Original Article

Psychological Health and Coronavirus Disease 2019-related Knowledge, Attitude, and Behavioral Practices among Industrial Workers: A Cross-sectional Study

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Abstract

Aim: The spread of the coronavirus disease 2019 (COVID-19) pandemic has imposed a high threat on the health of industrial workers as the most crucial source of the workforce in maintaining business and the community economy. The present study was conducted toevaluate the levels of psychological health and knowledge, attitude, and behavioral practice (KAP) relating to COVID-19 and to investigatethe individual and occupational risk factors associated with them. **Materials and Methods:** A cross-sectional study was conducted among 603 randomly selected workers from Tehran industrial city, Iran. Data collected through an online self-reporting questionnaire consisted of demographic variables, Depression, Anxiety, and Stress Scale (DASS-21), and items about KAP. Kruskal–Wallis, Mann–Whitney *U*-tests, and regression model analyses were performed to determine the factors associated with DASS-21 and KAP scales. **Results:** In this study, a prevalence of moderate to extremely severe symptoms was 30.2% for depression, 35.7% for anxiety, and 15.6% for stress. 89.9%, 95.3%, and 66% of the workers had moderate knowledge, attitude, and good behavioral practice, respectively. Home appliance industry (adjusted odds ratio [aOR] = 0.84, $P = 0.002$), work experience over 16–20 years old (aOR = 0.38, $P = 0.031$), and having an associate's degree (aOR = 0.82, $P = 0.02$) were positively associated with worker's attitude, depression, and knowledge, respectively. **Conclusion:** The findings indicated a considerable proportion of psychological health problems, particularly depression, anxiety, and stress among workers across industries. Occupational health services should provide interventions to improve knowledge, particularly in disease transmission, increase awareness, and emphasize appropriate preventive measures to reduce workplace chronic stressors and improve psychological health.

Keywords: Attitude, behavioral practice, coronavirus disease 2019, knowledge, psychological health

Introduction

Coronavirus disease 2019 (COVID-19) is an infectious respiratory pandemic caused by severe acute respiratory syndrome, coronavirus 2, which was first identified and confirmed in December 2019 in Wuhan, China.[1,2] SARS-CoV-2 can spread through human-to-human transmission and indirect contact with contaminated objects.[3] The most common symptoms of COVID-19 fever are dry cough and fatigue, which may lead to severe symptoms such as lung problems, chest pain, and difficulty speaking and moving.[4] In this regard, governments have issued many guidelines on several aspects of prohibition and control, such as social distancing, social seclusion, and quarantine adopted toward COVID-19.[5,6] Access to these guidelines and change in the behavior of workers in the workplace is possible by increasing and improving the level of knowledge, attitude, and behavioral practice (KAP) of individuals.[7]

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Prior studies on infectious disease epidemics showed that knowledge and awareness,[8] risk perception,[9] and efficacy belief help motivate people to adopt preventive behaviors.[10] In addition, the experiences of other countries during the epidemic have shown that public awareness is essential to ensure control of the prevalence of COVID-19 and that this awareness is influenced by the KAP of a population.[11,12] Despite these efforts, the implementation of guidelines may be neglected due to poor knowledge and attitudinal issues of individuals. These experiences, in turn, can influence adherence to personal protective measures, clinical outcomes, and psychological health.[13]

The spread of COVID-19 poses many threats to universal health, lifestyle work, and socioeconomic development.[14,15] Workplaces are standard settings for explosive infectious disease outbreaks due to transmission between workers and their close contacts in respective households and communities.[16] In addition, the result of the survey of 24 articles in a review study showed the highly infectiousnature of COVID-19 flowing transmission through contact,breathing, and coughing affected workers' psychologicalhealth undesirably by inducing fear, anxiety, and stress.[17] In literature studies conducted during the COVID-19 pandemic, it has become clear that most industries have suffered during this pandemic, and the widespread panic has profoundly affected the psychological health of workers working in the impacted industries.[18,19]

In general, the study of knowledge and behavioral of workers tochange misconceptions by determining the type of intervention,knowledge promotion, and development of preventionstrategies and health promotion programs that are the mosteffective measures during the epidemic and pandemic viraldiseases such as SARS, MERS, and has been Ebola.[20,21] They will play an important role in education, control planning, and the implementation of effective preventive measures during the COVID-19 epidemic as the most important health priority. Furthermore, evidence from previous studies suggested that industrial workers exposed to stressful working conditions during the COVID-19 pandemic may suffer increased psychological health symptoms.[22] On the other hand, the role of individual and occupational risk factors during the pandemic on the psychological health of industrial workers is less clear; therefore, the present study was conducted to evaluate the levels of psychological health, and KAP relating toCOVID-19 and to investigate the individual andoccupational risk factors associated with them.

Hypotheses

The research hypothesized that (1) psychological health symptoms are frequent in industrial workers during pandemic crises; (2) individual and occupational risk factors are effective in adopting the appropriate level of KAP of workers toward the COVID-19 pandemic; and (3) the perception of industrial workers about workplace stressors has a link with psychological health.

Materials and Methods

Research design, setting, and population

The present cross-sectional study was conducted in Tehran City, the Capital of the Islamic Republic of Iran, from October to December 2022. The total population of workers comprised around 680 working inward in selected industries including food, metal, wood, rubber, furniture, automotive, and home appliances. The inclusion criterion was employing work experience of at least 1 year. The working staff infected with COVID-19 or diagnosed with previous psychiatric or mental disorders were excluded.

We determined the sample size for a small population using the normal approximation to the hypergeometric distribution. A sample size of 603 was estimated at a 95% confidence level, a standard deviation of 0.5, with a 5% margin of error. First, seven industries were randomly selected by the lottery method from 24 industries. The proportional allocation was made to selected factories based on their numbers to get 603 samples. Then, the list of all workers was received from the requirement units by referring to the chosen industries. According to the inclusion criteria, samples were randomly selected to participate in the research.

The survey was administered using a Google Forms link shared on social networking sites such as WhatsApp and Telegram, the most accessible social media platforms in Iran. We used this method because retrieving data directly during the COVID-19 pandemic was impossible. The first section distributed the survey through a WhatsApp group, and participants were invited to complete the form. Next, we described the purpose of this study and provided details regarding informed consent. If workers were willing to participate in this study, they were asked to fill out the consent form and then directed to the online questionnaire.

Data collection and instruments

The present study was conducted through a survey with informed consent for the voluntary participation of workers. The first section of the questionnaire included demographic characteristics of worker's age, sex, marital status, education level, work experience, employment status, and type of industry.

The second part applied a Persian language revision of the Depression Anxiety Stress Scale-21 (DASS-21) to assess the psychological health of industrial workers. The DASS-21 was developed by Brown *et al*. in 1997 as a short form of the DASSs.[23] DASS-21 has been used in several studies conducted in Iran and has high internal consistency.[24,25] The reliability and validity of the burnout instrument in Iran were examined and confirmed by Sahebi *et al*., who reported Cronbach's alpha levels for depression, anxiety, and stress of 0.7, 0.67, and 0.49 dimensions of DASS-21, respectively.[26] The DASS-21 is a 21-item self-report instrument using a 4-point Likert scale ranging from "never" (0) to always (3). Three subscales containing seven items each measured depression, anxiety,

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and stress in the participants. These items includedepression (DASS-21 depression), assessing loss of affirmativefeelings, problem beginning work, feeling incuriosity, feelingplaintive, inability to become enthusiastic, feeling naught, andseeing life as absurd; anxiety (DASS-21 anxiety), comprisingsomatic and subjective symptoms of the drought of mouth,respiration difficulty, tremulous, worry of horrifying, feelingclose to fear, pulsations, and feeling dreaded without reason;and stress (DASS-21 stress), evaluating continues problem towind down, over-reacting to conditions, neural energy, feelingflustered, hard to unscrew, feeling intolerant of barriers, andfeeling rapid-affectioned. The final score of each subscale was gained by adding the scores of the questions related to that subscale. Afterward, the severity of symptoms was classified according to Table 1.

The third part applied a Persian language revision of the KAP to detect and assess the KAP of the COVID-19 disease. A total of 35 questions (including 18 for knowledge, 7 for attitude, and 10 for behavioral practice) were set to evaluate knowledge, attitude, and performance. The questions were adapted and modified from the World Health Organization's (WHO) infection prevention and control measures for COVID-19 and guidelines suggested by the country's Ministry of Health and Medical Education.[27,28] The knowledge section consists of 18 items, and each question had a possible response of "yes," "no," or "I don't know." The items assess the knowledge of transmission, symptoms of COVID-19, and other respiratory illnesses. The correct answer (yes) was coded as 1, while the incorrect answer (no/I don't know) was coded as 0. Individuals' views on preventive measures, willingness, and concern about COVID-19 were assessed using a 6-item attitude subscale with a three-point Likert scale (1, agree; 2, not sure; and 3, disagree). The behavioral practice section included 12-item health performance measures responding to COVID-19, and the answer had a 3-point Likert scale (1, always; 2, occasionally; and 3, never). The items related to KAP of COVID-19 are presented in Table 2 and Figures 1 and 2.

The validity of the questionnaire was performed by two relative content validity coefficients and confirmed using the opinions of six faculty members of occupational health and epidemiology of the university and experts in the field of instrumentation. After reviewing the criteria of relevance, simplicity, and clarity of each questionnaire expert, the mean scores of content validity ratio and content validity index (CVI) were 0.82 and 0.87, respectively. Furthermore, the reliability of the questionnaire was evaluated by the internal consistency method, and by a pilot study of 30 people fromthe study population, and Cronbach's alpha coefficient for the whole questionnaire was 0.81.

Table 1: Severity of depressive, anxiety, and stress disorders based on Depression, Anxiety, and Stress Scale-21 rating

Severity	Depression	Anxiety	Stress
Normal	0–9	0–7	0–14
Mild	10–13	8–9	15–18
Moderate	14–20	10–14	19–25
Severe	21–28	15–19	26–33
Extremely severe	>28	>20	>33

Data analysis

The study data analysis was carried out using the SPSS version 26. Descriptive statistics in graphs, tables, frequencies, and percentages were used to summarize the results, such as sociodemographic characteristics, DASS-21, and KAP. Kruskal–Wallis and Mann–Whitney *U*-tests were used to examine the relationship between other demographic variables with DASS-21 and KAP dimensions, such as different types of employment. Finally, Pearson's rank correlation analyseswere used to understand the relationships between twocontinuous variables. $P < 0.05$ was considered statistically significant.

Results

Sociodemographic characteristics of respondents

Out of the 680 workers in industries, 603 were involved in the study and made a response rate of 88.67%. The means and standard deviations of respondents' age were 34.42 ± 7.23, ranging from 17 to 55 years. The majority of the respondents were male (88.1%), aged 35–45 (58.7%), married (76.5%), and with temporary employment status (96.5%). Seventy point eight (70.8%) of the study subjects were from nonscientific colleges, and 21.8% had bachelor's degrees or higher. The automotive industry (19.6%) and woodcraft (8.5%) were the highest and lowest level of the study population, respectively. Data related to the characteristics of the industrial workers who participated in this research are given in Table 3.

Psychological health status

The psychological health status of the workers toward COVID-19 is displayed in Figure 3. The majority of participants had normal depression (62.5%), anxiety (64.3%), and stress (72.1%), with mean scores of 9.32 ± 8.6, 7.31 ± 7.3, and 10.75 ± 8.39, respectively. Overall, 27.2% of participants had one or more symptoms of psychological health problems of either depression, anxiety, or stress at different levels (mild, moderate, severe, or extremely severe).

Knowledge of respondents toward coronavirus disease 2019

One hundred and eleven (11.5%) of the workers mentioned the causes of COVID-19 as a virus, and 502 (90.7%) stated respiratory droplets and close contact as the method of transmission. Most (96.8%) identified fever and dry cough as the primary clinical manifestation of COVID-19, and 407 (82.4%) knew that people are generally susceptible to COVID-19. 229 (35.4%) believed that wearing face masks could reduce transmission, and only 70 (3.2%) responded that treatment of early symptoms and intensive care could help people with COVID-19 recover. Overall, 95% of workers considered that avoiding travel across cities,

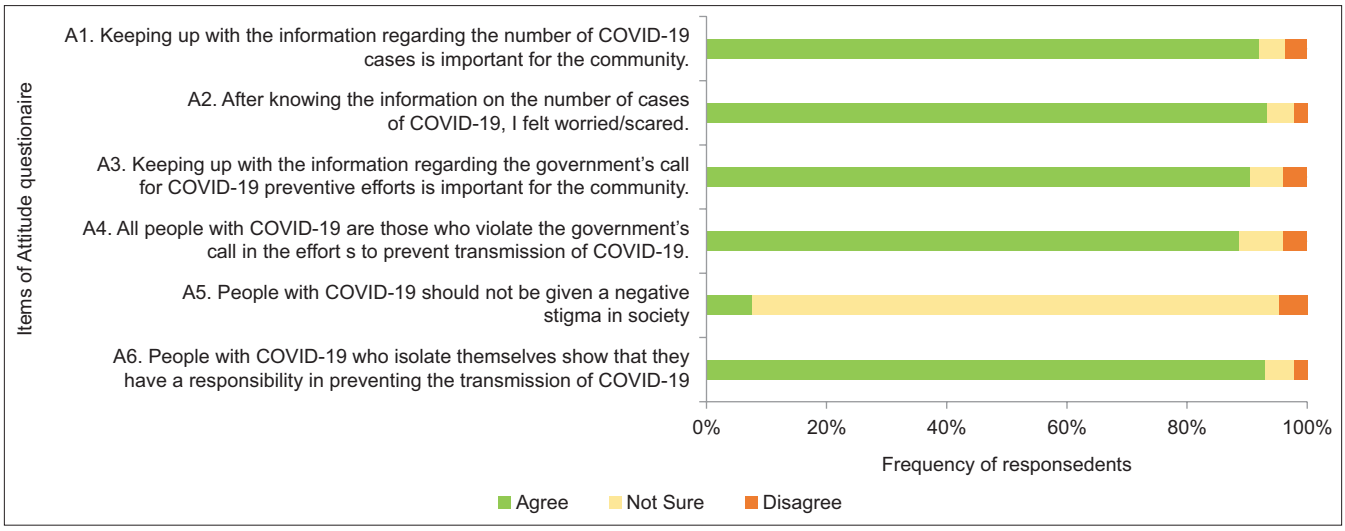

Figure 1: The attitude of the workers toward coronavirus disease 2019 (COVID-19). The attitude of workers in the industry toward COVID-19 was assessed with "3-level Likert scale" questions. The percentages of the attitudes of workers regarding COVID-19 are displayed in the diverging stacked bar chart

isolation, and treating people infected with the COVID-19 virus can reduce transmission. Other respondents toward knowledge items are reported in Table 1. Forty-nine (8.1%) of the study subjects had scored a knowledge score above the mean knowledge score (12.1) and had good knowledge about COVID-19.

Attitude of respondents toward coronavirus disease 2019

The attitude toward COVID-19 is displayed in Figure 1. Nearly 93% of workers agreed that maintaining the information regarding the numeral of COVID-19 and the government's invitation for preventive efforts was essential for society. Approximately 95% of workers agreed that they felt worried/scared after knowing the information on the number of cases of COVID-19. Over 89% of workers considered that all people with COVID-19 violated the government, and people with COVID-19 who isolated themselves showed that they had a responsibility to prevent the transmission of COVID-19. However, only 7.7% agreed that people with COVID-19 should not be given a negative stigma in the community. Overall, 26 (4.3%) of the study workers had scored an attitude score greater than the mean attitude score (5.1) and had a positive attitude toward COVID-19 prevention.

Behavioral practice of the respondents in coronavirus disease 2019 prevention

Twelve behavioral practice questions and the corresponding number of workers are shown in Figure 2. Overall, 402 (66.6%) of the workers scored behavioral practice above the mean behavioral practice score (4.18) and had suitable behavioral practices for COVID-19 prevention. Almost all workers reported regular behavioral practices of primary preventive measures against COVID-19. The rate of "always practice" in the categories of using a mask when going to public places (86.2%), washing hands (82%), and using hand sanitizer (77.2%) was high. However, only half of the workers reported doing well in the categories of immediately changing their clothes before entering the house and contacting family members.

Individual and occupational risk factors associated with Depression, Anxiety, and Stress Scale-21 and knowledge, attitude, and behavioral practice

The results of the Kruskal–Wallis statistical test showed that there was a significant difference between the total mean score of depression, anxiety, and stress only in the work experience ($P < 0.01$) and employment status ($P \leq 0.05$), so workers with the average low work experience (1–5 years) and informal employment status showed more symptoms of physiological health. Similarly, educational level and type of industry were significantly associated with workers' anxiety and stress, respectively ($P \leq 0.05$).

In addition, workers with longer working years, academic education, and the rubber industry have lower odds of experiencing depressive, anxious, and stress symptoms, respectively (all $P \leq 0.05$). The industrial workers reported moderate levels of knowledge (mean = 19.6, standard deviation [SD] = ±3.05), attitude (mean = 14.7, SD = ±3.45), and high level of behavioral practices (mean = 7.9, SD = ±0.91). The results of the Mann–Whitney *U* statistical test showed a significant difference between the mean score of knowledge and attitude according to sex ($P \leq 0.01$), so the average score of male and female workers was higher in terms of knowledge and attitude, respectively. Similarly, educational level, type of industry, and age were significantly associated with workers' KAP, respectively ($P \leq 0.05$) [Table 4].

Table 5 shows the odds of having psychological health symptoms and good KAP among industrial workers. The results showed

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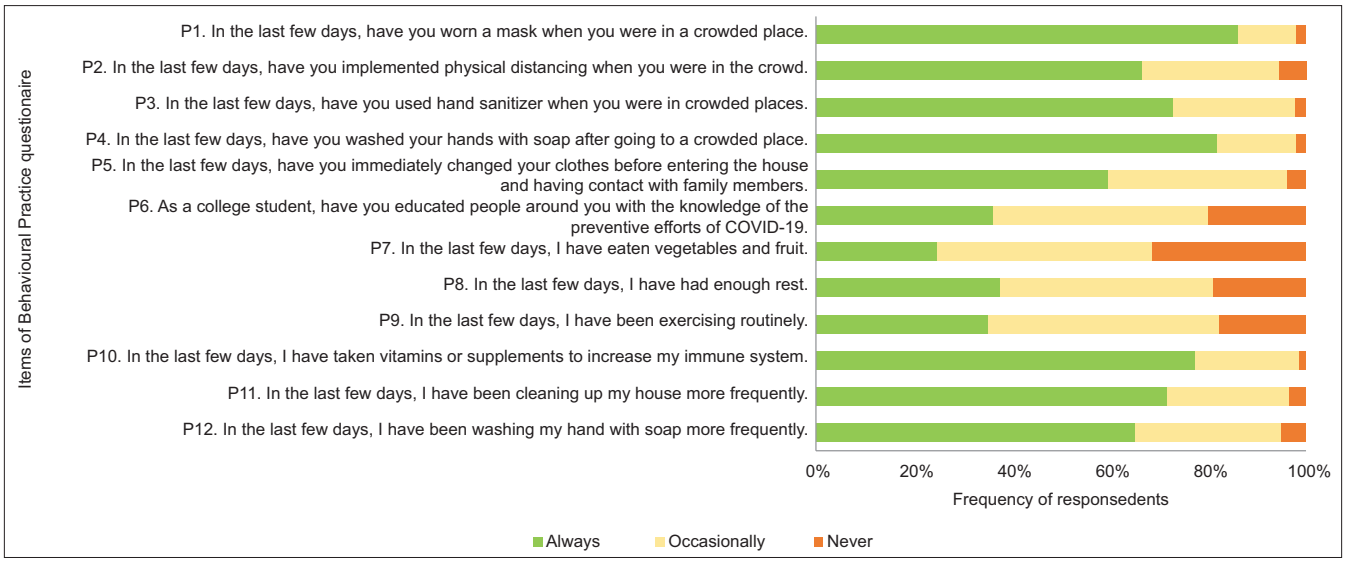

Figure 2: Behavioral practices of the workers toward coronavirus disease 2019 (COVID-19). The percentages of workers' behavioral practices of 12 preventive measures toward COVID-19 are plotted in the stacked bar chart

Table 2: The percentage of knowledge among participants toward coronavirus disease 2019 (*n*=603)

Questions	Correct answer - frequency, *n* (%)	Wrong answer - frequency, *n* (%)
K1. COVID-19 is a disease caused by coronavirus	111 (11.5)	492 (88.5)
K2. The primary clinical symptoms of COVID-19 are fever, fatigue, dry cough, and myalgia	532 (96.8)	71 (3.2)
K3. People with COVID-19 also show no symptoms, called OTG (people without symptoms)	517 (93.8)	86 (6.1)
K4. Not everyone with COVID-19 has an increasingly severe condition, except the elderly	501 (90.5)	102 (9.5)
K5. People with COVID-19 who have chronic diseases such as diabetes, heart disease, and obesity have an increasingly severe condition	461 (82.4)	142 (17.7)
K6. Children and teenagers do not need to make efforts to prevent COVID-19 infection because they have a strong immune system	375 (65)	198 (35)
K7. People with a strong immune system will not get infected with COVID-19	434 (76.9)	169 (23.1)
K8. People with COVID-19 who show no symptoms or OTG (people without symptoms) cannot infect the virus to others	389 (67.8)	214 (32.2)
K9. COVID-19 is spread through the respiratory droplets of people infected with COVID-19	502 (90.7)	101 (9.3)
K10. The dead bodies of people with COVID-19 who have not been buried can be a source of the spread of the COVID-19 virus	492 (88.7)	111 (11.3)
K11. The buried dead bodies of people with COVID-19 can be a source of the spread of COVID-19	191 (27.7)	412 (72.2)
K12. COVID-19 cannot penetrate face masks that are commonly worn by the public	229 (35.4)	374 (64.6)
K13. COVID-19 only spreads through objects, it is not airborne	140 (17.4)	463 (82.6)
K14. Currently, there is no effective drug for COVID-19, but the treatment of early symptoms and intensive care can help people with COVID-19 recover	70 (3.2)	533 (96.8)
K15. To prevent COVID-19 infection, we must avoid going to crowded places like markets and train stations as well as avoid using public transportation	523 (94.9)	80 (5)
K16. Avoid travel across cities can prevent the spread of COVID-19	513 (92.9)	90 (7.1)
K17. The transmission of the COVID-19 virus can be prevented by not touching the face	473 (84.8)	130 (15.2)
K18. Isolation and treatment of people infected with the COVID-19 virus are effective ways to reduce the spread of the virus	521 (94.5)	82 (5.5)

COVID-19: Coronavirus disease 2019, OTG: Orang tanpa gejala

that only workers with work experience of 16–20 years (adjusted odds ratio [aOR] = 0.38, P = 0.031) were inclined to experience depressive symptoms. In addition, work experience of 16–20 years (aOR = 0.33, P = 0.004), education level diploma (aOR = 0.15, P = 0.007), and automotive industry (aOR = 6.01, P = 0.001) were more inclined to experience anxiety symptoms. Workers with lower working years (aOR = 0.39, P = 0.007) and informal employment status (aOR = 7.77, P = 0.005) were inclined to experience stressor symptoms. In addition, workers with longer working years, academic education, and the rubber industry have lower odds of experiencing depressive, anxious, and stress symptoms, respectively (all $P \leq 0.05$).

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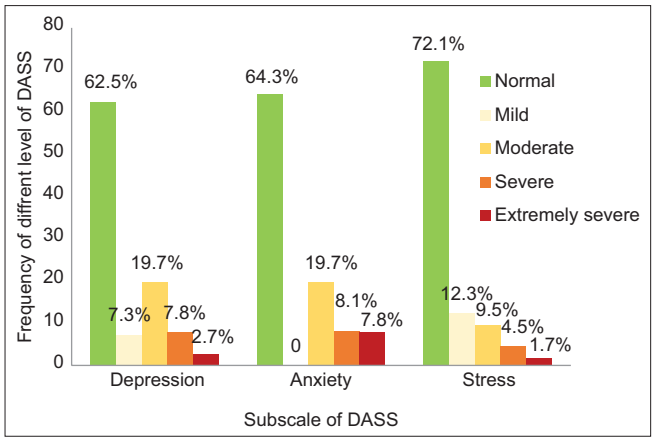

Figure 3: Prevalence of depression, anxiety, and stress among industrial workers during coronavirus disease 2019 ($n = 603$). DASS: Depression, Anxiety, and Stress Scale

In addition, the results showed that female workers (aOR = 2.89, $P = 0.039$), age range 45–55 (aOR = 0.56, $P = 0.01$) years, and education level associates (aOR = 0.82, $P = 0.02$) were significantly associated with the highest COVID-19 knowledge and behavioral practice scores, respectively. In addition, workers in the automotive industry were significantly associated with the highest COVID-19 attitude when compared to the reference groups.

Association between scores of Depression, Anxiety, and Stress Scale-21 and knowledge, attitude, and behavioral practice

Table 6 illustrates the correlation between the dimensions of DASS-21 and KAP among industrial workers during the COVID-19 pandemic. The analyses indicated that attitude scores were highly correlated with knowledge ($r = 0.119$, $P = 0.016$) and behavioral practice ($r = 0.752$, $P < 0.0001$). A considerable degree of correlation was also excited between depression and anxiety ($r = 0.650$, $P < 0.0001$) and depression with stress ($r = 0.676$, $P < 0.0001$). The anxiety perceived by workers was associated significantly with stress ($r = 0.564$, $P = 0.0001$) and behavioral practice score ($r = 0.107$, $P = 0.009$).

Furthermore, the results showed the different proportions of good KAP in various industries. Workers in the furniture industry experienced more positive knowledge, attitude, and preventive measures during the COVID-19 pandemic. Workers in the home appliance, automotive, and metal industries experienced more depression, anxiety, and stress, respectively, when compared to the reference groups [Figure 4].

Discussion

The COVID-19 pandemic is a devastating crisis of modern times, with profound consequences for economics, organizations, and workers all over the globe.[29] With industrial workers as the main assets of economic systems in societies, appropriate disease-preventive behaviors and maintaining their psychological health within industrial groups are crucial for pandemic control. For this reason, we surveyed the prevalence of workers' psychological health status and knowledge, attitude, and preventive protocol behavioral practices related to COVID-19 based on individual characteristics and occupational risk factors among Iranian industrial workers.

The finding of this study demonstrated that 30.2%, 35.7%, and 15.6% of the respondents were symptomatic, with 10.5%, 16.5%, and 6.2% severe cases of depression, anxiety, and stress. A study in Oman among health sector employees

Table 3: Sociodemographics characteristics of the industrial workers ($n = 603$)

Variables	Frequency, *n* (%)
Age	
0–25	52 (8.6)
25–35	142 (23.5)
35–45	354 (58.7)
45–55	55 (9.1)
Work experience	
1–5	281 (46.6)
6–10	141 (23.4)
11–15	83 (13.8)
16–20	60 (10.0)
≥21	38 (6.3)
Sex	
Male	531 (88.1)
Female	72 (11.9)
Marital status	
Single	142 (23.5)
Married	461 (76.5)
Educational level	
Lower diploma	106 (17.6)
Diploma	323 (53.2)
Associates	44 (7.3)
Bachelor's	104 (17.2)
Masters and higher	26 (4.6)
Employment status	
Permanent	10 (1.7)
Temporary	582 (96.5)
Informal	11 (1.8)
Type of industry	
Food	69 (11.4)
Metal	93 (15.4)
Wood	51 (8.5)
Rubber	73 (12.1)
Furniture	112 (18.6)
Automotive	118 (19.6)
Home appliance	87 (14.4)
Training history of COVID-19 infection prevention	
Yes	255 (40.6)
No	348 (59.3)
Assessment of safety and health at the workplace	
Acceptable	264 (42.3)
Unacceptable	339 (57.7)

COVID-19: Coronavirus disease 2019

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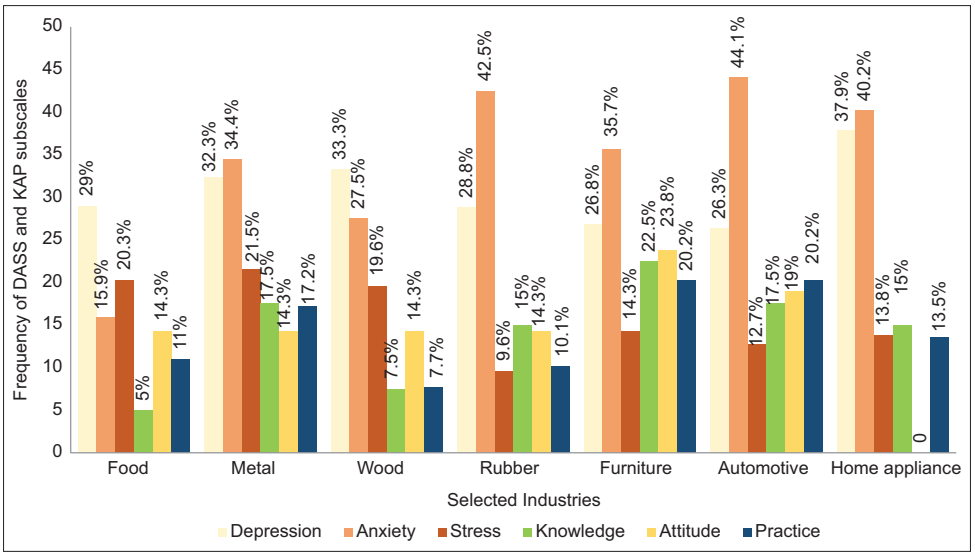

Figure 4: Prevalence of psychological health and good knowledge, attitude, and behavioral practice among workers in selected industries during coronavirus disease 2019 (n = 603). DASS: Depression, Anxiety, and Stress Scale, KAP: Knowledge, attitude, and behavioral practice

reported that the spread of depression and anxiety during the COVID-19 pandemic was 32.3% and 34.1%, respectively; these percentages are consistent with this study (corresponding 30.2% and 35.7%).[30] However, this study reported higher prevalence rates of psychological health symptoms than health sector employees of Singapore and India in the corresponding studies (10.6% depression, 13.3% anxiety, and 5.2% stress) and in the middle east oil industry (18% depression and 15% anxiety) before the COVID-19 pandemic.[22,31] Seemingly, depressive, anxious, and stress symptoms may be related to the type and severity of chronic workload stress in various occupational contexts, which need to be addressed in future studies.

The major findings of this study demonstrated that a high percentage of workers' knowledge and attitude against COVID-19 are at a moderate level. In contrast, more than half of the industry workers reported good preventive behavioral practices. Regarding COVID-19 knowledge, the research manifested a low percentage of participants with good knowledge, the same as those reported in several studies.[1,32] However, our results differed from a previous KAP study among construction industry workers in China at the beginning of the prevalence, which found that 95% of workers had good knowledge.[12] Therefore, individuals' KAP about the symptoms, transmission, and prevention of coronavirus depend on the research community, information, and educational programs in the cultural and social context.

In terms of attitude, most workers had a moderate attitude toward COVID-19. Various studies among different communities reported a good level of attitude in COVID-19 conditions.[13,33] Confidence in the successful control of COVID-19 and the curability of this disease seems to be one of the most important reasons for the upward attitude among workers in various industries. In this study, more than half of the workers had a high level of behavioral practice during the COVID-19 pandemic. This result agrees with Saudi Arabia's research on KAP COVID-19 prevalence, which reported good and safe COVID-19 prevention practices among security staff.[34] Appropriately, prevention methods and compliance with health protocols, including social distancing in various centers, hand hygiene, and using masks when leaving home, are necessary to prevent disease transmission.

Our study found that more significant psychological distress was observed for females and single workers under 35–55 years old; however, these individual risk factors had no statistically significant association with depression, anxiety, and stress levels. These findings are verified by an earlier study on oil and gas platform workers in the Persian Gulf, Iran.[35] However, some studies have claimed that sex and marital status have been associated with psychological health symptoms.[13,36] This study found a significant link between age and educational status with sufficient knowledge, behavioral practice, and anxiety and stress levels, which is verified by the results of other studies.[3,37] As a result, female workers aged 45–55 years had more information about COVID-19, which can direct health education efforts toward younger groups. These results were consistent with studies conducted in China and Malaysia, which showed that older age groups have more knowledge.[12,38]

Moreover, workers with higher levels of education were more aware. Workers who followed appropriate methods to prevent the prevalence of COVID-19 were more aware and followed proper techniques to prevent the extinction of COVID-19 versus experiencing higher levels of stress, which agrees with an earlier study on Chinese psychiatrists.[37] It appears that the level of education may affect factors such as the ability of individuals to recognize the correct information and take adequate measures to prevent COVID-19; however, weak life–

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Table 4: Mean, standard deviation, and the relationship between Depression, Anxiety, and Stress Scale-21 and knowledge, attitude, and behavioral practice subscales with demographic variables among industrial workers during coronavirus disease 2019 (*n*=603)

Variables	Mean±SD of DASS-21 subscales			Mean±SD of KAP subscales		
	Depression	Anxiety	Stress	Knowledge	Attitude	Practice
Age						
0–25	11.69±9.7	8.15±8.24	12.92±8.9	18.44±3.6	15.06±3.6	8.15±0.1
25–35	8.45±8.2	6.07±6.1	10.49±7.7	19.58±3.4	14.34±3.8	8.06±0.8
35–45	9.15±8.5	7.61±7.4	10.55±8.5	19.87±2.5	14.96±3.0	7.92±0.8
45–55	10.47±8.4	7.74±8.1	10.65±8.3	20.31±1.7	15.69±2.6	7.63±1.03
P	0.115	0.351	0.269	0.111	0.102	0.038*
Sex						
Male	9.14±8.3	7.30±7.2	10.75±8.1	19.81±3.1	14.15±3.4	7.97±0.9
Female	10.78±10.7	7.46±7.7	10.84±9.9	18.92±2.4	16.11±3.0	8.01±0.9
P	0.517	0.863	0.359	<0.0001**	0.001**	0.949
Marital status						
Single	10.69±9.8	7.41±7.1	11.47±8.8	19.75±2.9	14.95±3.2	7.95±0.9
Married	8.92±8.1	7.29±7.3	10.55±8.2	19.45±3.2	14.08±4.0	8.04±0.8
P	0.131	0.659	0.432	0.558	0.051	0.610
Educational level						
Lower diploma	9.79±7.0	9.0±6.8	9.88±6.5	20.31±3.4	14.60±4.2	7.71±1.2
Diploma	9.24±8.0	7.72±7.4	10.67±8.0	19.85±2.7	14.48±3.5	8.05±0.8
Associates	8.36±7.8	7.50±7.2	12.13±9.3	18.47±4.2	14.89±3.1	7.04±0.7
Bachelor's	9.25±10.5	4.76±7.1	10.76±9.6	19.65±3.0	14.93±3.3	7.82±0.7
Masters and higher	10.69±12.8	5.46±6.6	13.23±11.4	19.31±2.3	16.51±2.5	7.34±1.0
P	0.468	<0.0001**	0.732	0.030*	0.142	0.139
Work experience						
1–5	10.59±9.4	8.68±8.0	12.38±8.7	19.62±2.7	14.69±3.6	8.03±0.9
6–10	9.23±7.8	7.31±6.6	9.77±7.0	20.08±2.7	14.81±3.0	7.94±0.9
11–15	8.53±7.6	6.12±6.0	9.63±6.9	19.31±4.0	13.89±3.8	7.69±0.9
16–20	6.37±7.8	4.81±6.5	8.84±9.3	19.58±3.4	15.11±2.9	8.02±0.5
≥21	6.89±7.0	7.30±4.4	8.0±9.2	19.47±3.5	16.13±2.9	8.17±0.9
P	0.0003**	<0.0001**	<0.0001**	0.472	0.105	0.211
Employment status						
Permanent	9.11±8.4	2.88±3.8	13.33±9.5	6.86±6.3	4.46±7.6	2.7±2.7
Temporary	9.21±8.5	7.30±7.2	10.57±8.3	13.72±4.4	8.92±5.2	5.4±1.9
Informal	16.36±9.0	12.0±9.8	18.90±5.8	20.60±1.7	13.40±3.5	8.10±0.9
P	0.026*	0.050*	0.002**	0.253	0.177	0.730
Type of industry						
Food	4.52±5.7	3.14±5.7	10.78±9.6	19.67±2.4	15.0±3.2	7.93±1
Metal	9.87±9.9	6.90±7.0	11.03±8.6	19.77±3.5	15.24±3.2	7.92±1
Wood	6.54±7.7	6.54±7.7	11.25±8.5	19.06±3.7	15.47±2.8	8.06±0.9
Rubber	8.54±8.7	8.54±8.7	10.27±7.3	19.78±2.5	13.52±3.6	8.00±0.9
Furniture	9.44±9.2	7.78±7.5	11.14±8.6	19.86±2.4	15.36±3.4	7.93±0.8
Automotive	8.08±9.1	8.08±7.1	10.54±8.6	19.83±2.7	14.50±3.3	8.03±0.9
Home appliance	7.70±6.6	6.27±6.6	10.34±7.2	19.33±3.9	14.10±3.7	7.99±0.7
P	0.887	0.0019**	0.985	0.383	0.005**	0.436

*$P \leq 0.05$, **$P < 0.01$. SD: Standard deviation, DASS-21: Depression, Anxiety, and Stress Scale 21, KAP: Knowledge, attitude, and behavioral practice

work equilibrium, the crack between fact and anticipations, and higher engagement with media, scientific journals, the internet, etc., may affect factors such as the ability of individuals to recognize the correct information and take adequate measures to prevent psychological disorders caused by COVID-19.[39,40]

This study showed that sex was statistically associated with knowledge and attitude but had no significant association with behavioral practice. These findings are verified by the results of an earlier study on the food industries of Bangladesh.[33] Inversely, the study by Zheng *et al*., on practitioners of the construction industry, found that gender was related to practice but found no significant association with knowledge and attitude.[41] This study showed a significant link between years of work experience and physiological health symptoms.

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Table 5: Multivariable logistic regression analysis for factors associated with Depression, Anxiety, and Stress Scale-21 and knowledge, attitude, and behavioral practice subscales with demographic variables among industrial workers during coronavirus disease 2019 (*n*=603)

Variables	Depression		Anxiety		Stress		Knowledge		Attitude		Practice	
	aOR	*P*	aOR	*P*	aOR	*P*	aOR	*P*	aOR	*P*	aOR	*P*
Age												
0–25	1		1		1		1		1		1	
25–35	0.77	0.527	0.70	0.348	0.62	0.313	1.09	0.040*	0.92	0.15	0.91	0.650
35–45	0.60	0.171	1.41	0.311	0.81	0.620	1.12	0.012*	0.97	0.66	0.76	0.201
45–55	1.02	0.965	1.10	0.824	0.80	0.676	1.21	0.015*	1.04	0.52	0.56	0.025*
Sex												
Male	1		1		1		1		1		1	
Female	1.51	0.179	1.72	0.263	0.86	0.693	0.27	0.084	2.89	0.039*	1.90	0.032*
Marital status												
Single	1		1		1		1		1		1	
Married	0.69	0.119	1.15	0.507	0.89	0.675	0.98	0.580	0.93	0.230	1.10	0.034*
Educational level												
Lower diploma	1		1		1		1		1		1	
Diploma	1.26	0.402	0.51	0.007*	1.76	0.014*	0.93	0.370	0.99	0.877	1.47	0.032*
Associates	0.92	0.865	0.59	0.110	3.59	0.017*	0.82	0.020*	1.05	0.443	1.41	0.137
Bachelor's	1.38	0.381	0.14	0.001**	3.62	0.005**	0.90	0.210	1.03	0.554	1.11	0.587
Masters and higher	1.99	0.209	0.17	0.002**	4.20	0.021*	0.85	0.265	1.20	0.133	1.19	0.450
Work experience												
1–6	1		1		1		1		1		1	
7–10	1.02	0.929	0.92	0.717	0.39	0.007**	2.45	0.024*	0.36	0.116	0.89	0.642
11–15	0.79	0.467	0.68	0.187	0.51	0.116	1.12	0.838	1.03	0.998	1.06	0.826
16–20	0.38	0.031*	0.33	0.004**	1.56	0.297	1.22	0.761	1.25	0.256	1.40	0.356
≥21	0.80	0.658	0.22	0.004**	0.91	0.872	3.35	0.033*	1.72	0.424	1.52	0.335
Employment status												
Temporary	1		1		1		1		1		1	
Informal	1.65	0.504	1.14	0.838	7.77	0.005**	3.05	0.168	1.25	0.998	0.73	0.633
Permanent	0.72	0.724	0.19	0.137	2.37	0.338	2.70	0.997	1.32	0.995	0.82	0.998
Type of industry												
Food	1		1		1		1		1		1	
Metal	0.81	0.608	3.09	0.008**	0.90	0.817	1.05	0.290	0.95	0.41	0.76	0.179
Wood	1.05	0.908	2.05	0.143	0.78	0.647	0.98	0.841	1.02	0.73	1.18	0.485
Rubber	0.73	0.484	5.37	0.001**	0.31	0.001**	1.11	0.087	0.83	0.021*	0.96	0.964
Furniture	0.66	0.308	3.58	0.001**	0.56	0.210	1.10	0.095	0.94	0.349	0.71	0.084
Automotive	0.56	0.153	6.01	0.001**	0.46	0.099	1.10	0.067	0.89	0.046*	0.82	0.336
Home appliance	1.21	0.637	3.87	0.002**	0.40	0.060	1.09	0.102	0.84	0.002**	0.82	0.365

*$P \leq 0.05$, **$P < 0.01$. aOR: Adjusted odds ratio

Table 6: Correlation between psychological health and knowledge, attitude, and behavioral practice among industrial workers during coronavirus disease 2019 (*n*=603)

Variables	Depression, *r* (*P*)	Anxiety, *r* (*P*)	Stress, *r* (*P*)	Knowledge, *r* (*P*)	Attitude, *r* (*P*)	Practice, *r* (*P*)
Depression	1					
Anxiety	0.650 (<0.0001**)	1				
Stress	0.676 (<0.0001**)	0.564 (<0.0001*)	1			
Knowledge	0.024 (0.563)	0.011 (0.872)	0.040 (0.322)	1		
Attitude	0.048 (0.236)	−0.073 (0.072)	0.107 (0.009**)	0.119 (0.016*)	1	
Practice	0.026 (0.520)	−0.010 (0.802)	0.008 (0.853)	−0.042 (0.423)	0.752 (<0.0001**)	1

*$P \leq 0.05$, **$P < 0.01$

Furthermore, in line with a previous study by Sakkomonsri *et al*., our study demonstrated that the more experienced the industrial workers, the higher the stress, anxiety, and depression.[42] These findings indicate that participants with

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more work experience are more likely to have illnesses and family problems associated with psychological issues.[43] In the current study, we found an association between type of tenure and depression, anxiety, and stress levels, as informal workers had higher levels of stress, anxiety, and depression than workers with other types of employment. These results are consistent with those of Yani *et al*.[44] However, some studies have claimed that hired employees, due to the higher level of organizational competition among these employees and their higher awareness of work conditions and environment, had higher levels of stress, anxiety, and depression.[45,46]

Investigating different industries regarding KAP toward COVID-19 demonstrated a significant association and the critical role of training history of coronavirus infection prevention. Our study revealed a higher rate of KAP among workers in the furniture industry than among workers in other industries. Furthermore, investigating depression, anxiety, and stress toward COVID-19 demonstrated a higher rate of stress, anxiety, and depression among workers in the metal, automotive, and home appliance industries than workers in other industries. Anxiety symptoms were significantly associated with the total type of industries except for woodcraft. Our results showed some important key actionsagainst psychological health disorders and occupationalstress during the COVID-19 pandemic. First, the efforts ofindustrial workers and a high rate of training in the field ofsymptoms, transmission, and prevention of coronavirusdisease. Second, implementation of the recommendations ofleading organizations, including WHO and ILO, effectivelyconcerning occupational health. Third, provides somevaluable guidance for managers to develop plans fororganizational support.

This study found a significant association between depression and anxiety scores. As emotional depression increases, anxiety increases, similar to earlier studies' results.[36,47] Furthermore, in line with previous studies, our findings confirmed positive correlations between knowledge–attitude and attitude–behavioral practice;[7,48] however, there was no correlation between knowledge–behavioral practices. Therefore, it seems that proper knowledge is essential to accept better attitudes and take preventive measures to prevent and control the prevalence of the disease.

Strengths and limitations of the study

To our knowledge, this is the first study to evaluate the levels ofpsychological health, and KAP relating to COVID-19 of workers and investigates the risk factors associated with them in various industries in the Tehran Province. However, this study had some limitations that might influence when inferring the findings. First, the self-reported responses to the depression, anxiety, and stress questionnaire are based on the recall of learned facts, information, and reports of workers rather than direct observation, so there is a chance of recall bias, and the practice finding has limited generalizability. However, we asked workers to respond to the questionnaire anonymously to improve a more reliable response.

Second, despite collecting data on individual and work-related characteristics, this study did not have other variables that might relate to DASS-21, work–family conflict, and organizational factors. Future studies may examine a broader range of variables inside and outside the work environment. Finally, our study included a representative sample of industrial workers, we applied a cross-sectional design, and thus this study cannot conclude causal relationships.

Conclusion

This study revealed that workers in various industries had moderate knowledge, attitude, and satisfactory preventive performance. However, occupational risk factors have significantly impacted the psychological well-being of workers and have largely induced increasing severity levels of COVID-19-related depression, anxiety, and stress. Hence, to improve the psychological health system in industries, more consideration and awareness must be directed to the psychological well-being of the worker's workforce.

The results also confirm the correlation between perceived anxiety and the behavioral practice of the worker's industry toward the prevention guidelines for COVID-19. Conforming to the results, planning to design and maintain effective practical training periods for them can play an influential role in improving the awareness and attitude of workers toward the use of suitable preventive measures, ensuring early detection, and enhancing the effectiveness of psychological health interventions for physicians in the face of crises such as the COVID-19 pandemic.

Authors' contributions

All authors contributed to the study's conception, design, and investigation. MM: First draft of the manuscript, conceptualization, and investigation. MBK: Material preparation, conceptualization, methodology, data collection, analysis, and interpretation. ACH and SM: Investigation, writing–reviewing, and editing. ACH: Conceptualization, data collection, and interpretation. All authors reviewed and commented on previous versions of the manuscript. All authors read and approved the final manuscript.

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Conflicts of interest

There are no conflicts of interest.

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