

# The level of implementation of COVID-19 measures in workplaces: Ideas for the future

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## ABSTRACT

**Objective:** The initial phases of Coronavirus Disease 2019 (COVID-19) pandemic required a wide range of preventive measures for various settings, including workplaces. The evaluation of workplace applications may guide all stakeholders for future similar outbreaks. This study aimed to evaluate the practice of Turkish occupational safety and health (OSH) professionals regarding COVID-19.

**Materials and Methods:** The study included responses of OSH professionals who were members of three national organizations. Data were collected during the third peak of COVID-19 cases in Turkey.

**Results:** Of 457 respondents, 92.6% reported at least one infected worker, and 12.7% reported mortality among workers due to COVID-19. Multiple regression analyses revealed an association with workplace size  $\geq 250$  for any COVID-19 infection among workers (OR=6.70, 95% CI:2.64–16.98,  $p<0.001$ ) and for COVID-19 related mortality (OR=3.37, 95% CI:1.59–7.13,  $p=0.002$ ). Moreover, working in governmental business enterprises was related to COVID-19 related mortality (OR=4.83, 95% CI:2.33–10.01,  $p<0.001$ ). The mean number of available measures was significantly lower ( $p<0.001$ ) in governmental business enterprises, the service sector, and workplaces with less than 250 workers.

**Conclusion:** The results indicate a need for improvement in small- and large-sized workplaces, governmental business enterprises, and service sector workplaces.

**Keywords:** COVID-19, occupational medicine, workplace measure, occupational diseases, occupational safety and health professionals.

## INTRODUCTION

Coronavirus disease 2019 (COVID-19) was declared a pandemic on March 11, 2020, by the World Health Organization [1]. The rapid global spread has led to significant morbidity and mortality and influenced nearly all aspects of life, with varying national measures to control the outbreak [2]. The measures primarily aimed to decrease human contact and prevent transmission, mainly through the respiratory route [3]. The national measures were guided by international organizations, which have also published their suggestions for safe work as the knowledge has gradually increased [4,5].

The first case of COVID-19 in Turkey was diagnosed on March 10, 2020 [6]. Soon after, national-level preventive measures were announced [7]. At the initial phase of the outbreak, less was known about the disease. Thus, measures included large-scale lockdowns for non-essential public workplaces and all educational institutions. Afterward, re-opening strategies have gained importance to provide a safe return to work, and several guidelines were published for various workplaces and other settings [8-10]. According to international and national guidelines, the risk of COVID-19 at workplaces should be evaluated with the participation of all parties, particularly workers or their representatives, under the supervision of occupational safety and health (OSH) professionals [11,12].

Studies show a variation in the availability of COVID-19 measures. For example, a Chinese investigation demonstrated relatively lower frequencies of hand sanitizing and avoidance of social gatherings for meals or crowded places in factory workers, compared to the percentage of 96.8 for workers wearing a face mask in the workplace [13]. In a study conducted with healthcare workers in Turkey, employees attached less importance to protective measures such as social distance and wearing masks in areas where they considered the risk of contamination was low [14]. A survey conducted in December 2020–January 2021 by the G20 OSH Experts Network evaluated the country-level OSH responses in 12 countries and found the most frequent administrative and non-administrative measures were remote work and use of personal protective equipment (PPE), respectively [15].

The evaluation of the practice in the workplace may guide workers, employers, and the government for future similar outbreaks. Despite a wide range of national guidelines for COVID-19 protection measures in Turkey, studies on the level of practice in the workplace are scarce [8-10]. Therefore, this study aimed to evaluate the practice of Turkish OSH professionals regarding COVID-19.

## MATERIALS and METHODS

### Study design, participants, and the survey

This nation-level descriptive study included Turkish OSH professionals, namely occupational physicians, occupational safety experts, and other occupational health personnel. The participants were approached via the Occupational Physicians Society, the Risk Management Society and the Society for Other Occupational Health Personnel. Each society delivered the electronic survey link to its members' communication platform (e.g., Whatsapp messaging group, Google group, members' messaging group, etc.), and participants were obtained via snowball sampling. The web link to the survey was sent on April 9, 2021, and three reminders on the 5th, 10th, and 14th days. The survey was closed on May 9, 2021. The study period corresponds to Turkey's third peak of COVID-19, with a daily number of new cases exceeding 60,000 [16].

A 43-item electronic survey was used to collect the data via Google Forms. The survey questions were prepared by researchers following the Guidelines of the Ministry of Health, Ministry of Industry and Technology and Ministry of Family, Labor, and Social Services [8-10]. The survey included sub-headings as follows: workplace features, the practice of job organization, social distancing and PPE use, sanitization, and OSH training on COVID-19. Additional questions were also asked regarding measures for workers' transportation services, social distancing at the entry and exit areas, cafeterias, break areas, and dressing rooms, short employment allowance, and a history of dismissal with Code-29 (i.e., a dismissal by the employer due to the worker's violation of code of ethics and

goodwill) between March 2020 and April 7, 2020, during the termination ban. The participants were asked to answer considering their practices from the beginning of the pandemic to the period when the survey was administered. The participants were asked to choose among four set answers (i.e., always, partially, no idea, and no) for items under each subheading. Moreover, questions were also asked about the history of any COVID-19 infection and mortality due to COVID-19 in workers. A pre-test was performed on sixteen OSH professionals, and adjustments in the items to provide maximum clarity were made accordingly. The pre-test data were not included in the results.

### Statistical analysis

The analyses were based on workplace characteristics, including workplace ownership type, size, type of OSH services, and sector groups. Participants were accepted from different workplaces. The continuous variables are presented as mean  $\pm$  standard deviation (SD) or median and quartiles, and categorical variables as numbers and percentages. The answer of "always" was accepted as the availability of the measure. This answer was compared with any other answers. The mean numbers of available measures under each sub-heading were compared according to workplace characteristics using Student's t-test. The frequencies of COVID-19 disease and mortality were compared according to workplace characteristics using the chi-square test. Univariate and multiple logistic regression tests were performed to evaluate the relationship between workplace characteristics and history of any COVID-19 infection and mortality due to COVID-19 in workers. For all comparisons, type 1 error (alpha) was accepted as 0.05. The statistical analyses were performed using IBM SPSS for Windows v.25.0 (IBM Corp., Armonk, NY).

### Ethics

The study was performed following the principles of the Declaration of Helsinki. The study protocol was approved by the Ministry of Health General Directorate of Health Services and Non-interventional Clinical Researches Ethics Board of Hacettepe University (Board Decision Number: 2021/06-47). The administrative board of each society granted permission for the study, and informed consent was obtained from participants.

## RESULTS

The study included responses from 457 OSH professionals (174 occupational physicians, 128 occupational safety experts, and 155 other occupational health personnel). The mean and median of the total numbers of workers in the participants' workplaces were  $942.7 \pm 2057.5$  and 350 (first quartile: 92, third quartile: 1,000). The characteristics of OSH professionals' workplaces are presented in Table 1. Most of the workplaces were private enterprises (65.4%). Most workplaces were from either the service (45.1%) or the industry (43.5%) sectors. The percentage of workplaces with internal OSH units was 39.4%. More than forty percent of workplaces (41.8%) employed 500 or more workers.

The majority of OSH professionals (92.6%) reported any positive history of at least one worker contracting COVID-19. Moreover, 12.7% reported mortality among workers due to COVID-19. There was no significant relationship between any positive history of COVID-19 infection or any COVID-19-related mortality among workers and mean numbers of measures on job organization, social distancing and PPE, sanitization, and OSH training. The relationship between any history of COVID-19 infection and mortality among workers and workplace characteristics is shown in Table 2. A multiple regression model for any COVID-19 infection among workers revealed a statistically significant association with workplace size  $\geq 250$  (OR=6.70, 95% CI: 2.64–16.98,  $p < 0.001$ ) compared to workplace size  $< 250$ . The model for any history of mortality among workers due to COVID-19 revealed a significant relationship with governmental business enterprise (OR=4.83, 95% CI: 2.33–10.01,  $p < 0.001$ ) compared to other workplace types and workplaces with 250 or more workers compared to workplaces with less than 250 workers (OR=3.37, 95% CI: 1.59–7.13,  $p = 0.002$ ).

The frequencies of availability for each measure are shown in Table 3. The most frequently available measure was the education for hand hygiene (90.8%). The majority of the measures were available in more than half of the workplaces, but some measures, which included suspending the production or work (16.8%), avoiding face-to-face meetings (24.9%), and providing a time shift between entry and exit to avoid face-to-face contact

**Table 1.** The distribution according to the workplace characteristics

Characteristic		n	%
Workplace status	Private enterprise	299	65.4
	Government business enterprise	99	21.7
	Foreign capital enterprise	43	9.4
	Enterprises with public-private partnership	16	3.5
Sector	Service	206	45.1
	Industry	199	43.5
	Construction	42	9.2
	Agriculture	10	2.2
OSH services	Internal OSH unit	180	39.4
	External OSH service	178	38.9
	Any combination of OSH service types	78	17.1
	An authorized unit of the Ministry of Health	21	4.6
Size	≥500	191	41.8
	250-499	74	16.2
	50-249	106	23.2
	10-49	70	15.3
	<10	16	3.5
Total		457	100.0

OSH= Occupational safety and health

**Table 2.** Univariate and multiple logistic regression analysis of the relationship between workplace features and workers' history of COVID-19 diagnosis and mortality

COVID-19 diagnosis							
Workplace characteristics		n	%	Univariate		Multiple	
				OR (95% CI)	p*	OR (95% CI)	p*
Workplace status	Other <sup>†</sup>	358	90.5	Reference		-	-
	Governmental	99	100.0	-	<b>0.001</b>	-	-
Sector	Service	206	91.3	Reference		Reference	
	Other <sup>‡</sup>	251	93.6	1.41 (0.70-2.83)	0.338	1.10 (0.53-2.28)	0.789
OSH services	Other <sup>§</sup>	277	90.6	Reference		Reference	
	Internal	180	95.6	2.23 (0.99-5.04)	<b>0.049</b>	1.40 (0.60-3.29)	0.438
Size	<250	192	85.4	Reference		Reference	
	≥250	265	97.7	7.35 (2.99-18.18)	<b>&lt;0.001</b>	6.70 (2.64-16.98)	<b>&lt;0.001</b>
COVID-19 mortality							
Workplace characteristics		n	%	Univariate		Multiple	
				OR (95% CI)	p*	OR (95% CI)	p*
Workplace status	Other <sup>†</sup>	358	7.3	Reference		Reference	
	Governmental	99	32.3	6.10 (3.41-10.90)	<b>&lt;0.001</b>	4.83 (2.33-10.01)	<b>&lt;0.001</b>
Sector	Other <sup>‡</sup>	251	9.2	Reference		Reference	
	Service	206	17.0	2.03 (1.16-3.56)	<b>0.012</b>	1.12 (0.54-2.29)	0.766
OSH services	Other <sup>§</sup>	277	8.3	Reference		Reference	
	Internal	180	19.4	2.67 (1.52-4.69)	<b>&lt;0.001</b>	1.42 (0.76-2.66)	0.270
Size	<250	192	5.2	Reference		Reference	
	≥250	265	18.1	4.03 (1.98-8.18)	<b>&lt;0.001</b>	3.37 (1.59-7.13)	<b>0.002</b>

\*Bold values indicate statistical significance.

<sup>†</sup>Private enterprise, foreign capital enterprise, and enterprises with public-private partnership<sup>‡</sup>Industry, construction, agriculture<sup>§</sup>External, an authorized unit of the Ministry of Health, any combination of OSH service types

COVID-19, coronavirus disease 2019; PPE, personal protective equipment; SD, standard deviation

**Table 3.** The frequencies of available measures in the workplaces (n=457)

Measure	n	%
Job organization		
Applying flexible working models, including distant working or working from home, for the workers suggested a transition to flexible working by related guideline	329	72.0
Applying flexible working models, including distant working or working from home, for the workers other than those suggested a transition to flexible working by related guideline	260	56.9
Applying alternate working	261	57.1
Suspending the production or work	77	16.8
Changing work or shift hours to decrease the number of the workers in the workplace at a particular time	251	54.9
Providing a time shift between entry and exit to avoid face-to-face contact	197	43.1
Encouraging workers for the vacation leave, paid leave, or unpaid leave	230	50.3
Decreasing work activities with distant assignment	315	68.9
Limiting the entry of providers or visitors to the workplace	328	71.8
Updating the risk evaluation in line with the COVID-19 measures	412	90.2
Updating the emergency plans in line with the COVID-19 measures	410	89.7
Measuring the body temperature of workers in the workplace	364	79.6
Checking the workers' COVID-19 status using HES-codes	176	38.5
Checking the visitors' COVID-19 status using HES-codes	297	65.0
Evaluating workers with COVID-19 risky contact according to the guidelines	406	88.8
Isolating any COVID-19 case from other workers in a designated room	280	61.3
Social distancing and PPE use		
Avoiding face-to-face meetings	114	24.9
Adapting online methods for the meetings, conferences, or congresses	267	58.4
Providing adequate and appropriate PPEs to workers for protection against COVID-19	353	77.2
Sanitization		
Cleaning and disinfecting the surfaces, equipment and workplace media regularly	322	70.5
Providing adequate amount of hand sanitizers in easy-access areas	384	84.0
Providing adequate toilet and lavatory according to the number of workers	305	66.7
Placing adequate waste bins for paper towels, wet towels, gloves, and face masks in appropriate areas	332	72.6
Applying appropriate ventilation using external air ventilation or natural air circulation for the central ventilation systems	235	51.4
OSH training on COVID-19		
Training the workers on what to do in case of COVID-19 symptoms	406	88.8
Training the workers on what to do in case of a history of risky contact	412	90.2
Training the workers on hand hygiene	415	90.8
Placing visual and auditory warnings on COVID-19 measures	406	88.8
Total	-	100.0

COVID-19= Coronavirus disease 2019; HES-code= The code provided by the Ministry of Health to allow sharing COVID-19 status with third parties; PPE= Personal protective equipment; OSH= Occupational safety and health

(43.1%), were available in less than half of the workplaces. The responses for short employment allowance and history of dismissal with Code-29 were 40.0% and 6.1%, respectively. The most frequent measures for workers' transportation services, social distancing at the entry and exit areas, cafeterias, break areas, and dressing rooms are presented in Supplementary Table 1.

The overall mean number of the available measures in workplaces was  $18.70 \pm 5.90$ . According to sub-headings, the mean numbers of measures were  $10.05 \pm 3.69$  for job organization,  $1.61 \pm 0.90$  for social distancing and PPE,  $3.45 \pm 1.63$  for sanitization, and  $3.58 \pm 0.94$  for OSH training. The mean numbers of measures were significantly lower in governmental business enterprises ( $p < 0.001$ ), workplaces in the



service sector ( $p < 0.001$ ), and workplaces with less than 250 workers ( $p < 0.001$ ) (Table 4). This pattern was similar for job organization, sanitation and disinfection, and education. For the sub-heading of physical distance and PPE, lower mean numbers of measures were observed in workplaces in the service sector ( $p = 0.018$ ), workplaces without internal OSH department ( $p = 0.008$ ), and workplaces with less than 250 workers ( $p < 0.001$ ).

## DISCUSSION

The present study was conducted during the third peak of COVID-19 in Turkey to evaluate workplace practice according to OSH professionals' responses. In the literature, there are several alternatives for data source regarding similar studies. Garzillo et al. surveyed 41 workplaces located in the province of L'Aquila, Abruzzo, Italy [17]. An Algerian study evaluated 115 workplaces by visiting and asking one of the workplace officials about workplace measures [18]. In contrast, both Sasaki et al.'s and Ishimaru et al.'s studies evaluated the level of workplace measures through workers' responses [19,20]. The advantage of surveying OSH professionals includes their active role in determining and enforcing the measures, although this role might influence the accuracy of their responses. Future studies evaluating the views of both OSH professionals and workers may overcome this issue.

The measures were suggested in the very early stage of the pandemic by the authorities, including the Ministry of Health, enabling workplaces to adapt

rapidly [21]. In contrast to most of the measures, some measures, such as suspending production or work, avoiding face-to-face meetings, and providing a time shift between entry and exit to avoid face-to-face contact, were available in less than half of the workplaces. In Turkey, curfews and restrictions were enacted during surges in COVID-19 case numbers, with sectoral and activity-based exemptions [22]. Thus, the low frequency of the relevant measure may be a result of these exemptions.

The present study's results demonstrated lower mean numbers of available measures in workplaces in the service sector and workplaces with less than 250 workers. A Turkish study compared transportation and metal sectors and showed differences in job characteristics, physical distance, PPE use, and workplace size [23]. The sector-based differences were similar to other international studies [17,19]. Moreover, two studies from Japan similarly showed better implementation and announcement of measures in large enterprises [19,20]. Garzillo et al. showed a higher level of measures in larger companies [17]. This finding could also be related to additional factors depending on workplace size (e.g., the OSH culture and level of the OSH services), infection rates in the general population, and the level of community transmission.

There was a significant difference between governmental business enterprises and other workplace types in terms of mean numbers of available measures. Furthermore, the multiple regression model revealed a significant relationship

**Table 4.** The distribution of mean numbers of measures according to workplace characteristics (n=457)

Workplace characteristics		n	Job organization		Social distancing and PPE		Sanitization		OSH training		Total	
			Mean±SD	p*	Mean±SD	p*	Mean±SD	p*	Mean±SD	p*	Mean±SD	p*
Workplace status	Other <sup>†</sup>	358	10.56±3.55	<b>&lt;0.001</b>	1.65±0.89	0.076	3.65±1.55	<b>&lt;0.001</b>	3.69±0.82	<b>0.001</b>	19.54±5.58	<b>&lt;0.001</b>
	Governmental	99	8.22±3.64		1.46±0.90		2.73±1.74		3.22±1.25		15.64±6.05	
Sector	Other <sup>‡</sup>	251	10.81±3.50	<b>&lt;0.001</b>	1.70±0.85	<b>0.018</b>	3.67±1.48	<b>0.002</b>	3.72±0.79	<b>0.001</b>	19.90±5.49	<b>&lt;0.001</b>
	Service	206	9.12±3.72		1.50±0.94		3.19±1.78		3.42±1.09		17.23±6.07	
OSH services	Internal	180	10.37±3.41	0.133	1.74±0.86	<b>0.008</b>	3.57±1.54	0.232	3.63±0.84	0.435	19.31±5.37	0.072
	Other <sup>§</sup>	277	9.84±3.86		1.52±0.91		3.38±1.70		3.56±1.01		18.30±6.20	
Size	<250	192	9.09±3.66	<b>&lt;0.001</b>	1.39±0.90	<b>&lt;0.001</b>	3.18±1.76	<b>0.003</b>	3.51±1.03	0.120	17.16±5.92	<b>&lt;0.001</b>
	≥250	265	10.74±3.57		1.77±0.86		3.65±1.52		3.65±0.88		19.81±5.65	

\*Student's t-test. Bold values indicate statistical significance.

<sup>†</sup>Private enterprise, foreign capital enterprise, and enterprises with public-private partnership

<sup>‡</sup>Industry, construction, agriculture

<sup>§</sup>External, an authorized unit of the Ministry of Health, any combination of OSH service types  
PPE, personal protective equipment; SD, standart deviation

between being a governmental business enterprise and any history of mortality among workers due to COVID-19. Those results indicate a requirement for improving those workplaces, which may also serve as an example for private companies.

To the best of our knowledge, this is the first study evaluating the workplace practice regarding COVID-19 by surveying OSH professionals in a large number of Turkish workplaces. Moreover, the current study evaluates a substantial number of workplaces compared to other studies regarding COVID-19 measures. The study's strengths also include the diversity of workplaces, obtaining data from the OSH professionals who are directly responsible for the OSH services, and a wide range of measures evaluated. However, there are some limitations to the current study. Firstly, the level of participation might be lower than expected due to workplace conditions resulting from an ongoing pandemic and the study's method of electronic surveying. Although the survey was kept open for one month to overcome this issue, the results may not represent all workplaces. The analyses did not include the quality of the application and the effectiveness of preventive measures. Although not aimed at this study, the infection and mortality rates might be related to parameters other than the availability of workplace measures, such as local infection rates. As mentioned above, the responses of the participants might be influenced by their role in planning the measures and applying them in the workplace, in addition to intrinsic limitations of similar epidemiologic studies using the survey method.

To conclude, the current study's results reveal a need for improvement in small-sized workplaces, governmental business enterprises, and workplaces of the service sector, and on certain workplace measures, including prevention of the workers' face-to-face contact. Future studies may

provide a comprehensive assessment by evaluating the measures from both the workers' and OSH professionals' perspectives and the effectiveness of measures applied in, which may contribute to adjusting the deficiencies. These investigations within the context of workplace biological risk factors can contribute to the understanding of workplace safety and guide efforts to enhance preventive measures for future similar outbreaks.

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## Author contribution

Study conception and design: AA, BB, and CC; data collection: AA and BB; analysis and interpretation of results: AA and BB; draft manuscript preparation: AA and BB. All authors reviewed the results and approved the final version of the manuscript.

## Ethical approval

The study protocol was approved by the Ministry of Health General Directorate of Health Services and Non-interventional Clinical Researches Ethics Board of Hacettepe University (Board Decision Number: 2021/06-47).

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## Conflict of interest

The authors declare that there is no conflict of interest.

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**Supplementary Table 1.** The distribution of most frequent measures for workers' transportation services, social distancing at the entry and exit areas, cafeterias, break areas, and dressing rooms

	n	%
Workers' transportation services (n=237)		
Arranging single-seat, decreasing the workers per vehicle at least half, increasing the number of vehicles, and/or making a cross seating arrangement	202	85.2
Disinfecting the surfaces and/or providing hand sanitizers	87	36.7
Mandatory facial mask usage	63	26.6
Social distancing at the entry and exit areas (n=196)		
Placing signs at the ground or sight-level	57	29.1
Providing single-way entry and exit areas to prevent face-to-face contact	37	18.9
Adjusting the time of entries and exits as different hours and/or preventing the crowd by determining an order for worker groups	20	10.2
Social distancing at the cafeterias (n=336)		
Decreasing the capacity, decreasing the worker per table, and/or making a cross seating arrangement	269	80.1
Preventing the crowd by determining an order for worker groups or increasing the duration of meal break	121	36.0
Separating the tables or cafeteria personnel with plexiglass sheets	105	31.3
Social distancing at the break areas (n=226)		
Placing signs at the ground or sight-level, and/or providing physical distance between seats	142	62.8
Limiting the number of workers in the area	45	19.9
Preventing the crowd by determining an order for worker groups	38	16.8
Social distancing at the dressing rooms (n=177)		
Limiting the number of the workers in the rooms	83	46.9
Preventing the crowd by determining an order for workers	46	26.0
Increasing the distance between lockers, placing the lockers of workers of another shift or empty lockers between the lockers of workers of the same shift	28	15.8