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Investigating the Prevalence of Unsafe Behaviors and the Factors Affecting It Using a Cross-sectional Study in a Steel Company in Iran

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Investigating the prevalence of unsafe behaviors and the factors affecting it using a cross-sectional study in a steel company in Iran

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Investigating the prevalence of unsafe behaviors and the factors affecting it using a cross-sectional study in a steel company in Iran

Abstract

Background: Unsafe behaviors (UBs) are the most important cause of accidents (98 %). Therefore, identifying the cause of UBs is also significant. The aim of this study was to investigate the prevalence of UBs among the workers of a steel company in Iran and also to identify the factors affecting these behaviors.

Method: This cross-sectional study was conducted on 270 people from the employees of a steel company in Iran in 2016. The present study consists of two parts. 1) investigate the prevalence of UBs of workers using safety behavior sampling method, 2) identify the factors affecting UBs using a questionnaire (demographic sections, general health questionnaire, work-family conflict questionnaire, and UK's HSE job stress questionnaire). The data from the questionnaires were analyzed by SPSS 16.

Results: The frequency of observed UBs showed that out of 1310 observed behaviors, 531 cases (40.5%) were unsafe. Also, UB among the sample group was significantly higher than the control group ($P < .05$). The correlation between general health, work-family conflict, job stress, and UBs showed that general health had a significant relationship with UBs ($P < .05$).

Conclusions: The relationship between support scale in job stress and accident showed that organizational factors such as organizational climate, safety culture, management and cooperation between people are among the factors affecting the accident and with optimal management of these factors can play a significant role in future accidents.

Keywords: Unsafe behaviors, Safety behavior sampling, Steel company, Job stress

Persian abstract

پیش زمینه و هدف: رفتار ناایمن مهمترین عامل حوادث (98٪) است. بنابراین، شناسایی علل رفتار ناایمن نیز مهم است. هدف از این مطالعه بررسی شیوع رفتار ناایمن در بین کارگران یک شرکت فولاد سازی در ایران و همچنین شناسایی عوامل موثر بر این رفتارها بود.

روش کار: این مطالعه مقطعی بر روی 270 نفر از کارکنان یک شرکت فولاد در ایران در سال 2016 انجام شده است. مطالعه حاضر شامل دو بخش است: 1) بررسی شیوع رفتار ناایمن کارگران با استفاده از روش نمونه گیری رفتار ایمن، 2) شناسایی عوامل موثر بر رفتار ناایمن با استفاده از یک پرسشنامه چند بخشی جمعیت شناختی، پرسشنامه سلامت عمومی، پرسشنامه تعارض خانواده-کار و پرسشنامه استرس شغلی HSE انگلیس. داده های پرسشنامه ها توسط نرم افزار SPSS 16 تجزیه و تحلیل شد.

نتایج: فراوانی رفتار ناایمن مشاهده شده نشان داد که از 1310 رفتار مشاهده شده، 531 مورد (40/5٪) ناایمن بودند. همچنین، رفتار ناایمن در میان گروه نمونه به طور قابل توجهی بالاتر از گروه شاهد بود ($P < 0/05$). همبستگی بین سلامت عمومی، تعارض کار-خانواده، استرس شغلی و رفتار ناایمن نشان داد که سلامت عمومی با رفتار ناایمن رابطه معنی داری دارد ($P < 0/05$).

نتیجه گیری: رابطه بین مقیاس پشتیبانی در استرس شغلی و تصادف نشان داد که عوامل سازمانی از جمله جو سازمانی، فرهنگ ایمنی، مدیریت و همکاری بین افراد از جمله عوامل موثر در حادثه هستند و با مدیریت بهینه این عوامل می توانند نقش بسزایی در حوادث آینده داشته باشند.

کلمات کلیدی: رفتار ناایمن، نمونه گیری رفتار ایمن، صنعت فولاد، استرس شغلی

1. Introduction

The workforces have an important role in the service, survival, and success of organizations. Also, the most people in the world (more than 58%) spend a third of their lives in the workplace (1). The human resources in any organization are the most valuable resources of the organization, which attracts a lot of attention (2). Today, occupational accidents are recognized and estimated as one of the most important causes of disability and leading to death in developed and developing countries and it is estimated that more than 300,000 people die each year, and many cases of physical disability (3). Job accidents, no matter how severe they may be, cause great economic and social problems in society. According to the World Health Organization (WHO), 350,000 workers lose their life each year, and job injuries accounts for 0.9% of the world's disability adjusted life year (DALYS) (4). In the European Union, the number of days lost due to an annual work accident is reported to be 150 million days (5).

Due to the great importance of accident control, various researches and models have been presented in the field of cause detection of accidents, most of which are two factors of unsafe behaviors (UBs) and unsafe conditions (UCs) as the most important causes of accidents. Studies in industrialized countries indicate that about 90% of occupational accidents are caused by UBs (6). In " Industrial accident prevention", Henrich states that more than 85% of occupational accidents are due to UBs (7). These behaviors are derived from the inner and social characteristics of individuals (8). Research on UBs has examined a variety of factors, including individual characteristics, job stress, fatigue, and organizational factors such as safety culture. In addition to these characteristics, mental health of individuals can also be considered (9). The combination of UBs, UCs, and the inherent risk of the activity may lead to occupational accidents, and these risks may be exacerbated by job stress and psychological factors (10). Shevyakov points out that the lack of focus, fatigue, forgetfulness, reaction time, are the reasons why depressed workers are unsafe (11). Also, in many studies, the effect of mental health and depression on UBs has been studied and low mental health is considered as one of the causes of UBs (12). Job stress is a condition associated with job-related anxiety and stress that affects a person's mental and physical health (13), it can also affect a person's behavior at work (14). Leung et al. examined the effect of stress on UB of construction workers in Hong Kong and concluded that occupational injuries were closely related to their psychological and physical stress (15).

Another factor that is one of the social factors that has had a great impact on the mental health of the workforce and various studies have emphasized this issue is the work-family conflict. Work-family conflict is a type of conflict between a role in which the pressures of work and family roles on both sides or in some respects are inconsistent. This means that it becomes difficult to play job or family roles (16). Mazrolle, Bruening, and Casa believe that work-family conflict is caused by inconsistencies between job demands and family demands. In their view, this phenomenon occurs when the expectations and time constraints of a person's professional and personal life are not compatible, making it difficult to manage the two (17).

In order to control occupational accidents, one must first look for the roots and causes of these accidents. As mentioned above, the most important cause of accidents is UBs of workers. Therefore, identifying the cause of UBs is also significant. Past studies have cited factors such as stress, mental health, safety culture, and more. The aim of this study was to investigate the prevalence of UBs among the workers of a steel company in Iran and also to identify the factors affecting these behaviors.

2. Methods

The present cross-sectional study was conducted on 270 people from the employees of a steel company in Iran in 2016. The present study consists of two parts. The first part was to investigate the prevalence of UBs of workers using safety behavior sampling (SBS) method and the second part was to identify the factors affecting UBs using a questionnaire. The data collection tools in this study to identify the factors affecting UBs include a 5-part questionnaire consisting of demographic sections (including age, work experience, level of education, marital status, family head, shift working), general health questionnaire, work-family conflict questionnaire, and UK's HSE job stress questionnaire. In this study, first the aims of the study were explained to the participants and then they answered the questionnaires, which were anonymous. Written consent was also received from the participants.

2.1. Statistical population

The study population was all employees of the steel sector who worked in that sector between 2013 and 2016; participants were divided into two groups (each group has 135 people): had an accident (sample) and had not an accident (control). Participant with accident were collected by safety, health, and environmental (HSE) sector records during past 4 years (from 2013 to 2016). The second group was randomly selected from the same section that had no accidents during this period.

2.2. Part 1:

2.2.1. Safety behavior sampling method

In the method of SBS, it is assumed that a percentage of the time a person is doing safe or unsafe act can be determined. To do this, the number of observations required must be determined. In this method, the behaviors were matched with the checklist of safe behavior. In the present study, the safe behavior created using the opinion of industry safety experts and previous studies. The checklist includes 6 categories: unauthorized operation or operation at unsafe speeds, use unsafe equipment, unsafe loading (include loading, unloading, mixing, and blending), awkward posture, distracting others (include harassing, abusing, intimidating, shouting), non-use or inappropriate use of personal protective equipment (PPE). Sampling behavior with this method requires a pilot study, and after conducting it, knowing the number of UBs, the number of observations determined by equation 1 (18).

Equation1

$$N = \frac{Z^2_{0.95}(1-P)}{S^2\ P}$$

Where P is the ratio of unsafe behavior to total behavior in the pilot study (equation 2), S accuracy (5%) and Z reliability coefficient 95% according to the normal distribution table.

equation 2

$$P = \frac{N_1}{N_2}$$

where N_1 is UBs observed and N_2 is the total behavior observed in the pilot study. After conducting the pilot study of 200 samples of behavior, determining the volume of the final sample to perform the behavior was done as follows.

$$P = \frac{N_1}{N_2} = \frac{110}{200} = 0/55 = 55\%$$

A pilot study showed that 55% of behaviors in this industry are unsafe, and finally, the study required 1256 behavioral sampling and 1310 behavioral samples were observed.

$$N = \frac{Z^2_{0/95}(1-P)}{S^2\ P} = \frac{3/8416 \times 0/45}{(0/05)^2 \times 0/55} = 1256$$

2.2.2. Part 2 (questionnaires):

General Health Questionnaire

This questionnaire is one of the screening tools used in epidemiological studies of mental disorders, which was developed by Goldberg in 1972 (19). The questionnaire has 28 questions on four subscales: physical symptoms, anxiety and insomnia, social functioning and depression. Each of these 4 scales has 7 questions. A person's score will vary from zero to 28, and a lower score indicates better mental health.

Work-Family Conflict Questionnaire

Work-family conflict assessed by Carlson and Kumar (2000) questionnaire. The questionnaire assesses 18 items of the six dimensions of work-family conflict. The responses ranges are from 1 (completely opposed) to 5 (completely agree) using the Likert scale. A higher score on this test will indicate a greater work-family conflict. The subjects of this questionnaire are divided into six categories of three subjects and each category has three questions. 1) Time based work to family conflict (that is, the amount of time spent work roles and reducing time spent on family roles), 2) time-based family to work conflict (that is, the amount of time spent on family roles and reducing time spent on work), 3) Pressure based work to family conflict (that is, the amount of energy that is expended on work roles and reduces energy for family roles), 4) Pressure based family to work

conflict (that is, the amount of energy that is expended on family roles and reduces energy for the job roles), 5) Behavior based work to family conflict (that is, interfering with work behaviors and norms in family behaviors and norms), 6) behavior based family to work conflict (that is, interfering with family behaviors and norms in work behaviors and norms) (20).

UK's HSE Job Stress Questionnaire

Job stress assessment and monitoring is performed using a number of questionnaires, in which the HSE job stress questionnaire belonging to the UK Health and Safety Executive was used. The questionnaire has 35 questions in seven subscales: demands, control, support by managers, support among colleagues, relationships, role, and change. The questionnaire has a 5-point Likert score of never = 5, rarely = 4, sometimes = 3, often = 2, always = 1, and the score below the scale of demand and communication in reverse. The final score of each section is divided by the number of questions in that section to get a weighted score between 1 and 5. In each section and in general, increasing the score (the closer it is to 5 on the scale) indicates high stress.

2.3. Statistical analysis

The data from the questionnaires were analyzed by SPSS 16. In analytical section, Mann-Whitney, Chi-square test, Spearman correlation and linear regression were used.

3. Results

The mean (SD) of age and work experience were 35.04 (5.493) years and 11.51 years (5.713) in the sample group and 36.42 (5.677) years and 12.50 (5/518) years in the control group, respectively. Most of the subjects in the sample group (51.9%) and the control (54.8%) had a diploma and 122 (90.4%) of the sample and 124 (91.9%) of the control group were married (Table 1).

The frequency of observed UBs in the two studied groups showed that out of 1310 observed behaviors, 531 cases (40.5%) were unsafe. Also, UBs among the sample group was significantly higher than the control group (Figure 1). Also, checklist categories, the relative frequency of each UBs showed that the most observed behavior (38%) is related to non-use or inappropriate use of PPE, followed by awkward posture with 20.2% (Figure 2).

Table 2 shows the mean scores obtained from the questionnaires between the two sample and control groups. As can be seen in the table, only in the stress and subscales section of the support (management and colleagues), there was a significant difference between the two study groups ($P < .05$).

The correlation between general health, work-family conflict, job stress, and UBs between the two studied groups showed that the variables general health, work-family conflict, and job stress were significantly corelated ($P < .001$). Also, general health had a significant relationship with unsafe behavior ($P < .05$) (Table 3).

4. Discussion

The aim of this study was to investigate the prevalence of unsafe behaviors and the factors affecting it in a steel company. The results of the study showed a significant relationship between general health, job stress (support of managers) and unsafe behavior. Also, the results of SBS showed that the most UBs was related to non-use or inappropriate use of PPE. In addition, the prevalence of unsafe behavior observed for all observations was 39.81% and there was a significant difference between the two studied groups.

According to various studies that have investigated UBs in various industries, the percentage of unsafe behavior observed in the present study is the average of other studies, so that Azadeh et al. up to 59% have also been shown (21). The study of Negahdari et al. in the electricity industry also showed that 45% of all observed behaviors are unsafe and the most UBs is due to non-use of PPE. They also found that there was a significant relationship between the two groups of accidents and without accidents in the occurrence of UBs (22). Non-use or inappropriate use of PPE has always been a major factor in the accident. This type of UBs has been introduced in recent years as one of the 6 main causes of occupational accidents in Iran (23). There are several factors influencing the prevalence of this type of UBs, including the role of the organization in providing appropriate PPE for the type of work and employees, appropriate training on how to use this type of equipment properly and the importance of using this type of equipment and the job inspections. Mohammad Fam et al. in a study of UBs in the Iranian gas industry concluded that 37% of the observed behaviors were unsafe and the most common cause of unsafe behavior is related to the awkward posture and then non-use or inappropriate use of PPE (16). These results are similar to the present study. The cause of UBs depends on several factors, such as the type of job, the organizational climate, and the type of industry. According to this fact that the steel industry is one of the major industries, and also has very difficult working conditions, UBs, in addition to being influenced by individual differences, are also influential organizational factors. Also, nonconformity of ergonomic principles at work and having awkward postures are the main causes of work-related musculoskeletal disorders, which are considered to be the cause of occupational diseases, absenteeism and loss of workforce (24).

The results of the present study showed that general health had a significant relationship with occupational accidents in the industry in general. According to the results of general health research, people who had an accident were in a more inappropriate situation than the other group. In addition, the results showed that a higher mean score was observed among the sample group, which indicates lower general health in these people. Khandan et al. in their study, which investigated the relationship between general health and UBs, found that the overall scores on the general health of the participants ranged from 35 to 81 in severe cases. Also, they found that general health and occupational accidents did not have a significant relationship (25). And their results are contrary to the present study, and one of the reasons for this difference is the type of industry studied. It is likely that the difficult nature of some industries, such as steel, could be a factor in reducing general health. The results of linear regression in the present study also showed

that is a significant relationship between job stress and general health. Zare et al. also investigated the general health and quality of sleep and their relationship with occupational accidents in the employees of the industrial company. Their results showed that general health with a mean score of 29.4 in the accident group has a higher score than the accident-free group, and this difference is significant. They also found that the depression score was the lowest and the social dysfunction was the highest, but there was no significant difference between the two groups of had accident and those who did not have accident (26)

The present study examined job stress in the seven subscales. The final results showed that the final score of job stress had not a significant relationship with the occupational accidents, but this relationship was shown to be significant under the support of managers. The study of Yadegar et al. also showed a high level of job stress in petrochemicals (27), which the results are similar to the present study. The results showed that due to the fact that the demand subscale has a higher stress score, no significant relationship was found between the two study groups. Given that there was no significant relationship between the two groups and everyone understands this type of stress equally, it can be concluded that appropriate management can reduce this type of stress in their environment by increasing people's awareness. It also showed a significant relationship between the two groups based on the results of the support subscale, and considering that the mean score in sample group (2.94) did not exceed the mean score of case group (2.69). It can be concluded that discrimination between individuals and reduction of support by managers increases stress among individuals. Julià et al. investigated the relationship between lack of organizational support and job stress and accidents. In their study, they considered the role of organizational support in two ways: the support of mangers and the policies of the organization regarding increasing motivation and promotion of individuals and the support of colleagues. This study shows that reducing organizational support increases stress as well as increases the incidence of accidents. In addition, they found that job stress was not significantly associated with accidents among male employees (28). The results of this study are similar to the present study, so that the present study showed that reducing the support of managers or in fact reducing organizational support has played a role in the occurrence and experience of accidents among people and also when job stress in general. Lack of significant differences in stress and organizational support indicate that the occurrence of the accident depends primarily on the organizational climate and policy, support of colleagues and managers, and in another case is related to the stressful conditions of the job. This result is also similar to various studies that have examined organizational factors as well as job stress (29, 30).

5. Conclusion

The results of the present study showed that UBs and general health as well as job stress and general health were significantly related in the two groups. The relationship between support scale in job stress and accident showed that organizational factors such as organizational climate, safety culture, management and cooperation between people are among the factors affecting the accident and with optimal management of these factors can play a significant role in future accidents.

Correlation analysis between variables showed that social stressors such as work-family conflict can also be a factor in reducing general health. Therefore, in order to reduce the incidence of musculoskeletal disorders and accidents and also to increase the general health of employees, in addition to considering job-related stress, industry management should also pay attention to the social factor of work-family conflict and manage employees' stress with optimal management.

Implications

Unsafe behavior is one of the most important safety issues in industries. Identifying the factors affecting unsafe behavior and controlling these behaviors can be effective in reducing accidents. Organizations should record the prevalence of unsafe employee behavior. To do this, the method presented in the present study can be applied.

Limitations

This study clearly has some limitations. The most important one lies in the fact that due to the nature of the studied company; women were not included in the statistical population of the present study. Therefore, work-family conflict, which is more common in women, was not examined comprehensively, and in future studies, it is suggested that both genders be examined in order to provide a more complete conclusion.

List of abbreviations

UBs: Unsafe Behaviors

UCs: Unsafe Conditions

SBS: Safety Behavior Sampling

UK: United Kingdom

HSE: Health and Safety Executive

PPE: Personal Protective Equipment

Declarations

Ethics approval and consent to participate: Approved by Tehran University of Medical Sciences No. IR.TUMS.SPH.REC.1397.265.

Consent for publication: All authors have consent for publication. It also mentioned in Cover letter.

Availability of data and materials: Not applicable

Competing interests: Authors declare that there is no competing of interests.

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Authors' contributions: H.R.S was the leader of study and edited the final manuscript. H.R gathered data of questionnaires and was a major contributor in writing the manuscript. M.M, A.K gathered data of safety behavior sampling and was a major contributor in writing the manuscript. A.Z analyzed data and was a major contributor in writing the manuscript. All authors read and approved the final manuscript."

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Figures legend

Figure 1: The frequency of unsafe behaviors observed among the studied workers

Figure 2: The prevalence (%) of categorized unsafe behaviors among the participants

Figures

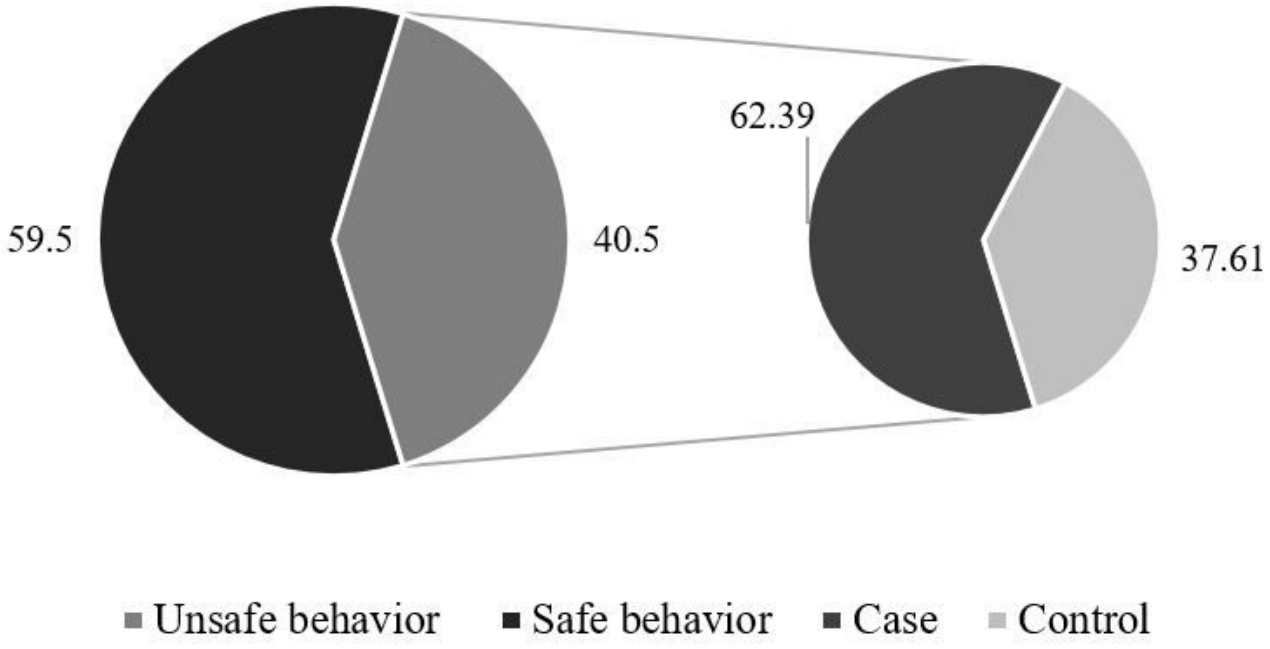


Figure 1

The frequency of unsafe behaviors observed among the studied workers

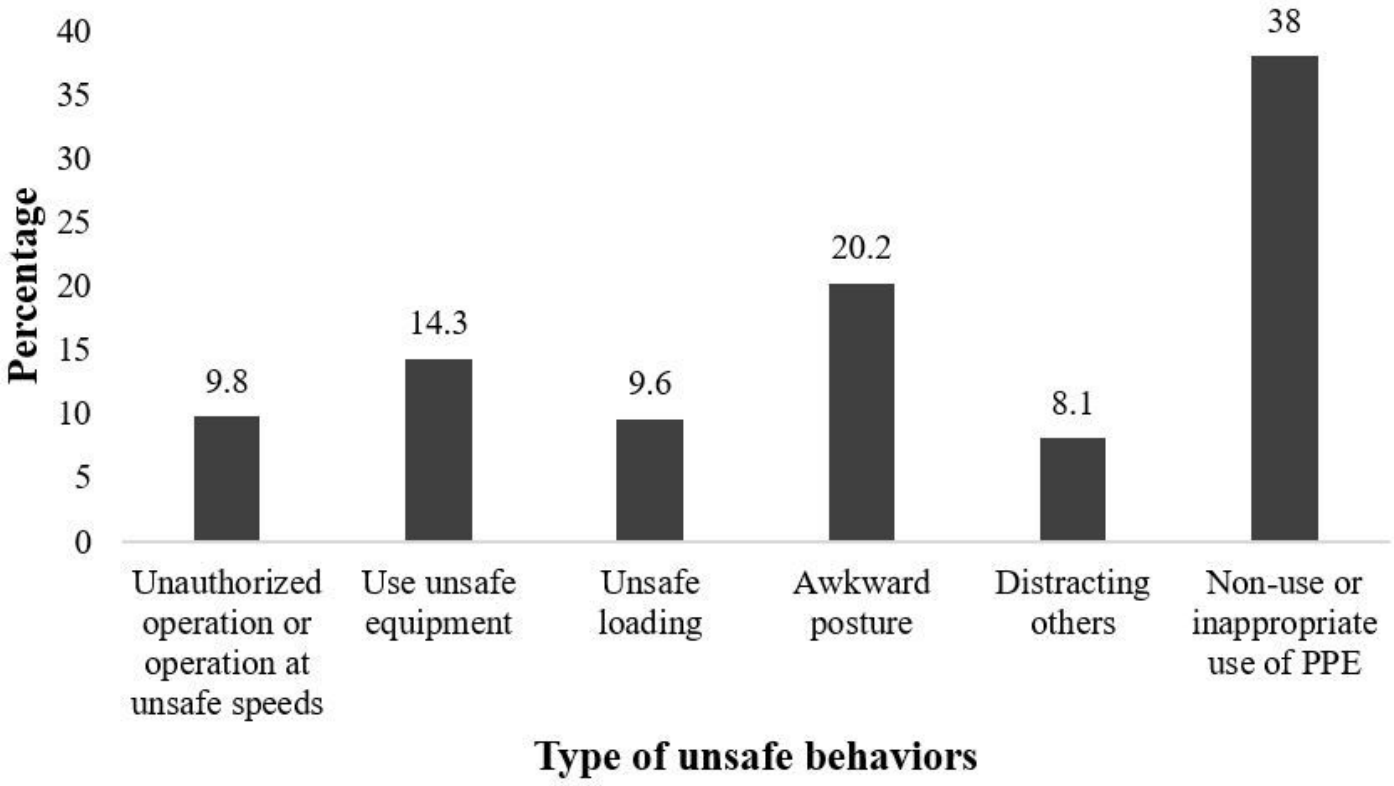


Figure 2

The prevalence (%) of categorized unsafe behaviors among the participants

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- Tables.docx