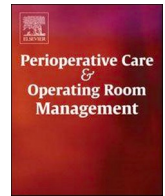




Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

Elsevier hereby grants permission to make all its COVID-19-related research that is available on the COVID-19 resource centre - including this research content - immediately available in PubMed Central and other publicly funded repositories, such as the WHO COVID database with rights for unrestricted research re-use and analyses in any form or by any means with acknowledgement of the original source. These permissions are granted for free by Elsevier for as long as the COVID-19 resource centre remains active.



## Turnover intention among operating room nurses during the COVID-19 outbreak and its association with perceived safety climate

Mojgan Lotfi, Associate professor of Medical and surgical nursing department<sup>a</sup>, Omid Zadi Akhuleh, Surgical Technology; Instructor<sup>b,\*</sup>, Aysan Judi, student of Critical care nursing; student research committee<sup>c</sup>, Mohammadtaghi Khodayari, Assistant professor<sup>d</sup>

<sup>a</sup> Nursing and midwifery faculty, Tabriz University of Medical Science, Tabriz, Iran

<sup>b</sup> Department of Medical-Surgical Nursing & Operating Room, School of Nursing and Midwifery, Tabriz University of Medical Sciences, Tabriz, Iran

<sup>c</sup> Urmia University of Medical Sciences, Urmia, Iran

<sup>d</sup> Department of Public Health, School of Allied Medical sciences, Maragheh University of Medical Sciences, Maragheh, Iran

### ARTICLE INFO

#### Keywords:

Turnover intention  
Safety climate  
Operating room  
COVID-19 outbreak

### ABSTRACT

**Background:** In critical situations such as the COVID-19 pandemic, nurses always face a lot of stress that can increase their turnover intention. Since a suitable safety climate in the workplace is considered an important factor in preventive management of occupational hazards and people's adaptation to stressful conditions, the present study aimed to determine Turnover intention among operating room nurses during the COVID-19 outbreak and its association with perceived safety climate.

**Methods:** In this descriptive correlational study, participants were 190 operating room nurses working at public hospitals in Mazandaran (Iran) who were selected by stratified random sampling. Data were collected using the Anticipated Turnover Scale and the Nurses' Safety Climate Questionnaire and analyzed using SPSS16.

**Results:** The results of the linear regression analysis revealed that safety climate significantly reduced turnover intention among nurses in the COVID-19 pandemic ( $P < 0.001$ ). An increase of one unit in the total score of safety climate led to a 0.6 reduction in the turnover intention of operating room nurses.

**Conclusion:** The present findings demonstrated an unfavorable safety climate perceived by perioperative nurses in the COVID-19 pandemic, with a significant inverse relationship with turnover intention. Strategies such as training personnel on the prevention of the disease transmission in the surgery of patients infected with or suspected of COVID-19, creating a proper supportive environment for personnel, and providing appropriate protective equipment to prevent infection with COVID-19 seem absolutely vital to improving the safety climate in the operating room, thereby reducing turnover intention.

### 1. Introduction

In December 2019, COVID-19 emerged in Wuhan, China, by the severe acute respiratory syndrome Coronavirus 2 (SARS-CoV-2), which affects the respiratory system.<sup>1</sup> The virus has spread rapidly across the world so that the number of infected cases reached 210 million people with more than 4.4 million deaths globally and over 4.5 million infected people with a death rate of  $> 100,000$  in Iran at the end of August 2021.<sup>2</sup>

Due to their direct contact with patients, health care workers, particularly nurses, play an important role in preventing the outbreak of COVID-19 through appropriate care and preventive measures.<sup>3</sup> Therefore, nurses are more prone to COVID-19-induced stress and show

psychological problems and symptoms more than other groups of society. The effect of this virus on the psychological problems of nurses has been confirmed in various studies.<sup>4</sup> A high prevalence of anxiety, depression, stress, and suicide attempts has been reported in nurses of Iran in the COVID-19 period. In addition, nurses in the CCU, ICU, and emergency wards have been shown to experience more job stress and psychiatric problems during the COVID-19 period.<sup>5</sup>

In a ward such as the operating room (OR), many trauma, emergency, and even elective patients may be diagnosed with, suspected of, or asymptomatic to COVID-19. These conditions, particularly those in which patients present for surgery but they are in the incubation period and the OR staff is focused on surgical issues, may cause the infection of

\* Corresponding author at: Tabriz- Shariati St., School of Nursing and Midwifery, Tabriz, Iran.

E-mail address: [Omid.zd.axule73@gmail.com](mailto:Omid.zd.axule73@gmail.com) (O.Z. Akhuleh).

<https://doi.org/10.1016/j.pcorm.2021.100233>

Received 9 September 2021; Received in revised form 28 November 2021; Accepted 11 December 2021

Available online 15 December 2021

2405-6030/© 2021 Elsevier Inc. All rights reserved.

staff with COVID-19.<sup>67</sup> Some medical and care personnel are directly in contact with patients' airways, and the patient's respiratory activities or some medical procedures, such as endotracheal intubation, cause the release of suspended particles in the patient's airway in the OR air. The production of aerosols considerably increases in laparoscopic and endoscopic surgeries and when using electrocautery.<sup>8</sup> Therefore, it can be argued that OR staff are also exposed to a lot of physical injuries and psychological stress in the face of the COVID-19 epidemic.<sup>6</sup> One of the less-studied variables that can affect the psychophysical pressures caused by COVID-19 in OR staff is the turnover intention, and there is a research gap among OR nurses in this field.

Turnover intention is an important prediction of the actual turnover and is a cognitive stage that occurs before real turnover referring to a thought or mental decision about staying or turnover.<sup>9</sup> Various studies reported turnover intention in 15–44% of nurses in the world before the outbreak of COVID-19.<sup>10</sup> In Iran, the nurses' turnover rates were reported to be 32.7 and 35% in two studies.<sup>11</sup>

However, the rate and percentage of nurses' turnover intention were not specified in the COVID-19 period, and only the presence of this problem in nurses has been reported in some studies. In the COVID-19 outbreak, for example, the turnover intention was studied as one of the consequences of COVID-19 caused by factors such as nurses' anxiety and fear of COVID-19.<sup>12</sup>

A systematic review study by Chan et al. divided the factors associated with turnover intention into organizational and personal categories, with the former including organizational work environment, organizational culture, organizational commitment, working shifts and hours, and social support, and the latter comprising job satisfaction, burnout, and demographic factors.<sup>13</sup>

Among these, one of the important factors is the safety climate of employees in the workplace, whose health can reduce occupational hazards, facilitate jobs, and provide services. Safety climate is a measure of the values, attitudes, and perceptions of individuals about safety in an organization and reflects the extent of paying attention to the safety and health of employees at the highest levels of management.<sup>14</sup> Safety climate can be used as a tool for preventive management of the occurrence of diseases and occupational injuries. This means that various occupational diseases can be totally prevented by constant monitoring and improvement of safety climate instead of waiting for the occurrence and then evaluation and prevention of these diseases.<sup>15</sup>

Christian et al. reported a close relationship between safety climate and occupational injuries as well as the safety function of individuals.<sup>16</sup> A positive relationship between safety climate and safety behavior as well as a negative relationship between safety climate and occupational injury rates were shown in a study by Nahrgang et al. .<sup>17</sup> The relationship between safety climate and occupational injuries was proven in another meta-analysis study by Beus et al. .<sup>18</sup> Doroodi et al. also reported a significant positive relationship between employees' perception of safety climate and job satisfaction, in other words, job satisfaction increased with increasing employees' safety climate.<sup>19</sup>

A study to determine turnover intention among OR nurses during the COVID-19 outbreak will attract researchers' attention to this important issue and the role of workplace safety climate in its anticipation. There is a need for research on the problems of OR nurses, including turnover intention, to develop psychiatric strategies to reduce the devastating effects of crises, particularly COVID-19. It will also help policy-makers to understand the problems of nurses, provide plans for reducing the COVID-19-related problems, and manage human resources at times of crisis. Therefore, the present study was conducted to evaluate turnover intention among OR nurses during the COVID-19 outbreak and its relationship with safety climate at hospitals of Mazandaran University of Medical Sciences

## 2. Materials and methods

### 2.1. Design

The present descriptive-correlational study aims to identify the variables related to turnover intention in OR nurses during the COVID-19 crisis to clearly depict the relationship between the predictor variable (safety climate) and the criterion variable (turnover intention). This study seeks to examine whether or not there is a relationship between the safety climate of OR nurses and their turnover intention in the COVID-19 pandemic.

### 2.2. Setting and participants

The research was conducted in public hospitals of Mazandaran province in Iran from March 2019 to January 2021. The study population consisted of two occupational groups of perioperative and anesthesia nurses.

In this study, the sample size was determined using Morgan's table. Since the total population of perioperative nurses working in the studied hospitals was 440 individuals, a sample size of 205 nurses was calculated considering a 95% confidence level and sampling accuracy of  $d = 5\%$ .

Perioperative and anesthesia nurses of public hospitals in Mazandaran were sampled by stratified sampling method. To this end, the sample number of each center was obtained by calculating the sample size according to Morgan's table and obtaining the total number of staff working in the operating room (OR) wards of the hospitals under study. Accordingly, the estimated number of samples was divided by the total number of nurses, and the result was multiplied by the number of nurses in each center to determine the number of samples in each center. After calculating the share of each center, sampling was done randomly using a table of random numbers.

Inclusion criteria were having at least one year of work experience in the OR and at least an associate degree in perioperative and anesthesia nursing. Disinclination to participate in the study, incomplete response to the questionnaire questions (less than 85% of the questions), and having an executive and managerial position were the exclusion criteria in this study.

### 2.3. Data collection and procedures

The current study was designed based on the STROBE guidelines for observational studies.

In the present research, data collection tools consisted of three sections: demographic information, anticipated turnover scale (ATS), and safety climate scale (SCS).

- 1 The demographic information questionnaire was a researcher-made form that included personal information such as age, gender, marital status, level of education, work experience, specialization, and overtime hours.
- 2 The ATS was designed and validated by Hinshow et al. This scale consists of 12 items each scored on a Likert scale from 1 (strongly disagree) to 7 (strongly agree). The present study employed an ATS modified by Liou, who reduced the Likert response range to 1–5 points. A higher score on this scale indicates a greater turnover intention. This tool was first translated and validated by Hariri et al. In Iran, the content validity and reliability of the tool were confirmed by the internal consistency ( $\alpha = 0.80$ ) and retest ( $r = 0.81$ ) methods. The total score of turnover intention ranges from 12 to 60 (12–27.99, 28–43.99, and 44–60 indicating low, medium, and high intentions, respectively).<sup>20</sup>
- 3 The SCS was designed and validated by Ghasemi et al. and consists of 19 items each scored on a Likert scale from 1 (strongly agree) to 5 (strongly disagree). This scale has four dimensions, and the first to the

fourth dimensions were respectively named management commitment to safety (5 items), work pressure perceived by the individual (5 items), supportive environment (4 items), and safety training (5 items). The validity and reliability of the SCS dimensions were also evaluated using Cronbach's alpha coefficient, with values of 0.85, 0.84, 0.88, and 0.77 obtained for the first, second, third, and fourth dimensions, respectively, indicating the appropriate and acceptable internal stability of the SCS. The total safety climate score ranges from 19 to 95 (19–44.99, 45–69.69, and 70–95 indicating poor, moderate, and good levels, respectively) .<sup>21</sup>

2.4. Ethical considerations

After obtaining approval from Institutional Review Board and Vice-Chancellor for Research and Technology of Mazandaran University of Medical Sciences (ethical code: IR.MAZUMS.REC.1398.1403) and presenting it to the affiliated hospitals, the researcher referred to hospitals during the weekdays and in the morning, evening, and night work shifts, to access to all staff and after stating the study objectives individually and obtaining written consent, the questionnaire was given to qualified people and by spending the necessary time that was appropriate to the nurses' request according to the workload and speed of response, the questionnaires were completed by the nurses and finally collected by the researcher. to observe the ethical standards, the questionnaires were distributed among the participants without mentioning their names, and the participants were ensured about the confidentiality of information.

2.5. Statistical analysis

Collected data were analyzed by SPSS Ver. 16 software using descriptive statistics, linear regression test, analysis of variance (ANOVA), and independent t-test at a significant level of  $P < 0.05$ . The

normality of data distribution was evaluated by the Kolmogorov-Smirnov test, which showed a normal distribution of the collected data ( $P > 0.05$ ).

3. Results

3.1. participants' demographic information

Data of 190 participants were analyzed in this study, and 15 questionnaires were excluded due to defects in the inserted information. The mean  $\pm$  standard deviation of the participants' age was  $27.2 \pm 4.7$  years (range 21–48 years). The mean  $\pm$  standard deviation of participants' work experience was  $5.2 \pm 3.9$  (range 1–25 years). Perioperative and anesthesia nurses comprised 111 (58.4%) and 89 (41.6%) participants, and the majority were female (61.1%) with a bachelor's degree (81.6%). The full demographic characteristics are shown in Table 1.

3.2. Results related to safety climate and its dimensions

Among the different dimensions of safety climate, the safety training and the supportive environment dimensions with means  $\pm$  standard deviations of  $3.42 \pm 0.52$  and  $2.95 \pm 0.82$ , respectively, attained the highest and lowest means from nurses' viewpoints (Table 2). Overall, the safety climate from the nurses' views was evaluated at a moderate level with a mean  $\pm$  standard deviation of  $63.2 \pm 11.6$  (range 19–95).

The mean total score of safety climate had a significant relationship only with the overtime work type variable ( $P = 0.04$ ) and was not significantly correlated with the other demographic and occupational variables. The mean score of safety climate was higher in nurses with voluntary overtime work than those with mandatory overtime (Table 1).

As shown in Fig. 1, the safety climate of nurses in ORs was assessed as moderate, good, and poor by 72.6%, 23.6%, and 3.7% of the

**Table 1**  
Socio-demographic characteristics of study subjects and their relationship with turnover intention and Safety climate ( $n = 190$ ).

| Variables              | Frequency       | Percentage  | TI Mean $\pm$ SD | P   | SC Mean $\pm$ SD | P     |
|------------------------|-----------------|---|------------------|---|------------------|-------|
| Occupational groups    |                 |   |                  |   |                  |       |
| Perioperative nurse    | 111             | 58.4%   | 32.6 $\pm$ 9.1   | 0.466   | 61.8 $\pm$ 11    | 0.542 |
| Anesthesia nurse       | 79              | 41.6%   | 31.6 $\pm$ 8.8   |   | 62.8 $\pm$ 11.3  |       |
| Gender                 |                 |   |                  |   |                  |       |
| Male                   | 74              | 38.9%   | 32.3 $\pm$ 9.8   | 0.803   | 62.35 $\pm$ 12.7 | 0.939 |
| Female                 | 116             | 61.1%   | 32 $\pm$ 8.4     |   | 62.22 $\pm$ 10.1 |       |
| Marital status         |                 |   |                  |   |                  |       |
| Single                 | 118             | 62.1%   | 32.3 $\pm$ 9.3   | 0.720   | 62.32 $\pm$ 10.8 | 0.930 |
| Married                | 72              | 37.9%   | 31.8 $\pm$ 8.3   |   | 62.19 $\pm$ 11.7 |       |
| Educational Level      |                 |   |                  |   |                  |       |
| Associate              | 7               | 3.7%  | 33.8 $\pm$ 8.05  |   | 60 $\pm$ 12.32   |       |
| BSc                    | 155             | 81.6%   | 32.4 $\pm$ 8.6   | 0.431   | 62.1 $\pm$ 10.6  | 0.641 |
| MSc                    | 28              | 14.7%   | 30.2 $\pm$ 11.1  |   | 63.85 $\pm$ 13.6 |       |
| Employment Status      |                 |   |                  |   |                  |       |
| Official               | 21              | 11.1%   | 32.8 $\pm$ 7.02  |   | 58.8 $\pm$ 9.15  |       |
| Contractual            | 30              | 15.8%   | 31.7 $\pm$ 9.2   | 0.979   | 63.8 $\pm$ 11.3  |       |
| Bespoke                | 35              | 18.4%   | 32.1 $\pm$ 9.5   |   | 63.54 $\pm$ 10.1 | 0.380 |
| Project                | 104             | 54.7%   | 32.1 $\pm$ 9.2   |   | 62.1 $\pm$ 11.7  |       |
| OTW type               |                 |   |                  |   |                  |       |
| Voluntary              | 96              | 50.5%   | 31.01 $\pm$ 9.38 | 0.07  | 63.8 $\pm$ 11.1  | 0.04  |
| Involuntary            | 64              | 49.5%   | 33.3 $\pm$ 8.4   |   | 60.6 $\pm$ 11.1  |       |
| Quantitative Variables | Mean $\pm$ SD   | TI (Linear regression results)                                  | P                | SC (Linear regression results)                                    | P                |       |
| Age*                   | 27.2 $\pm$ 4.7  | UnStd B:0.04<br>AdjR <sup>2</sup> : -0.005<br>Std Error: 0.132  | 0.744            | UnStd B: -0.079<br>AdjR <sup>2</sup> : -0.004<br>Std Error: 0.164 | 0.630            |       |
| Work Experience*       | 5.2 $\pm$ 3.9   | UnStd B:0.07<br>AdjR <sup>2</sup> : -0.004<br>Std Error: 0.156  | 0.612            | UnStd B: -0.04<br>AdjR <sup>2</sup> : -0.005<br>Std Error: 0.032  | 0.352            |       |
| OTW (Hours/month)*     | 51.4 $\pm$ 35.1 | UnStd B:0.001<br>AdjR <sup>2</sup> : -0.005<br>Std Error: 0.019 | 0.970            | UnStd B: -0.016<br>AdjR <sup>2</sup> : -0.003<br>Std Error: 0.023 | 0.496            |       |

SD: Standard Deviation OTW: Overtime work TI: turnover intention SC: Safety Climate \*: Predictors

**Table 2. Descriptive results of dimensions and items of safety climate.**

| Dimension                       | Item  | Frequency (percent) |  |           |           |                   | M±SD      |
|---------------------------------|---|---------------------|--|-----------|-----------|-------------------|-----------|
|                                 |   | Strongly agree      | Agree  | No idea   | Disagree  | Strongly disagree |           |
| Management commitment to safety | Preventing peoples' exposure to occupational disease takes precedence for management.   | 126(66.3)           | 33 (17.4)  | 20 (10.5) | 7(3.7)    | 4(2.1)            | 3.38±0.84 |
|                                 | Hospital and ward management attach importance to the personnel's health  | 16(8.4)             | 34 (17.9)  | 53 (27.9) | 57(30)    | 30(15.8)          |           |
|                                 | It is important for the hospital to prevent people from suffering occupational injuries/diseases.                                   | 19(10)              | 48 (25.3)  | 53 (27.9) | 43 (22.6) | 27(14.2)          |           |
|                                 | When occupational injuries/diseases are seen, the organization acts decisively to find the causes and prevent the recurrence        | 25(13.2)            | 37 (19.5)  | 54 (28.4) | 46 (24.2) | 28(14.7)          |           |
|                                 | It is important for the organization to report all the occupational injuries/diseases.  | 32(16.8)            | 68 (35.8)  | 43 (22.6) | 32 (16.8) | 15(7.9)           |           |
| Perceived work pressure         | I have always adequate time to follow safety instructions.  | 27(14.2)            | 41 (21.6)  | 19(10)    | 75 (39.5) | 28(14.7)          | 3.27±0.87 |
|                                 | Due to my low workload, I always seek to comply with the safety instruction.  | 19(10)              | 25 (13.2)  | 22 (11.6) | 79 (41.6) | 45(23.7)          |           |
|                                 | Most of the time, I face time constraints to properly do my work.   | 67(35.3)            | 82 (43.2)  | 17 (8.9)  | 22 (11.6) | 2(1.1)            |           |
|                                 | The number of the OR personnel does not meet the workload.  | 98(51.6)            | 52 (27.4)  | 17 (8.9)  | 20 (10.5) | 3(1.6)            |           |
|                                 | I have usually much work to do which makes me ignore occupational hazards   | 56(29.5)            | 70 (36.8)  | 27 (14.2) | 25 (13.2) | 12(6.3)           |           |
| Supportive environment          | In my working environment, unsafe conduct of affairs will be met with negative reactions from supervisors.                          | 27(14.2)            | 54 (28.4)  | 57(30)    | 39 (20.5) | 13(6.8)           | 2.95±0.82 |
|                                 | Supervisors always talk to me over the significance of instructions and ways to prevent infectious diseases transmission.           | 12(6.3)             | 44 (23.2)  | 48 (25.3) | 56 (29.5) | 30(15.8)          |           |
|                                 | In my work unit, there is no disagreement or argument among the personnel.  | 10(5.3)             | 52 (27.4)  | 35 (18.4) | 55 (28.9) | 38(20)            |           |
|                                 | Me and my colleagues always discuss ways to prevent occupational diseases.  | 20(10.5)            | 61 (32.1)  | 67(30)    | 33 (17.4) | 19(10)            |           |
|                                 | In my working environment, people are encouraged to engage in planning and decision-making on their occupational safety and health. | 38(20)              | 56 (29.5)  | 51 (26.8) | 33 (17.4) | 12(6.3)           |           |
| Safety training                 | I have already received enough training about self-protection against occupational injuries/diseases.                               | 46(24.2)            | 90 (47.4)  | 19(10)    | 24 (12.6) | 11(5.8)           | 3.42±0.52 |
|                                 | The personnel have received necessary training on occupational hazards (e.g., facing infectious agents) and ways to prevent them.   | 28(14.7)            | 77 (40.5)  | 33 (17.4) | 36 (18.9) | 16(8.4)           |           |
|                                 | I became acquainted with occupational hazards in early employment training.   | 29(15.3)            | 69 (36.3)  | 50 (26.3) | 32 (16.8) | 10(5.3)           |           |
|                                 | The hospital holds periodic training on the significance of occupational injuries/diseases and how to prevent them.                 | 21(11.1)            | 56 (29.5)  | 54 (28.4) | 39 (20.5) | 20(10.5)          |           |
|                                 | <b>Total mean</b>   |                     | 63.2 ± 11.6 (min:19, Max:95), 3.27±0.58 (out of 5) |           |           |                   |           |

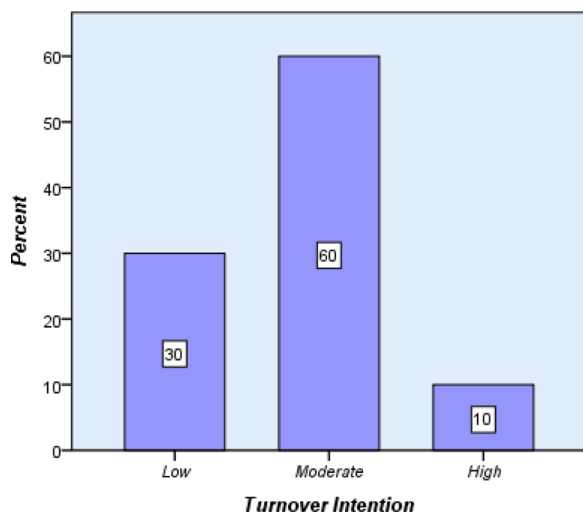


Fig. 1. frequency of turnover intention of nurses according to the 3 levels.

participants, respectively.

3.3. Results related to turnover intention among or nurses

The mean score (32.14. ± 8.9, range 12–60) of turnover intention

among OR nurses were estimated at a moderate level. The mean total score of turnover intention was not significantly related to all the demographic and occupational variables (Table 1).

According to Fig. 2, the turnover intention was assessed at moderate, high, and low levels among 60%, 10%, and 30% of the nurses,

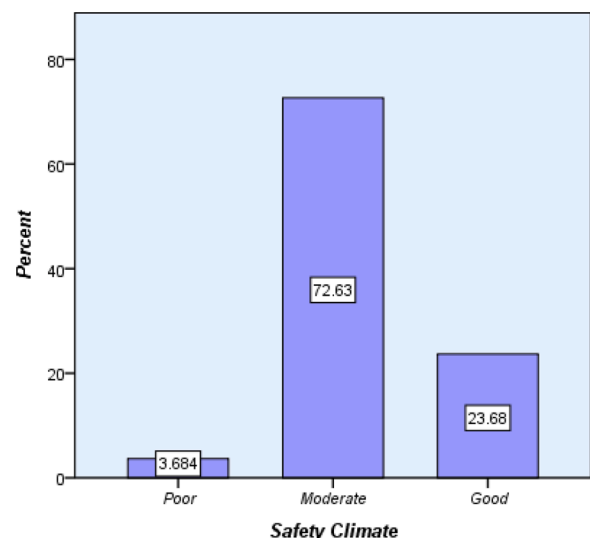


Fig. 2. frequency of nurses' safety climate according to the 3 levels.

respectively.

### 3.4. Relationship between turnover intention and safety climate

The results of linear regression analysis (Table 3) showed that safety climate had a significant reducing effect on nurses' turnover intention in the COVID-19 pandemic ( $P < 0.001$ ). An increase of one point in the total score safety climate led to a 0.6 reduction in the turnover intention score of OR nurses.

The scatter plot shows that in a low average safety climate ( $< 40$ ), the average score of turnover intention is at a level of 50. With an increase in the average safety climate score of nurses, especially from 40 to 80, there is a decrease of 25 points in the average turnover intention score of nurses. The results indicate that the safety climate of nurses with an average of 80 can reduce the turnover intention of OR nurses to an average of  $< 20$  (Fig. 3).

## 4. Discussion

This study aimed to determine the turnover intention of OR nurses during the COVID-19 pandemic and its relationship with the safety climate in ORs of educational and medical centers in Mazandaran province.

The results showed a moderate level of turnover intention in the OR staff. Similarly, Hariri et al.<sup>20</sup> examined some factors related to the turnover intention of nurses and found a moderate level of turnover intention. Other consistent studies include those by Salimi et al.<sup>22</sup> on intensive care unit (ICU) nurses and Hoseini-Esfidarjani et al.<sup>23</sup> who reported a moderate turnover intention. On the other hand, Dashtgrad et al.<sup>24</sup> conducted a study on OR staff before the COVID-19 pandemic and reported a low turnover intention, which does not correspond to our results.

To explain this finding, it can be argued that nurses are the front line of treatment staff for patients with COVID-19, and mortality of patients and infection of their own or colleagues, as well as mortality of their colleagues, in this period is a major threat to them that may increase their turnover intention. Nurses' anxiety and fear about COVID-19 have been shown to increase the reported rate of their turnover intention.<sup>12</sup> Therefore, this can justify their high rates of turnover intention compared to previous research. In other words, it can be concluded that the anxiety, fear, and stress of nurses about COVID-19, as well as their anxiety and stress about dealing with patients with COVID-19, can cause their reports of turnover intention.

The results of a study, which examined turnover intention with a question, showed a high rate of turnover intention in nurses working in ICUs.<sup>25</sup> The difference in these results can be attributed to the difference in the assessment tool because the ATS questionnaire was used in the present study while Dashtgrad et al.<sup>24</sup> and Hesam et al.<sup>25</sup> used a researcher-made questionnaire and only question, respectively, to assess employees' turnover intention. Other reasons for the difference in turnover intention rates include differences in research environments and the various definitions of this phenomenon.

The present study also aimed to investigate the safety climate of nurses in ORs. In general, the safety climate was at a moderate level from the nurses' viewpoints, which is in line with the studies of Sarsangi

et al.<sup>26</sup> and Yarmohammadi et al.<sup>27</sup> McCaughey et al.<sup>28</sup> assessed a favorable safety climate from the viewpoints of US health care workers, which is not in agreement with the present study. The lower score of the safety climate in our studied nurses than the American nurses may be because the occupational safety of different occupations is of high attention in developed countries, and therefore employees feel that their safety is very important in the workplace, thereby improving the safety climate.

Among the various dimensions of safety climate, the safety training dimension attained the highest mean from the viewpoints of OR nurses in the present study. Qualified and effective safety training leads to an increase in nurses' awareness of their occupational hazards, the benefits of using personal protective equipment (PPE), and complying with safety instructions, ultimately improving their safety behavior and reducing the likelihood of occupational accidents. Safety training plays a critical role in increasing the safety knowledge level of individuals<sup>29</sup> and is expected to increase the rate of safe behaviors in individuals, as proven in several studies. Yao et al.<sup>30</sup> found that safety training programs played an important role in promoting nurses' safety behavior and preventing occupational injuries. Another study revealed that providing new safety equipment to prevent occupational injuries and diseases would not be effective unless accompanied by holding appropriate training workshops.<sup>31</sup> During the COVID-19 pandemic, OR staff should also receive the necessary training about protective measures, including the use of PPE such as hats, goggles, face masks (N95), face shields, latex gloves, and various other types of gowns (surgical and coverall gowns) during all therapeutic interventions; they should also employ preventive measures during the surgical procedures of patients with or suspected of an infectious disease.<sup>32</sup> Lotfi et al.<sup>8</sup> reported that the status of compliance with preventive standards against the transmission of COVID-19 in ORs was not in a good condition and required educational measures and interventions to improve the situation.

In the present study, the dimension of management commitment to safety was reported as another influential dimension in the OR safety climate. Likewise, Seo<sup>33</sup> and Cheyne and Cox<sup>34</sup> identified this dimension as the most important safety climate dimension in industries and marine platforms, respectively. Experience has generally shown that the manager's commitment of an organization to safety is the most important factor determining the level of safety in that organization, and actions in improving the level of safety will not be effective without this factor.<sup>35</sup>

Among the dimensions of safety climate, the supportive environment dimension gained the lowest average from the viewpoints of perioperative nurses. This dimension reflects the role of supervisors and co-workers and has been demonstrated by many studies to be important in safety behavior, safety performance, and the rate of accidents and injuries. In environments where there is an unfavorable supportive environment for safety measures, people are generally disinclined to adopt safety behaviors and comply with safety instructions. In such environments, one's safe behaviors will be ridiculed by others, and unsafe behaviors are considered a sign of courage.<sup>36</sup> In a study by Vortman et al.<sup>37</sup> on barriers to prevent the dangers of electrocautery smoke in ORs, perioperative nurses believed that one of the main barriers to smoke suctioning from the surgical field as a precautionary measure was surgeons' objection as they thought that smoke suctioning would slow down the operation speed and make noise.

The present study is the first to evaluate the relationship between safety climate and turnover intention in perioperative nurses. The results showed a significant inverse relationship between the safety climate perceived by nurses and their turnover intention. Similarly, Todd et al. presented evidence that the safety climate of workplace had a significant inverse relationship with the turnover intention of workers.<sup>38</sup> A positive relationship between safety climate and job satisfaction as well as a negative relationship between safety climate and turnover intention, was shown in a study on miners conducted by Balogun et al.<sup>39</sup> In Taiwan, Wang et al.<sup>40</sup> conducted a study on TV reporters and demonstrated a significant inverse relationship between a positive

**Table 3**  
Correlation of Turnover intention with safety climate.

|                | Unstandardized Coefficients |           | Standardized Coefficients | t      | P-value |
|----------------|-----------------------------|-----------|---------------------------|--------|---------|
|                | B                           | Std error | Beta                      |        |         |
| Constant       | 69.64                       | 2.46      |                           | 28.23  | 0.001   |
| Safety climate | -.602                       | .039      | -.748                     | -15.44 | 0.001   |

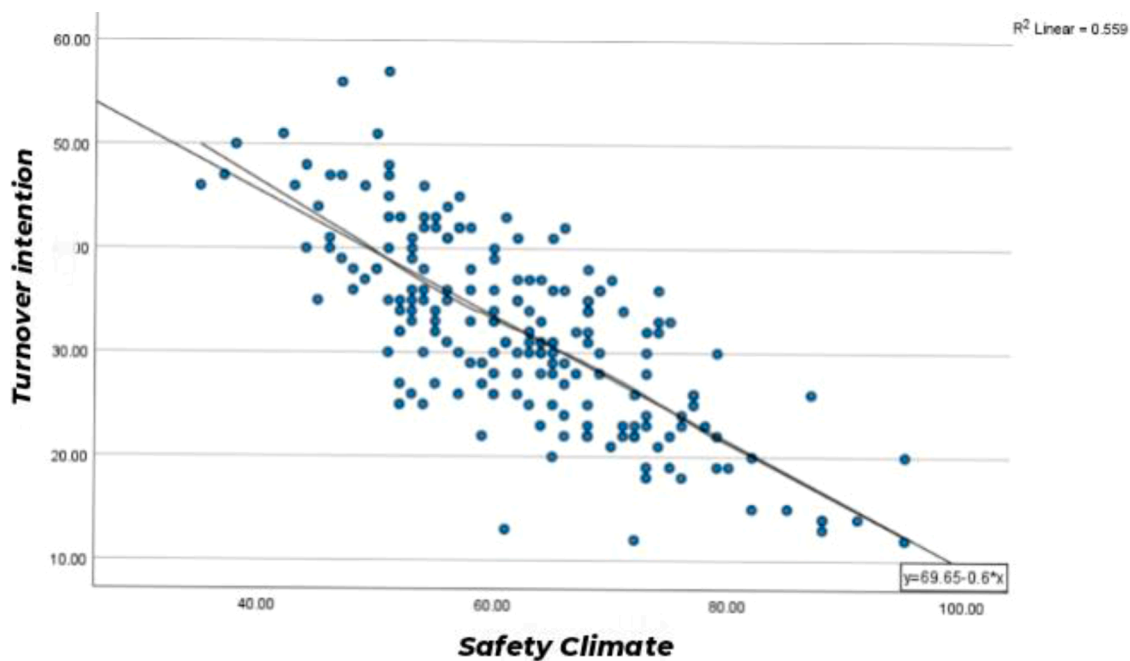


Fig. 3. Distribution diagram between turnover intention and safety climate.

workplace safety climate and turnover intention, which agrees with the present results. The safety climate indicates the relative importance of safety in an organization and high levels of management that underpins all measures taken to promote safety in an organization. Safety climate is also a prospective indicator in safety management and occupational health. Our findings demonstrated an unfavorable safety climate in the examined ORs. Consequently, nurses and other staff are always prone to occupational injuries and diseases, reduced job satisfaction, and thus increased turnover intention, hence, there is a need to improve and develop organizational safety.

#### 4.1. Study limitations

Lack of similar research on “Turnover intention among operating room nurses during the COVID-19 outbreak and its association with perceived safety climate” to compare and interpret the results was the main limitation of this study. Another limitation of this study was using a questionnaire, which has a self-report aspect, to collect the data. Thus, the answers might be affected by incorrect answers.

## 5. Conclusion

The results of the present study show a significant relationship between turnover intention and the safety climate of nurses in the COVID-19 pandemic, and the safety climate predicts turnover intention in OR nurses. Therefore, it is worthwhile for managers to improve the safety climate in the COVID-19 pandemic as the safety climate itself is a factor in turnover intention. They should also implement strategies, such as staff training on preventing disease transmission in surgery of patients infected with or suspected of COVID-19, creating a proper supportive environment for staff, and providing suitable PPE to prevent infection with COVID-19.

#### CRediT authorship contribution statement

**Mojgan Lotfi:** Conceptualization, Methodology, Writing – original draft, Data curation. **Omid Zadi Akhuleh:** Visualization, Investigation, Software, Data curation. **Aysan Judi:** Formal analysis, Data curation. **Mohammadtaghi Khodayari:** Conceptualization, Methodology,

Writing – original draft, Data curation.

#### Declaration of Competing Interest

All authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

#### Funding

No funder

#### Ethical approval

The project’s compliance with the ethical code was approved by the Ethics Committee of Mazandaran University of Medical Sciences (IR.MAZUMS.REC.1398.1403).

#### Acknowledgments

The authors would like to thank all participants who voluntarily participated in the study.

#### References

- Gorbalenya A.E., Baker S.C., Baric R., et al. Severe acute respiratory syndrome-related coronavirus: The species and its viruses—a statement of the Coronavirus Study Group. 2020.
- Zangrillo A, Beretta L, Silvani P, et al. Fast reshaping of intensive care unit facilities in a large metropolitan hospital in Milan, Italy: facing the COVID-19 pandemic emergency. *Critical Care Resuscit.* 2020;22(2):91–94.
- Nemati M, Ebrahimi B, Nemati F. Assessment of Iranian nurses’ knowledge and anxiety toward COVID-19 during the current outbreak in Iran. *Arch Clin Infect Dis.* 2020;15(COVID-19), e102848.
- Pappa S, Ntella V, Giannakas T, et al. Prevalence of depression, anxiety, and insomnia among healthcare workers during the COVID-19 pandemic: a systematic review and meta-analysis. *Brain Behav Immun.* 2020;88:901–907.
- Yáñez JA, Jahanshahi AA, Alvarez-Risco A, et al. Anxiety, distress, and turnover intention of healthcare workers in Peru by their distance to the epicenter during the COVID-19 crisis. *Am J Trop Med Hyg.* 2020;103(4):1614.
- Chew M-H, Koh FH, Ng KH. A call to arms: a perspective on safe general surgery in Singapore during the COVID-19 pandemic. *Singapore Med J.* 2020;61(7):378.
- Nasiri E, Shabanzad S. Examining the experiences of operating room staff in dealing with patients with covid-19 - a qualitative study. *Nurs Midwif J.* 2021;18(12): 956–964.

- 8 Lotfi M, Zamanzadeh V, Aghazadeh A, et al. Observance of preventive standards against COVID-19 transmission in operating rooms: a cross-sectional study. *Perioperat Care Oper Room Manag.* 2021, 100212.
- 9 Zadi Akhule O, Nasiri formi E, Lotfi M, et al. The relationship between occupational hazards and intention to leave the profession among perioperative and anesthesia nurses. *Nurs Midwif J.* 2020;18(7):532–542. <https://doi.org/10.29252/unmf.18.7.532>.
- 10 Duffield CM, Roche MA, Homer C, et al. A comparative review of nurse turnover rates and costs across countries. *J Adv Nurs.* 2014;70(12):2703–2712.
- 11 Sokhanvar M, Kakemam E, Chegini Z, et al. Hospital nurses' job security and turnover intention and factors contributing to their turnover intention: a cross-sectional study. *Nurs Midwif Stud.* 2018;7(3):133–140.
- 12 Labrague LJ, de Los, Santos JAA. Fear of Covid-19, psychological distress, work satisfaction and turnover intention among frontline nurses. *J Nurs Manag.* 2021;29(3):395–403.
- 13 Chan ZC, Tam WS, Lung MK, et al. A systematic literature review of nurse shortage and the intention to leave. *J Nurs Manag.* 2013;21(4):605–613.
- 14 Ghasemi FKO, Moghimbeigi A, Mohammadfam I. A path analysis model for explaining unsafe behavior in workplaces: the effect of perceived work pressure. *Int J Occup Saf Ergon.* 2018;24(2):303–310.
- 15 Memarbashi E, Mohammadzadeh F, Boroujeni ZA, et al. The relationship between nurses' safety climate in the operating room and occupational injuries: a predictive correlational study. *Perioperat Care Oper Room Manag.* 2021, 100206.
- 16 Christian MS BJ, Wallace JC, Burke MJ. Workplace safety: a meta-analysis of the roles of person and situation factors. *J Appl Psychol.* 2009;94(5):1103–1127.
- 17 Nahrgang JD, Morgeson FP, Hofmann DA. Safety at work: a meta-analytic investigation of the link between job demands, job resources, burnout, engagement, and safety outcomes. *J Appl Psychol.* 2011;96(1):71.
- 18 Beus JM, Dhanani LY, McCord MA. A meta-analysis of personality and workplace safety: addressing unanswered questions. *J Appl Psychol.* 2015;100(2):481.
- 19 Doroodi HAK, Hashemi M. Relationship of job injuries mediated by the perception of work climate and job satisfaction, stress and turnover in staff of educational Hospitals at Zanjan University of Medical Sciences. *Prevent Care Nurs Midwif J.* 2016;6(3):71–81.
- 20 Hariri GR, YF Zagheri, Tafreshi M, Shakeri N. Assessment of some factors related to leave in nurses and their demographic character in educational hospitals of Shahid Beheshti University of Medical Sciences. *Journal of Health Promotion Management.* 2012;1(3):17–27 (persian).
- 21 Ghasemi F, Akbari H, Akbari H, et al. Designing and Validating a Questionnaire for Assessing the Safety Climate among Nurses. *J Milit Med.* 2018;20(5):488–499.
- 22 Salimi S, Pakpour V, Feizollahzadeh H, et al. Resilience and its association with the intensive care unit nurses' intention to leave their profession. *Hayat.* 2017;23(3):254–265.
- 23 Hoseini-Esfidarjani S-S, Negarandeh R, Janani L, et al. The intention to turnover and its relationship with healthy work environment among nursing staff. *Hayat J.* 2018;23(4):318–331.
- 24 Dashtgrad A, Moudi A, RahmaniMoghadam E, et al. The study of the correlation between the rate of burnout and intention to leave job among operation room workers in South Khorasan Hospitals in 2016. *J Rafsanjan Univ Med Sci.* 2018;16(12):1114–1125.
- 25 Hesam M, Asayesh H, Roohi G, et al. Assessing the relationship between nurses' quality of work life and their intention to leave the nursing profession. *Quart J Nurs Manag.* 2012;1(3):28–36.
- 26 Sarsangi V, Khalevandi A, Zarei E, et al. Attitude of the nurses of kashan educational hospitals toward workplace safety climate in 2014. *Commun Health J.* 2017;8(1):18–27.
- 27 Yarmohammadi H, Sohrabi Y, Salimi H, et al. The Attitude of Nurses in Hospitals of Kermanshah towards Safety climate. *Occup Hygiene Health Promot J.* 2020;3(4):309–318. <https://doi.org/10.18502/ohhp.v3i4.2455>.
- 28 McCaughey D, Dellifraire JL, McGhan G, et al. The negative effects of workplace injury and illness on workplace safety climate perceptions and health care worker outcomes. *Saf Sci.* 2013;51(1):138–147.
- 29 Lu C-S, Yang C-S. Safety leadership and safety behavior in container terminal operations. *Saf Sci.* 2010;48(2):123–134.
- 30 Yao W-X, Wu Y-L, Yang B, et al. Occupational safety training and education for needlestick injuries among nursing students in China: intervention study. *Nurse Educ Today.* 2013;33(8):834–837.
- 31 van der Molen HF, Zwinderman KA, Sluiter JK, et al. Better effect of the use of a needle safety device in combination with an interactive workshop to prevent needle stick injuries. *Saf Sci.* 2011;49(8–9):1180–1186.
- 32 Kamer E, Çolak T. What to do when a patient infected with COVID-19 needs an operation: a pre-surgery, peri-surgery and post-surgery guide. *Turk J Colorectal Dis.* 2020;30(1):1–8.
- 33 Seo Dd-C, Torabi MR, Blair EH, et al. A cross-validation of safety climate scale using confirmatory factor analytic approach. *J Saf Res.* 2004;35(4):427–445.
- 34 Cox S, Cheyne A. Assessing safety culture in offshore environments. *Saf Sci.* 2000;34(1–3):111–129.
- 35 Hopkins A. *Making Safety Work: Getting Management Commitment to Occupational Health and Safety: Allen and Unwin.* 1995.
- 36 Mullen J. Investigating factors that influence individual safety behavior at work. *J Saf Res.* 2004;35(3):275–285.
- 37 Vortman R, Wendler MC, McPherson S. A Delphi technique study to understand nurses' knowledge and concerns regarding surgical smoke. *Perioperat Care Oper Room Manag.* 2021;24, 100193.
- 38 Smith JG, Morin KH, Wallace LE, et al. Association of the nurse work environment, collective efficacy, and missed care. *West J Nurs Res.* 2018;40(6):779–798.
- 39 Balogun AO, Andel SA, Smith TD. Digging Deeper" into the relationship between safety climate and turnover intention among stone, sand and gravel mine workers: job satisfaction as a mediator. *Int J Environ Res Public Health.* 2020;17(6):1925.
- 40 Wang C-H, Yen C-D. Leadership and turnover intentions of Taiwan TV reporters: the moderating role of safety climate. *Asian J Commun.* 2015;25(3):255–270.