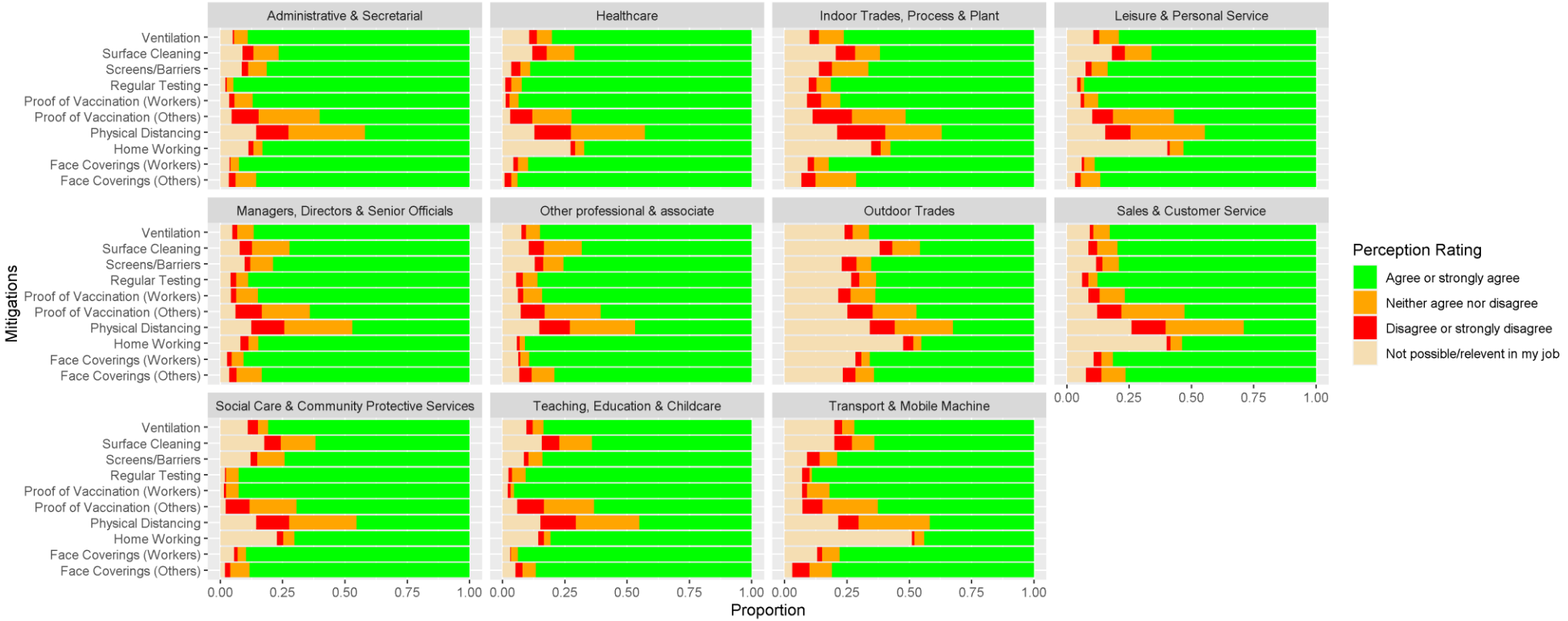
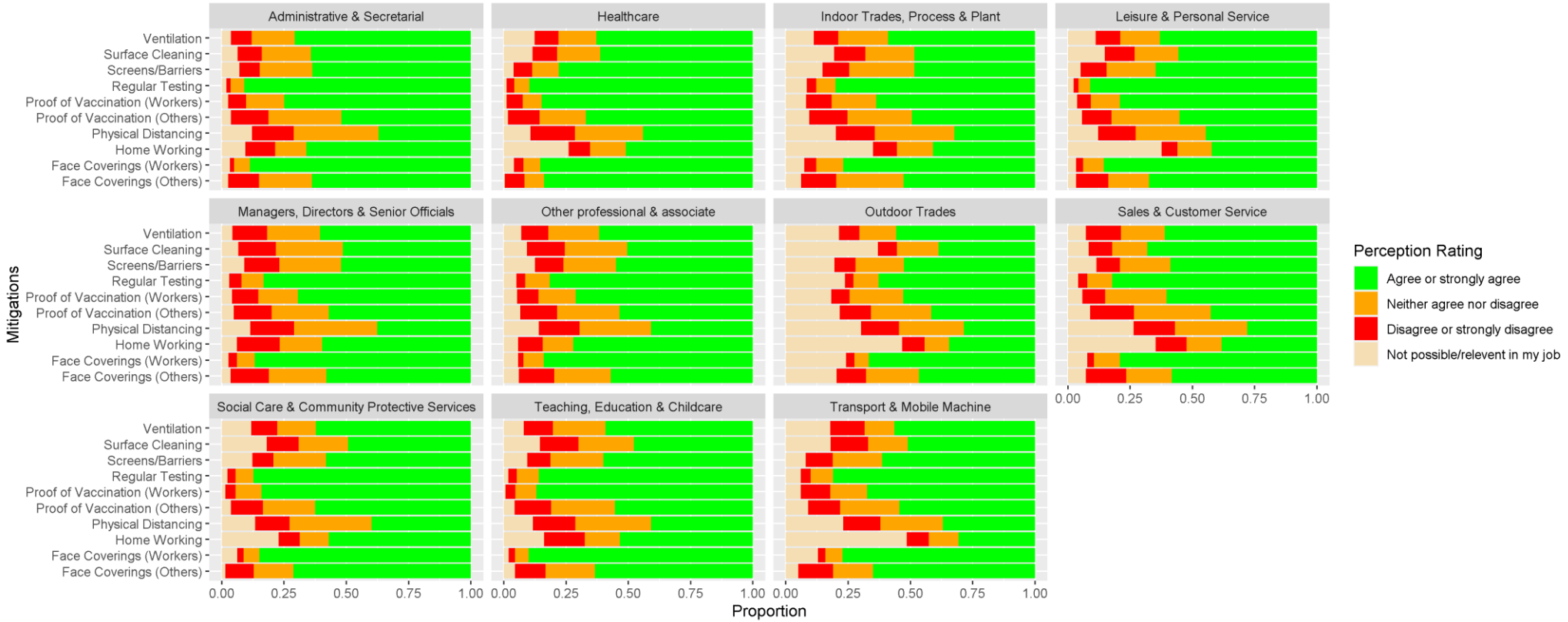


Figure F13b. Perceptions of Mitigation Methods in February 2022


Administrative & Secretarial
Healthcare
Indoor Trades, Process & Plant
Leisure & Personal Service
Managers, Directors & Senior Officials
Other professional & associate
Outdoor Trades
Sales & Customer Service
Social Care & Community Protective Services
Teaching, Education & Childcare
Transport & Mobile Machine
Ventilation
Surface Cleaning
Screens/Barriers
Regular Testing
Proof of Vaccination (Workers)
Proof of Vaccination (Others)
Physical Distancing
Home Working
Face Coverings (Workers)
Face Coverings (Others)
Mitigations
0.00
0.25
0.50
0.75
1.00
Proportion
Perception Rating
Agree or strongly agree
Neither agree nor disagree
Disagree or strongly disagree
Not possible/relevent in my job

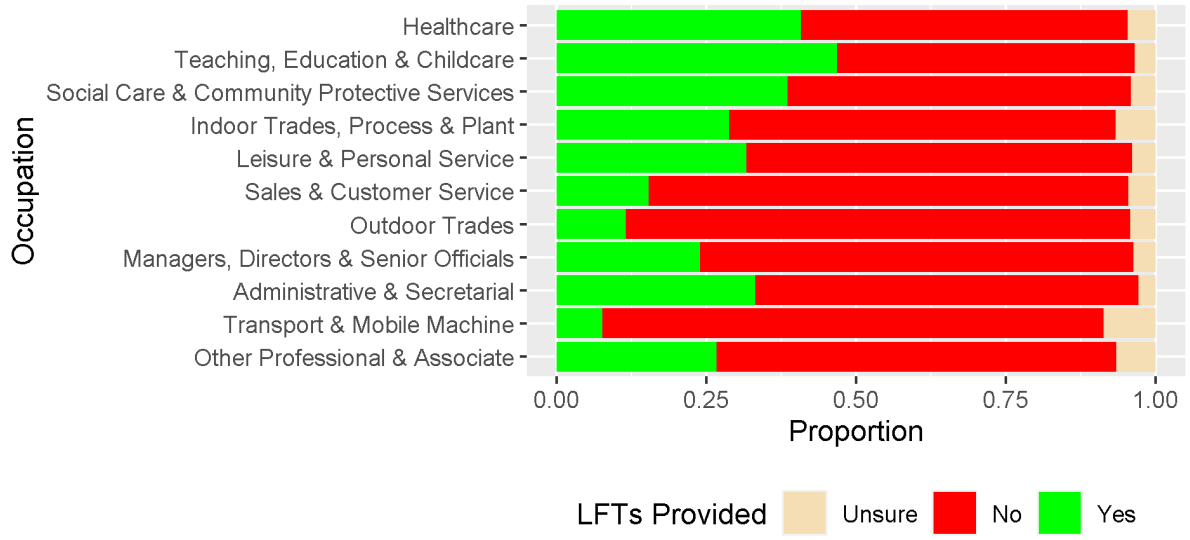
G. *How does the uptake of lateral flow testing (LFT) differ by occupational sector?*

Update: This analysis was nested within the survey described above, and followed the same analytical approach outlined in Section F. We investigated workplace approaches to lateral flow testing (required / recommended / not discussed / unsure) by occupation and over time since the third national lockdown. Findings are illustrated in Figure G1 below. We found evidence for an interaction between occupation and time, indicating that changes in workplace LFT approaches varied over time depending on participants' occupation. Healthcare, teaching and childcare, and social care and community protective service occupations demonstrated the highest proportion of workers required to take LFTs in order to attend work during the first three time periods. By February 2022, the proportion required decreased substantially for the latter two groups. Considerable proportions of workers in other occupational groups (>25%) reported no explicit guidance around LFT usage, with this response becoming the dominant category for trades, leisure and service, and transport occupations by February 2022.

We also enquired whether participants' workplaces provided on site lateral flow testing at any point during the study period, with findings illustrated in Figure G2. Access to on-site testing differed substantially by occupation. Less than half of participants in all categories reported access to on-site testing, with the greatest access amongst teaching, education and childcare (47%), healthcare (41%), social care and community protective service workers (39%). Access was lowest amongst outdoor tradespeople (11%) and transport and mobile machine operatives (8%).

Figure G1. Workplace Approach to Lateral Flow Testing (LFT) over Time

Figure G2. Lateral Flow Testing (LFT) Ever Provided on Worksite



H. *Which occupational sectors are of concern due to a combination of low vaccine uptake, high exposure risk and high proportions of workers with chronic illness?*

To address this research question, we conducted analyses investigating (1) uptake of three-dose vaccination by occupation, (2) clinical vulnerability by occupation (3) vaccination uptake amongst the clinically vulnerable by occupation and (4) vaccination uptake by workplace exposure.

Methods

We included 19,216 employed or self-employed adults who provided their occupation upon study registration and had information available on vaccination status via linkage to national sources or weekly self-report. Participants' occupation was coded into the eleven categories used in previous studies (see section A for details). Participants' current vaccination status at the time of data extraction (01/03/2022) was derived, in order of preference, from either linkage to official COVID-19 vaccination records via the UK National Immunisation Management Service (NIMS) or from weekly Virus Watch surveys including questions around any COVID-19 vaccinations received. Vaccination status was coded as unvaccinated, one dose, two doses, or three or more doses. The following binary-coded vulnerability-relevant variables were included based on data self-reported to Virus Watch: clinical vulnerability (based on presence of any condition set out by official UK sources to

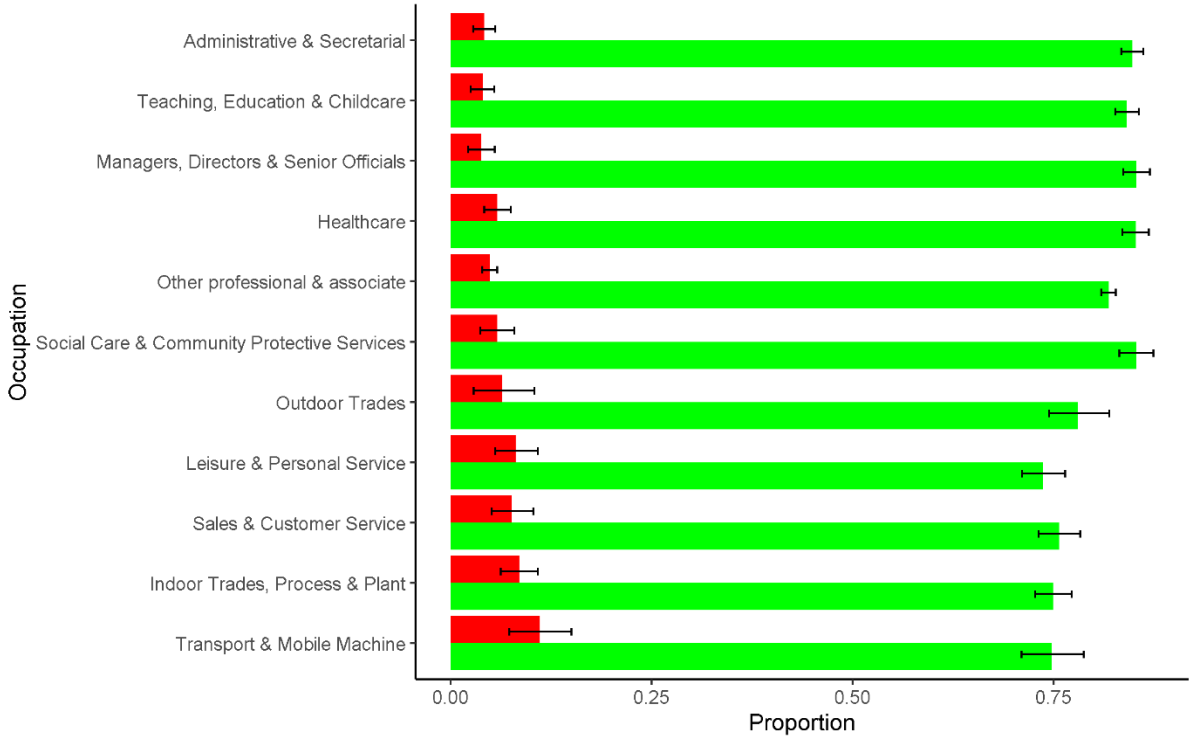
indicate vulnerability or extreme vulnerability to severe COVID-19; obesity (body mass index>=30), and age (younger <60 versus older ≥60). Workplace exposure was derived based on median score on the Job Exposure Matrix derived from UK Standard Occupational Classification 2020 codes (please see https://doi.org/10.1093/ije/dyab168.678) and ranged in the sample from 1 (low risk) to 3 (high risk).

We calculated proportions and Sison-Glaz multinomial confidence intervals for each occupational group for: vaccination status, vulnerability, vaccination status stratified by vulnerability-relevant factors, and vaccination status stratified by workplace exposure.

Findings

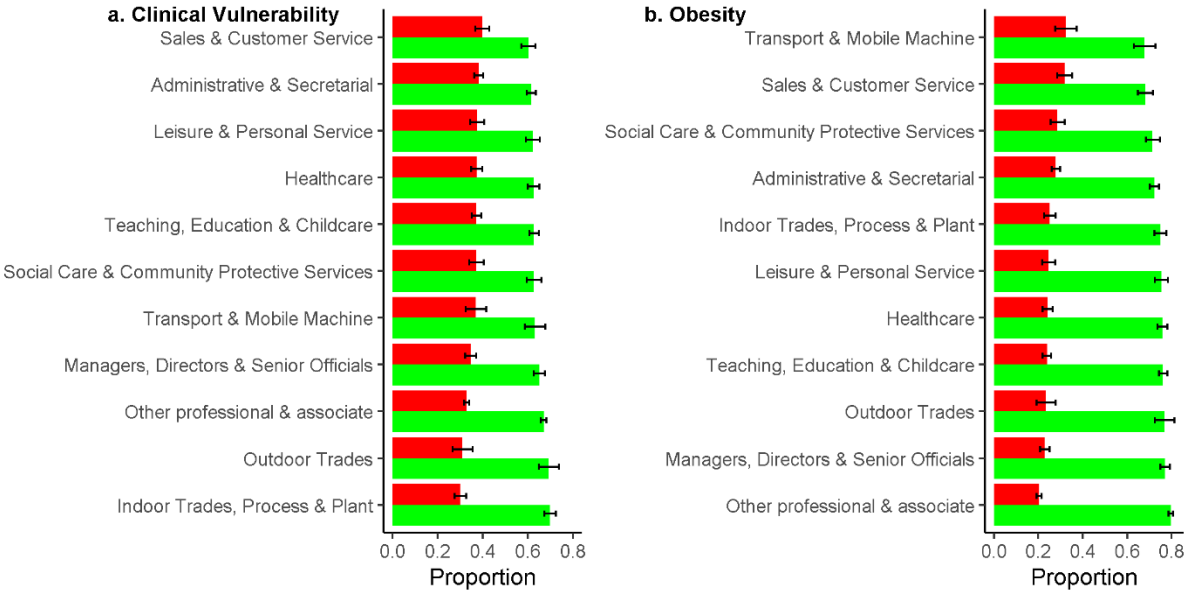
Across the full sample, 5.4% of participants were unvaccinated, 1.5% had received one COVID-19 vaccine dose, 11% two doses, and 82% three doses by 01/03/2022. Substantial differences in vaccination uptake emerged by occupation (Figure H1). Three-dose vaccination uptake was highest for managerial, social care and community protective service, and healthcare workers (all 85%), and lowest for indoor trades (74%). Indoor and outdoor trades, leisure and personal service, transport, and sales occupations all had three-dose vaccination uptake <80%, with confidence intervals indicating lower uptake than most other groups. The proportion of unvaccinated participants ranged from 4% in administrative, managerial, and teaching and childcare occupations to 11% in transport occupations.

Figure H1. Proportions and 95% Confidence Intervals for Vaccination Status: Unvaccinated (Red) and Three-Dose Vaccinated (Green) by Occupation



Occupational differences in vulnerability also emerged. Sales and customer service occupations demonstrated relatively high levels of clinical vulnerability (Figure H2a) and workers living with obesity (Figure H2b), and obesity was highest in transport and mobile machine operatives (Figure H2b).

Figure H2. Proportions and 95% Confidence Intervals for Clinical Vulnerability (H2a) and Obesity (H2b) by Occupation



Note: Red denotes at-risk group and green the lower risk group (e.g. clinically vulnerable versus non-vulnerable)

When stratified by vulnerability-relevant factors, the majority of workers within at-risk clinical and age groups received three vaccination doses across occupations (all >75% received three dose vaccination). Occupational differences in vaccination status were more apparent amongst non-vulnerable workers, following patterns similar to those described for the full cohort above. However, transport occupations had the highest proportion of unvaccinated vulnerable workers according to clinical vulnerability status (Figure H3a), obesity status (Figure H3b), and age (Figure H3c).

Figure H3a. Proportions and 95% Confidence Intervals for Vaccination Status Stratified by Clinical Vulnerability and Occupation

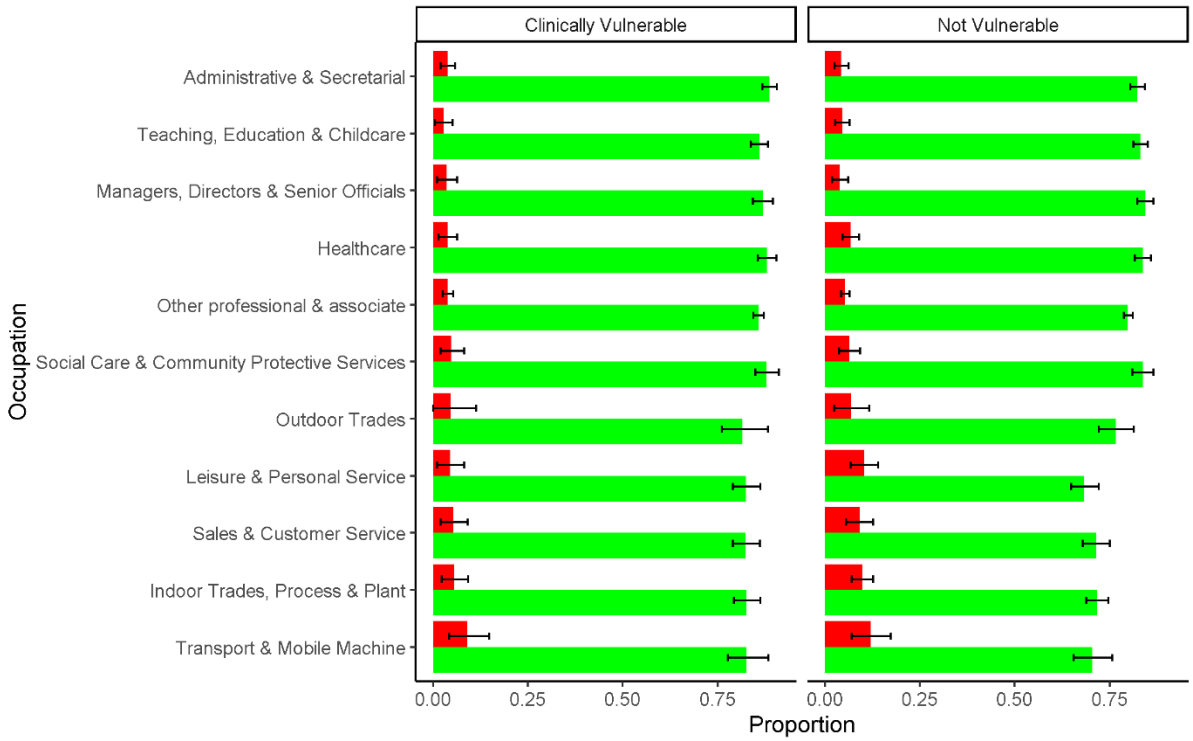


Figure H3b. Proportions and 95% Confidence Intervals for Vaccination Status Stratified by Obesity Status and Occupation

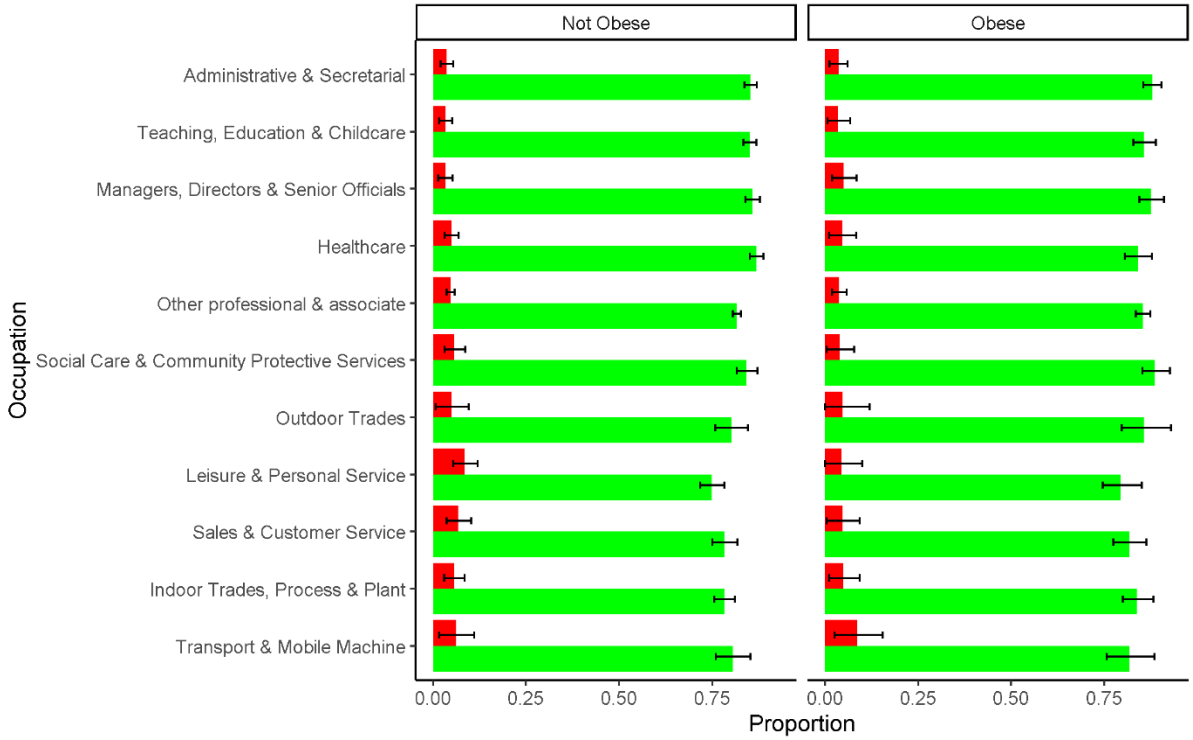
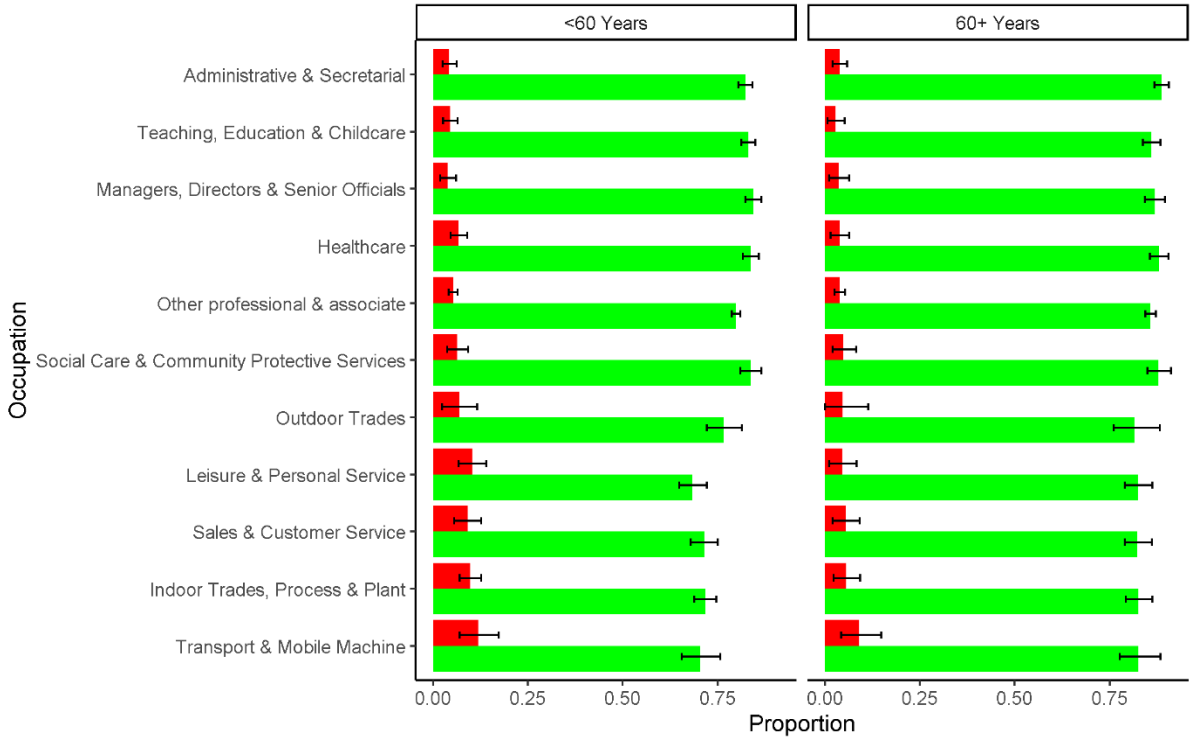


Figure H3c. Proportions and 95% Confidence Intervals for Vaccination Status Stratified by Age Group and Occupation



Patterns of overall vaccination uptake were similar for workers in positions with low, elevated, and high work-related SARS-CoV-2 exposure risk (Figure H4), with >80% having received three-dose vaccination. Differences between exposure levels emerged, however, by occupations (Figure H5). Notably, high-risk leisure and personal service and transport workers had substantially lower rates of three-dose vaccine uptake than most other groups. Not all occupational groups were represented in all exposure levels in the Virus Watch sample.

Figure H4. Proportions and 95% Confidence Intervals for Vaccination Status (Unvaccinated and Three-Dose Vaccinated) by Job Exposure Risk

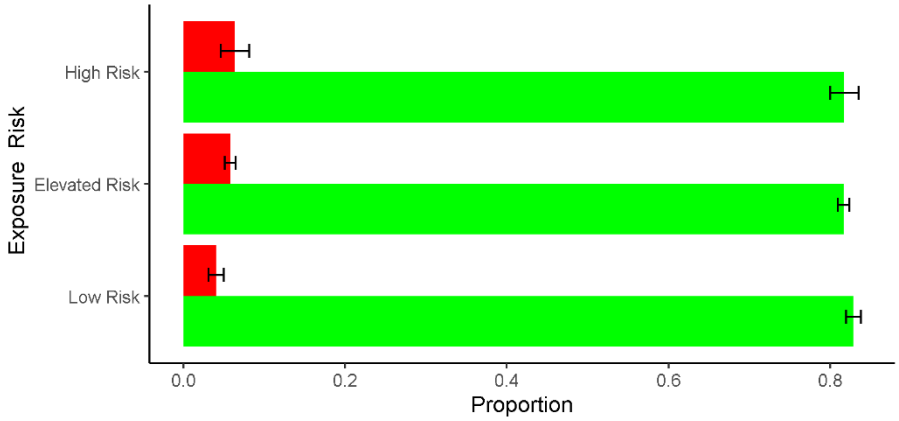
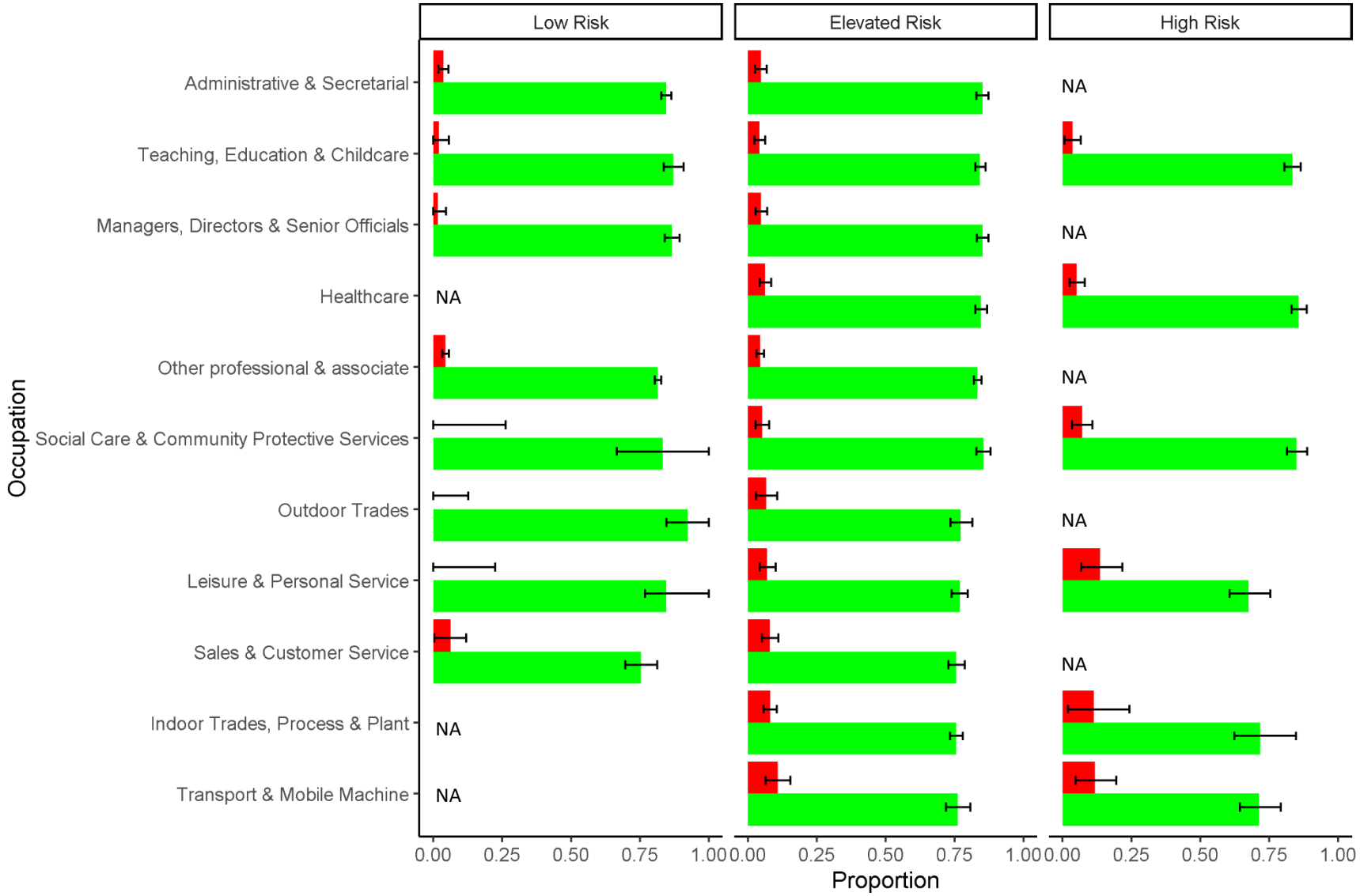


Figure H5. Proportions and 95% Confidence Intervals for Vaccination Status (Unvaccinated and Three-Dose Vaccinated) Stratified by Job Exposure Risk and Occupation (*note: NA means no occupations at given risk level were present in the sample*)

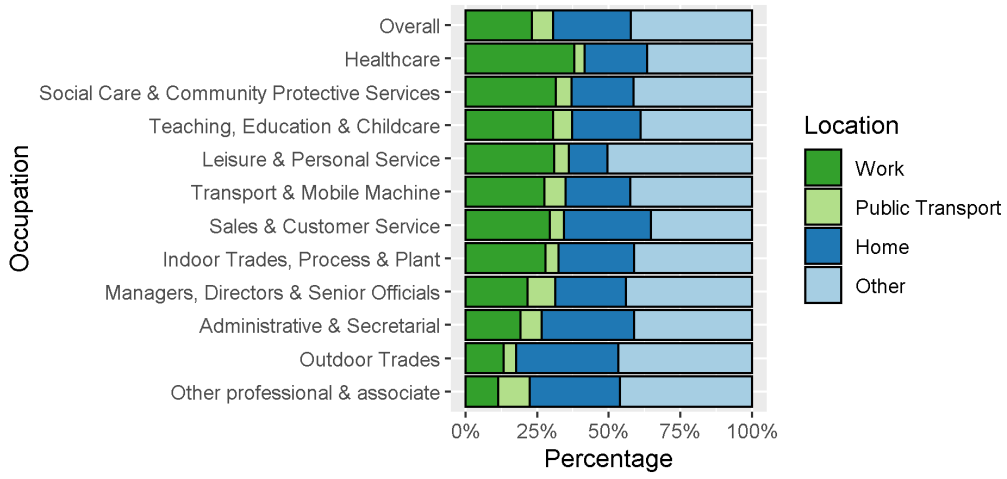


I. *What is the relative contribution of workplace exposure to national transmission and how does this vary through the pandemic?*

Update: This question has been addressed via two analyses in Virus Watch. First, the pre-print detailed in Section D estimated the population attributable fraction (i.e., proportion of infections acquired within the Virus Watch cohort attributable to exposure at work) based on logistic regression adjusted for sociodemographic factors, vaccination status, public transport usage, visiting retail venues, and other non-household contacts. The workplace was identified as an important source of non-household transmission. We estimate that 7% of infections were directly attributable to in-person workplace attendance in the second wave of the infection in England and Wales. Detailed results are provided in the pre-print cited in Section D (Hoskins et al., 2021) and are ongoing for subsequent waves of the pandemic.

We also extended an analysis initially performed as part of the paper cited below which described participants' perceived location of COVID-19 acquisition for those who had a clinically confirmed infection. We stratified this analysis by occupation to investigate any potential differences in perceived location of acquisition (workplace versus other) across occupational groups, and updated the dataset to include recent infections. Findings are presented in Figure I1. Overall, 26% believed that they acquired SARS-CoV-2 at work. Estimates of the proportion of infections attributed by participants' to workplace transmission ranged from 44% in healthcare workers to 13% in other professional and associate occupations. Many of the groups at elevated infection risk in the study detailed in Section A had a relatively high proportion of participants attributing the workplace as their site of SARS-CoV-2 acquisition.

Figure I1. Perceived Location of SARS-CoV-2 Acquisition by Occupation



We lacked the sample size to disaggregate these occupational findings further, but plan to update all other analyses in the paper cited below to include recent waves of the pandemic.

> Beale S, Byrne T, Fragaszy E, Kovar J, Nguyen V, Aryee A, Fong WL, Geismar C, Patel P, Shrotri M, Patni N. Reported exposure to SARS-CoV-2 and relative perceived importance of different settings for SARS-CoV-2 acquisition in England and Wales: Analysis of the Virus Watch Community Cohort. Wellcome Open Research. 2021 Sep 21;6(242):242.

General Summary

This package of analyses from the Virus Watch study aimed to further current understanding occupational SARS-CoV-2 infection risk and work-related transmission of COVID-19. We identified both the workplace and public transport – often used for commuting to and from work – as a significant location of COVID-19 transmission based on both testing data and on participants' perceptions of where they acquired COVID-19. We identified substantial differences in occupational risk of SARS-CoV-2 infection beyond the impact of non-occupational demographic, health-related, and behavioural factors, with workers in healthcare, teaching, indoor trade and process/plant, and leisure and personal service occupations at elevated risk.

Differential infection risk was qualified by differences in access to sick pay, vulnerability, workplace contact, and COVID-related mitigation methods between occupations and over time. Access to sick pay was lowest for workers in trade, transport, and leisure and personal service occupations. Concerningly, these occupations also demonstrated relatively high proportions of unvaccinated workers, including unvaccinated workers in high-risk groups for transport occupations. However, overall uptake of three-dose COVID-19 vaccination was found to be high across occupations within the cohort.

Healthcare and education workers demonstrated multiple elements of contact-related risk in the workplace. Across all occupations, the intensity of direct and indirect contact increased and usage of COVID-related mitigation methods decreased over time. This decrease was particularly prominent in periods when restrictions were relaxed, most notably in late February 2022. Despite decreasing usage of mitigation methods in workplaces, acceptance of most mitigation methods remained substantial in February 2022 and was particularly high (>80%) for regular testing and requiring face coverings for workers.

These findings underscore the importance of work as a determinant of risk during the COVID-19 pandemic and indicate potential areas underlying differences between occupations. Where relevant, we plan to update analyses to include subsequent waves of the pandemic in light of the emergence of new variants and changes in legislation.

The PROTECT COVID-19 National Core Study on transmission and environment is a UK-wide research programme improving our understanding of how SARS-CoV-2 (the virus that causes COVID-19) is transmitted from person to person, and how this varies in different settings and environments. This improved understanding is enabling more effective measures to reduce transmission – saving lives and getting society back towards 'normal'.

Virus Watch Study Findings (Report 2)

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