

# Knowledge, Attitudes and Behaviors Regarding Occupational Risks and Standard Precautions Among Healthcare Workers in North Cyprus: A Descriptive Cross-sectional Study

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## Abstract

**BACKGROUND/AIMS:** The occupational risks of healthcare workers (HCW) are well established. The aim of this study was to assess the knowledge, attitudes and behaviors of healthcare professionals regarding occupational risks and standard precautions.

**MATERIAL AND METHODS:** This cross-sectional study was conducted in three hospitals in North Cyprus, aiming to access HCW with a questionnaire developed by the researchers, with 3 knowledge, 9 perception and attitude, 22 behavior, and 10 health hazard items. The data were analyzed using SPSS18.0. Descriptive statistics with univariate and bivariate analyses were performed with significance level set as  $p < 0.05$ .

**RESULTS:** The response rate was 80.7%, and 83% of the participants considered the institutional precautions to be unsatisfactory, while 57.5% described their work as very risky, 50.7% reported experiencing at least one sharps injury, and 37.1% reported exposure to chemicals during their professional activities. The nursing profession and night shift work were predictors of higher stress and risk perceptions and occupational injury. The vaccination rates of the recommended vaccines were low. The technician profession and working in the state institution were predictors of lower rates of hepatitis vaccination and the female gender for lower rates of tetanus vaccination. Only 18.4% of the participants reported regular mask use and 50.6% effective gloves use while contacting patients. Nurses followed by physicians exhibited better performance regarding personal protective equipment use. Compliance with standard precautions was unsatisfactory in general: responses manifested levels of correct knowledge as 40.5%, correct attitudes as 53.9%, and correct behaviors as 52.1%.

**CONCLUSION:** A definite need to develop educational and administrative interventions to improve compliance with standard precautions was established. The public health authorities were informed about the outputs.

**Keywords:** Healthcare workers, occupational risk and injury, standard precautions, personal protective equipment use, North Cyprus

## INTRODUCTION

Healthcare workers (HCW) are all individuals engaged in work actions with the intent of improving the health of the people. Healthcare facilities around the world employ about 60 million workers. HCWs

include medical doctors, nurses, laboratory technicians, pharmacists and providers of health management and supportive services such as drivers, cleaners and cooks.<sup>1</sup> HCWs are exposed to a broad variety of risks including biological, chemical, physical, ergonomic and psychosocial hazards; fire and explosion risks and electrical hazards.<sup>2,3</sup> Violence

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against health workers, burnout, and musculoskeletal disorders are also widespread. To their own health and safety, the occupational health problems of HCWs are closely related to patients and the community health.<sup>1</sup>

Infectious diseases in general pose a major threat to the health of HCWs globally. In a systematic review covering 10 years, increased risk from infectious diseases concentrated among specific professions including HCWs.<sup>4</sup> For example, measles infection was found to occur 13-14 times more frequently among health workers compared to the normal population. Consequently, immunization is one of the specific preventive measures for the health of HCWs. Currently, a routine vaccination program is recommended for all workers in healthcare facilities, while some vaccines are only suggested under certain circumstances. Influenza, chickenpox, measles-mumps-rubella (MMR), tetanus, and hepatitis B vaccines are recommended for all health professionals.<sup>5,6</sup> MMR vaccination is recommended for all HCWs in some European countries, USA, Canada, and Australia and is compulsory for all HCWs in Finland.<sup>6</sup> On the other hand, there is a consensus that typhoid, hepatitis A, meningococcus, and BCG vaccines should be provided for HCWs where the risk is high for these conditions.<sup>6,7</sup> Effective immunization programs have resulted in a decline in infectious diseases among HCWs recently.

Low adherence to standard precautions is one of the main reasons for the impact of infectious diseases on the health of HCWs. The primary reasons for low adherence include insufficient education, inadequate provision of protective equipment, and hazardous working conditions.<sup>1,4,8</sup> Standard precautions include both individual and community level measures. Pre- and in-service training of health professionals on workplace safety, warning signs, and other measures for increasing awareness are among basic preventive approaches. Another major preventive measure is the use of appropriate personal protective equipment (PPE). PPE is designed to protect workers from various work-related health hazards that may affect their health and safety.<sup>4</sup> The main forms of PPEs specifically for use by HCWs are masks, gloves, aprons, lead aprons, face shields, and goggles. However, knowledge and awareness of the risks and precautions do not necessarily result in compliance with preventive measures. In one study, although 97% of the participants were fully aware of the benefits of using PPEs, only 25% were actually in adherence with the standard precautions.<sup>9</sup>

The European Union program of 2010 (32/EU program) has introduced precautions for the prevention of cutting and piercing wounds among HCWs. The preventive measures recommended are education, escalating awareness, healthy and careful use and disposal of cutting and piercing equipment and continuous and effective use of PPEs.<sup>10</sup>

The most prominent risks for healthcare professionals in Türkiye have been identified as infections, exposure to radiation, anesthetics and chemicals, injuries, violence, exhausting and strenuous working conditions, high workload, and neuromusculoskeletal traumas.<sup>11</sup> Similar conditions are observed to be prevalent in North Cyprus as well although there is a lack of evidence-based research on the issue.<sup>12</sup>

The results of research on the assessment of the knowledge and behaviors of HCWs toward universal precautions have highlighted low levels of knowledge about control measures and poor adherence with the precautions.<sup>13-16</sup> Some studies have demonstrated the positive

impact of policies like infection control programs, periodic training and infection reporting systems.<sup>14</sup>

The only study on the health and safety of HCWs in North Cyprus was published in 2021. The study illustrated the conditions in a university hospital in Kyrenia.<sup>17</sup> In this study, 57.5% of the HCWs had a satisfactory level of correct knowledge, 37.3% had satisfactory positive attitudes, and 30.9% had satisfactory practices toward standard precautions. Occupation was a predictor, and doctors were less likely to have satisfactory knowledge and practice compared with nurses. The findings revealed substandard adherence to standard precautions among HCWs.<sup>17</sup>

The objective of the current study was to assess the working conditions and health hazards of HCWs in addition to their knowledge levels, attitudes, and practices with respect to occupational risks and standard precautions.

## MATERIALS AND METHODS

### Study Design and Setting

This cross-sectional study was conducted among HCWs in Famagusta city of North Cyprus. The study setting included a state hospital and two private hospitals. A purposive sampling method was used, and the aim was to access all HCWs of the hospitals with a questionnaire. The time frame of the data collection period was 01.11.2016 to 31.05.2017.

The participants were divided into 4 groups for analysis purposes: Group 1-physicians, group 2-nurses, group 3-technicians and other professions, group 4-cleaning staff. Group 3 included laboratory, radiology and anesthesia technicians, physiotherapists, dietitians, security guards, and ambulance drivers.

The approval of the Ethics Committee of the Near East University and the permissions of the three hospital administrations were obtained. (Near East University Ethics Committee Report (approval number: 2016/40-330, date: 20.10.2016). Informed consent of the participants was obtained before the interview.

### Data Collection Method and the Study Tool

The study tool was a questionnaire developed and administered face to face by the researchers. The questionnaire was designed after a thorough literature search of previous studies.<sup>18,19</sup>

The questionnaire consisted of 55 questions in five sections, including demographic and professional features, perceptions of occupational risks and diseases, history of occupational accidents and diseases, compliance with standard precautions, and PPE use. The first section including medical history consisted of 13 questions on the socio-demographics of the participants.

The perceptions of occupational risks and disease were covered by 5 questions, while the history of occupational diseases and accidents was investigated by 4 questions. Standard precautions section including knowledge, attitude and practice items consisted of 28 questions, of which 9 were on PPE use. Radiology technicians were questioned about the use of lead aprons, while doctors and nurses were questioned about their behaviors regarding invasive intervention practices with 5 additional questions.

The study tool included 3 knowledge: 5 perception: 4 attitude: 22 behavior items and 10 health hazard event items.

### Statistical Analysis

The data were entered, cleaned and analyzed using IBM SPSS (Statistical Package for the Social Sciences) version 18.0 (SPSS Inc, Chicago, IL, USA). The total scores of the participants' knowledge, attitude, and behavior responses were divided into 2 categories as satisfactory and unsatisfactory. The ratios of the total correct responses were calculated for each item group. A satisfactory level of knowledge, attitude, and behavior was set as the answer choice representing the best practice on the issue related to the question.

Univariate analyses were conducted for descriptive statistics including means, frequency, and percentages to describe the characteristics of the study sample. Bivariate analyses were performed to calculate the relationships between the categorical variables regarding satisfactory levels of knowledge, attitude, and behavior using Pearson's chi-square test and Fisher's exact test. The significance level was set as  $p < 0.05$ .

Terms and definitions were accepted in compliance with the literature.<sup>18,20</sup>

## RESULTS

Of the 409 HCWs employed at the three hospitals, 330 completed the questionnaire, with a response rate of 80.7%.

### Socio-economic and Professional Characteristics and Working Conditions of the Participants

The socio-economic and professional characteristics of the participants are presented in Table 1. Of the participants, 67.9% were female, 54.2% were under 40 years of age, and the distribution according to profession revealed 43.6% nurses, 22.2% physicians, 12.1% cleaning staff and 11.6% technicians. The mean age was  $38.0 \pm 8.8$ , median: 38, minimum and maximum: 20-71. The data about other professions are presented in Table 1. Of the total participants, 30.5% were daily smokers, 7.3% were occasional smokers and 5.5% were former smokers. Notably, smoking rates were 36.8% among nurses and 26.0% among physicians.

Of all participants, 62.1% were employees of the public hospital, while 37.9% were working at the two private hospitals. The mean weekly working duration was 42 h per week. HCWs work more than 40 h per week comprised 36.0% of the total for the public hospital compared to 82.5% for the two private hospitals. The employees of the private hospitals worked significantly more hours weekly than those of the public hospital ( $\chi^2=65.6$ ,  $p < 0.001$ ).

The analysis of the working conditions revealed that 53.8% worked night shifts and 45% had eight or more night shifts per month. Nurses comprised the professional group with the highest rate of night shifts of 69.3% because of the general employment system for nurses in North Cyprus.

### Occupational Injuries and Diseases

The participants' history of occupational accidents and injuries is presented in Table 2.

About half of the participants (50.7%) had experienced accidents or were injured while working. Furthermore, 3.4% had experienced chemical

**Table 1. The socio-economic and professional characteristics of healthcare workers participating in the study (Famagusta, 2017)**

Socio-economic/professional features	n	%
<b>Age (n=330)</b>		
<40 years of age	179	54.2
≥40 years of age	151	45.8
<b>Sex (n=330)</b>		
Male	106	32.1
Female	224	67.9
<b>Profession (n=330)</b>		
Physician	73	22.2
Nurse	144	43.6
Laboratory technician	20	6.1
Radiology/surgery technician	18	5.5
Physiotherapist	5	1.5
Dietitian	2	0.6
Ambulance driver	9	2.7
Transporter	13	3.9
Caregiver	6	1.8
Cleaning staff	40	12.1
<b>Workplace (n=330)</b>		
State hospital	205	62.1
Private hospital 1	54	16.4
Private hospital 2	71	21.5

**Table 2. History of occupational accidents and injuries experienced by the participants (Famagusta, 2017)**

Injury history	n	%
<b>Piercing injury during work (n=322)</b>		
Never	154	47.8
Once	54	16.8
Occasionally	104	32.3
Frequently	5	1.6
Don't remember	5	1.6
<b>Chemical splash (n=326)</b>		
Never	205	62.9
Occasionally	111	34.0
Frequently	10	3.1
<b>Chemical burns (n=319)</b>		
Yes	11	3.4
<b>Type of chemical burn (n=10)</b>		
Chemical splash to eyes	4	40.0
Chemical exposure to oral mucosa	2	20.0
Chemical splash to face	3	30.0
The exposure of respiratory system to waste anesthetic gases	1	10.0
<b>The status of PPE use during chemical burn accident (n=10)</b>		
No PPE	9	90.0
Don't remember	1	10.0
<b>Allergies during work (n=323)</b>		
Latex glove allergy	72	22.3
Drug allergy	21	6.5
Other	10	3.1

PPE: Personal protective equipment.

burns, 90% of whom were without PPEs during the accidents. Of the total, 32.3% indicated occasionally experiencing sharp injuries.

Among the physicians and nurses, 65.6% stated that they had experienced injuries at least once while performing injections. The nurses reported the highest rate of experiencing chemical exposure with 47.5% and piercing injury with 66.2%. Frequencies of penetrating injury history among the occupation members were 66.2% for the nurses, 58.3% for the physicians, and 17.8% for the cleaning staff (significantly lower for the cleaning staff with  $p < 0.001$ ). A history of chemical exposure and sharp injury was highest among nurses.

### Working Conditions

Significant differences were demonstrated between the night- and day-shift workers for some occupational conditions including skin health problems related to latex glove use (66.9% versus 47.9% respectively,  $p = 0.01$ ). The frequencies of sharps - related injuries and chemical exposure were also higher for those who had night-shift work compared to day-shift work (60.2% versus 39.3%,  $p = 0.01$  for sharps injuries and 43% versus 29% for chemical exposures).

### Perceptions of the Participants Related to Their Working Conditions

Approximately 90% of the participants described their work as stressful (89.7%). Among the cleaning staff, a significantly lower proportion ( $\chi^2 = 23.43$ ,  $p < 0.001$ ) described their work as stressful than the other groups. Regarding professional risks, 57.5% of the total participants perceived their working conditions as very risky and 36.0% as moderately risky. The perceptions of the nurses about their own professional risks were the highest with 69.9%.

On the other hand, the proportion of participants who described their work as high risk was significantly higher for night-shift workers (70.3%) compared to day-shift workers (41.5%) ( $p < 0.001$ ). Similarly, state hospital workers' risk perception of their job was significantly higher than private hospital workers (65.0% versus 45.1%,  $\chi^2 = 15.87$ ,  $p < 0.001$ ).

Of the participants, only 17% perceived infection prevention measures at their workplace to be satisfactory. State hospital HCWs rated these measures as unsatisfactory with a rate of 98% and private hospital workers with 57.9%, where the difference was significant ( $\chi^2 = 86.42$ ,  $p < 0.001$ ). Likewise, night-shift workers reported a significantly higher rate of unsatisfactory responses compared to day-shift workers in this respect (87.6% versus 69.2% respectively,  $p < 0.001$ ).

### Knowledge on Infection Prevention Measures

The question about the duration of handwashing was responded correctly by 77.9% of the nurses, 70.0% of the cleaning staff, 63.9% of doctors, and 60.6% of group 4. Only 24% of the participants responded satisfactorily to the question about hepatitis B's transmission and hepatitis C.

The results of the survey regarding safe handling and disposal of syringes indicated that only 16.7% of the doctors, 19.2% of the nurses, and 18% in total of the two groups provided the correct answers. Moreover, 83.3% of the physicians, 80.8% of the nurses, and 82% in total stated that re-capping of the needle sticks was the correct behavior, the difference between the two groups being non-significant ( $p = 0.782$ ).

### Behaviors Regarding Infection Prevention Measures

Of the participants, 50.5% reported consistent handwashing before examining or caring for a patient, while 6.0% stated they never washed their hands before touching a patient. On the other hand, 81.8% indicated regular handwashing after examining or caring for a patient, while 0.6% stated they never washed their hands after contacting a patient.

### Vaccination Status

Vaccination rates in general were low among the participants; 28% of the participants had received no vaccinations at all during their professional career. The behaviors of the participants regarding vaccinations are presented in Table 3.

Of the total participants, 83.9% were vaccinated for hepatitis B. The participants vaccinated for hepatitis B, tetanus, and influenza comprised 6.4% of the respondents. The frequency of hepatitis B-vaccinated professionals was 78.5% among the participants from the state hospital compared to 92.7% for the private hospitals, the difference being significant.

The behaviors of the participants regarding getting tested and vaccinated for some infections according to professions are presented in Table 4.

Hepatitis B vaccination status was found to be 98.6% among physicians, 79.8% among nurses, and 91.4% among the cleaning staff. Group 3 professionals, including technicians and other professionals, had a significantly lower rate with 71.2% (Table 4).

Only 17.4% of the participants reported being vaccinated at least once for influenza during their professional career. There was a significant difference between state hospital workers (21.5%) and private sector workers (10.8%) regarding influenza vaccination ( $\chi^2 = 5.81$ ,  $p = 0.016$ ), but vaccination rates were unsatisfactory for both groups.

**Table 3. The vaccination status of the participants (Famagusta, 2017)**

Vaccination status	n	%
<b>Tetanus vaccination in the last 5 years (n=326)</b>	171	52.5
Hepatitis B lifelong vaccination (n=329)	276	83.9
<b>Vaccinations during professional career (n=311)</b>		
None	87	28.0
Hepatitis B	181	58.2
Tetanus	101	32.5
Influenza	50	16.1
Hepatitis A	2	0.6
Other (MMR, pneumococcus, measles, meningococcus)	8	2.5
<b>Multiple vaccinations during professional career (n=311)</b>		
Hepatitis B only	87	28.0
Hepatitis B + tetanus	59	19.0
Hepatitis B + influenza	13	4.2
Hepatitis B + tetanus + influenza	20	6.4
Tetanus only	18	5.8
Influenza only	13	4.2
Tetanus + influenza	4	1.3
Hepatitis A + hepatitis B	2	0.6
MMR: Measles-mumps-rubella.		

Similarly, state hospital HCWs were vaccinated for tetanus during their professional career significantly more than private hospital workers (40.8% versus 25.0%) as well ( $\chi^2=8.6$ ,  $p=0.004$ ). Of the participants, 52.5% had been vaccinated for tetanus in the last 5 years. Regarding genders, 46.1% of the female participants and 65.7% of the male participants reported being vaccinated for tetanus during the last five years, the difference being significant ( $\chi^2=13.38$ ,  $p<0.001$ ). On the other hand, tetanus vaccination was highest among physicians with 54.2% and lowest among the cleaning staff with 18.2% ( $\chi^2=17.7$ ,  $p=0.007$ ).

- Attitudes and behaviors regarding PPE use.

- The behaviors of the participants regarding the use of PPE in general are displayed in Table 5. The frequency of those wearing gloves regularly when contacting a patient was 48.6% and 95.8% of these reported they renewed the gloves for every patient. Conversely 2.8% of the total reported they never wore gloves in professional practice. There were no significant differences between HCWs 40 years of age and above and those 40 years of age below 40 years regarding mask and glove use attitudes and behaviors and experiencing sharps injuries. However, other precautions such as vaccinations for tetanus and hepatitis B were implemented significantly higher among professionals 40 years and over.

Of the total, only 18.4% reported regular and 23.5% frequent use of masks during close contact with the patients. Of the mask users, 52.9% thought that masks should be renewed for every patient, while 39.3% believed that changing a mask daily would be sufficient. Notably 20% of the participants never wore masks while in close contact with a patient.

Among radiology technicians, 72.7% responded that they rarely wore lead aprons while being exposed to X-rays, while the rest reported frequent use during exposure.

- The use of goggles among participants was low as 75.6% had never used goggles and 29.3% responded that goggles use is not needed at all.

The distribution of the attitudes and behaviors of the participants regarding PPE use regarding professions is demonstrated in Table 6.

Of the nurses, 100% expressed the opinion that gloves should be used during work consistently. The cleaning staff comprised the group with the lowest frequency regarding the necessity of glove use with 85.4%.

On the other hand, the behaviors of the participants differed from their attitudes: Only 55.6% of the nurses and 49.8% of the doctors indicated that they used gloves consistently when working with patients. Of those wearing gloves, 88.7% of the doctors and 71.0% of the nurses changed gloves for every patient.

The rates of regular mask use were 16% among nurses and 20% among physicians. The regular mask use rate was highest among the cleaning staff with 33%. Mask use was significantly higher among the cleaning staff compared to other professions ( $p<0.001$ ).

General evaluation of the knowledge, attitude and behavior responses about compliance with standard precautions manifested that the level of correct knowledge was 40.5% in total, for attitudes 53.9% and behaviors (or practices) 52.1%. Vaccination status of the participants demonstrated that 28% had not been vaccinated at all by any vaccine after they started their professional career.

**DISCUSSION**

In this cross-sectional study, the knowledge, attitudes and behaviors of HCW on occupational health and standard precautions were investigated, along with their working conditions and occupational hazards. The results indicated that private hospital employees worked significantly more hours than state hospital workers. Nurses had the highest rates of health hazards. As a consequence, job risk perception among nurses was higher than that among other professional groups. While more than half of the total participants perceived their job as very risky, the rate of this perception was highest among nurses with 70%. The higher smoking rate among nurses of 36.8% may be attributed to all these unfavorable factors. The predictors of higher stress and risk perceptions were night shift work, the nursing profession, and working in the state hospital.

Most of the participants had been previously tested for hepatitis B and C by screening tests and the rates were highest for physicians, followed by nurses. Similarly, the frequency of hepatitis C screening was 69% in a study in Türkiye.<sup>21</sup>

**Table 4. The distribution of the participants according to professions regarding their behaviors on being tested and vaccinated for some infections (Famagusta, 2017)**

“S” status	Profession physician		Nurse		Group 3*		Cleaners		(%), $\chi^2$	p
	n	%	n	%	n	%	n	%		
Tested for HIV in previous year (n=329)	29	39.7	46	32.2	27	40.3	16	34.8		0.083
Tested for hepatitis B&C (n=320)	69	97.2	126	88.1	44	66.7	37	86.0	21.88	<0.001
<b>Hepatitis B infection status (n=318)</b>										
Vaccinated	72	98.6	115	79.8	47	71.2	42	91.4		
Not infected, not vaccinated	1	1.4	23	16.0	13	19.7	2	4.3		
Infected and immunized	0	0	0	0	1	1.5	0	0		
Hepatitis B carrier	0	0	1	0.7	0	0	0	0		
No information	0	0	5	3.5	5	7.6	2	4.3		
Tetanus vaccine in the last 5 years (n=324)	42	57.5	66	47.5	38	57.6	25	54.3		0.462
PPD skin test (n=323)	39	54.2	64	45.4	23	34.8	8	18.2	17.7	0.007

\*Group 3: Laboratory, radiology, anesthesia technician; physiotherapist, dietician, security guard, ambulance driver. HIV: Human immunodeficiency virus, PPD: Purified Protein Derivative.

**Table 5. The behaviors of the participants regarding their use of personal protective equipment (Famagusta, 2017)**

Behavior		
Frequency of mask use (n=310)	n	%
Always	57	18.4
Frequently	73	23.5
Rarely	155	50.0
Never	25	8.1
Frequency of glove use (n=311)		
Always	151	48.6
Frequently	104	33.4
Rarely	46	14.8
Never	10	3.2
Frequency of apron use (n=301)		
Always	64	21.3
Frequently	33	11.0
Rarely	98	32.5
Never	106	35.2
Frequency of use of goggles (n=283)		
Always	13	4.6
Frequently	9	3.2
Rarely	47	16.6
Never	214	75.6
Frequency of lead apron use (n=11)*		
Always	0	0
Frequently	3	27.3
Rarely	8	72.7
Never	0	0

\*Only radiology technicians.

**Table 6. The attitudes and behaviors of the participants regarding the use of PPEs according to professions (Famagusta, 2017)**

Attitude and behavior	Profession								χ <sup>2</sup>	p
	Physician		Nurse		Group 3*		Cleaner			
	n	%	n	%	n	%	n	%		
<b>Attitude regarding glove use (n=313)</b>										
Should always be worn during working hours	69	97.2	135	100	61	92.4	35	85.4		
No need to wear gloves all the time	2	2.8	0	0.0	5	7.6	6	14.6		
<b>Attitude regarding mask use (n=308)</b>										
Should always be used during working hours	30	42.9	81	61.8	31	47.7	21	50.0	7.88	0.049
No need to use all the time	40	57.1	50	38.2	34	52.3	21	50.0		
<b>Behavior regarding glove use (n=306)</b>										
Uses all working hours	29	49.8	75	55.6	28	42.4	19	48.7	5.33	0.149
Does not use regularly	42	59.2	60	44.4	33	57.6	20	51.3		
<b>Mask use behavior (n=310)</b>										
Uses all working hours	14	20.0	22	16.3	8	12.1	13	33.3	8.05	0.045
<b>Glove use when touching a patient (n=316)</b>										
Regularly	25	35.2	78	54.9	26	39.4	24	64.9	13.53	0.004
<b>Mask use when contacting a patient (n=320)</b>										
Regularly	16	21.9	22	15.3	10	15.4	20	52.6	26.79	<0.001
<b>Changing gloves per patient (n=193)**</b>										
Always	55	88.7	93	71.0						0.379
Occasionally	7	11.3	38	29.0						
<b>Handwashing duration (n=314)</b>										
Correct	46	63.9	106	77.9	40	60.6	28	70.0	8.15	0.043
Incorrect	26	36.1	30	22.1	26	39.4	12	30.0		

\*Group 3: Laboratory, radiology, anesthesia technicians; physiotherapist, dietitian, security guard, ambulance driver. \*\*Only physicians and nurses. PPE: personal protective equipment.

On the other hand, vaccination rates in general were low in the current study, as 28% of the respondents had received no vaccines at all after starting the profession. Hepatitis B vaccination had the highest lifetime rate among other vaccines, although 12% were still not vaccinated for hepatitis B at all. Hospital type and profession were predictors of hepatitis B vaccination, with significantly lower rates for state hospital workers and the group including laboratory technicians.

Two studies among HCWs investigating hepatitis B vaccination rates reported these rates as 83.1% and 50.4% respectively.<sup>7,21</sup> In the review of Haviari et al.<sup>6</sup>, the rates of hepatitis B vaccination were reported in the range of 63-95%. The review also reported pertussis immunization rates of 14-73% and MMR rates of 87-97%. However, pertussis and MMR vaccination rates in our study were very low, contrary to international findings.

Although influenza vaccination has been recommended for all health professionals in many countries, only 16.1% of the participants in our study reported receiving the vaccine at least once after starting their profession. Hospital type was a predictor for influenza vaccination with significantly higher rates for state hospital workers. Likewise HCWs who were vaccinated for influenza in the previous year comprised only 4.3% in a study in Türkiye.<sup>7</sup>

In a meta-analysis published in 2011, the vaccination rates for seasonal influenza among health professionals were 7.5-63.0%.<sup>5</sup> Influenza vaccination rates among HCWs were determined to be 60% in a study conducted in South Korea<sup>22</sup> and 51.4% among primary HCWs in Jerusalem.<sup>23</sup> In the review by Haviari et al.<sup>6</sup>, influenza vaccination ranged from 15 to 90%. To conclude, influenza vaccination rates among HCWs exhibit a broad variation depending on the national and local circumstances.<sup>6</sup> The vaccination status established in this study is far from satisfactory, except for a relatively higher rate for hepatitis B. Our study points to the urgent need for interventions to escalate the vaccination rates in North Cyprus.

Of the total, slightly more than half of the participants responded that they had experienced sharps injuries at least once during their professional life, with the highest rate being among nurses with 66.2%. The nursing profession, night shift work, and working in a private hospital were predictors of more injuries and accidents. Consistent with our findings, other studies have shown that nurses were exposed to penetrating and cutting and other work-related injuries more frequently than other HCWs.<sup>24,25</sup> The frequencies observed among nurses ranged from 61% to 89%, as demonstrated by a number of studies.<sup>21,24,26,27</sup>

The increase in the frequency of injuries during night shift work has also been reported.<sup>28</sup> Likewise, injuries mostly occur during the later periods of prolonged working hours and among HCWs with less professional experience.<sup>26,29</sup>

Regarding injury type, 15.7% of all injuries were found to be due to invasive interventions in one study.<sup>30</sup> A study from Serbia reported that 60.6% of HCWs had experienced at least one needle stick injury during their professional practice. Nurses had a higher risk of needle stick injuries than doctors. Among the factors contributing to needle stick injuries, recapping needles and decontamination/cleaning instruments after surgery were more frequent among nurses, whereas use of a needle before an intervention was more common among doctors.<sup>27</sup>

In our study, the frequency of chemical spill accidents at least once was 37.1%, rising up to 43% during night shifts, while the frequency of chemical burns was 3.4%. The comparison of the professions showed that 48.5% of the nurses, 35% of the physicians, and 23% of the other groups had experienced chemical spills. In a study conducted in Cameroon, 36.7% of HCWs mentioned they had been exposed to blood or body fluids in the last three months, with frequencies of 43% among nurses, 16.4% among physicians, and 5.5% among laboratory workers. On the other hand, other studies reported more frequent injuries among physicians.<sup>31,32</sup> Distribution according to injury type in another study exhibited frequencies of exposures as blood or body fluid spills 60.3%, needle stick injury 28.7% and cuts 10.9%.<sup>33</sup>

Skin health problems were experienced by 58.3% of the participants and 22% reported latex glove allergies in the current study. The reasons for refraining from glove use were examined in a study where 65.3% of the participants indicated allergic conditions as the cause of their reluctance to wear gloves. The level of latex allergy was stated as 11.8%<sup>7</sup> and 57%<sup>34</sup> in two different studies.

PPE use behaviors were investigated in depth in the current study. The attitudes of the nurses were better than those of the other professions regarding PPE use. The rates of satisfactory attitudes of the nurses concerning regular mask and glove use were high; all of the nurses shared the opinion that gloves should be used consistently during work hours. However, their behaviors were not in compliance with their attitudes. Similarly although 97% of the participants were fully aware of the benefits of using PPE, only 25% were actually practicing according to the safety rules in one study.<sup>9</sup>

The regular mask use rate was significantly higher among cleaning staff (33.3%) compared with physicians (22%) and nurses (16%). The low level of mask use among physicians and nurses remains a matter of concern. Glove use when contacting a patient was significantly lower among physicians with 35%, compared to 55% for nurses and 64% for cleaners. Regular glove use was highest among nurses. An important point to be considered in this respect is that the survey was conducted before the COVID-19 pandemic.

The correct response rates to the knowledge questions were not satisfactory since the expectation is that nurses and doctors will provide mostly correct answers. These included questions on the sufficient duration of handwashing, the route of the transmission of hepatitis B and C, and compliance with safe injection and disposal criteria. The results showed no significant differences between doctors and nurses in this regard. In a previous study conducted in Northern Cyprus, 57.5% of the HCWs had a satisfactory level of correct knowledge, 37.3% had satisfactory positive attitudes, and 30.9% had satisfactory practice toward standard precautions. Occupation was a predictor, and doctors were less likely to have satisfactory knowledge and practice compared with nurses.<sup>17</sup>

### Study Limitations

One of the limitations of the study is that the survey was based on a convenience sample and hence, was not representative of all the health professionals in the country. Thus our study findings have limited generalizability. Also, the sample population was small and an interviewer-administered questionnaire may have relatively lower reliability compared to more objective measurements. The study was done before the start of the COVID-19 pandemic and hence the situation

might have changed regarding the use of some PPEs, specifically mask and glove use.

## CONCLUSION

According to the results of this study, most participants had substandard levels of knowledge, attitudes, and behaviors toward standard precautions. The study results point to the need for educational programs on occupational health and safety precautions.

HCW have high risks of infection and other occupational diseases and accidents.

1. A country-wide comprehensive program for HCWs is a prerequisite for any progress on this issue.
2. In this context, pre- and periodic examinations and training programs unique to each occupational group on standard precautions should be mandatory for all HCWs and controlled by the health authority.
3. Future research should aim to investigate a more comprehensive sample of HCWs for a better view of the situation.

## MAIN POINTS

- The predictors of higher stress and risk perceptions were night shift work, the nursing profession, and working in the state hospital.
- The nursing profession, night shift work, and working in a private hospital were predictors of higher rates of injuries and accidents.
- Profession and hospital type was predictors of hepatitis B vaccination, with significantly lower rates for state hospital workers and the group including laboratory technicians.
- Hospital type was a predictor of influenza vaccination with significantly higher rates for state hospital workers and the male gender for higher rates for tetanus vaccination.

## ETHICS

**Ethics Committee Approval:** The approval of the Ethics Committee of the Near East University and the permissions of the three hospital administrations were obtained. (Near East University Ethics Committee Report (approval number: 2016/40-330, date: 20.10.2016).

**Informed Consent:** Informed consent of the participants was obtained before the interview.

**Peer-review:** Externally peer-reviewed.

## Authorship Contributions

Concept: A.K., Ö.A., Design: A.K., Ö.A., Data Collection and/or Processing: A.K., Ö.A., Analysis and/or Interpretation: A.K., Ö.A., Literature Search: A.K., Ö.A., Writing: A.K., Ö.A.

## DISCLOSURES

**Conflict of Interest:** No conflict of interest was declared by the authors.

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