

Original Article

**Survey of Personal Protective Devices Usage in Industrial Workers in Yazd, Iran in 2011**

Amir Houshang Mehrparvar<sup>1</sup> Maryam Fazlalizadeh<sup>1</sup> \***Mehrdad Mostaghaci**<sup>1</sup>

1- Department of Occupational Medicine, School of Medicine, Shahid Sadoughi University of Medical Sciences, Yazd, Iran

\*[mehrdadmoghaci@gmail.com](mailto:mehrdadmoghaci@gmail.com)

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**Abstract**

**Background and purpose:** Many workers are exposed to workplace hazards. Many occupational diseases are preventable by personal protective devices (PPDs). Though many workers do not use PPDs or their protection by PPDs is not sufficient. This study was designed to assess the quality of PPDs usage among industrial workers.

**Materials and Methods:** In a cross-sectional study, 648 workers from four main industries (tile and ceramic, metal, textile, and chemical) were evaluated for PPDs use. The quality of appropriate PPDs was defined according to the workplace exposures, available PPDs, and time of exposure. The reasons for non-usage of PPDs were evaluated as well. Data were analyzed by SPSS using chi-square test.

**Results:** On average, 56.8%, 69.6%, and 61.6% of workers were exposed to noise, and respiratory and dermal exposures, respectively. From the workers who needed PPDs, 77.8%, 26.3%, and 21% used gloves, respirators and hearing protection devices, respectively. The most frequent reason for non-usage was discomfort while wearing PPDs.

**Conclusion:** This study showed an unsatisfactory situation in the industries for PPDs usage: Low compliance rate, inadequate training programs, and low quality of usage.

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**Key words:** Workplace, Protective Devices, Ear Protective Device, Respiratory Protective Device, Gloves Protective

## 1. Introduction

Occupational health is an important concern of the working population (1). Occupational exposure to different hazards may result in different kinds of diseases. The most common occupational diseases are upper respiratory irritation, occupational asthma and bronchitis, noise-induced hearing loss and contact dermatitis (2).

Analysis by the British Health and Safety Executive suggests that 5.5 million employees in 224,000 workplaces in Great Britain could be at risk of occupational respiratory diseases (3).

Approximately, 600 million workers are exposed to occupational noise worldwide (4). There is a high prevalence of hearing loss in workers exposed to hazardous noise (5). It is estimated that 16-24% of hearing impairment is work-related (6). 22 million US workers (17%) reported exposure to hazardous workplace noise (7).

It is estimated that more than 13 million workers in the United States are potentially exposed to chemicals that can be absorbed through the skin and may cause different dermatologic diseases (8).

Most occupational diseases are preventable by different methods such as engineering controls, administrative measures and personal protective devices (PPDs) (9). The engineering and administrative measures are more acceptable but more costly. It is recommended that when these control measures are not feasible, PPDs should be used (5,7,10); though many workers do not use PPDs or their protection by PPDs is not sufficient due to different reasons (11-15).

Macfarlane et al. found that up to 10-40% of farmers do not use respirators during work with pesticides (13). Edelson et al. in a study on construction workers showed that only 20% of the workers used ear protectors more than 90% of the time (16). Rashaad and Dickinson in a study on gold miners showed that 93% of workers reported using hearing protection devices (HPDs), but only 50% of

them were observed wearing HPDs (14). Maisareh and Saeid investigated the workers of a factory and showed that although HPDs were provided for 80.5% of the workers, only 5.1% wore it regularly (17).

There are different reasons for workers not wearing PPDs, i.e., lack of knowledge, concern that it may impair ability to communicate, discomfort, and lack of availability (7,18,19).

Our country as a developing country experiences a fast development in various industries; so many workers in these industrial settings are exposed to different occupational hazards especially chemical and physical ones. Prevention of occupational diseases is very important in this population. Due to the high cost of engineering and administrative controls, using PPDs is an important control measure.

In this study, we aimed to evaluate the quality of using various PPDs (including HPDs, respirators and gloves) by workers in various industries and the reasons for not to use them.

## 2. Materials and Methods

In a cross-sectional descriptive study from May to September 2011, 648 workers were evaluated for PPDs use. The subjects were selected by cluster sampling from six industrial workplaces in Yazd, Iran. Clusters were selected from main industries in this province, i.e. tile and ceramic, metal, chemical manufacturing and textile industries.

A questionnaire including demographic data was filled for each subject. Workplace exposures (including chemical and physical) were evaluated by an industrial hygiene institute and the most important physical and chemical hazards were identified. The appropriate HPD (considering noise reduction rating) was defined according to the noise level. The appropriate respirator was defined according to the most important and dangerous inhalational exposure, and the

appropriate gloves were defined according to the most important and dangerous chemicals with dermal exposure. Noise exposure at or >85 dBA (8 h time-weighted average) (20) and respiratory and dermal exposures more than threshold limit value (21) were defined as the situations in which the workers needed to use HPDs, respirators and gloves, respectively.

Then, the response to these questions was obtained from interview with the worker and was approved by a walkthrough survey and interview with the factory industrial hygienist and the employer:

- Does the worker need a kind of PPD (HPD/respirator/gloves)?
- Is appropriate PPD (HPD/respirator/gloves) available for the worker?
- If yes, does the worker use the PPD (HPD/respirator/gloves)?
- If yes, does the worker correctly use the PPD (HPD/respirator/gloves)?
- Is the worker trained about using the PPD?

Data were analyzed by SPSS for Windows (version 19, SPSS Inc., Chicago, IL, USA) using chi-square test. The level of significance was set at  $P < 0.050$ . An informed consent was obtained from all subjects. This research was approved by the ethics committee of the research council of Shahid Sadoughi University of Medical Sciences

### 3. Results

Six hundred and forty-eight industrial workers from four main industries in Yazd (tile, metal, textile and chemical manufacturing) including eight factories (two factories from each industry) entered the study. The average age of the workers was  $34.8 \pm 9.67$  years (range: 19-67 years). On average, they had worked for  $9.07 \pm 6.20$  years (range: 0.1-28 years).

The number of participants from tile, chemical, metal and textile industries was 124

(19%), 109 (17%), 271 (42%) and 144 (22%), respectively. On average 368 workers (56.8%) were exposed to respiratory hazards, 451 (69.6%) to dermal hazards and 399 (61.6%) to the loud noise who needed PPDs. Gloves were the PPDs, which were most frequently used when needed. The detailed data are shown in tables 1-4. Table 1 shows the frequency of using PPDs when needed.

**Table 1.** Frequency of PPDs use when needed

PPDs	PPDs needed	PPDs used
	n (%)	n (%)
Respirator	368 (56.8)	97 (26.3)
Gloves	451 (69.6)	351 (77.8)
Hearing protection	399 (61.6)	84 (21)

PPD: Personal protective devices

From these subjects the frequency of using respiratory, hearing and skin protecting devices in the whole shift was 28%, 43% and 20%, respectively. Table 2 shows that how the workers in all evaluated factories used PPDs.

There was a statistically significant difference in PPDs use among different age groups, hence younger workers less frequently used PPDs ( $P < 0.001$ , odds ratio = 0.332, 95% confidence interval [CI] = 0.238-0.463). This difference was also significant for respirators, gloves, and hearing protectors, separately. There was a statistically significant difference between duration of employment and PPDs use, hence the lower the duration of employment, the less PPDs use ( $P < 0.001$ , odds ratio = 0.376, 95% CI = 0.266-0.531).

Type of industry had a significant effect on PPDs use. Table 3 shows the frequency and quality of PPDs use in different industries.

All groups of workers were asked about training for indication of use and usage of PPDs. Totally 8.3%, 2% and 29% have received training sessions about respirators, ear protectors and gloves, respectively.

Table 4 shows the frequency of reasons for not using PPDs. Some workers needed more than 1 kind of PPDs and some selected more than 1 reason.

**Table 2.** The quality of PPDs usage in all factories

PPDs use	Respirator	Ear protector	Gloves
	n (%)	n (%)	n (%)
Appropriate PPDs			
Yes	95 (97.9)	79 (94)	265 (75.5)
No	2 (2.1)	5 (6)	86 (24.5)
Usage method			
Correct	88 (90.7)	30 (35.7)	313 (89)
Incorrect	9 (9.3)	54 (64.3)	38 (11)
Time of change			
Suitable	68 (70.1)	78 (93.5)	290 (68)
Unsuitable	29 (29.9)	6 (6.5)	47 (14)

PPD: Personal protective devices

**Table 3.** Frequency and quality of PPDs use in different industries

PPD	Metal (n = 271)	Chemical (n = 109)	Tile (n = 124)	Textile (n = 144)
	n (%)	n (%)	n (%)	n (%)
Respirator				
Need	22 (8)	81 (74)	124 (100)	141 (98)
Use	20 (91)	5 (6)	69 (56)	2 (1.4)
Suitable	20 (100)	5 (100)	67 (97)	2 (100)
Correct use	14 (70)	5 (100)	69 (100)	2 (100)
HPD				
Need	224 (83)	56 (5)	98 (97)	21 (14.6)
Use	69 (25.5)	3 (5)	9 (7.3)	3 (15)
Suitable	69 (100)	0	8 (89)	3 (100)
Correct use	26 (9.6)	1 (33)	3 (33)	3 (100)
Gloves				
Need	235 (87)	92 (85)	121 (98)	2 (1.4)
Use	230 (97)	17 (18.5)	105 (87)	2 (100)
Suitable	171 (63)	6 (37.5)	87 (83)	2 (100)
Correct use	203 (75)	6 (37.7)	78 (73)	2 (100)
Total				
Need	481	229	343	164
Use	319 (66.3)	25 (10.9)	183 (53.3)	7 (4.3)
Suitable	260 (81.5)	11 (44)	162 (88.5)	7 (100)
Correct use	243 (76.2)	12 (48)	150 (81.9)	7 (100)

PPD: Personal protective devices, HPD: Hearing protection devices

**Table 4.** The frequency of reasons for non-usage of PPDs

Reason	Number	Percent
I don't need it.	87	13.4
I don't know that I need it	126	19.4
It is difficult to use	259	45.5
It is harmful to use	106	16.4
I can't work when wearing it	64	9.9
I can't communicate when wearing it	126	19.4
It is not available for me	42	6.5
I have a disease that prohibits its use	72	11.1

PPD: Personal protective devices

#### 4. Discussion

One of the methods of controlling occupational exposures is using PPDs. Different kinds of PPDs are used in various

workplaces for workers' protection against occupational hazards. In our country, PPDs with most frequent use include: Ear protectors, respirators, and gloves. PPDs as

the last control measure in the workplace are very popular due to their low cost in comparison to other controls such as engineering and administrative. In this study, we evaluated the frequency of PPDs use and the quality of their usage in four main industries in Yazd, Iran in 2011.

Findings of this study suggest that workers are exposed to various health hazards in the workplaces, and regular and correct use of PPDs was not satisfactory, which was consistent with some other studies (22-28).

The number of workers who were trained about PPDs was very low for hearing and respiratory protection, but was good for skin protection. In the study of Greskevitch et al. in the USA, the level of training for respirator use was much higher than our study, although they had evaluated a different industry (12).

In the current study, younger people used PPDs less satisfactorily which was consistent with the study of Macfarlane et al. (13). Among three kinds of PPDs, the highest compliance rate was observed for gloves, which was consistent with the study of Giannandrea et al., although they had compared gloves with some PPDs other than respirators and HPDs (15).

The compliance rate of respirator usage was low (about 26%) in this study consistent with some other studies (13,14,17). The frequency of respirator usage was 10-40% in the study of MacFarlane et al. (13). The frequency of HPDs usage in this study was very low (21%) and lower than the two other PPDs which was consistent with the study of Rashaad and Dickinson (14); this frequency was 62% in the USA (29) and 28% in Nigeria (27).

The most frequent reason for non-usage of PPDs was discomfort with their use. The two other most common reasons include lack of knowledge about their benefits and difficulty in communication (especially for HPDs) consistent with the study of Kahan and Ross (30) and Svensson et al. (31). In the study of Rashaad and Dickinson the most frequent

reason for non-usage of HPDs was lack of knowledge about noise effects on hearing (14).

In our study, the overall quality of PPDs usage was better in the metal industry, which may be due to the workers' consideration of the metal industry as a very hazardous workplace, and also it can be explained by this fact that in this province, metal factories are larger and more developed than other industries.

### **Limitations**

We could not assess other PPDs (e.g. goggles) because they are not routinely used in our industries. Most of the industrial workers in our country are males, so we couldn't compare the variables between two genders.

### **Conclusion**

This study showed an unsatisfactory situation in the industries for PPDs usage: Low compliance rate, insufficient training programs, and low quality of usage. Considering the high frequency of workers' exposure to occupational hazards and the importance of PPDs for protection, paying attention to this problem would be critical.

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