Original Article

An Assessment of the Knowledge, Attitude, and Practice Toward Standard Precautions Among Health Workers From a Hospital in Northern Cyprus

Gulifeiya Abuduxike*, Songul Acar Vaizoglu, Ozen Asut, Sanda Cali

Department of Public Health, Faculty of Medicine, Near East University, Cyprus

A R T I C L E  I N F O

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A B S T R A C T

Background: The objective was to assess the knowledge level, attitude, and practice of health care workers towards standard precautions, and to identify the related factors. Furthermore, it was attempted to identify the proportion of having the experience of needle stick injuries (NSIs) and associated factors among participants.

Methods: A cross-sectional study was conducted in a teaching hospital among 233 health workers using a self-administered questionnaire. The questionnaire included eight knowledge items, seven practice items, and five attitude items. Based on the mean score of each category, responses were grouped into “satisfactory” and “unsatisfactory”. Univariate, bivariate, and multivariable logistic regression analyses were done.

Results: The mean age of the participants 32.95 (SD ± 9.70) and 62.2% of them were women. 57.5% of the staff had a satisfactory level of correct knowledge (>5 correct answers), 37.3% had a satisfactory positive attitude (>3 correct answers), and 30.9% had a satisfactory practice (>3 correct answers) towards standard precautions. The occupation was one of the predictors as doctors were less likely to have satisfactory knowledge and practice compared to nurses (OR = 0.269, 95% CI: 0.10–0.70 and OR = 0.248, 95% CI: 0.08–0.77, respectively). Out of 174 participants, 31.6% of them reported experiencing NSIs and support staff were 71% less likely to experience NSIs compared to nurses & paramedics.

Conclusion: The findings revealed a substandard adherence of standard precautions among participants, which highlighted the necessity of the provision of a periodic, tailored training program based on the occupational and risk exposure.

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1. Introduction

Healthcare workers (HCWs) play an important role in providing prevention, diagnosis, treatment, and care to people in diverse healthcare settings. According to the World Health Organization (WHO), HCWs are all people who are involved in activities that aim at enhancing health, include those who provide health services such as doctors, nurses, laboratory technicians, pharmacists, and those providing health management and supporting services such as officers, drivers, cleaners, and cooks [1,2]. Health workers are exposed to a number of occupational hazards in healthcare settings, including biological, chemical, ergonomic, physical, and stress/violence [1,3–6]. Among these, blood-borne pathogens such as hepatitis B virus, hepatitis C virus, and human immunodeficiency virus (HIV) comprised major risks to health workers, particularly HCWs who are exposed to blood and body fluids through sharps or needlestick injuries (NSIs) during the care for the patients [1,3,5–7].

It was reported that of 35 million HCWs worldwide, about two to three million of them every year experience NSIs that contributed to 40–65% of all hepatitis B virus and hepatitis C virus, and 4.4% of HIV infections globally [1,3,5–8]. Gabriella et al stated in a review that according to the nationwide surveillance report by the Italian Study Group for Occupational Risk of HIV infection (SIROH), of 24,009 mucocutaneous exposures, 4% occurred in the laboratory, 65% took place in transporting and manipulating samples, 6% occurred while performing phlebotomy to the patients, and 14% while cleaning and
disinfecting the environment [10]. This report also suggested inadequate compliance and a lack of knowledge about standard protections (SPs) using personal protective equipment [10].

To reduce the occupational risks for HCWs, it is essential to educate and encourage health workers to practice SPs in healthcare settings, which is defined as “a group of infection prevention practices that apply to all patients, regardless of infection status. It is based on the principle that all blood, body fluids, secretions, excretions except sweat, nonintact skin, and mucous membranes may contain transmissible infectious agents” [7,10,11]. Particularly, infection control education is one of the crucial components of the risk management training in healthcare settings; the training should highlight the implementation of a series of standard precaution measures and enforce routine safe practices to protect both HCWs and service users [7,10]. The routine safety practices include hand hygiene; the use of personal protective equipment; the safe use and disposal of sharps/needles; safe handling and disposal of clinical waste, spillage of blood, and bodily fluids; decontamination of equipment and the environment; and safe management of linen [10,11,38,40,41].

There are abundant studies published in this area to assess the knowledge, attitude, and practice of health workers in different countries toward universal precautions in various healthcare settings worldwide [5,7,9,12–18]. Most of them have reported a low level of knowledge about infection control precautions [9,13,14,17,19,20] and poor adherence [7–9,13,20,21,39] with the standard precautions among health professionals. Some studies highlighted that factors such as having an infection-control policy, providing periodic training programs on safety injections and precautionary practice, as well as establishing a well-developed infection reporting system in the healthcare settings significantly affect the level of knowledge and compliance of health workers with the prevention strategies [7,15–18,20,22–25]. However, there is a vast information gap in this area as there is no single study done in the Turkish Republic of Northern Cyprus (TRNC) among HCWs. Thus, the objective of the study was to assess participants’ knowledge level, attitude, and practice of HCWs toward SPs, and to identify the related factors attributed to the knowledge, attitude, and practice toward SPs. Moreover, we attempted to identify the proportion of having the experience of NSIs and related factors that increase the risks of NSIs among participants. The long-term aim of the study is to provide evidence-based recommendations for the stakeholders to develop adequate training programs and practical guidelines in the healthcare settings in the country.

2. Materials and methods

2.1. Study design and duration

The cross-sectional study was conducted from March to April 2019 at the Kyrenia University Dr. Suat Günsel Hospital. The ethical approval was obtained from the ethics committee of Near East University with a project number of YDU/2019/67-765 (approved on 28.03.2019). Meanwhile, official permission was obtained from the hospital management to conduct the research among health personnel.

2.2. Study setting and sampling

The study site was Kyrenia University Dr. Suat Günsel Hospital, which is among the four private health facilities situated in Kyrenia. The private hospital has 150 beds consisting of all health units, including emergency, surgery, cardiology, internal medicine, pediatrics, gynecology and obstetrics, and operating rooms. In this study, HCW was defined as “all paid and unpaid persons working in healthcare settings who have the potential for exposure to infectious materials (e.g., blood, tissue, and specific body fluids and medical supplies, equipment, or environmental surfaces contaminated with these substances)” [26]. Thus, a purposive sampling method was used, and all personnel working at the hospital at the time of the data collection were included in the study. Of the total 258 health workers, 233 of them responded to the questionnaire with a respondent rate of 90.3%. The health workers included were medical doctors, nurses, laboratory scientists, paramedics, pharmacists, physiotherapists, administrators, drivers, and cleaning staff that work at the hospital as all of them are known to be exposed to different levels of hospital hazards.

2.3. Study tools

A structured self-administered questionnaire was constructed through an extensive literature review [7–9,13,17,25,28]. Content validation was done by four public health experts, and construct validation was completed through a pilot testing of the questionnaires before data collection [29]. Detailed information was provided to the participants regarding the purpose of the study and confidentiality. A written informed consent was taken from the participants before the data collection, and the data were collected under the supervision of the researchers. The questionnaire consisted of 38 questions with four components. The first section included questions related to participants’ sociodemographic characteristics, such as sex, age (in years), nationality (Turkish, Northern Cyprus, others), marital status (married, single, others), education level, occupation, department, and work experience. The educational level indicated the highest level of schooling attained and was classified into three groups: “secondary or less,” “high school,” and “university or above”. Information on medical checkups status was assessed using questions: “Have you ever done medical checkups before you start your current job?” and “Have you ever been asked to do routine medical checkups at your current workplace?” with answers of “yes”, “no,” and “do not remember”. Based on the responses, the occupation of the participants was categorized into three groups: “doctors”, “nurses and paramedics,” and “support staff’. Participants’ departments were grouped into three, namely, “emergency and wards,” “clinics & polyclinics,” and “support & administrative units”.

The second part comprised eight questions regarding the participants’ perceptions and knowledge regarding standard precautions, workplace hazards, and hospital safety and control measures (Table 1). The knowledge toward standard precautions, such as washing hands before and after touching the patient and wearing gloves when touching the patients, was asked. Moreover, participants’ knowledge of the existence of infection control measures, the safety training program provided to them at the hospital, and its adequacy was assessed. Responses to items of knowledge were “yes” or “no,” and correct responses were given a score value of “1” according to the Disease Control and Prevention Center guideline on standard precautions [27,28] (Table 1).

The third part consisted of seven questions pertaining to the practicing of standard precautions such as using protective clothing that include goggles/eyeglasses, gowns, bonnets when caring for patients. There were four questions regarding the safety precautionary practices while performing injections. The practice of wearing gloves when they perform injections was asked with “yes” or “no” responses. In addition, participants were asked if they change the gloves while contacting with another patient (yes or no). Lastly, there were two questions regarding the practice of safe disposal of sharps/needle waste, including whether they recap the needle again (always, sometimes, never, or not applicable) and whether they dispose of the
used needle in the specific sharps container. The answer was described in 5 categories “always,” “sometimes,” “never,” “there is no sharp container,” or “not applicable”. For each question, “1” score was given for the correct response of “always”, while the zero score was assigned to all other responses. The total score for practice ranged from zero to seven (0–7), whereas for the total knowledge score ranged from zero to eight (0–8).

Participants’ attitude toward standard precautions was assessed using five questions which were focused on their attitude toward using masks, gloves, aprons, surgical caps, and eyeglasses and how often they should use those protections. The answer provided were “no need to use at all”, “no need to change for each patient”, “change once per day” or “change for each patient”. Positive responses with the right attitude were given the score of “1”, while a zero score was assigned to all other responses. Thus, the total attitude score ranged from zero to five (0–5). Two questions were asked regarding their attitude on their daily job whether it is risky and stressful. An additional question was asked to know that if they were warned by their attitude on their daily job whether it is risky and stressful. An additional question was asked to know that if they were warned by

regained from zero to seven (0–7), whereas for the total knowledge score ranged from zero to eight (0–8).

2.4. Data analysis

The data were analyzed using IBM SPSS (Statistical Package for the Social Sciences) version 23 (SPSS Inc., Chicago, IL, USA). Descriptive statistics including frequency, percentage, mean, and standard deviation (SD) were done to describe the characteristics of the study sample. The total scores of participants’ knowledge, practice, and attitude were dichotomized into satisfactory and unsatisfactory categories based on the cutoffs which determined based on the mean scores. Namely, a satisfactory level of knowledge was score > 5, a satisfactory practice was score > 3, and a satisfactory positive attitude was score > 3. Bivariate analysis using the Chi-square (χ²) test [32] was done to examine the relationships between categorical variables such as a satisfactory level of knowledge, attitude, and practice regarding standard precautions using contingency tables. The Fisher’s exact test was used for some variables where the expected cells are less than 5 [33]. Exposure variables having a p < 0.05 level of significance in bivariate analysis was entered to construct the final model of multivariable logistic regression analysis. The odds ratio (OR) and confidence interval (CI) were presented with the p value set at <0.05.

3. Results

The mean age of the participants was 32.95 (SD ± 9.70) and 62.2% of them were women. Table 1 illustrates the frequency of the participants with the correct responses regarding each item constituted the knowledge, practice, and attitude toward SPs. Overall, higher proportions of participants had responded correctly to the knowledge and attitude items compared with practice questions. The mean score (±SD) for knowledge items was 5.73 (±1.72), while the mean scores for the practice and attitude items were 2.52 (±1.76) and 2.84 (±1.68), respectively. Based on the mean scores, 57.5% of the staff had a satisfactory level of correct knowledge (>5 correct answers), 37.3% had satisfactory positive attitude (>3 correct answers), and only 30.9% had a satisfactory practice (>3 correct answers) toward SPs.

Most of the staff answered correctly to the knowledge items related to washing hands (69.8% and 84.5%), workplace safety (85.8%), the existence of the infection control committee (81.1%), and training programs (74.7%). However, almost half of them did not know if the training program was adequate (45.9%). Fewer participants answered correctly in the majority of the practice items, except questions related to using gloves when doing the injection (73.4%), changing gloves for each patient (89.3%), and disposing of the used needles to the special container (98.0%). About 47% of them reported that they did recap the used needle before disposal. Moreover, participants had a positive attitude toward using gloves (95.8%) and masks (70.4%), where fewer participants stated that it is necessary to use the bonnet (63.4%), gown (57.7%), and eyeglasses (55.3%) for each patient as SP measures.

The distribution of sociodemographic and other work-related characteristics of the participants by their occupation was presented in Table 2. Except for gender, all other characteristics of the participants have shown statistically significant differences between doctors, nurses/paramedics, and support staff. Support staff consisted of 24 secretaries, 9 drivers, 20 technicians, 9 security personnel, 15 cleaners, 16 porters, and 28 other office personnel. Almost all doctors have shown to have a university or above education level (p = 0.000), more than 10 years of working experience (p = 0.000), married (p = 0.005), and worked in the clinics, polyclinics, emergency, and ward units compared with nurses/paramedics and support staff (p = 0.000). However, a significantly higher proportion of participants who worked as support staff were from TRNC compared with other occupational groups (p = 0.004). A significantly higher proportion of doctors have reported that they had work-related diseases (p = 0.011) and stated that their job is stressful (p = 0.001) compared with their counterparts.

Table 3 shows the relationships between sociodemographic characteristics of the participants having a satisfactory level of knowledge, practice, and attitude toward SPs. Younger participants (<25 years compared with >30 years) and nurses/paramedics shown a significantly higher tendency of having a satisfactory knowledge compared with other occupational groups. Regarding the practice of SPs, factors such as being a doctor, working in clinics and polyclinics, and also having a university or above education level have significant relationships with having satisfactory practice compared with their counterparts. On the contrary, having a lower education level and being a support staff were shown to be significantly related to having a positive attitude, while a significantly higher proportion of staff from other countries showed to have a positive attitude compared with staff who were originally from Turkey and TRNC. The experience of having a NSI did not show any significant relationship with having satisfactory knowledge, practice and attitude toward SPs among participants.

Of all, 174 participants answered the question regarding the experience of NSIs and 31.6% (55) of them reported experiencing
NSIs at least once during the work. Table 4 illustrates the relationship between sociodemographic characteristics and job-related factors with experiencing NSIs during work. Being a nurse/paramedic has shown to have a significantly higher tendency of experiencing NSIs compared with other occupations. Meanwhile, it was shown that a significantly higher proportion of participants who had the experience of NSIs reported being aware of the infection control committee at their workplace.

The results of multivariate logistic regression analysis were presented in Table 5. Types of occupation have shown to be a significant predictor for the participants to have a satisfactory level of knowledge and practice toward SPs. Doctors were less likely to have a satisfactory knowledge and practice compared with nurses and paramedics (OR = 0.269, 95% CI: 0.10–0.70 and OR = 0.248, 95% CI: 0.08–0.77, respectively), whereas the support staff were four times more likely to have satisfactory knowledge toward SPs compared with nurses and paramedics (OR = 4.017, 95% CI: 2.03–7.95). Moreover, participants who worked at the support units were less likely to have satisfactory practice compared with nurses and paramedics. Interestingly, being a foreigner was the only predictor attributed to having a satisfactory attitude as participants from other countries had 2.93 (95% CI: 1.06–8.12) times the odds of having a positive attitude compared with those who did not. Those who worked as support staff at the hospital (OR = 0.392, 95% CI: 0.18–0.86) tend to have fewer experiences of NSIs compared with nurses and paramedics.

4. Discussion

One of the key strengths of the present study was to provide evidence-based information on the knowledge, practice, and attitudes of the health personnel who were working at a teaching hospital toward workplace health and safety measures, which is remaining as a knowledge gap in Northern Cyprus. Furthermore, the findings of this study, which revealed a substandard adherence of health personnel toward standard precautionary measures, highlighted the necessity of the government-driven, nationwide studies on this topic among health personnel from all public and private health facilities in the country. Such studies are essential to provide evidence to develop specific strategies and customized training programs to improve the awareness, adherence, and compliance of health personnel toward prevention measures in healthcare settings.

In the present study, all sociodemographic characteristics of the participants except gender were shown statistical significant differences between doctors, nurses and paramedics, and support staff. Some differences (education, work experience, departments) were comparable with the findings from a study by Askarian et al [29], whereas some (gender, age) were inconsistent with a study conducted in Iran [29]. It was found that the correct answers for each knowledge, practice, and attitude items were much lower than the findings from a study by Asmr Y. et al [8], whereas some (gender, age) were inconsistent with a study conducted in Iran [29]. It was found that the correct answers for each knowledge, practice, and attitude items were much lower than the findings from a study by Askarian et al in the university-affiliated hospital of Shiraz, Iran [29]. For instance, the proportion of answering correctly to the knowledge items related to washing hands before (69.4% vs 94.0%) and after (84.5% vs 94%) caring for patients and wearing gloves (62.7% vs 95%) was much lower in our study. The proportion of correct answers for all practice and attitude items was much lower than that for knowledge items, and this was in line with the aforementioned study. Such discrepancy might be due to the differences in study designs and study participants in these studies as a majority of these study participants were doctors [29], surgeons [30], and some were only conducted among nurses [31]. Particularly, the usage of goggles/eyeglasses (4.3%), gowns

| Items for knowledge of SPs (yes – 1) | n/total | % |
|------------------------------------|---------|---|
| Q1 Do you wash your hand before patient care? | 161/232 | 69.4 |
| Q2 Do you wash your hand after patient care? | 197/233 | 84.5 |
| Q3 Do you wear gloves while caring for the patient? | 146/233 | 62.7 |
| Q4 Do you think your workplace is safe in terms of hospital related infections? | 200/233 | 85.8 |
| Q5 Do you know if the infection control and prevention measures are adequate at your workplace? | 126/233 | 54.1 |
| Q6 Do you know if there is an infection control and committee at the hospital? | 189/233 | 81.1 |
| Q7 Do you know if there is any workplace training and education program for workers? | 174/233 | 74.7 |
| Q8 Do you think the training program is adequate for workers? | 143/233 | 61.4 |
| **Mean Knowledge score (±SD) = 5.73 (±1.72), Range: 0–8** | | |

| Items for practice of SPs (always = 1) | n/total | % |
|--------------------------------------|---------|---|
| Q1 Do you wear goggles/eyeglasses during patient care to protect from body fluids/bloods, splashes or sprays? | 10/233 | 4.3 |
| Q2 Do you wear a gown during patient care to protect mucous membranes from body fluids/bloods, splashes or sprays? | 50/233 | 21.5 |
| Q3 Do you wear surgical cap (bonnet) when you care for patients? | 29/233 | 12.4 |
| Q4 Do you use your gloves when you perform injection for patients? | 113/154 | 73.4 |
| Q5 Do you change your gloves when you perform injection for another patient? | 158/177 | 89.3 |
| Q6 Do you recap the used needle after injection? | 79/147 | 53.7 |
| Q7 Do you dispose the used needle in the special sharps’ container? | 149/152 | 98.0 |
| **Mean Practice Score (±SD) = 2.52 (±1.76), Range: 0–7** | | |

| Items for attitude regarding SPs (Yes = 1) | n/total | % |
|------------------------------------------|---------|---|
| Q1 Do you think it is necessary to wear a mask when caring for patients? | 143/203 | 70.4 |
| Q2 Do you think it is necessary to use gloves when caring for patients? | 205/214 | 95.8 |
| Q3 Do you think it is necessary to wear a gown when caring for patients? | 105/182 | 57.7 |
| Q4 Do you think it is necessary to wear goggles/eyeglasses when caring for patients? | 73/132 | 55.3 |
| Q5 Do you think it is necessary to wear bonnet/cap when caring for patients? | 90/142 | 63.4 |
| **Mean attitude score (±SD) = 2.84 (±1.68), range: 0–5** | | |

AD, standard deviation; SP, standard protection.

4. Discussion

One of the key strengths of the present study was to provide evidence-based information on the knowledge, practice, and
(21.5%), and bonnets (12.4%) of HCWs in our study was much lower than that in other studies [14,18,29,32,33]. However, the proportion of participants that reported to be trained with workplace health and safety precautions in our study was higher (74.7% vs 48.5%) than the findings from a study by Beyamo et al, which questioned the efficiency of the training as the practice and attitude of the HCWs were not adequate in the present study [39]. The insufficiency of the training as the practice and attitude of the HCWs showed no significant relationship with age [39]. Moreover, the findings from other developing countries, where the gender [6,31,36], marital status [35], and work experience [34–36] were shown to be significant factors related to their knowledge and compliance toward SPs. In the present study, bivariate analysis of the independent variables with the knowledge level showed that a higher proportion of the younger participants (<25ys) had satisfactory knowledge (66.7% vs 48%, p < .05) compared with older personnel (>30ys), whereas our study did not show a statistically significant difference with age [39]. Moreover, the same study also found that participants with shorter work experience (<5ys) were 2.5 times more likely to comply with the SPs than those who have more than 10 years of work experience [39].

Most of the sociodemographic (such as gender, marital status) and work-related characteristics (work experience) of the participants in our study were shown no significant relationships with their knowledge, practice, and attitude toward SPs. These findings are comparable with the results from some studies [29,33], whereas contrary to the study findings from other developing countries, where the gender [6,31,36], marital status [35], and work experience [34–36] were shown to be significant factors related to their knowledge and compliance toward SPs. In the present study, bivariate analysis of the independent variables with the knowledge level showed that a higher proportion of the younger participants (<25ys) had satisfactory knowledge (66.7% vs 48%, p < .05) compared with older personnel (>30ys), which is consistent with the findings from a study by Hakim et al in Egypt [38]. However, Beyamo et al reported that older HCWs (>30ys) were more likely to comply with the SPs than younger counterparts (<25ys), whereas our study did not show a statistically significant difference with age [39].

### Table 2

| Distributon of sociodemographic characteristics and some work-related factors of the participants by occupations (N = 233). |
|-----------------|-----------------|-----------------|-----------------|-----------------|
|                 | Doctors         | Nurses/paramedics | Support staff   | Total           |
|                 | n               | %               | n               | %               | n               | %               | n               | %               |
| Gender          |                 |                 |                 |                 |                 |                 |                 |                 |
| Male            | 20              | 52.6            | 26              | 35.1            | 42              | 34.7            | 88              | 37.8            | 4.271           | 0.118           |
| Female          | 18              | 47.4            | 48              | 64.9            | 79              | 65.3            | 145             | 62.2            | 57.33           | 0.000           |
| Age (years)     |                 |                 |                 |                 |                 |                 |                 |                 |
| <25             | 2               | 5.3             | 40              | 54.1            | 56              | 46.3            | 98              | 42.0            | 36.6            | 0.001           |
| 25–30           | 36              | 94.7            | 16              | 21.6            | 50              | 41.3            | 102             | 43.8            | 4.86            | 0.088           |
| >30             | 2               | 5.3             | 40              | 54.1            | 56              | 46.3            | 98              | 42.0            | 36.6            | 0.001           |
| Marital status  |                 |                 |                 |                 |                 |                 |                 |                 |
| Married         | 27              | 71.1            | 29              | 39.2            | 63              | 52.1            | 119             | 51.1            | 0.005           |
| Single          | 8               | 21.1            | 43              | 58.1            | 54              | 44.6            | 105             | 45.1            | 14.66           | 0.005           |
| Divorced        | 3               | 7.8             | 2               | 2.7             | 4               | 3.3             | 9               | 3.8             |                  |                 |
| Nationality     |                 |                 |                 |                 |                 |                 |                 |                 |
| Turkish         | 21              | 55.3            | 32              | 43.2            | 38              | 31.4            | 91              | 39.1            | 15.50           | 0.004           |
| TRNC            | 15              | 39.5            | 40              | 54.1            | 63              | 52.1            | 118             | 50.6            |                  |                 |
| Others          | 2               | 5.2             | 2               | 2.7             | 20              | 16.5            | 24              | 10.3            |                  |                 |
| Department      |                 |                 |                 |                 |                 |                 |                 |                 |
| Emergency and ward units | 29 | 76.3 | 37 | 50.0 | 35 | 28.9 | 101 | 43.3 | 31.93 | 0.000 |
| Clinics and polyclinics | 8 | 21.1 | 22 | 29.7 | 42 | 34.7 | 72 | 30.9 |                  |                 |
| Support units   | 1               | 2.6             | 15              | 20.3            | 44              | 36.4            | 60              | 25.8            |                  |                 |
| Work experience |                 |                 |                 |                 |                 |                 |                 |                 |
| <5 years        | 2               | 5.3             | 46              | 62.2            | 96              | 79.4            | 144             | 61.8            | 104.37          | 0.000           |
| 5–10 years      | 8               | 21.2            | 18              | 24.3            | 20              | 16.5            | 46              | 19.7            |                  |                 |
| >10 years       | 28              | 73.7            | 10              | 13.5            | 5               | 4.1             | 43              | 18.5            |                  |                 |
| Education level |                 |                 |                 |                 |                 |                 |                 |                 |
| High school or less | 1 | 2.6 | 2 | 2.7 | 54 | 44.6 | 57 | 24.5 | 159.89 | 0.000 |
| College and undergraduate | 9 | 23.7 | 70 | 94.6 | 59 | 48.8 | 138 | 59.2 |                  |                 |
| University or above | 28 | 73.7 | 2 | 2.7 | 8 | 6.6 | 38 | 16.3 |                  |                 |
| Work-related diseases |                 |                 |                 |                 |                 |                 |                 |                 |
| Yes (risky)     | 36              | 94.7            | 66              | 89.2            | 99              | 81.8            | 201             | 86.3            | 4.86            | 0.088           |
| No              | 2               | 5.3             | 8               | 10.8            | 22              | 18.2            | 32              | 13.7            |                  |                 |
| Perceived workplace stress | yes (stressful) | 36 | 94.7 | 72 | 97.3 | 97 | 80.2 | 205 | 88.0 | 14.71 | 0.001 |
| No              | 2               | 5.3             | 2               | 2.7             | 24              | 19.8            | 28              | 12.0            |                  |                 |

* Fisher’s exact test.
In contrast to these results, there were no statistically significant differences found between working experience and the knowledge, practice, and attitude regarding SPs in our study. The findings of our study showed that the types of departments in which HCWs were working have shown to be a significant predictor of the compliance toward SPs as the personnel from the support units were 58% less likely to practice SPs than the HCWs in emergency and ward units (OR = 0.420, 95%CI: 0.18–0.99). This finding is in line with the findings of the study done by K. Nichol et al in Canada [35]. In our study, positive attitudes toward workplace safety and health precautions among participants were low which is in line with a study conducted in Iran [29], and participants from other countries have shown to have three times more positive attitudes toward work among HCWs than participants from Turkey. This might be due to the sample size and the data collection method of our study.

Of 174 participants who answered questions on NSIs, 31.6% (55) of them reported to have experienced NSIs at least once in their workplace, and this is lower than that in several studies in developing countries [7,8,33,37]. Asmr Y. et al reported that having the experience of NSIs was not statistically associated with their knowledge level which is similar to the findings in our study [8]. However, the study also found that having NSI experience was reversely related to their practice of SPs [8], which was not seen in the present study. It was found that 53.7% of the participants in our study had recapped the used needle during work, and the proportion is lower than the percentage of HCWs suffered from NSIs (67.9%) in a study conducted at the University of Alexandria teaching hospitals. The study also revealed that recapping used needle was one of the most common risk factors to have a higher risk of NSIs as it accounted for over one-third (36%) of NSIs among doctors in this study than ours. The study also found that the type of the profession was one of the predictors for sustaining an NSI during the last five years, which is comparable with the results of our study [8].

A study by Cutter and Jordan (2012) reported that among nurses (43%) and surgeons (57%) of total 315 HCWs, 58.1% of them had NSIs during the last five years, which is considerably higher than our results [28]. This is most probably due to the higher proportion of the study. The study also found that the type of the profession was one of the predictors for sustaining an NSI at five years, which is comparable with the results of our study. However, doctors were more likely to have NSIs than nurses, whereas in our study, nurses were at higher risk than doctors and support staff [28]. Moreover, the results of the logistic regression analysis have shown that support staff were about 61% less likely to experience NSIs than nurses. Other work-related factors did not

| Factors | Satisfactory knowledge (%) | Satisfactory practice (%) | Satisfactory attitude (%) |
|---------|-----------------------------|---------------------------|---------------------------|
| Gender  |                             |                           |                           |
| Male    | 62.5 (55)                   | 35.2 (31)                 | 40.0 (32)                 |
| Female  | 54.5 (79)                   | 28.3 (41)                 | 35.9 (49)                 |
| Age (years) |                           |                           |                           |
| <25     | 66.7 (22)                   | 30.3 (10)                 | 37.5 (12)                 |
| 25–30   | 64.3 (63)                   | 28.6 (28)                 | 38.7 (36)                 |
| >30     | 48.0 (49)                   | 33.3 (34)                 | 35.9 (33)                 |
| Marital status |                           |                           |                           |
| Married | 56.3 (67)                   | 30.3 (36)                 | 41.3 (45)                 |
| Single  | 59.0 (62)                   | 30.5 (32)                 | 34.3 (34)                 |
| Divorced | 55.6 (5)                    | 44.4 (4)                  | 22.2 (2)                  |
| Nationality |                           |                           |                           |
| Turkish | 56.0 (51)                   | 38.5 (35)                 | 34.1 (29)                 |
| TRNC    | 58.5 (69)                   | 26.3 (31)                 | 33.9 (37)                 |
| Others  | 58.3 (14)                   | 25.0 (6)                  | 65.2 (15)                 |
| Occupation |                           |                           |                           |
| Doctors | 44.7 (17)                   | 57.9 (22)                 | 23.7 (9)                  |
| Nurses & paramedics | 79.7 (59) | 23.0 (17) | 32.4 (24) |
| Support staff | 47.9 (58) | 27.3 (33) | 45.7 (48) |
| Department |                           |                           |                           |
| Emergency and ward units | 62.5 (45) | 33.3 (24) | 37.7 (26) |
| Clinics and polyclinics | 61.4 (62) | 37.6 (38) | 33.7 (34) |
| Support units | 45.0 (27) | 16.7 (10) | 44.7 (21) |
| Work experience |                           |                           |                           |
| <5 years | 62.5 (90)                   | 27.1 (39)                 | 41.1 (53)                 |
| 5–10 years | 50.0 (23) | 32.6 (15) | 35.6 (16) |
| >10 years | 48.8 (21) | 41.9 (18) | 27.9 (12) |
| Educational level |                           |                           |                           |
| High school or less | 57.9 (33) | 24.6 (14) | 56.3 (27) |
| College & Undergraduate | 60.9 (84) | 28.3 (39) | 34.4 (45) |
| University above | 44.7 (17) | 50.0 (19) | 23.7 (9) |
| NSI experience (174) |                           |                           |                           |
| Yes     | 20.1 (35)                   | 10.3 (18)                 | 10.1 (17)                 |
| No      | 40.2 (70)                   | 27.0 (47)                 | 26.6 (45)                 |

| Factors          | NSI experience (%) | Total | χ² | p   |
|------------------|--------------------|-------|----|-----|
| Occupation       |                    |       |    |     |
| Doctors          | Yes 27.3 (19)      | 16.0 (14) | 34.9 (15) | 10.64 | 0.005 |
| Nurses & paramedics | Yes 49.1 (31) | 43.4 (15) | 68.9 (19) |
| Support staff    | 13 23.6 (59)       | 49.5 (72) | 72.4 (15) |
| Recapping the used needle | Yes | 50.0 (47) | 54.7 (14) | 70.3 (12) | 0.26 | 0.610 |
| Disposing the used syringe to the special sharp's container | Yes | 100.0 (86) | 96.6 (134) | 97.8 (107) | 0.15 | 0.751 |
| Have ever had any training about SPs | Yes | 72.7 (85) | 71.4 (125) | 71.8 (103) | 0.03 | 0.859 |
| Perception on the adequacy of the SPs training | Adequate | 61.8 (71) | 59.7 (105) | 60.3 (106) | 0.70 | 0.787 |
| Perceived workplace risk | Yes (risky) | 94.5 (103) | 89.1 (115) | 89.1 (108) | 2.47 | 0.116 |
| Perceived workplace stress | Yes (stressful) | 94.5 (106) | 89.1 (158) | 90.8 (103) | 1.35 | 0.246 |
| Awareness of having an infection control committee at workplace | Yes | 92.7 (92) | 77.3 (143) | 82.2 (104) | 6.10 | 0.000 |
| Work-related diseases | Yes | 3.6 (5) | 4.2 (7) | 4.0 (23) | 2.83 | 0.242 |
| Don’t remember | 40 | 16.2 (11) | 9.2 (21) | 12.1 (21) | 1.00 | 0.050 |

SP, standard protection. * Fisher’s exact test.
show any significant relationship with having NSIs experience among participants. Particularly, receiving education/training regarding SPs, self-perception of job risks, and stress were not statistically significant in relation to having NSIs, which is in line with several other studies [6,8,18,30,37].

The study has a few limitations to be noted. First, the results of this study should be evaluated with caution because of the study design and the purposive sampling method used. Only one teaching hospital was included as it is challenging to obtain permission to conduct research in the government hospitals and other health facilities in Northern Cyprus. The Kyrenia University Dr. Suat Günsel Hospital is one of the two teaching hospitals under Near East University. The authors would like to thank all the intern students and study participants for their contributions to this study. We would like to thank Int. Dr. Altan Kamburca, Int. Dr. Osman Yangin, Int. Dr. Kerem Berk Toprak, Int. Dr. Ibrahim Yangin and Int. Dr. Yusuf Abodan for their contributions to this study.

### 5. Conclusion

The study has revealed that the majority of HCWs who participated in this study has an unsatisfactory level of knowledge, inadequate practice, and negative attitude toward standard precautions at the workplace. The types of occupations were one of the attributable factors to significantly influence their perception and compliance with SPs. Moreover, nurses have shown to be the highest risk group in experiencing NSIs among all. It is highly recommended for hospital management and stakeholders to provide a periodic training program, which is tailored to each occupation group based on their job descriptions and risk exposures. Having an actively functioning hospital infection control committee would positively affect HCWs’ adherence with SPs. The results of this study might provide preliminary evidence to the stakeholders and government to take action to conduct further nationwide studies on this topic to fill the gap in knowledge. Furthermore, in the long run, the systematic improvement in HCWs’ knowledge and practice toward SPs will improve the overall quality of the service delivery and economy of the entire healthcare system as a result of improving the health of HCWs and reducing various hospital-associated infections.

### Authors’ contributions

GA was involved in the study design, data collection, data entry, analysis, and drafted the original manuscript. SAV was involved in the study design, data collection, data entry, and analysis. OA and SC contributed to the study design particularly the questionnaire development, data collection, and data entry. All authors read and approved the final manuscript.

### Conflicts of interest

All authors have no conflicts of interest to declare.

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Appendix A: Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.shaw.2020.09.003.

References

[1] World Health Organization. The joint WHO-ILO-UNAIDS policy guidelines on improving health workers’ access to HIV and TB prevention, treatment, care and support services. Geneva; 2010.

[2] World Health Organization (WHO). Health workers. Geneva Switzerland: World Health Organization; 2020.

[3] Wilburn SQ, eijkmans Gerry. Preventing needlestick injuries among healthcare workers: a WHO–ICN collaboration. Int J Occup Environ Health [Internet] 2004;53(10):451–6 [cited 2020 Feb 13]. Available from: www.ijoeh.com.

[4] World Health Organization and International Labour Organization. Occupational safety and health in public health emergencies: a manual for protecting healthcare workers. BMC Res Notes [Internet] 2016;9(71):14 [cited 2019 Sep 22]. Available from: http://www.ncbi.nlm.nih.gov/pubmed/26852406.

[5] Aluol OO, Adebayo AE, Adebis EF, Owgbemi MK, Abiboye AT, Popola BF. Knowledge, attitudes and perceptions of occupational hazards and safety practices among Nigerian healthcare workers. BMC Res Notes [Internet] 2016;9(71):14 [cited 2019 Sep 22]. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4618079/

[6] Giardina M, Cantine MC, Tomarchio E, Veronese L. A review of healthcare failure modes and effects analysis (HFMEA) in healthcare workers. BMC Res Notes [Internet] 2016;9(71):14 [cited 2019 Sep 22]. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4618079/

[7] Hosoglu S, Akalin S, Sunbuli M, Oktun M, Ozturk R. Healthcare workers’ compliance with universal precautions in Turkey. Med Hypotheses 2011;77(6):1079–82.

[8] Asmr Y, Beza L, Engida H, Bekelcho T, Tsegaye N, Aschale Y. Assessment of knowledge and practices of standard precaution against blood borne pathogen among doctors and nurses at adult emergency room in Addis Ababa, Ethiopia. Emerg Med Int [Internet] 2019:1–8. https://doi.org/10.1155/2019/2926415 [cited 2020 Feb 19]. Available from:

[9] Hanif M, Mohamed AM, Kassem MS, Shawki M. Needlestick injuries among health care workers of University of Alexandria hospitals. East Mediterr Health J 2011;17(1):26–35.

[10] De Carli G, Abiteboul D, Puro V. The importance of implementing safe sharps practices in the laboratory setting in Europe [Internet]. Biochem Med 2014, 24(1):45–56. https://doi.org/10.11613/BM.2014.007.

[11] NHS Foundation Trust. Infection prevention and control policies and procedures [Internet]. London, UK; 2018 [cited 2019 Sep 23]. Available from: https://www.candi.nhs.uk/sites/default/files/Infection Prevention and Control Policy and Procedures_CL05_Jan 2018.pdf.

[12] Nemcov J, Nf N, Cu MED. Infection control in the healthcare settings: Part 1—principles of infection control Important Infection control in the health care setting [Internet]. 2012. 51 p [cited 2019 Sep 23]. Available from: https://www.ioi.org/wcml/selected-published-hospitals-of-medicated-proprietary—ioi-ado/docs/documents/legaldocument/wcmcs_115837.pdf.

[13] Nupmanova Z, Patel N, Nurbakhyt A, Akhmetova GM, Kovtunenko N, Nurbakhyt A, Akhmetova GM, Kovtunenko N, Nurbakhyt A, Akhmetova GM, Kovtunenko N. Knowledge and practices in the laboratory setting in Europe [Internet]. Biochem Med 2014;5(1):177–84. https://doi.org/10.11613/BM.2014.051.

[14] Balikby HH, El Beltagy KE, El-Saied AA, Salem M, Jagger J. Benchmarking of percutaneous injuries at a teaching tertiary care center in Saudi Arabia relative to United States hospitals participating in the Exposure Prevention Information Network. Am J Infect Control [Internet] 2011;39(7):5–56. https://doi.org/10.1016/j.ajic.2010.08.012.

[15] Alemie GA. Exploration of healthcare workers’ perceptions on occupational risk of HIV transmission at the University of Gondar Hospital, Northwest Ethiopia. BMC Res Notes [Internet] 2012;5(704):4 [cited 2020 Feb 12]. Available from: http://www.biomedcentral.com/1756-0500/5/704.

[16] Arinze-Onyia SU, Ndu AC, Aguwa EN, Modede I, Iwahwe UN. Knowledge and practice of standard precautions by health-care workers in a tertiary health institution in Enugu, Nigeria. Niger J Clin Pract [Internet] 2018;21(2):149–55 [cited 2019 Sep 23]. Available from: www.ncbi.nlm.nih.gov/pmc/articles/PMC6071229/.

[17] Darawad Muhammad W, Al-Hussami Mahmoud. Jordanian nursing students’ knowledge of, attitudes towards, and compliance with infection control precautions. Nurse Educ Today [Internet] 2013;33(6):580–3. https://doi.org/10.1016/j.nedt.2012.06.004 [cited 2020 Feb 12]. Available from:

[18] Fayaz SH, Higuchi M, Hiroswa T, Sarker MAB, Djabbarova Z, Hamajima N. Knowledge and practice of universal precautions among health care workers in national hospitals of Shiraz, Iran. J Infect Dev Ctries [Internet] 2014;8(4):335–42 [cited 2020 Feb 12]. Available from: https://jidpc.org/index.php/journal/article/view/4143.

[19] Martins A, Coelho AC, Vieira M, Matos M, Pinto ML. Age and years in practice as factors associated with needlestick and sharps injuries among health care workers in a Portuguese hospital. Acad Med Prev 2012;47:11–5.