Frequency of Workplace Controls and Associations With Safety Perceptions Among a National Sample of US Food Retail Workers During the COVID-19 Pandemic

Caitlin Ceryes, RN, MPH, Joelle Robinson, MPH, Erin Biehl, MSPH, Andrea L. Wirtz, PhD, Daniel J. Barnett, MD, MPH, and Roni Neff, PhD

Objectives: Explore workplace control frequencies and factors associated with US food retail workers' safety perceptions during COVID-19. **Methods:** An online, cross-sectional survey captured working conditions and safety perceptions among a large, national sample of US food retail workers from July to October 2020. **Results:** Overall, 40.3% reported feeling "not so" or "not protected" by COVID-19 controls. Administrative controls were more commonly reported (56.8% reported ≥5 controls) than engineering (19.5% reported ≥3). Fomite-related controls were more common than those reducing interpersonal contact. After adjustment, organizational safety climate (prevalence ratio (PR): 1.53, 95% CI: 1.24, 1.89), and perceived strict prevention measure enforcement (PR: 0.60, 95% CI: 0.46, 0.78) were associated with safety perceptions. **Conclusions:** Many workers do not feel well-protected by COVID-19 controls. Safety climate and control enforcement are associated with workers' COVID-19 safety perceptions.

Keywords: COVID-19, food retail worker, occupational health, occupational stress, workplace protections

From the Department of Environmental Health and Engineering, Johns Hopkins Bloomberg School of Public Health, Baltimore, Maryland (Ceryes, Barnett, Neff); Johns Hopkins Center for a Livable Future, Baltimore, Maryland (Ceryes, Biehl, Neff); Department of Health Behavior and Society, Johns Hopkins Bloomberg School of Public Health, Baltimore, Maryland (Robinson); Department of Epidemiology, Johns Hopkins Bloomberg School of Public Health, Baltimore, Maryland (Wirtz).

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Clinical significance: Many food retail workers do not feel well-protected by employers' COVID-19 controls. Perceived enforcement and workplace safety climate were strongly associated with safety perceptions. Enhancing workplace communication, protection enforcement, and safety commitment could help essential food retail workers feel better protected. Controls reducing interpersonal contact should be prioritized.

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Address correspondence to: Roni Neff, PhD, Johns Hopkins Bloomberg School of Public Health, Center for a Livable Future, 111 Market St., Ste. 840, Baltimore, Maryland 21202 (rneff1@jhu.edu).

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INTRODUCTION

The COVID-19 pandemic represents a novel occupational safety and health threat for US workers, especially those considered "essential." While workers in other sectors have stayed home, the nation relies upon food retail workers to maintain food access throughout the pandemic. Despite extensive press coverage, little systematic data exist characterizing food system workers' experiences or describing how employer practices impact workers' safety perceptions and COVID-19 risks. As infection waves and workplace exposures persist, a pressing need exists to assess working conditions and identify critical practice and policy supports to increase workers' safety and reduce COVID-19-related occupational stress for this essential group.[1]

US Food Retail Workforce

The US food and beverage retail sub-sectors employ approximately 4.3 million workers in supermarkets, grocery stores, warehouse clubs, supercenters that sell food, convenience stores, and specialty food stores.[2,3] Stockers, order fillers, and cashiers hold 1.4 million jobs, with other common positions including food preparers, packagers, butchers, and customer representatives.[4] Food and beverage retail workers' median wage ($12.36 per hour) falls well below the national median ($19.14 per hour).[4] In contrast to other sectors, food retail jobs have increased during COVID-19.[5]

While limited national-level occupational COVID-19 data exist, union and media reports document substantial COVID-19 morbidity and mortality among food retail workers.[6,7] Mounting evidence demonstrates racial disparities in COVID-19 health outcomes among essential workers,[8] and that workplaces, including food retailers, represent key occupational and community COVID-19 transmission sites.[9]

Current Worker Safety Recommendations

In March 2020, the US Occupational Safety and Health Administration (OSHA) issued basic guidance for workplaces to prepare for COVID-19 using controls prioritized according to the Hierarchy of Controls.[10] This framework ranks controls in descending order according to their effectiveness (ie, hazard elimination; substitution; engineering controls; administrative controls; and personal protective equipment (PPE)). OSHA encourages engineering controls, which isolate workers from COVID-19, and administrative controls, which include anti-infection workplace policies and practices, and PPE use. PPE ranks lowest on the hierarchy; however, masks remain important in reducing workers' exposure to the public.[11] This guidance carries neither statutory nor regulatory power, and little is known about controls enacted to keep food retail workers safe across the United States during the COVID-19 pandemic.

COVID-19, Stress, and Working Conditions

A growing literature, mostly focused on healthcare workers, documents occupational stress, exposure concerns, and working

conditions for essential workers during the COVID-19 pandemic. Studies link ''essential'' work with anxiety, depression, insomnia, burnout, and material hardship.[12–17] Among grocery workers, smaller studies have found associations between psychological distress and inability to socially distance at work, commuting by public transit, and having limited PPE access.[12,15] Several conceptual models describe workplace stress antecedents and inform interventions. The Job Demands-Resources (JD-R) model posits that high work-related demands contribute to stress and negative individual (eg, disease, injury, and burnout) and organizational outcomes (eg, high turnover).[18] Retail job demands can include high work pace, customer-related emotional labor, and long or irregular shifts.[19,20] Anecdotally, these demands have increased during the COVID-19 pandemic,[11,21] along with concerns about COVID-19 transmission, job insecurity, and work-life imbalance.[5]

Per the JD-R, job resources, including control/autonomy, managerial and coworker support,[22] and organizational safety climate (eg, employees' shared perceptions of safety priorities, policies, and procedures, influenced by managerial commitment, employee behavioral norms, and worker safety participation)[23,24] can mitigate negative work demand effects.[18] Some evidence suggests that employer practices, including control implementation and training, disease surveillance, communication, and transparency, may help mitigate COVID-19 transmission, enhance feelings of protection, and reduce essential workers' stress and fear.[14,25,26]

Helping workers feel protected at work has relevance for both reducing stress and improving actual safety outcomes. Early studies indicate that essential workers who feel protected by employers or governments during COVID-19 exhibit decreased general anxiety symptom prevalence.[27] Correlations of workplace COVID-19 cases and deaths with OSHA safety complaints suggest workers' safety perceptions can reflect actual workplace risks.[9] However, how food retail workers view COVID-19 practices and what helps workers feel protected remains largely unknown.

This study explores the following research questions:

1. What workplace controls have employers applied to protect food retail workers during the COVID-19 pandemic?
2. How protected do these workers feel during the COVID-19 pandemic?
3. What workplace factors are associated with these workers feeling protected during the COVID-19 pandemic?

Through this analysis, we identify potential practice and policy interventions to support food retail workers through this and future pandemics, and reveal research avenues.

METHODS

This study uses data from the US Food Worker COVID-19 Survey, a national, cross-sectional self-administered survey available online via Qualtrics between July 31 and October 2, 2020. This study documented working experiences and conditions between March and September, across food industries including production, processing, distribution, retail, service, and food assistance. This manuscript focuses on food retail workers.

Sampling

We recruited an online sample via targeted Facebook and Instagram advertisements, using a marketing strategy designed in partnership with social media marketing firm, Bytes.co. Each ad set included recruitment photos and text describing study goals, inclusion criteria, and survey incentive (one in 10 chance for a $25 gift card.) Bytes.co deployed and managed ad sets in English and Spanish, with targeting criteria including major employers, job titles, interests, and demographics (Appendix A, http://links.lww.com/JOM/A900). Eligible respondents were food chain workers who attended work in person since March 11, 2020, lived in the United States, were over 18 years old, and could read English or Spanish.

We aimed to obtain a sample with demographic characteristics resembling the underlying national population of food workers. The research team met with Bytes.co weekly to adjust ad targeting based on real-time monitoring of participant characteristics. Study selection criteria remained unchanged, but we aimed to ensure Facebook ads were seen by a diverse group of workers. We attempted to increase sample diversity by increasing the budget for ads targeting Facebook-designated ''multicultural affinity groups,'' and focusing ads in zip codes with less than 50% ''white, non-Hispanic'' residents per the 2010 US Census.[28] Potential respondents could share ads to groups or pages, but research team members did not directly promote the study. We prevented fraudulent entries by restricting duplicate IP addresses and including unique random identifiers for incentive raffle entries.

Retail worker sample size was determined based on power calculations suggesting that 1000 respondents would provide a 3.1% margin of error with 95% confidence for feeling protected, our primary outcome of interest. The Johns Hopkins Bloomberg School of Public Health Institutional Review Board considered this study exempt (category 2) from oversight (IRB No. 12549).

Survey Development

The instrument (Appendix B, http://links.lww.com/JOM/A901) captured COVID-19 working conditions across the food system. Where possible, we used validated items and scales, though sometimes edited for clarity or condensation. Worker and food industry representatives, and occupational health, disaster preparedness, and survey design experts reviewed the instrument. We established face validity through one-on-one cognitive interviews with food retail ($n = 1$) and restaurant workers ($n = 2$).[29] Workers who participated in cognitive testing did not serve as expert reviewers. The final instrument contains 114 items and was translated and back-translated from English to Spanish. Median survey length was 20.6 minutes.

Most items' recall period was from the pandemic declaration (March 11, 2020) to the time of survey. Some questions focused on the past month. Respondents could skip any question after the demographic screening.

Measures

Demographics included age, race, gender identity, ethnicity, income, and geographic location.

Organizational/Occupational Attributes

Occupational characteristics included job tenure, full/part-time status, employer size, retail store type, and union membership. We assessed the past month organizational safety climate using a validated 6-item scale measuring: (i) managerial safety commitment, (ii) safety feedback, (iii) worker safety practice engagement, and (iv) coworker behavioral norms.[23] Workplace social support (past month) and quantitative work demands (since March 11) were measured using medium-length scales from the Copenhagen Psychosocial Questionnaire III.[30] Scores were dichotomized at median values for multivariable analyses. We established internal consistency for scales using Cronbach alpha above 0.70.[31]

Workplace COVID Prevention Measures and Conditions

Respondents selected all controls provided from March 11th until the time of survey from a March 2020 OSHA-recommended list[10] containing seven administrative and six engineering controls. Engineering and administrative controls were analyzed individually and grouped by count for multivariate analyses. There was less

variation in reported engineering controls, which are typically more expensive and logistically demanding to implement, with a large fraction of the sample reporting two or fewer. Engineering control counts were placed in three analytic categories (0–1 control; 2 controls; 3 or more controls) designed to maintain balance across groups. Administrative controls demonstrated more variability than engineering controls and were grouped into four analytic categories (0–2 controls; 3–4 controls; 5 controls; and 6 or more). We asked whether employers provide formal COVID-19 case updates, who enforce controls, how strictly they are enforced, whether participants had had COVID-19, and whether participants thought they would contract COVID-19 at work since March 11th. We also asked about pay fairness and customer interactions in the past month.

Sense of Protection

Our main outcome was ''Overall how well do you think your employer's prevention measures protect you from COVID-19 at work?'' – ''in the real world.'' We also asked this question in terms of ''if (prevention measures were) done perfectly.'' Responses were measured using a 4-point scale (very protected, somewhat protected, not so protected, and not at all protected) collapsed into a dichotomous variable (more vs less protected).

State-level Policy: We matched participants' US state with a state-level legal mask mandate enforcement indicator sourced from state social distancing policies up to the time of survey.[32]

Statistical Analysis

Using STATA 14I/C, we conducted descriptive analyses on complete case data to assess engineering and administrative control prevalence across the sample and explore differences in reported sense of protection by demographics and occupational factors. Depending on variable type and distribution, we explored associations and correlations between binary protection groups and reported controls using parametric and non-parametric tests. Descriptive tests were two-tailed and used significance level <0.05.

Answers were not forced beyond demographic screening, and items later in the survey exhibited frequent item non-response. Missing data analysis revealed items were missing at random. We used Multiple Imputation by Chained Equations[33] to impute variables with missing data for multivariable analyses, which ranged from <1% (race, ethnicity) to 27.9% missing (COVID-19 case status).

We explored bivariate associations between covariates and sense of protection using log-binomial models, or modified Poisson regressions if log-binomial models failed to converge.[34] Covariates were considered for multi-variable model inclusion based on an *a priori* conceptual framework (Appendix C, http://links.lww.com/JOM/A902) (gender, race, and organization size) and bivariate association ($P < 0.10$) with the outcome (age, work demands, safety climate, social support, COVID case status, and control enforcement).

Multivariable Analyses

We estimated associations between workers' sense of protection and workplace COVID-19 controls controlling for age, gender, race, organization size, COVID-19 case status, perceived control enforcement, safety climate, social support, and work demands. We assessed multicollinearity using variable inflation factors , which were below five for all variables except age category. We conducted sensitivity analyses restricted to complete case data, complete outcome data, and those who reported working in the past month before survey completion. Imputed, complete case, and sensitivity analysis estimates did not meaningfully differ; we report imputed bivariate and multivariable estimates here. Given the risk of recall bias in the variables of interest among participants with prior COVID-19 disease, we conducted stratified analysis within which the models were run separately for COVID-19 cases ($n = 152$) and non-cases ($n = 987$). We observed no qualitative differences in the results produced by the stratified analysis compared to the analysis that included COVID-19 cases and non-cases (Appendix D, http://links.lww.com/JOM/A903). Thus, the results presented here include the full imputed sample ($N = 1,168$) and are adjusted for potential confounding by the history of COVID-19.

RESULTS

Overall, 1,445,856 accounts viewed ads, 62,529 clicked the survey link, 7395 viewed the consent, and 7282 consented, yielding an 11.6% participation rate. Of those who passed the screener and quality checks (answered ≥20% of questions or viewed survey for ≥5 minutes, $n = 3831$), 1269 identified as food retail workers.

Respondents were mostly female (74.1%), white (91.8%), non-Hispanic (93.2%), non-union (61.9%), and average age 47 (SD 11.9). Most (98.5%) had worked at their food retail job in the past month. Table 1 presents sample characteristics.

COVID-19 Control Prevalence

Among 1269 respondents who reported workplace controls, the most frequently reported were administrative, with 56.8% reporting five or more of seven possible options. Figure 1 presents frequencies by outcome groups. Appendix E, http://links.lww.com/JOM/A904 presents frequencies in the total sample and by outcome groups.

In the total sample ($n = 1269$) the most frequently reported administrative controls were social distancing signs or markings (89.5%), customer mask policies (88.4%), employee PPE policies (82.8%), employer-provided soap/sanitizer (80.8%), and increased cleaning (76.9%). Only 55.5% reported employee COVID-19 training, and 57.8% reported employee symptom-checks. Few reported limiting crew sizes (7.3%).

Engineering controls were less prevalent than administrative controls, with 7.8% reporting zero engineering controls, and less than 1% reporting five or more (from six possible). See-through barriers between employees and customers (88.0%) were most prevalent. Less than half reported curbside or drive-through pick-up (42.1%) and a quarter reported spacing workstations (25.8%). Ventilation controls, including fans, air filters, or opening external doors were least commonly reported (7.2%).

Most workers (82.8%) reported employee PPE requirements. When asked what PPE was required (select all that apply), 99% reported masks or face shields, 35.9% reported gloves, and 1.1% reported gowns.

Sense of Protection

Of 1205 workers who answered the question, 40.3% felt ''*not so protected*'' or ''*not protected*'' (henceforth, ''less protected'') by their employer's prevention measures. Table 2 presents bivariate associations between feeling protected ''in the real world'' and covariates of interest.

Associations with Controls

All workplace controls were associated with workers' feelings of protection ($P < 0.05$) except for signs or markings encouraging social distancing. In bivariate models, prevalence ratios for feeling protected increased as the number of engineering controls and administrative controls increased (Table 2).

Correlations with working conditions

Workers' sense of real-world protection was positively correlated with confidence they would not contract COVID-19 at work ($\rho = 0.41$, $P < 0.001$) and with feeling fairly paid for working during COVID-19 ($\rho = 0.32$, $P < 0.001$). Of those who answered ($n = 1085$),

TABLE 1. Participant Demographics and Occupational Characteristics Among a National Sample of Food Retail Workers in the United States ($N = 1269$)

	Total
	n (%)
Age in years ($n = 1269$)*	
18–24	48 (3.8)
25–44	448 (35.3)
45–65	727 (57.2)
≥65	47 (3.7)
Gender ($n = 1269$)*	
Female	941 (74.1)
Male	313 (24.7)
Other	16 (1.3)
Race ($n = 1266$)*	
White	1,162 (91.8)
African American	22 (1.7)
Other/mixed race	82 (6.5)
Ethnicity ($n = 1243$)*	
Not Hispanic/Latinx	1158 (93.2)
Hispanic/Latinx	85 (6.8)
Store type ($n = 875$)	
Small/specialty store	72 (8.2)
Supermarket/box store	803 (91.8)
Household income ($n = 930$)†	
<$24,999	218 (23.4)
≥$25,000	712 (76.6)
US census region ($n = 1195$)	
Northeast	244 (20.4)
Midwest	241 (20.2)
South	447 (37.4)
West	263 (22.0)
Union status ($n = 1248$)	
Non-union member	773 (61.9)
Union member	475 (38.1)
Employer size ($n = 1211$)	
1–49	188 (15.5)
50–499	981 (81.0)
More than 500	42 (3.5)
Hourly status ($n = 939$)†	
Full time	642 (68.4)
Part time	245 (26.1)
Other	52 (5.5)
Worked in last month ($n = 1269$)*	
Yes	1251 (98.5)
No	18 (1.4)
Had COVID-19 ($n = 915$)*	
Yes	115 (12.6)
No	800 (87.4)
Safety climate score ($n = 960$)*	
High	526 (54.8)
Low	434 (45.2)
Social support score ($n = 1045$)*	
High	521 (49.9)
Low	524 (50.1)
Work demands score ($n = 1157$)*	
High	731 (63.2)
Low	426 (39.8)

*Forced-response question.
†Questions that were not forced-response and appeared toward the end of the survey exhibited higher non-response rates.
Possible score ranges: safety climate: 6–24.
Social support, work demands: 0–100.

only 39.5% agreed with the statement, "*My employer formally updates us about any staff cases of COVID-19*." Formal updates were positively correlated with feeling protected ($\rho = 0.37$, $P < 0.001$). Most (98.1%) reported working with customers; allowing "too many" customers in stores was negatively correlated with feeling protected ($\rho = -0.36$, $P < 0.001$).

Perceived Control Fidelity and Enforcement

Almost half (47.3%) who answered ($n = 1194$) indicated a discrepancy between ideal ("perfect world") and actual ("real world") control implementation. When asked how strictly controls were enforced ($n = 1235$) 62.8% responded "somewhat" or "not very" strictly. When asked who was responsible for enforcing controls ($n = 1265$, check all that apply) respondents most commonly reported managers (63.2%), followed by themselves (21.5%), and coworkers (21.4%). Few reported enforcement by security guards (10.3%) or law enforcement (4.0%).

Associations Between Workplace Controls and Perceived Safety

Table 3 presents modified Poisson regression results from two models that examined perceived safety and workplace COVID-19 controls, controlled for age, gender, race, organization size, COVID-19 case status, perceived control enforcement, organizational safety climate, workplace social support, and work demands. After adjustment, greater numbers of engineering and administrative controls were non-significantly positively associated with feeling protected. Higher safety climate scores were positively associated with feeling protected (PR: 1.53, 95% CI: 1.24, 1.89). Reporting "not very strictly" enforced controls were negatively associated with feeling protected (PR: 0.60, 95% CI: 0.46, 0.78). (Appendix F., http://links.lww.com/JOM/A905 contains complete case results.)

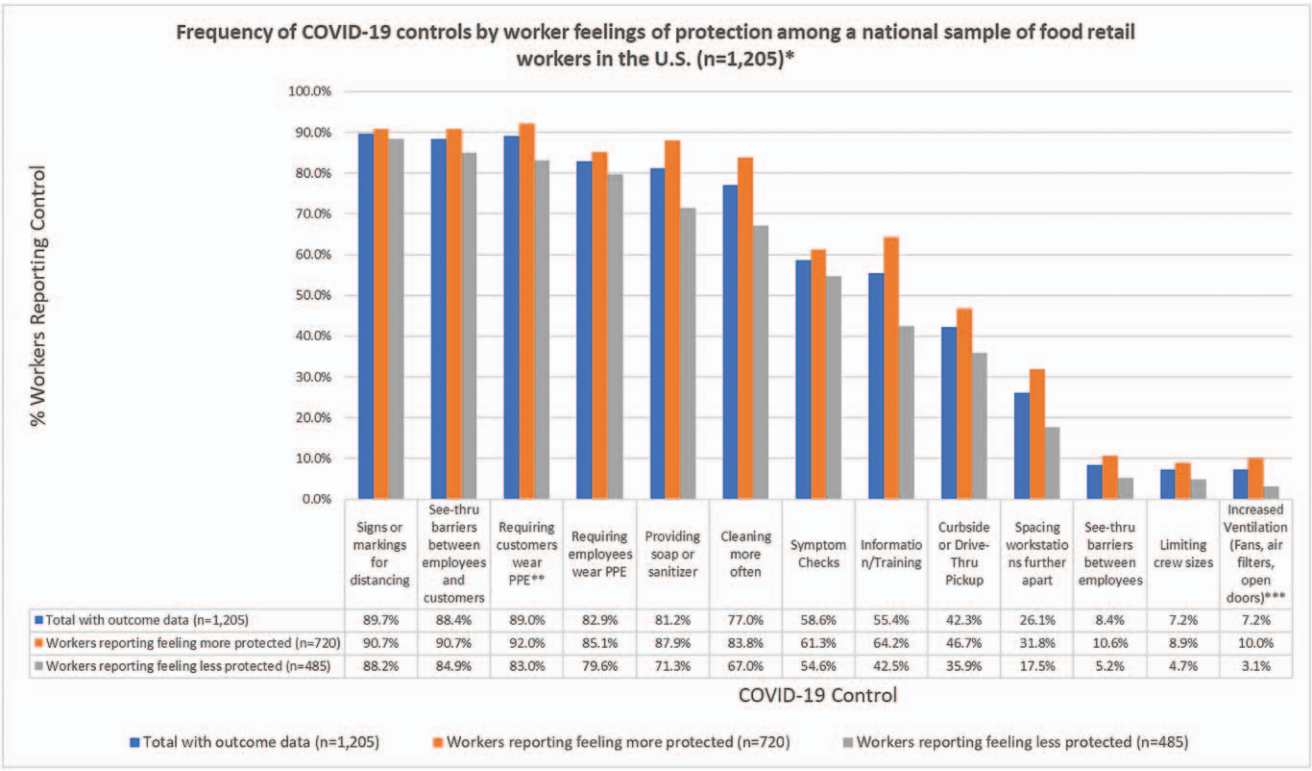
DISCUSSION

Workplace safety control implementation, organizational safety climate, and perceived enforcement were associated with increased food retail workers feelings of safety during the COVID-19 pandemic. These results provide insights into COVID-19 controls in food retail, and the importance of enforcement and organizational safety climate in maintaining workers' confidence in controls. Both feeling safe and being safe are important for workers' mental health and well-being. While we were only able to measure feeling safe, the frequency of controls and perceived enforcement could be considered actual worker safety indicators.

Workplace Safety Controls

Our results offer insights into workplace safety controls present in food retail 5 to 6 months into the pandemic, and how workers view them. First, we found that administrative controls were reported more than engineering controls. This finding is unsurprising, as administrative controls require less planning and initial investment than engineering controls.[35] However, they also often require worker effort and rely on worker/customer adherence, whereas engineering controls are more robust to individual behaviors.[35] Indeed, the only control not significantly associated with workers feeling protected was signage encouraging social distancing, which could be easily ignored.

Second, our findings suggest inconsistency between best practices to prevent COVID-19 and the controls reported in this sample. Our data reflect workers' experiences from the beginning of the pandemic until August and September 2020. By this time, public health scientists had reached the consensus that fomite COVID-19 transmission presents far less risk than interpersonal contact with an infected person.[36] Still, many cited controls primarily targeting fomite transmission, including providing soap or hand sanitizer (80.8%) and increased cleaning (76.9%). Eighty-two percent reported employee mask requirements, and slightly more (88.4%) reported customer mask requirements. However, other controls to limit interpersonal contact and dispersal of droplet



	Signs or markings for distancing	See-thru barriers between employees and customers	Requiring customers wear PPE**	Requiring employees wear PPE	Providing soap or sanitizer	Cleaning more often	Symptom Checks	Information/Training	Curbside or Drive-Thru Pickup	Spacing workstations further apart	See-thru barriers between employees	Limiting crew sizes	Increased Ventilation (Fans, air filters, open doors)***
Total with outcome data (n=1,205)	89.7%	88.4%	89.0%	82.9%	81.2%	77.0%	58.6%	55.4%	42.3%	26.1%	8.4%	7.2%	7.2%
Workers reporting feeling more protected (n=720)	90.7%	90.7%	92.0%	85.1%	87.9%	83.8%	61.3%	64.2%	46.7%	31.8%	10.6%	8.9%	10.0%
Workers reporting feeling less protected (n=485)	88.2%	84.9%	83.0%	79.6%	71.3%	67.0%	54.6%	42.5%	35.9%	17.5%	5.2%	4.7%	3.1%

FIGURE 1. All protections were associated with the sense of protection except for ''signs or markings for social distancing.'' *Respondents missing outcome data ($n = 64$) are excluded from this graph. Control frequencies for the full sample are located in Appendix D, http://links.lww.com/JOM/A903. **Respondents were only asked this question if they worked with customers ($n = 1175$ with outcome data), ''customer PPE requirement'' was not included in overall administrative control count but analyzed separately. ***Fans/air filters and leaving doors open were separate control options in the survey, and were condensed to ''ventilation controls'' for reporting.

particles, like curbside pickup, spacing workstations, limiting crew sizes, or improving ventilation, were far less common. While cleaning and handwashing are recommended by the US Centers for Disease Control and Prevention to protect employees, the fact that we observed associations between feeling protected and these less effective controls could suggest that workers overestimate their benefits, or are affected by ''hygiene theatre''[37] subliminal messaging. Focusing on these controls without simultaneously engaging controls that reduce close interpersonal contact could potentiate workplace infections and create a false sense of security for workers and the public.

Workplace Supports and Relationship to Workers' Sense of Safety

The JD-R model posits that workplace supports mitigate stressors' effects, especially if supports make stressors more predictable, understandable, and controllable for workers.[18] This aligns with our finding that feeling protected is positively associated with strict safety practice enforcement, which could increase perceived COVID-19 exposure predictability and control.

We found a strong association between workplace safety climate and workers feeling protected, even after adjustment for all covariates. These findings affirm others' findings that this construct remains a valuable indicator of safety and health prioritization, and represents key modifiable support during the COVID-19 pandemic.[38] Specifically, our findings identify similar links between organizational safety climate and employee safety perceptions as those found among essential healthcare workers. Safety activities, like planning, training, and access to PPE, have been associated with healthcare workers' willingness to respond and psychological outcomes during emerging infection outbreaks,[39–41] including COVID-19.[14,25] Frequent and transparent organizational communication, a key component of safety climate, has been associated with healthcare workers' feelings of protection both in previous pandemics[41,42] and during COVID-19.[25] Notably, we found a lack of communication-related activities, including employee training (58% reporting) and formal case updates (39.5%). We suggest that increased use of these practices and inclusion in regulatory standards (as in California[43]) could enhance workers' sense of safety. Additionally, workers' perceptions of controls, managerial safety commitment, enforcement, and safety climate could reflect a shared underlying construct. These interactions require further study, especially regarding impacts on COVID-19 prevention measure effectiveness in food retail and other essential work environments.

Finally, while we analyze in-store interventions here, these findings should not detract from other external, economic supports food retail workers need, including permanent pay increases to a living wage, paid family and worker sick leave, mental health support, hazard pay, and healthcare benefits.

This study provides timely information about food retail working conditions during the COVID-19 pandemic from a national food retail worker sample. Our sampling strategy enabled us to reach participants across the United States without recruiting through employers or labor groups, which could bias results. Despite broad geographic representation, we experienced challenges typical of such web-based surveys, including item nonresponse, overrepresentation of white females,[28,44] and inability to compare potential with actual respondents. While we limited item

TABLE 2. Bivariate Associations Between Independent Covariates and Sense of Protection During the COVID-19 Pandemic Among a National Sample of Food Retail Workers in the United States ($N = 1168$)

	Risk/prevalence ratio	95% Confidence interval	*P*-value
Age			
18–24	Ref		
25–44	1.25	0.78, 2.00	0.36
45–64	1.46	0.92, 2.31	0.11
≥65	1.76	1.01, 3.07	0.05
Gender			
Female	Ref		
Male	1.02	0.86, 1.21	0.83
Other response	0.84	0.38, 1.88	0.67
Race*			
White	Ref		
African American	1.06	0.62, 1.80	0.84
Other or >1 race	1.09	0.81, 1.46	0.57
Ethnicity*			
Non-Hispanic/Latinx	Ref		
Hispanic/Latinx	1.14	0.86, 1.52	0.35
Union status*			
Non-union member	Ref		
Union member	0.91	0.78, 1.07	0.26
Number of employees*			
<50	Ref		
50–499	1.06	0.86, 1.31	0.58
More than 500	0.88	0.54, 1.41	0.59
COVID case status*			
Did not have COVID-19	Ref		
Had COVID-19	0.76	0.59, 0.98	0.03
In-store protection enforcement*			
Strictly	Ref		
Somewhat strictly	0.81	0.69, 0.96	0.01
Not very strictly	0.39	0.31, 0.48	<0.001
State mask mandate enforcement*			
Not legally enforced	Ref		
Legally enforced	0.86	0.71, 1.04	0.11
Quantitative work demands score*	0.99	0.99, 1.00	<0.001
Safety climate score*	1.10	1.08, 1.12	<0.001
Social support score*	1.01	1.01, 1.02	<0.001
Engineering controls			
0–1 controls	Ref		
2 controls	1.17	0.99, 1.39	0.07
3 or more controls	1.60	1.32, 1.93	<0.001
Administrative controls			
0–2 controls	Ref		
3–4 controls	0.99	0.73, 1.35	0.96
5 controls	1.52	1.12, 2.05	0.01
6–7 controls	1.65	1.23, 2.23	0.001

*Imputed variable.

non-response bias using multiple imputations, these challenges reduce generalizability. We emphasize the urgent need for continuing research reflecting essential worker population diversity. Given existing social inequities, our findings may overrepresent total controls and levels of safety climate, while underrepresenting job demands. However, given in-person research limitations during the pandemic, the pressing need to document conditions facing essential workers, and challenges in accessing representative food worker populations via alternate means, we consider our approach valuable and warranted.

This is a cross-sectional study, meaning our results cannot identify causal relationships. There is a risk of recall bias associated with the history of COVID-19 disease; however, we did not identify any observable differences in stratified analysis by COVID-19 history and controlled for potential confounding by disease history in the models. Given the descriptive and exploratory nature of this study, we have not adjusted for multiple testing, meaning that spurious associations could have been observed.[45] Continuing research is needed to further characterize the associations presented here.

In conclusion, many ''essential'' US food retail workers, who play a central role in maintaining national food security, do not feel well-protected from occupational COVID-19 exposures. Identifying working conditions and controls associated with workers' sense of protection reveals opportunities for future research, and potential strategies to mitigate pandemic-related occupational stress. This research provides evidence that not only enactment of controls but also strict enforcement and workplace safety climate are associated with workers feeling protected. More research is needed to parse the relationships between these constructs, and examine how well workers' sense of protection aligns with their actual protection from workplace COVID-19 exposures. As the COVID-19 pandemic

TABLE 3. Associations Between COVID-19 Controls, Working Conditions, and Prevalence Ratio (PR) for Feeling Protected Among a National Sample of Food Retail Workers in the United States ($n = 1168$)

	Unadjusted PR, 95% CI *P* value	Model 1* PR, 95% CI *P* value	Model 2† PR 95% CI P value
Engineering controls (ref: 0–1 control)			
2 controls	1.17 (0.99, 1.39) 0.07	1.02 (0.85, 1.21) 0.87	1.01 (0.85, 1.21) 0.90
3 or more controls	1.60 (1.32, 1.93) <0.001	1.21 (0.96, 1.48) 0.07	1.20 (0.97, 1.47) 0.10
Administrative controls (ref: 0–2 controls)			
3–4 controls	0.99 (0.74, 1.37) 0.96	0.84 (0.61, 1.15) 0.27	0.83 (0.61, 1.15) 0.26
5 controls	1.52 (1.12, 2.05) 0.01	0.99 (0.72, 1.36) 0.92	0.99 (0.72, 1.37) 0.95
6–7 controls	1.65 (1.23, 2.23) 0.001	0.98 (0.71, 1.36) 0.91	0.98 (0.71, 1.37) 0.92
High safety climate (ref: safety climate score below median)	2.14 (1.8, 2.54) <0.001	1.58 (1.29, 1.93) <0.001	1.53 (1.24, 1.89) <0.001
High work demands (ref: work demands score below median)	0.73 (0.62, 0.85) <0.001	0.87 (0.74, 1.02) 0.09	0.88 (0.74, 1.03) 0.12
Protection enforcement (ref: very strictly enforced)			
Somewhat strictly	0.81 (069, 0.96) 0.01	0.99 (0.83, 1.18) 0.90	0.99 (0.83, 1.18) 0.83
Not very strictly	0.39 (0.31, 0.48) <0.001	0.59 (0.45, 0.76) <0.001	0.60 (0.46, 0.78) <0.001

*Model 1: Controlled for age, gender, and race.
†Model 2: Controlled for age, gender, race, organization size, COVID-19 case status, and social support.
Ref = reference.

and future pandemics preparedness planning continues, research into interventions that support essential workers should be prioritized.

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