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ORIGINAL ARTICLE

Occupational infection control measures and frontline workers' perceived COVID-19 risk during the fourth wave of the pandemic in Canada: A cross-sectional survey

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ABSTRACT

Background: Under the *Occupational Health and Safety Act*, every person employed in Canada has the right to a safe work environment. Yet, research shows that essential workers in Canada have experienced a disproportionate burden of COVID-19 transmission and deaths throughout the pandemic. In light of ongoing reported COVID-19 outbreaks in Canadian essential sectors and rising national case numbers as of July 2021, this study aimed to examine workers' perceptions of the prevalence and effectiveness of occupational COVID-19 control measures during the fourth wave of the pandemic in Canada.

Methods: Individuals working on site in Canada from July 1 to November 30, 2021 were recruited through the Canadian Union of Public Employees (N=421). Data were collected on workplaces' implementation of the COVID-19 Hierarchy of Controls. Adjusted odds ratios (AOR) and 95% confidence intervals (CI) generated from logistic regression models were used to estimate the likelihood of feeling protected at work vs. feeling unprotected or unsure according to participant characteristics and workplace control measures.

Results: The 421 respondents were predominantly female (75%, N=316), college-educated (63%, N=265), and in non-management roles (86%, N=364). Participants in education (AOR=0.4, 95% CI=0.2-0.9) or transportation/warehousing (AOR=0.3, 95% CI=0.1-0.9) were less likely to feel protected than those in healthcare. Ventilation adjustments (16%, N=66) and random or universal COVID-19 testing were rare (≤3%, N≤13), 40% (N=170) of participants' workplaces used a contact tracing program. Employees adherence to physical distancing and masking requirements varied by occupational sector. Physical barriers (AOR=2.8, 95% CI=1.4-16.8), handwashing stations (AOR=4.8, 95% CI=1.4-16.8), testing of close contacts (AOR=2.1, 95% CI=1.2-3.7), and temperature checks (AOR=2.2, 95% CI=1.0-4.7) were associated with feeling protected at work after accounting for sector and managerial effect.

Conclusion: Limited COVID-19 controls were identified in transportation, manufacturing, warehousing, and education settings. Workers highlighted a need for improved ventilation, and upscaled asymptomatic screening, test and trace, and isolation efforts. Respondents' uncertainty regarding the implementation of out-of-sight infection controls coupled with gaps in workers' and scientists' perceptions of effective safety measures indicate a need for improved communication strategies between occupational health experts, supervisors, and employees on pandemic risks and procedures.

KEYWORDS

infection control; COVID-19; workplace; Canada; frontline workers; Delta

INTRODUCTION

To combat workplace infectious disease outbreaks, the Canadian Centre for Occupational Health and Safety (CCOHS), in accordance with the World Health Organization (WHO), "advises that a layered approach to prevent and control occupational transmission of COVID-19 be determined and implemented following the Hierarchy of Controls [1], a system used to combine and deploy effective public health and occupational safety and health (OSH) controls within an organization [1, 2]. From most to least effective, recommended controls for all workplaces include eliminating the hazard by facilitating remote work when possible (Elimination); replacing the hazard with something less hazardous (Substitution); encouraging vaccination, improving ventilation, and installing

Funding: This research was funded by Science Foundation Ireland (grant number 20/COV/8539).

Conflicts of interest: None to declare.

Consent for publication: Informed consent to participate in this study was obtained from all participants. All participants were 18 years of age or older. Methods were performed in accordance with the guidelines and regulations outlined in the Declaration of Helsinki. This study was approved for exemption from full ethical review by the University College Dublin Human Research Ethics Committee – [Sciences (HREC-LS)]. Research Ethics Exemption Reference Number (REERN): LS-E-21-138-Perrotta.

physical barriers and hand hygiene equipment (Engineering controls); communicating rules and procedures, staggering shifts, screening and testing, disinfecting environmental surfaces, expanding access to sick leave (Administrative controls); and complementing other measures with the use of suitable and efficient personal protective equipment (PPE) [1, 2].

Under the *Occupational Health and Safety Act*, every person employed in Canada has the right to a safe work environment [3]. Yet, research shows that essential workers in Canada have experienced a disproportionate burden of COVID-19 transmission and deaths throughout the pandemic [4], and that sociodemographic inequalities in occupational risks of exposure driven by overrepresentation of women, immigrants, minority groups, and low-income workers in medium-to-high-risk industries (i.e., healthcare and social assistance, agriculture, food manufacturing, educational services, and transportation and warehousing) have left certain individuals at disproportionate risk of infection [5, 6]. Beyond physical risk, anxiety due to fear of contracting COVID-19 and infecting family members in conjunction with fear of the financial consequences of taking time off work can adversely affect frontline employees' mental health [7]. Thus, improved worker protections in lower-paid, medium-to-high-risk occupational settings are needed to optimize the equity and effectiveness of Canada's COVID-19 response.

Noting gaps concerning the prevalence and distribution of COVID-19 controls within Canadian workplaces continuing to operate during the pandemic, Smith *et al*. [8] examined the occupational control measures in place according to 53,316 employed respondents to Statistics Canada's Labour Force Survey from July to September 2020 (this time period coincided with relatively low daily case counts in Canada). Generally high levels of workplace COVID-19 controls were identified, however, those working in the agricultural, construction, transportation, warehousing, and education industries identified fewer measures in place. In July 2021, to account for widespread vaccinations and in light of ongoing reported outbreaks in Canadian essential sectors and rising national case numbers [5], our research team sought to provide an update on the COVID-19 protections available to essential workers in Canada according to occupational sector. Using a validated online survey instrument, this study aimed to examine workers' perceptions of the prevalence of occupational COVID-19 control measures during the fourth pandemic wave in Canada, and to assess how implemented measures related to feeling safe at work.

METHODS

Participants and study design

The sample comprised participants who were working part-time or full-time on site in Canada during the Delta-driven fourth wave of the pandemic (July 1 to November, 30 2021). Participants were recruited online through non-probability convenience sampling techniques. Of 12 geographically and occupationally representative OSH organizations and trade unions contacted by the researchers, three agreed to email the survey link to their constituents and/or post the survey link on their website: the Ontario Occupational Health Nurses Association (~400 members), BC General Employees' Union (~3,600), and Canadian Union of Public Employees (~700,000). Eligibility criteria included: 1) aged 18 or over; and, 2) actively employed from July to November, 2021; and, 3) fluent in English, French, Spanish, Hindi, Polish, or Chinese. Participants working full-time from home were excluded from the study.

All data were collected using a validated, multilingual online questionnaire for surveying the COVID-19 prevention and control measures used in global workplaces [9]. Participants were given access to a study information sheet from the survey homepage. Informed consent to participate was requested before the survey could begin. The study's procedures were reviewed and approved by the University College Dublin Human Research Ethics Committee (LS-E-21-138-Perrotta), and complied with the Declaration of Helsinki.

Control Measures

At the *Elimination* level, participants were asked if they were able to work part-time from home. As no measures for replacing the hazard with a non-hazardous substance have been identified, no questions were asked at the *Substitution* level. Participants were asked *"Which of the following measures are currently in place in your workplace in response to COVID-19?"* and instructed to select 'Yes', 'No', or 'Unsure' from the following recommended measures [1, 2]:

- **Engineering controls:** vaccination status, ventilation adjustments, air-quality monitoring, physical barriers, handwashing stations;
- **Administrative controls:** frequent disinfection of touched surfaces, COVID-19 signage, worker bubbles, facility entry restrictions, contact-tracing program, access to paid COVID-19 sick leave, COVID-19 testing of symptomatic, close contact, random groups, or all employees, self-isolation of symptomatic, close contact, or COVID-19-positive employees, and screening using temperature checks, or symptom reporting; and,
- **PPE:** masking requirement, training for use of PPE.

To assess adherence to administrative controls and PPE, participants were asked how often (1) they were able to maintain a 1-meter physical distance at work [10]; and, (2) masks were worn correctly by colleagues (response options: Never, Rarely, Sometimes, Always). Participants were also asked, *"Do you feel protected from COVID-19 at work?"* (response options: Yes, No, Unsure).

Data analysis

Participants' occupations falling under the North American Industry Classification System (NAICS) were regrouped to balance for sample size:

- **Office-based Trades/Services:** Real estate or rental and leasing; finance or insurance; information and communication; professional, scientific, or technical services, administration, labour union.
- **Outdoor Trades/Services:** Mining and quarrying; construction; water supply; sewerage, waste management or remediation services; forestry, fishing, hunting or agriculture support; golf course maintenance.

- **Retail Trades/Services:** Accommodation or food services; retail trade; arts, entertainment, or recreation; health and fitness; cleaning activities.
- **Public Administration:** Public administration and defence; law enforcement; corrections.
- **Transportation, Manufacturing:** Transportation or warehousing; manufacturing and food processing.
- **Healthcare:** Doctor, nurse, laboratory technician working outside of hospital setting.
- **Hospital:** Healthcare professional working in hospital setting.
- **Long-term care facility (LTCF):** LTCF, assisted living facility.
- **Social Services:** social support worker, home visits.
- **Educational Services**: teacher at day care, primary, secondary, university level.

Chi square and Fisher Exact tests were performed to assess differences in implemented control measures according to occupation type. Odds ratios (OR) and adjusted odds ratios (AOR) generated from logistic regression models were used to estimate the likelihood of feeling protected at work vs. feeling unprotected or unsure according to participant characteristics and workplace control measures. Control measures responses were re-coded as Yes = 2, No or Uncertain = 1 for logistic regression analyses under the hypothesis that employees must be aware of control measures in place in order to feel protected by them. To account for multiple comparisons, a Bonferroni correction was applied during univariable analysis, and the significance threshold set at $p < 0.01$. Variables emerging as significant were included in multivariable analysis, and stepwise descending selection by Akaike information criterion (AIC) performed to determine the best-fit multivariable model (significance level: $p < 0.05$). Participants for whom a certain response was missing were excluded from statistical test(s) involving that variable. Analysis was performed using R version 4.0.2. Maps of participant responses were rendered with the R Studio Leaflet package (R Foundation for Statistical Computing, Vienna, Austria).

Results

Participant Characteristics

608 surveys were initiated in Canada, of which 187 were excluded from analysis due to missing occupational sector (N=59), incompletion (N=19), or because respondents worked full-time from home (N=100), or were not working at the time of data collection (N=9). *Figure 1* shows the geographic range of survey responses yielding primarily from British Columbia, Alberta, Ontario, and Nova Scotia. At a glance, no geographic patterns emerged in respondent occupations or feeling protected at work. Respondents' socio-demographic and occupational characteristics are displayed in Table 1. The 421 included respondents were predominantly female (75%, N=316), college-educated (63%, N=265), and in non-management roles (86%, N=364) at public institutions (68%, N=286).

Univariable logistic regression results for feeling protected at work vs. feeling unprotected or unsure are displayed in *Table 1*, and results from the adjusted model in *Table 2*. Working in a management role (AOR=2.9, 95% CI =1.1-7.9) significantly increased a participant's likelihood of feeling protected from COVID-19 at work after adjustment for occupation type and multilevel control measures. Conversely, participants in education (AOR=0.4, 95% CI = 0.2-0.9) or transportation/warehousing (AOR=0.3, 95% = 0.1-0.9) were less likely to feel protected than those in healthcare.

Elimination

A remote working option was unavailable to most participants (81%, N = 342) (Table 1) though this varied significantly by occupation type ($p < 0.001$, Figure 2). Working from home part-time did not significantly increase the likelihood of a participant feeling protected while on the job (OR=0.8, 99% CI=0.5-1.9).

Engineering Controls

Nearly all participants had received at least one dose of an approved COVID-19 vaccine (89%, N=329). Only two workers had not yet received access to a vaccine; 45 were unvaccinated by choice. Ventilation adjustments (16%, N=66) and air quality monitoring (5%, N=22) were rarely identified, whereas most participants reported handwashing stations (92%, N=388). Physical barriers (43%, N=179) were more present in office-based, public administration, and outdoor sectors than in healthcare settings, education, and transportation/manufacturing ($p=0.008$).

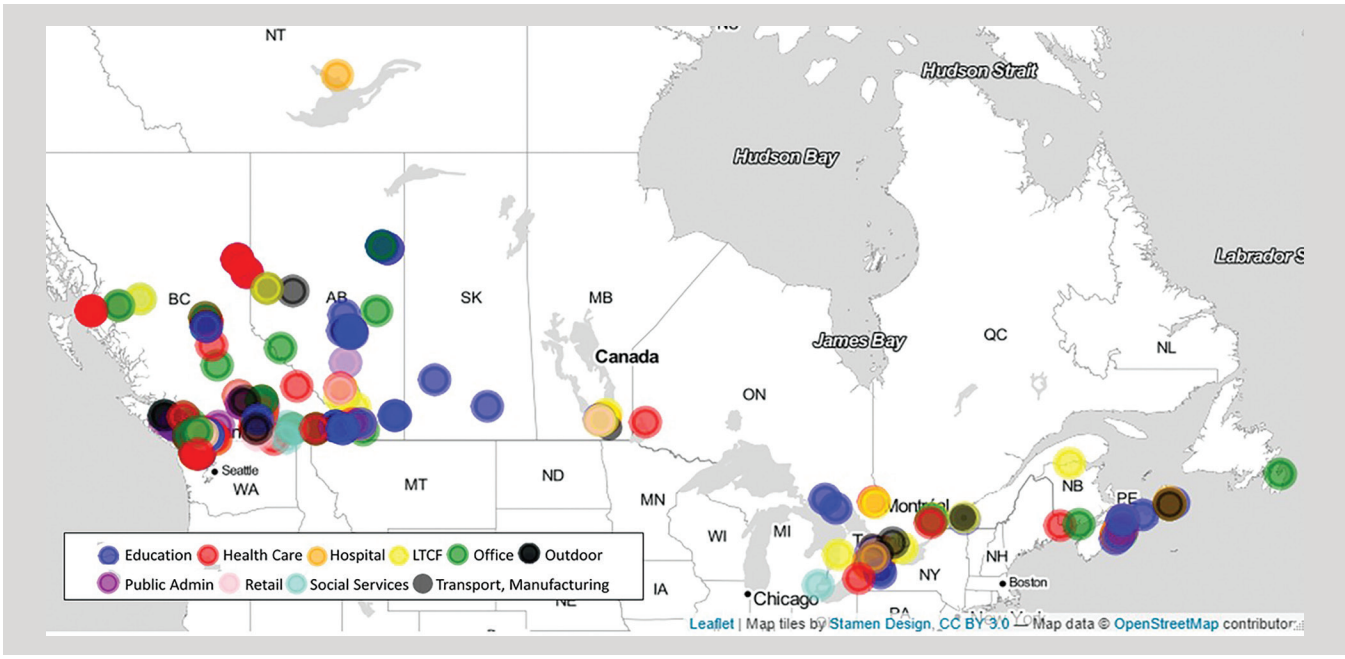
Physical barriers (AOR=2.8,95% CI=1.6-4.7) and handwashing stations (OR=4.8, 99% CI=1.4-17) significantly increased a participant's likelihood of feeling protected at work after adjustment for occupation, rank, and administrative control measures.

Administrative Controls

Most respondents reported disinfection procedures (84%, N=355) and use of COVID-19 signage (80%, N=337). By contrast, worker bubbles (23%, N=96) were not widely used, and facility entry restrictions varied by occupation ($p < 0.001$, Figure 2). Physical distancing was more frequently adhered to in office- and outdoor-based settings than other occupational settings ($p < 0.001$, Figure 3).

Symptom reporting took place in half of participants' workplaces (N=191). Temperature checks were indicated less frequently (18%, N=74). Less than 3% (N=13) of surveyed workers had undergone random or universal COVID-19 testing; approximately one third reported testing of symptomatic workers or close contacts. A majority of hospital and LTCF respondents had undergone some type of workplace testing, compared to a minority of those from non-healthcare settings ($p = 0.003$, Figure 2). Only 40% (N=170) of participants' workplaces used a contact tracing program. Most employees had access to paid COVID-19 sick leave (59%, N=249) and/or were required to stay at home if a close contact (64%, N=268).

Worker bubbles, entry restrictions, testing and self-isolation of close contacts, temperature checks, symptom reporting, contact tracing, and adherence to physical distancing were all independently associated with feeling protected at work



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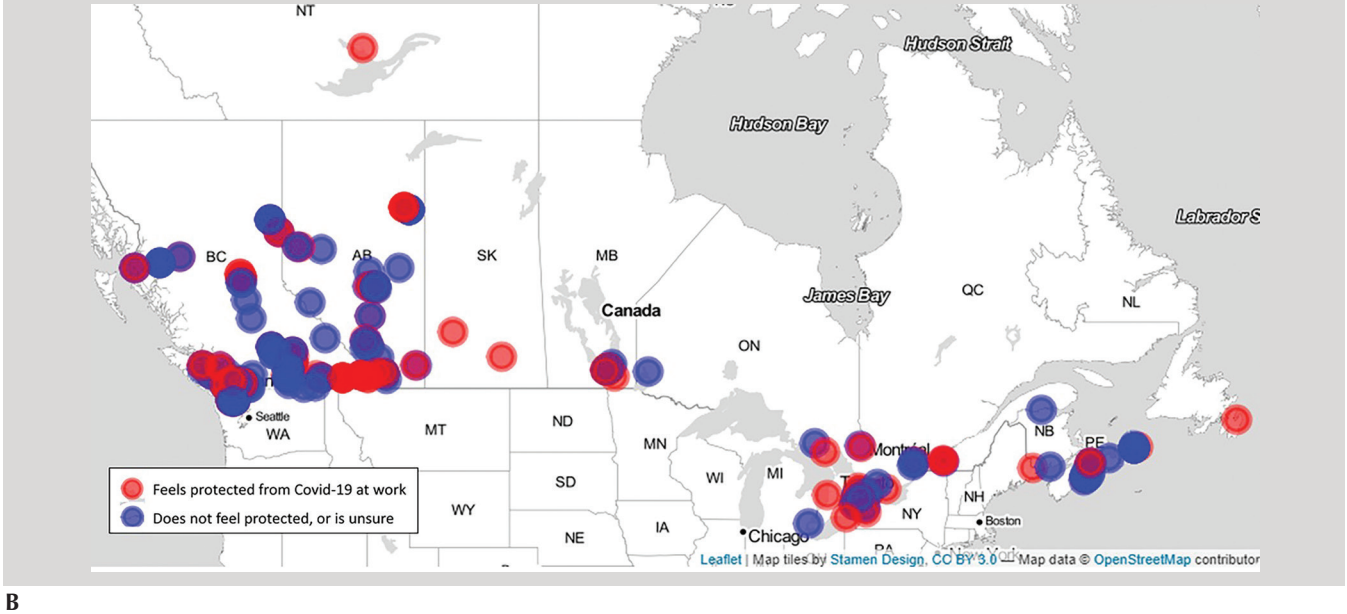

B

Figure 1: Geographic distribution of 421 actively working respondents according to (A) occupation type and (B) whether or not they felt protected from COVID-19 at work from July 1 to November, 30 2021.
***Note**: Each dot represents one response.*

(Table 1). However, only the effects of testing close contacts (AOR=2.1, 95% CI = 1.2-3.7) and temperature checks (AOR=2.17, 95% CI = 1.0-4.7) remained significant in the adjusted model (Table 2). More ubiquitous measures such as COVID-19 signage and isolation requirements for symptomatic or COVID-19 positive workers were not associated with feeling protected at work.

PPE

Most respondents were required to wear masks at work (72%, N=302), particularly in healthcare-related or transport and manufacturing industries ($p < 0.001$, Figure 2). The provision of training for use of PPE varied significantly by occupational sector ($p < 0.001$), as did the frequency with which masks were worn correctly (p=0.01, Figure 3). Independent associations between masking use, adherence, and PPE training, and feeling protected at work were attenuated after adjustment for occupation, rank, and engineering/administrative controls.

One-third of respondents felt unprotected from COVID-19 at work (N=128) and 13% were unsure (N=53). In the transport/manufacturing, retail, and education sectors, these ratios were higher ($p = 0.002$, Figure 3).

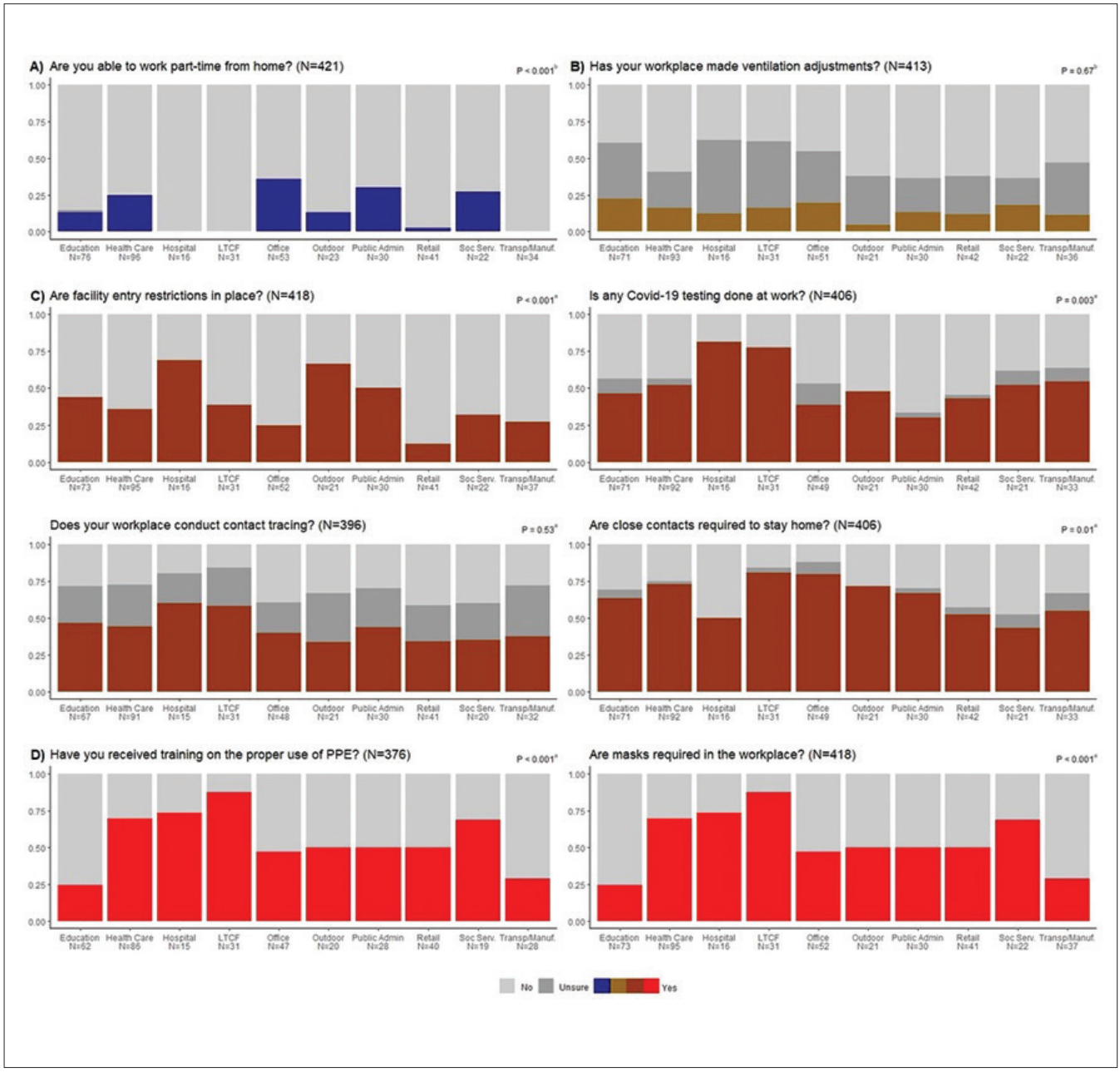

Figure 2: COVID-19 Elimination (A), Engineering (B), Administrative (C), and PPE (D) control measures used in Canadian workplaces from July 1 to November, 30 2021, according to 421 surveyed workers.
Note: *[a]Chi square test [b]Fisher Exact test.*

DISCUSSION

Using a cross-sectional, online survey, this study examined frontline workers' awareness of occupational COVID-19 control measures in place during the fourth-pandemic wave in Canada and how those measures related to risk perception. Results revealed sector-level differences in COVID-19 controls and feeling protected on the job. Respondents from non-healthcare occupations such as education, retail trades, and transportation/manufacturing systematically reported fewer controls in place and a greater sense of unprotection. Engineering controls, despite their increased effectiveness, were less frequently reported than administrative controls or PPE irrespective of occupation. We believe this snapshot of workers' perceptions calls to light several important considerations for Canada's ongoing and future pandemic, occupational safety and health response.

First, according to workers, workplaces appear to have 'gotten it right' in many ways. COVID-19 control measures highlighted in national workplace health and safety guidance [1] including mask wearing, handwashing stations, isolation/quarantine, disinfection, and vaccination were used in most respondents' workplaces. Workers in Canada reported a

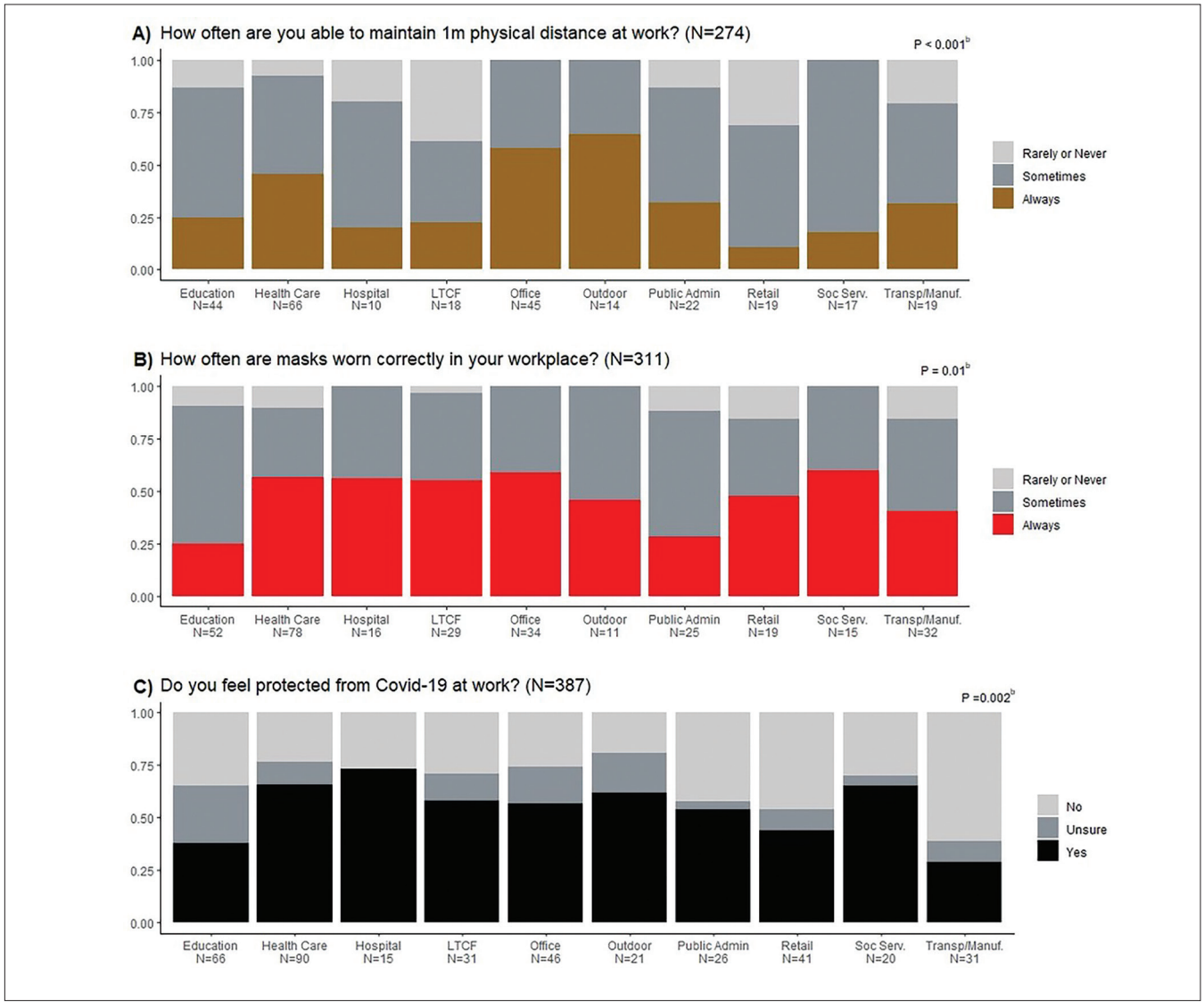

Figure 3: Workers' perceptions of adherence to physical distancing (A), mask wearing (B), and feeling protected from COVID-19 (C) in Canadian workplaces from July 1 to November, 30 2021.
Note: *[b]Fisher Exact test.*

higher average number of occupational protective measures overall compared to individuals who took the same survey in China, Ireland, Argentina, and the UK [9]. Two-thirds of study participants felt protected from COVID-19 at work, particularly those in high-risk healthcare and hospital settings where outbreaks involving the Delta variant were reported during the study period [11]. Nevertheless, similar to results of the Statistics Canada's Labour Force Survey conducted from July to September 2020 [8], workers identified persistent low levels of protections in transport, warehousing, manufacturing, and education settings one year later.

Engineering controls such as ventilation adjustments and air quality monitoring are critical for mitigating airborne transmission of SARS-CoV-2 in indoor settings, particularly in the context of the hyper-infectious Delta variant dominant at the time of data collection [12, 13]. Yet, only 16% of participants were aware of environmental adjustments having taken place in their workplace as of November 2021. The effectiveness of complementary measures like physical barriers depends on good ventilation [14]; indicating that for the 80 survey respondents whose workplaces reportedly had not made changes to ventilation but used physical barriers, the latter measure may have been doing little to redirect respiratory emissions at potential cost to employee health and to the company. Administrative controls were more widely reported and, encouragingly, symptom reporting and isolation strategies for symptomatic workers not uncommon. Yet, because a high proportion of Delta infections took place during the pre-symptomatic phase [15, 16], low reported rates of asymptomatic screening, testing and isolation measures coupled with limited use of contact tracing likely impeded the prevention and control of workplace outbreaks. Furthermore, the effectiveness of administrative controls and PPE depends on adherence to those controls. Despite the administrative changes reported and prevalence of masking requirements, a minority of

respondents felt that physical distancing and mask wearing were correctly adhered to all of the time.

In some instances, workplaces may have implemented control measures unbeknownst to survey respondents. This is most plausible in the case of less visible engineering or administrative controls (30% of respondents marked 'Unsure' when asked if ventilation adjustments and contact tracing were used, though this could also indicate uncertainty regarding the definitions of these terms). Canada's Occupational Health and Safety act entitles workers to know about and participate in health and safety decisions [3], and for good reason. If unapprised of safety measures in place, workers may experience anxiety based on overestimated perceived risk of contracting COVID-19. The 87 workers we surveyed who were unsure if they had access to paid COVID-19 sick leave may have been more inclined to come in to work if symptomatic or a close contact. Studies have also demonstrated positive associations between perceived risk of contracting COVID-19 at work and disengagement, turnover intention, burnout, and low morale amongst frontline employees [17]. In contrast, research indicates that strengthening formal and informal communication paths between supervisors and employees could encourage employee adherence to COVID-19 controls and reduce emotional exhaustion [18, 19]. As many respondents were unsure about their workplace's application of out-of-sight control measures despite widely reported use of signage, more active communication tools and strategies (i.e., collaborative development, exploiting established informal communication-and-support networks of workers, solid orientation programs with education on safety measures and proper use of PPE) are an important consideration in Canada [20].

Improved OSH communications are also critical for addressing the gap identified in this study between workers' and scientists' perceptions of effective COVID-19 safety measures. Multivariable analysis revealed physical barriers, handwashing stations, testing of close contacts, and temperature checks as the measures most associated with feeling protected at work after accounting for sector and managerial effect. However, researchers have contested the sensitivity of temperature checks for SARS-CoV-2 detection and as previously noted, the effectiveness of physical barriers without appropriate ventilation and/or in settings with long-duration contacts [14, 21]. Alternatively, while "no-visitor" policies implemented in Canadian healthcare settings reduce SARS-CoV-2 transmission risk, they may have trickle-down consequences for employee mental health. The absence of family members or designated support persons who are important in the delivery of patient-centred care (e.g., feeding, mobility, emotional support) can, by increasing healthcare professionals' workload, contribute to stress and burnout [22, 23]. These examples underline the importance of engaging with workers to identify effective, acceptable, and feasible OSH solutions; all the more so because vulnerable Canadian workers tend towards a "wait-and-see" approach when they have safety concerns [24], and because workers used to performing operations may unknowingly become acclimated to unacceptable risk over time [25].

This study, although meticulously conducted is not free of limitations. In this regard, it is important to note the potential for sample bias inherent to the non-probability convenience sampling techniques used. The viewpoints expressed by constituents of the Ontario Occupational Health Nurses Association, BC General Employees' Union, and Canadian Union of Public Employees represented in this study may not be representative of frontline Canadian workers as a whole, particularly workers without the protections afforded by union membership. As well, small numbers due to lower survey uptake in non-healthcare settings required us to aggregate NAICS classifications, thereby preventing the reporting and interpreting of results by specific occupation. External validity may be impacted by the limited ability of an online survey instrument to capture viewpoints of workers with limited literacy skills and/or access to technology. Internal validity may be impacted by differences between workers perceptions of effective controls vs. empirical measures of effective controls (e.g., 111 workers surveyed on correct mask wearing had not received training on PPE use). Despite these limitations, this study serves as an important follow-up to the Statistics Canada's 2020 Labour Force Survey [8] by demonstrating the ongoing need for improved COVID-19 control measures' implementation and adherence in frontline occupational settings over one year into the COVID-19 pandemic.

CONCLUSION

Essential workers surveyed from July to November 2021 highlighted a need for improved ventilation, and upscaled asymptomatic screening, test and trace, and isolation efforts in high-to-medium risk occupational settings in Canada. Respondents' uncertainty regarding the implementation of out-of-sight infection controls coupled with gaps in workers' and scientists' perceptions of effective safety measures indicate a need for improved communication strategies between occupational health experts, supervisors, and employees on pandemic risks and procedures.

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Table 1: Demographic and occupational characteristics, workplace COVID-19 controls in place, and univariable logistic regression results for feeling protected from COVID-19 at work vs. feeling unprotected or unsure: 421 workers surveyed in Canada, July to November 2021.

		N (Total = 421)	%	Do you feel protected from COVID-19 at work? Yes vs. No or unsure (N=387[a]) Crude OR (99% CI)
Outcome Variable				
Feels protected at work	Unsure	53	13	
	No	128	30	
	Yes	206	49	
	NA	34	9	
Gender	Female	316	75	Ref
	Male	95	23	1.21 (0.63-2.31)
	NA	10	3	
Age	18 to 34	60	14	Ref
	35 to 44	90	21	1.12 (0.46-2.72)
	45 to 54	124	29	1.25 (0.54-2.92)
	55 to 64	131	31	1.23 (0.54-2.8)
	65 and over	16	4	1.33 (0.31-5.77)
	NA	0	0	
Education Level	College degree or higher	265	63	Ref
	Secondary school diploma	76	18	1.14 (0.57-2.27)
	Some secondary school	31	7	2.09(0.7-6.25)
	Vocational training	33	8	1.8 (0.65-5.01)
	NA	16	4	
Occupational Sector[b]	Healthcare	95	23	Ref
	Education	74	18	**0.32 (0.13-0.76)*** **
	Retail Trades/Services	42	10	0.41 (0.15-1.11)*
	Hospital	16	4	1.44 (0.29-7.22)
	Long-term Care Facility	31	7	0.73 (0.24-2.18)
	Office-based Trades/Services	52	12	0.68 (0.26-1.78)
	Outdoor Trades/Services	22	5	0.85 (0.23-3.1)
	Public administration, Corrections	30	7	0.61 (0.19-1.96)
	Social Assistance	22	5	0.98 (0.26-3.71)
	Transportation, Warehousing, Manufacturing	37	9	0.21 (0.07-0.69)***
	NA	0	0	
Role[b]	Employee	364	86	Ref
	Management	36	9	3.07 (0.97-9.72)*
	NA	21	5	

Continued

		N (Total = 421)	%	Do you feel protected from COVID-19 at work? Yes vs. No or unsure (N=387[a]) Crude OR (99% CI)
Company Status	Private-for-profit	44	10	Ref
	Private-not-for-profit	55	13	1.29 (0.43-3.82)
	Public	286	68	0.88 (0.37-2.13)
	NA	36	9	
Company Size	Large (>250 employees)	176	42	Ref
	Mid-size	104	25	1.07 (0.55-2.07)
	Small (< 50 employees)	118	28	1.15 (0.61-2.17)
	NA	23	5	
Elimination				
Work-from-Home	Never	342	81	Ref
	Sometimes	73	17	0.81 (0.46-1.89)
	NA	6	1	
Engineering Controls				
Vaccinated for COVID-19+	No[c]	47	11	Ref
	Yes	329	89	0.83 (0.37-1.87)
	NA	0	0	
Ventilation Adjustments[b]	Unsure	132	31	Ref
	No	215	51	
	Yes	66	16	2.26 (1.07-4.79)**
	NA	8	2	
Air Quality Monitoring	Unsure	137	33	Ref
	No	254	60	
	Yes	22	5	1.96 (0.59-6.58)
	NA	8	2	
Physical Barriers+[b]	No	239	57	
	Yes	179	43	**2.68 (1.54-4.67)*** **
	NA	3		
Handwashing Stations+[b]	No	30	7	Ref
	Yes	388	92	**7.49 (1.81-31.07)*** **
	NA	3	1	
Administrative Controls				
Disinfection of Touched Surfaces+[b]	No	63	15	Ref
	Yes	355	84	**4.03 (1.68-9.67)*** **
	NA	3	1	
COVID-19 Signage+	No	84	20	Ref
	Yes	337	80	1.51 (0.7-3.22)
	NA	0	0	
Worker Bubbles+[b]	No	322	76	Ref
	Yes	96	23	**2.46 (1.25-4.82)*** **
	NA	3	1	
Facility Entry Restrictions+[b]	No	265	63	Ref
	Yes	153	36	**1.75 (1-3.04)****
	NA	3	1	
Symptomatic Testing[c]	Unsure	32	8	Ref
	No	223	53	
	Yes	151	36	1.68 (0.97-2.91)*
	NA	15	4	
Testing if Close Contact[c]	Unsure	31	7	Ref
	No	237	56	
	Yes	138	33	**2.08 (1.17-3.68)*** **
	NA	15	4	

		N (Total = 421)	%	Do you feel protected from COVID-19 at work? Yes vs. No or unsure (N=387[a]) Crude OR (99% CI)
Universal Testing	Unsure	49	12	Ref
	No	347	82	
	Yes	10	2	0.37 (0.06-2.23)
	NA	15	4	
Random Testing	Unsure	49	12	Ref
	No	344	82	
	Yes	13	3	0.75 (0.17-3.22)
	NA	15	4	
Receives paid time off for COVID-19	Unsure	87	21	Ref
	No	60	14	
	Yes	249	59	1.4 (0.82-2.41)
	NA	25	6	
Close Contacts Remain Home[c]	Unsure	20	5	Ref
	No	118	28	
	Yes	268	64	**1.83 (1.05-3.2)****
	NA	15	4	
Symptomatic Workers Remain Home	Unsure	11	3	Ref
	No	30	7	
	Yes	365	87	**1.84 (0.75-4.53)**
	NA	15	4	
COVID-19 Positive Workers Remain Home[b]	Unsure	10	2	Ref
	No	27	6	
	Yes	369	88	**2.44 (0.91-6.57)***
	NA	15	4	
Temperature Checks[b]	Unsure	49	12	Ref
	No	283	67	
	Yes	74	18	**2.27 (1.1-4.67)****
	NA	15	4	
Symptom Reporting[b]	Unsure	48	11	Ref
	No	167	40	
	Yes	191	45	**2.33 (1.36-3.99)*****
	NA	15	4	
Contact Tracing Program[b]	Unsure	105	25	Ref
	No	121	29	
	Yes	170	40	**2 (1.16-3.42)*****
	NA	25	6	
Physical Distancing Maintained[d]	Rarely or Never	33	8	Ref
	Sometimes	141	33	2.66 (0.88-8.03)
	Always	100	24	**7.6 (2.26-25.58)*****
	NA	147	35	
PPE				
Masking Required+[b]	No	116	28	Ref
	Yes	302	72	**2.31 (1.27-4.23)*****
	NA	3	1	
Training on Proper use of PPE+[b]	No	221	52	Ref
	Yes	200	48	**3.17 (1.84-5.48)*****
	NA	0	0	
Masking Maintained[d]	Rarely or Never	25	6	Ref
	Sometimes	141	35	3.62 (0.9-14.46)
	Always	145	34	**9.01 (2.22-36.6)*****
	NA	110	26	

*NA – Not Answered. Ref – Reference Variable. + 'Unsure' response option not available for this question. *p < 0.05, **p < 0.01, ***p < 0.001*

[a] *NA = 34 due to missing outcome variable*

[b] *Variable tested in the full adjusted model*

[c] *Only two of 47 unvaccinated respondents had not yet had access to the COVID-19 vaccine; the remaining 45 preferred not to be vaccinated*

[d] *Not tested in the full adjusted model due to large quantities of missing data*

Table 2: Multivariable logistic regression results for feeling protected from COVID-19 at work vs. feeling unprotected or unsure based on demographic and occupational characteristics, and workplace COVID-19 controls in place from July to November 2021 in Canada (N=387).

		Adjusted OR (95% CI)[a] (N=387[b])
Occupational Sector	Healthcare	Ref
	Education	**0.39 (0.17-0.89)***
	Retail Trades/Services	0.51 (0.21-1.29)
	Hospital	2.19 (0.49-9.84)
	Long-term Care Facility	0.39 (0.14-1.1)
	Office-based Trades/Services	0.65 (0.28-1.53)
	Outdoor Trades/Services	1.01 (0.31-3.31)
	Public administration, Corrections	0.56 (0.19-1.64)
	Social Assistance	1.31 (0.42-4.12)
	Transportation, Warehousing, Manufacturing	**0.31 (0.11-0.86)***
Role	Manager vs. Employee	**2.89 (1.05-7.93)***
Ventilation Adjustments	Yes vs. No/Unsure	1.34 (0.66-2.73)
Physical Barriers	Yes vs. No	**2.77 (1.63-4.73)*****
Handwashing Stations	Yes vs. No	**4.81 (1.37-16.84)***
Disinfection of Touched Surfaces	Yes vs. No	2.04 (0.92-4.53)
Worker Bubbles	Yes vs. No	1.77 (0.95-3.29)
Testing if Close Contact	Yes vs. No/Unsure	**2.11 (1.2-3.72)***
Close Contacts Remain Home	Yes vs. No/Unsure	2.01 (0.76-5.35)
Temperature Checks	Yes vs. No/Unsure	**2.17 (1.01-4.65)***
Contact Tracing Program	Yes vs. No/Unsure	1.57 (0.95-2.59)
Training on Proper use of PPE	Yes vs. No	1.53 (0.91-2.59)

*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$
[a] *Stepwise descending variable selection using AIC.*
[b] *NA = 34 due to missing outcome variable*

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