Prevention measures and risk factors for COVID-19 in Iranian workplaces

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Abstract.

BACKGROUND: Exposure to the coronavirus (COVID-19) in industrial workplaces has caused concerns all over the world. Implementation of prevention measures is the best solution for protection of workers' health.

OBJECTIVE: The present study investigated prevention measures and risk factors for the COVID-19 infection in Iranian small, medium, and large industries.

METHODS: This study was conducted on 349 occupational health, safety, and environment professionals working in different industries. Data was collected using a checklist of prevention measures for COVID-19 and a questionnaire of risk factors for the infection.

RESULTS: The results demonstrated that 32.60% of industries reported positive cases of COVID-19. The mean of prevention measures in all the dimensions, except use of personal protective equipment (PPE), was in favorable status. Among prevention measures against COVID-19, the dimensions of education, engineering controls, use of PPE, use of hand washing soap and disinfectant, and physical distance were not significantly different among small, medium, and large industries. However, administrative controls were statistically lower in small and medium industries compared to the large industries. Moreover, screening was statistically lower in small industries than in large industries. The mean risk factors of ventilation, use of common tools and equipment, and physical distance as well as total risk factors were not statistically different among different industries.

CONCLUSION: Workers are at risk of COVID-19 infection. The risk factors of ventilation, sharing tools and equipment, and physical distance are critical in classification of risk of infection with COVID-19 in industrial settings.

Keywords: Control, industry, infection, risk, coronavirus

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1. Introduction

Following the outbreak of pneumonia in February 2019, a new virus called coronavirus (COVID-19) was finally identified as the cause of respiratory

diseases, which spread to other parts of the world, including Iran, and infected thousands of people.

COVID-19 can cause severe pneumonia with acute respiratory distress syndrome and severe shortness of breath due to accumulation of water in the lungs, which can eventually lead to human death. People infected with COVID-19 can transmit the virus through respiratory secretions, especially during sneezing or coughing. The virus can be transmitted from a distance of about two meters. Surfaces contaminated with the patient's mucus or respiratory droplets are also a major transmission source of the virus. This virus has been reported to survive in the air for 8 hours, which poses a new challenge. Thus, it is necessary to implement strict prevention measures in industrial environments [1, 2]. Enclosed spaces and air pollution of industrial workplaces could increase the risk of exposure to COVID-19. In some industrial workplaces, due to the nature of the work, workers need to work close to one another or use common tools and devices that increase the risk of spreading COVID-19 [1].

Various organizations, such as occupational safety and health administration (OSHA) and world health organization (WHO), have made recommendations to employers to prevent the prevalence of COVID-19 in various workplaces [3, 4]. The present study aimed to determine prevention measures and risk factors for COVID-19 in small, medium, and large industries.

2. Methodology

The study was verified by Iran's National Committee for Ethics in Biomedical Research (IR.IUMS.REC.1399.060). The number of samples was based on the census and availability of participants. The sample population was 349 occupational health, safety, and environment experts working in different industries in Iran. The industries were classified into three groups: small (less than 20 workers), medium (20–50 workers), and large (more than 50 workers). The study was conducted march 2020 after the spread of COVID-19 in the country. Data was collected using a self-constructed checklist and a questionnaire.

The checklist was designed according to national and international protocols and guidelines for control of COVID-19 in workplaces. The checklist contained questions about prevention measures for COVID-19, such as engineering controls, education, administrative controls, screening, use of personal protective equipment (PPE), and use of hand washing soap and disinfectant. The questions were of closed ended type, with the mean score of each dimension being between 1-2. Mean scores above 1.5 showed unfavorable prevention measures and below 1.5 showed favorable prevention measures.

Based on the occupational health and safety experts' opinions, the main risk factors for COVID-19 infection in workplaces were number of workers, ventilation condition, physical distance between workers, and shared use of tools and equipment, as included in the questionnaire. Based on the risk factors of number of worker, ventilation condition, physical distance, shared use of tools and equipment, the risk level was classified into five groups: 1 (very low), 2 (low), 3 (moderate), 4 (high), and 5 (very high). Due to the prevalence of COVID-19, the checklist and the questionnaire were distributed via online system.

2.1. Statistical analysis

The SPSS version 16 was used for analysis of the data. ANOVA analysis was performed to compare the means of prevention measures, risk factors, and the risk level among different industries. A *p*-value of 0.05 was considered statistically significant. In descriptive statistics, mean, standard deviation (SD), frequency, and percent (%) were used.

3. Results

The results demonstrated that prevention measures were favorable in all the dimensions except use of PPE. Among prevention measures for COVID-19, the dimensions of education, engineering controls, use of PPE, use of hand washing soap and disinfectant, and physical distance were not significantly different in various industries ($P > 0.05$). However, the dimension of administrative controls and screening were meaningfully different among industries ($P < 0.05$). The administrative controls were statistically lower in small and medium industries than in large industries ($P < 0.05$). Moreover, screening was statistically lower in small industries than in large industries ($P = 0.018$) (Table 1).

The mean of management corporation in prevention measures for COVID-19 was statistically different among various industries ($P = 0.046$). Accordingly, a significant difference was detected between small and large industries ($P = 0.019$) (Table 2).

Table 1
Comparing Mean (SD) of prevention measures for coronavirus in different industries

Prevention measures	Type of industry			P value
	Small	Medium	Large	
Education	1.16 (0.28)	1.11 (0.26)	1.12 (0.25)	0.636
Engineering controls	1.35	1.30	1.21	0.675
Use of PPE	1.50 (0.40)	1.53 (0.41)	1.56 (0.40)	0.703
Administrative controls	1.35 (0.28)	1.30 (0.25)	1.21 (0.25)	0.004
Screening	1.37 (0.42)	1.28 (0.35)	1.21 (0.35)	0.036
Use of hand washing soap and disinfects	1.27 (0.26)	1.28 (0.21)	1.24 (0.22)	0.386
Physical distance	1.41 (0.27)	1.43 (0.26)	1.37 (0.27)	0.275

Table 2
Mean (SD) corporation of management in control of coronavirus

	Type of industry			P value
	Small	Medium	Large	
Management corporation	1.23 (0.32)	1.69(0.26)	1.13(0.24)	0.046

Table 3
Mean (SD) and frequency (%) of positive cases in different industries

Positive cases	Type of industry			P value
	Small	Medium	Large	
Mean(SD)	1.56 (0.50)	1.84(0.37)	1.66(0.47)	0.013
Frequency(%)	14(43.8)	9(16.4)	87(34.1)	

Table 4
Mean (SD) of risk factors of exposure to coronavirus in different industries

Risk factor	Type of industry			P value
	Small	Medium	Large	
Ventilation	2.41(1.94)	1.67(1.51)	1.92(1.69)	0.153
Use of common tools	3.75(1.88)	4.12(1.67)	4.38(1.45)	0.064
Physical distance	3.40 (0.87)	3.12(1.04)	3.22(0.97)	0.432
Risk level	2.93 (0.74)	2.59(0.60)	2.81(0.69)	0.044

The results also demonstrated that 32.60% of industries reported positive cases of COVID-19. The mean number of positive COVID-19 cases was significantly different among different industries ($P = 0.13$). In this regard, the mean number of positive COVID-19 cases was more in small industries than in medium industries ($P = 0.008$), and also, more in large industries compared to medium industries ($P = 0.010$) (Table 3).

The mean risk factors of ventilation, sharing tools and equipment, and physical distance as well as total risk factors were not statistically different among various industries ($P < 0.05$). According to Table 4, the risk level was statistically different among different industries ($P < 0.05$). Accordingly, the risk level was significantly different between small industries and medium industries ($P = 0.028$), and also, between medium industries and large industries ($P = 0.027$).

4. Discussion

There is currently no specific antiviral treatment or vaccine for COVID-19, and clinical treatment for this virus has been so far limited to palliative care and support. Workplaces could increase the risk of COVID-19 infection. This study aimed to investigate prevention measures and risk factors for COVID-19 infection in different industries.

The results indicated that the spread of COVID-19 varied among workers in different industries. The main way to fight COVID-19 was to maintain personal hygiene and follow a proper diet [5, 6]. Improving personal hygiene, wearing medical masks, having adequate rest, and providing proper ventilation are proper control strategies to fight COVID-19 [7]. Our findings showed that the means of education, engineering controls, use of PPE, use of hand washing soap and disinfectant, and observance of physical distance were not statistically different in different industries. In our study, training signs of infection with COVID-19, use of PPE, and observance of physical distance were considered as subset of education dimension. In the engineering control dimension, ventilation and face recognition system were considered instead of using fingerprint. In the physical distance dimension, teleworking, resting at home in case of having symptoms of COVID-19 infection, using video conferencing to hold meetings, canceling unnecessary meetings, and using extra work shifts were considered. The results also showed that use of PPE was not favorable in all industries, which can be due to lack of access to PPE (especially face mask) in first months of COVID-19 prevalence. Due to the significance of COVID-19 infection and mandatory implementation of COVID-19 prevention protocols

in workplaces, prevention measures were observed in most workplaces.

Administrative controls include provision of appropriate resources for prevention and control of infection in workplaces with the aim of providing sufficient manpower according to the workload. Screening is also used to check for COVID-19 symptoms [8]. In the present study, it was observed that administrative controls and screening were more prevalent in large industries than in small and medium industries. Similarly, safety and health issues were more observed in large industries than in small and medium industries.

Management corporation could be considered a major factor in preventing COVID-19 [9, 10]. According to our findings, the rate of management participation was more in small industries than in medium and large industries.

The major risk factors for COVID-19 in workplaces could be poor ventilation, shared use of tools and equipment, and physical distance. The results demonstrated that the risk factors of poor ventilation, shared use of tools and equipment, and physical distance were not statistically different in different industries. The risk level was higher in small industries than in medium industries, and also, higher in large industries compared to medium industries. Thus, the risk of COVID-19 infection was low in medium industries compared to other industries.

5. Conclusion

The prevalence of COVID-19 infection was reported in industrial workplaces, and implementation of prevention measures had a major role in controlling COVID-19. The results of the current study showed that most industries implemented prevention measures for COVID-19 control. Risk factors in workplaces included poor ventilation, shared use of tools and equipment, and physical distance. The risk level of COVID-19 infection was different among different industries. It is necessary to implement strict prevention measures to maintain workers' health in industries.

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Conflict of interest

The authors do not have any conflicts of interest.

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