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# Knowledge, Attitude, And Practice Of Standard Infection Control Precautions Among Healthcare Workers In Prince Mohammad Airport, Medina, Saudi Arabia, (2022) Cross-Sectional Survey

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**Abstract:**

**Background:** Infection control procedures are essential, particularly in an airport like Prince Mohammad National Airport, frequently used by travelers and pilgrims coming for Hajj and Umrah. This study aimed to evaluate the knowledge, attitude, and practice of healthcare workers at Prince Mohammad Airport regarding standard infection control precautions.

**Methods:** This cross-sectional study was conducted online using a validated, modified closed-ended questionnaire. One hundred and seven healthcare workers were selected using convenient sampling. The SPSS program, version 28 analyzed the collected data. Both descriptive and inferential statistics, the Mann-Whitney U test, the Kruskal-Wallis H test, and multiple logistic regression were used. A p-value $\leq 0.05$ was considered significant in all tests.

**Results:** A total of 107 HCWs participated in the study. Most of them 99 (92.5%), were male, 78 (72.9%) were aged between 30- 40 years, 66 (61.7%) had less than five years of experience, and the majority of them, 93 (86.9%) received training on infection control standard precautions. Overall, good knowledge, positive attitude, and good practice toward standard precautions were (63.60%), (72.90%) and (90.70%) receptively. The profession and qualification had a significant impact on attitude. Physicians and HCWs with higher education had higher attitude mean scores than others.

**Conclusion**: Most HCWs had good practice, attitude, and knowledge, respectively. Training programs for HCWs may help update and strengthen their understanding of infection control standard precautions.

**Keywords:** healthcare workers; infection control; standard precautions, knowledge, attitude, and practice.

## Introduction

### Background:

Healthcare Workers (HCWs) are more vulnerable to contracting infections due to their work. They are at risk of various occupational hazards in the hospital, including exposure to bloodborne infections such as HIV and hepatitis B and C virus (HBV and HCV) and respiratory infection(1, 2).

The World Health Organization (WHO) reports that the prevalence of hospital-acquired infections in hospital settings ranges from 5.7% to 19.1% (3). Although there has been increased awareness and a restriction of rules regulating infection control precautions and the prevention of hospital infections, some

studies show that healthcare workers' understanding of behaviors regarding hospital-acquired infections is still limited (4).

Although international air travel has increased the pace and breadth of human mobility, it has resulted in a worldwide infectious disease transport network that can transfer infections into non-endemic areas and allow the fast spread of new or modified zoonotic agents (5).

In a country like Saudi Arabia, where millions of people visit for the Hajj, knowledge and attitudes about infections are critical health issues. The importation or exportation of infectious diseases and their transmission among participants and the local population is one of the essential public health problems associated with large gatherings. The arrival of large numbers of pilgrims can compromise the health system of the host countries (6).

While disease outbreaks and other acute public health threats are often unpredictable and require various responses, the International Health Regulations (2005) (IHR) provide an overarching legal framework that defines the country's rights and responsibilities when dealing with public health events and emergencies that may cross borders (7). And while there are newly developing and reemerging diseases, such as COVID-19 and monkeypox, that make infection control procedures more essential, particularly in an airport like Prince Mohammad National Airport, which is frequently used by travelers and pilgrims from various countries with varying epidemiological backgrounds coming for Hajj and Umrah, which increases the risk of communicable disease transmission to both visiting pilgrims and their contacts.

According to a study conducted at King Abdulaziz Airports, The outcomes of the study revealed the necessity for ongoing monitoring and assessment of healthcare workers regarding the prevention of infectious illnesses among pilgrims to prevent the spread of these diseases among pilgrims' contacts in their home countries (8).

There is a framework for dealing with infectious and public health emergencies in our health surveillance center at Prince Mohammad airport in Medina, which is based on (IHR). In addition, healthcare workers at the Airport must be familiar with standard infection-control practices and preparations we have when dealing with an infectious disease.

Therefore this study aimed to evaluate the knowledge, attitude, and practice of healthcare workers at Prince Mohammad airport regarding infection control precautions.

**Methods:**

**Study Design, Setting, and sample :**

This was a descriptive cross-sectional survey of the healthcare workers in Prince Mohammad Airport, KSA, between September 2022 and October 2022.

Study population: Healthcare workers were eligible for inclusion in this survey if they had worked at the center for more than 6 months and given their consent to participate in the study. Healthcare workers who hadn't worked at the center for 6 months were excluded.

The sample was convenience sampling, calculated using a 5% margin of error and 95% confidence level. It calculated by

Slovene's formula: $n = \frac{N}{(1+Ne^2)}$

$n = \frac{142}{(1+142*0.05^2)}$ =104.8. the study included 107 persons

**Data collection Tool:**

A self-administered questionnaire was used to assess healthcare personnel's awareness of infection control procedures at Prince Mohammad Airport to evaluate if they are prepared for public health emergencies.

The questions are based on the CDC and WHO standards for infection control routine precautions. The pre-test findings showed adequate internal consistency reliability of the questionnaire, with Cronbach's alpha above 0.7**.**

**The survey was divided into four sections:**

The first section included questions regarding the healthcare workers' demographic and professional information.

The second section assessed the knowledge of HCWs by asking questions about the knowledge (9 items). A scoring system was applied to determine each subject's knowledge level, with 1 point for each correct answer and 0 for an incorrect answer. A total of 12 points, ≥ 8 points (≥ 80% of total marks), was considered sufficient knowledge. Participants were grouped into 2 categories according to their level of knowledge: bad (< 8 points) and good ( ≥ 8 points).

The third section of the questionnaire assessed the attitude of HCWs regarding standard infection control precautions using the 5-point Likert scale. 7 questions were asked the answering and scoring systems were (from 5 to1 point) according to the correct answer. Participants were grouped into 2 categories according to their level of attitude: positive (< 28 points) and good (≥ 28 points).

The fourth section of the questionnaire assessed the practice. 7 questions were asked, with a similar scoring system as attitude.

**Statistical Analysis:**

The data were analyzed by using the IBM SPSS statistics version 28. Frequency and percentages were used to describe the knowledge, attitude, and practice. The normality of data was tested using the Kolmogorov-Smirnov test. Both descriptive and inferential statistics involve the Mann-Whitney U test, the Kruskal Wallis H test, and multiple logistic regression results. A p-value ≤ 0.05 was considered significant in all tests.

**Results**:

A total of 107 HCWs participated in the study. Most were male, 99 (92.5%), 78 (72.9%), aged between 30 and 40. More than one-third of them 41 (38.3%), were health inspectors, 33 (30.8%) nurses, 19 (17.8%) physicians, 43 (40.2%) had Bachelor's degrees, 66 (61.7%) had less than five years experience, and the majority of them 93 (86.9%) received training on infection control standard precautions. The demographic characteristics of study participants are shown in Table 1.

More than half of the HCW (63.60%) generally had good knowledge. Most participants (95.3%) stated that standard precautions are used for the care of all patients regardless of their diagnosis and perceived infection status, (while 99.1%) reported that hands should be washed with soap and water before and after handling potentially infectious materials irrespective of wearing gloves and (98.1%) knew gloves must be changed during patient care if you move hands from a contaminated body site to a clean body site. The majority of the participants (96.3%) thought performing hand hygiene is required before and after patient care, (96.3%) stated mask must be placed on coughing patients to prevent the potential dissemination of infectious respiratory secretions from the patient to others, whereas only (62. 6%) knew washing hands before clean, aseptic procedures are one of the five moments of hand hygiene. It is good mentioning that (94.4%) knew the purpose of using a gown or apron is to protect clothes from splashes or sprays of blood and body fluids, but only (56.1%) reported that all personal protective equipment (PPE) should be removed before leaving the patient's environment. Sixty percent knew the appropriate immediate action after pricking the finger

with an IV line needle was to dress the wound and inform the infection control supervisor: table 2 and figure 1.

Table 3 and figure 2 showed that about three-quarters of the participants (72.90%) had a positive attitude towards infection control standard precautions. Most of the study participants (98.1%) believed that standard precautions prevent the spread of infections from patients to HCWs and vice versa, (94.4%) thought transmission of infectious organisms can be reduced by adhering to standard and contact precautions, and (86.9%) reported that in the absence of standard precautions health care facilities can be the source of infection and disease epidemics. The majority of the participants (84.1%) did not agree that HCWs should not use PPE because it may harm patients psychologically, (85.1%) did not agree that changing gloves are not necessary during procedures, even if heavily contaminated, (24.3%) believed it is not logical to assume all patients are contagious unless their infection has been confirmed and (69.1%) stated that standard precaution is easy to follow.

In table 4 and figure 3, most of the participants (90.70%) had good practice (95.3%) constantly washing their hands immediately after contacting any blood, body fluid, secretion, excretion, or dirty substances (91.6%) and always wear gloves when drawing blood samples and more than three-fourths of the participants (76.6%) always wear protective suits or gown when performing operations/procedures that might induce spraying of blood, body fluid, secretions, or excretions. Although most participants (98.1%) always dispose of needles, blades, or any other single-use sharp objects in a sharp disposal container after use, only (22.4%) never recap needles immediately using the one-handed method after use. More than half (63.6%) always use hand wash/hand sanitizer before wearing gloves, and (85.0%) often wear masks when conducting procedures that are likely to generate splashes of blood, body fluids, secretions, or excretions.

The result of the multiple linear regression in table 5 showed that gender, age, profession, previous experience, and previously received training were no significant predictors of knowledge, attitude, and practice.

Table 6 revealed that profession and qualification had a significant impact on attitude. Physicians and HCWs with higher education had higher attitude mean scores than others.

**Discussion**

In general, more than half of the HCWs (63.60%) had a satisfactory knowledge level, in agreement with previous studies among health care workers (HCWs) in a University Hospital in Qassim, Saudi Arabia (67.6%) had adequate knowledge (9), among primary care professionals in Abha City, Saudi Arabia (68.4%) had good knowledge (10), in Nigeria (77.9%) correctly described universal precaution and infection control (11), 70.8% of healthcare providers had adequate knowledge of infection prevention in Wogdie District, Northeast Ethiopia (12). In Vietnam, most respondents showed good knowledge (rural hospital: 65.3%, urban hospital: 73.4%) (13). Possible explanations for this disparity in response include demographic differences in the study population, study location, and the study tool used for data collection.

In our study, most HCWs showed good knowledge of hand hygiene and wearing gloves and masks. However, the knowledge gaps were shown in the timing of removed personal protective equipment (PPE) and appropriate immediate action after pricking the finger with an IV line needle at 43.9% and 39.3%, respectively. There were no statistically significant differences in participants' knowledge according to their sociodemographic characteristics or previous training. Airport staffs handling the flow of travelers during peak times (pilgrimage season), such as immigration, customs, security, and healthcare workers, are in danger of infection. As a result, all of these individuals should continuously be educated about potential health threats at the airport, as well as preventive strategies, how to employ preventive methods, and what to do in the event of a public health emergency occurrence at the airport (14).

In the current study, about three-quarters of the participants (72.90%) had a positive attitude toward standard infection control precautions. Similar to what is reported from a study among dentists in Saudi

Arabia that reported 85.9%o of them had a positive attitude regarding personal protective equipment such as dental goggles, masks, and gloves are useful in protecting them from suspected COVID-19 patients(15), Abha City, Kingdom of Saudi Arabia (88.2%) (10), Qassim, Saudi Arabia (61.5%) (9), multicentric study in India 73% (16), Northern Red-Sea Hospitals, Eritrea (91.6%) (17). In contrast, only 37.3% had a satisfactory positive attitude toward standard precautions among health workers from a Hospital in Northern Cyprus(18). The profession and qualification had a significant impact on attitude. Physicians and HCWs with higher education had higher attitude mean scores than others.

The present study found that most participants (90.70%) had a good practice. This result is higher compared with the findings from studies conducted in Eritrea (77.1%)(17), the university hospital in Qassim, Saudi Arabia (73.2%)(9), India (57%)(16), Ethiopia (55%)(12), Malaysia (53.1%)(19), primary care professionals in Abha City, Kingdom of Saudi Arabia (50.5%)(10) and Northern Cyprus (30.9%)(18). These discrepancies in infection control standard precautions practice in different countries may be related to variations in education, training, organizational culture, policies, availability of the equipment and material, presence of infection control guidelines, and monitoring of their implementation. As well as fear of HCWs during pandemic attacks.

In our study, only (22.4%) never recap needles immediately using the one-handed method after use, and more than half (24.9%) seldom use the hand wash/hand sanitizer before wearing gloves. Educating HCWs on how to dispose of needles after use is essential. There were no statistically significant differences regarding participants' practice according to their sociodemographic characteristics or previous training.

**Limitation**:

- Our study findings were based on the data collected from a single center, which might limit the generalizability of the findings. Further studies on the national level may be useful.
- We can't rule out the possibility of information bias as it was self-reported data.

**Conclusion:**

Most HCWs had good practice, attitude, and knowledge, respectively. Some gaps were found in knowledge and practice, such as the time of removal of the personal protective equipment (PPE) and the appropriate immediate action after pricking the finger with a needle, as well as how to dispose of needles after use properly. As a result, organizing training programs for HCWs may help update and strengthen their understanding of infection control standard precautions and promote positive knowledge and practice.

- **Declarations**

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**Table 1: Sociodemographic characteristics of participants (n=107).**

| **Variables** | N (%) |
|---|---|
| **Sex** | |
| Male | 99 (92.5%) |
| Female | 8 (7.5%) |
| **Age** | |
| < 30 | 5 (4.7%) |
| 30 - 40 | 78 (72.9%) |
| > 40 | 24 (22.4%) |
| **Working experience** | |
| ≤ 5 years | 66 (61.7%) |
| > 5 years | 41 (38.3%) |
| **Profession** | |
| Physician | 19 (17.8%) |
| Nurse | 33 (30.8%) |
| Pharmacist | 6 (5.6%) |
| Health inspector | 41 (38.3%) |
| Public health specialist | 8 (7.5%) |
| **Received training** | |
| Yes | 93 (86.9%) |
| No | 14 (13.1%) |
| **Qualification** | |
| Diploma | 49 (45.8%) |
| Bachelor | 43 (40.2%) |
| Higher education | 15 (14.0%) |

**Table2: Knowledge of Health care workers on infection control standard precautions (n=107).**

| Items | Correct response |
|---|---|
| Standard precautions are used for the care of all patients regardless of their diagnosis and perceived infection status | 102 (95.3%) |
| Hands should be washed with soap and water before and after handling potentially infectious materials, irrespective of wearing gloves | 106 (99.1%) |
| Gloves must be changed during patient care if you move hands from 'contaminated body site' to 'clean body site.' | 105 (98.1%) |
| Performing hand hygiene is required before and after patient care | 103 (96.3%) |
| Washing hands before clean, aseptic procedures is not one of the five moments of hand hygiene | 67 (62. 6%) |
| The appropriate immediate action after pricking the finger with an IV line needle is to dress the wound and inform the infection control supervisor | 65 (60.7%) |
| Removed all personal protective equipment (PPE) before leaving the patient's environment | 60 (56.1%) |
| Mask must be placed on coughing patients to prevent the potential dissemination of infectious respiratory secretions from the patient to others | 103 (96.3%) |
| The purpose of using a gown or apron is to protect clothes from splashes or sprays of blood and body fluids | 101 (94.4%) |

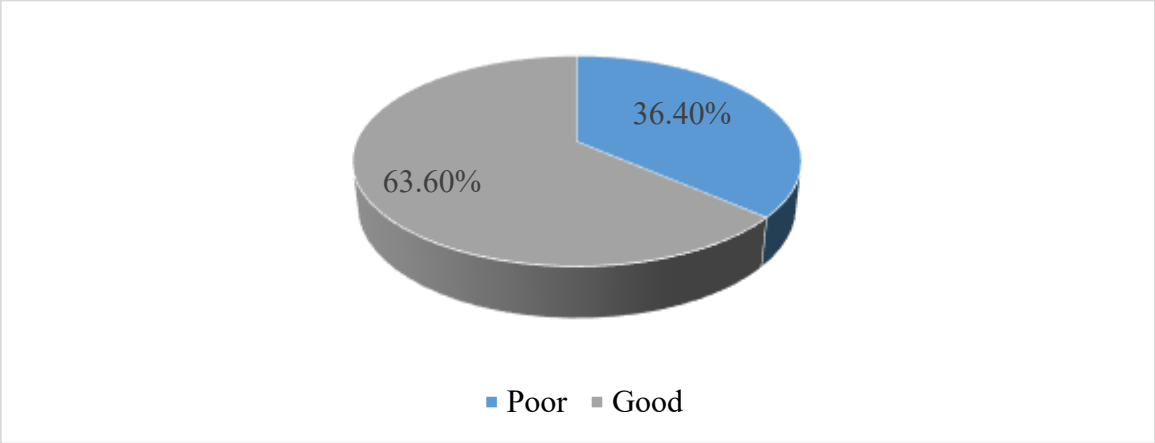


**Figure 1: Knowledge grade of HCWs regarding infection control standard precautions (n=107).**

**Table3: Attitude of Health care workers on infection control standard precautions(n=107).**

| Items | Strongly disagree | Disagree | Natural | Agree | Strongly agree |
|---|---|---|---|---|---|
| Standard precautions prevent the spread of infections from patients to HCWs and vice versa. | 0 (0%) | 0 (0%) | 2 (1.9%) | 18 (16.8%) | 87 (81.3%) |

| | | | | | |
|---|---|---|---|---|---|
| Changing gloves is not necessary during procedures, even if heavily contaminated. | 83 (77.6%) | 8 (7.5%) | 3 (2.8%) | 3 (2.8%) | 10 (9.3%) |
| HCWs should not use PPE because it may harm patients psychologically. | 73 (68.2%) | 17 (15.9%) | 6 (5.6%) | 4 (3.7%) | 7 (6.5%) |
| Transmission of infectious organisms can be reduced by adhering to standard and contact precautions. | 0 (0%) | 3 (2.8%) | 3 (2.8%) | 38 (35.5%) | 63 (58.9%) |
| It is not logical to assume all patients are contagious unless their infection has been confirmed. | 39 (36.4%) | 29 (27.1%) | 13 (12.1%) | 15 (14.0%) | 11 (10.3%) |
| In the absence of standard precautions, healthcare facilities can be the source of infection and disease epidemics | 2 (1.9%) | 8 (7.5%) | 4 (3.7%) | 30 (28.0%) | 63 (58.9%) |
| Standard precaution is not easy to follow. | 39 (36.4%) | 35 (32.7%) | 12 (11.2%) | 12 (11.2%) | 9 (8.4%) |

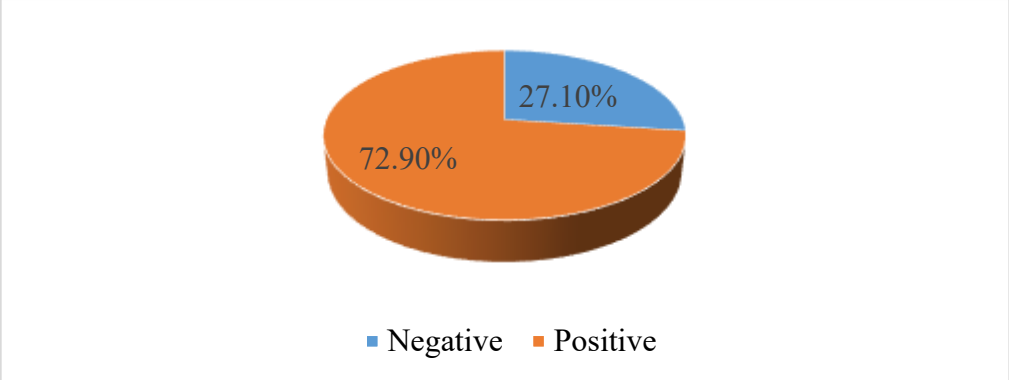


**Figure 2: attitude grade of HCWs regarding infection control standard precautions (n=107).**

**Table 4: Practice of Health care workers on infection control standard precautions (n=107).**

| **Items** | Never | Rarely | Sometimes | Often | Always |
|---|---|---|---|---|---|
| I wash my hands immediately after contacting any blood, body fluid, secretion, excretion, or dirty substances | 1 (.9%) | 0 (0%) | 0 (0%) | 4 (3.7%) | 102 (95.3%) |
| I wear gloves when drawing blood samples. | 1 (.9%) | 0 | 0 | 8 (7.5%) | 98 (91.6%) |

| | | | | | |
|---|---|---|---|---|---|
| I wear protective suits or gowns when performing operations/procedures that might induce the spraying of blood, body fluid, secretions, or excretions. | 3 (2.8%) | 2 (1.9) | 9 (8.4%) | 11 (10.3%) | 82 (76.6%) |
| After use, I dispose of needles, blades, or other single-use sharp objects in a sharps disposal container. | 1 (.9%) | 1 (.9%) | 0 | 0 | 105 (98.1%) |
| I Recap needles immediately using one hand method after the use | 24 (22.4%) | 8 (7.5%) | 6 (5.6%) | 10 (9.3%) | 59 (55.1%) |
| I need to use hand wash/hand-sanitizer before wearing gloves. | 2 (1.9%) | 3 (2.8%) | 21 (19.6%) | 13 (12.1%) | 68 (63.6%) |
| I need to wear masks when conducting procedures that are likely to generate splashes of blood, body fluids, secretions, or excretions. | 3 (2.8%) | 4 (3.7%) | 9 (8.4%) | 91 (85.0%) | 3 (2.8%) |

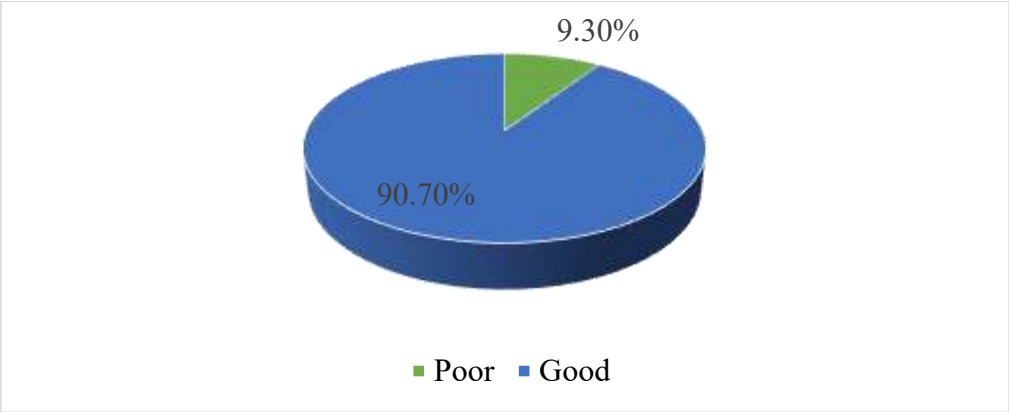


**Figure 3: practice grade of HCWs regarding infection control standard precautions (n=107).**

**Table5: Association between sociodemographic characteristics and level of knowledge, attitude, and practice of standard infection control precautions among healthcare workers**

| Characteristics | Knowledge | | | | Attitudes | | | | Practice | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Poor** (N, %) | **Good** (N, %) | **P-value** | **OR** (95% CI) | **Poor** (N, %) | **Good** (N, %) | **P-value** | **OR** (95% CI) | **Poor** (N, %) | **Good** (N, %) | **P-value** | **OR** (95%CI) |
| **Sex** | | | | | | | | | | | | |
| Male | 37(37.4%) | 62(62.6%) | .487 | 1 | 29(29.3%) | 70(70.7%) | .999 | -- | 10(10.1%) | 89(89.9%) | .999 | -- |
| Female | 2(25.0%) | 6(75.0%) | | .1.84(.33-10.1) | 0(0.0%) | 8(100%) | | -- | 0(0.0%) | 8(100%) | | -- |
| **Age** | | | | | | | | | | | | |
| ≤40 | 30(36.1%) | 53(63.9%) | .618. | 1 | 24 (28.9%) | 59(71.1%) | .822 | 1 | 9(10.8%) | 74(89.2%) | .447 | 2.55(.23-28.58) |
| > 40 | 9(37.5%) | 15(62.5%) | | 1.33(.43-4.12) | 5(20.8%) | 19(79.2%) | | 1.16(.31-4.41) | 1(4.2%) | 23(95.8%) | | |
| **Experience** | | | | | | | | | | | | |
| ≤ 5 years | 21(31.8%) | 45(68.2%) | .126 | 1 | 19(28.8%) | 47(71.2%) | .660 | 1 | 7(10.6%) | 59(89.4%) | .999 | 1 |
| > 5 years | 18(43.9%) | 23(56.1%) | | .47(.18-1.24) | 10(24.4%) | 31(75.6%) | | 1.27(.43-3.75) | 3(7.3%) | 38(92.7%) | | 1 (.20-5.10) |
| **Profession** | | | | | | | | | | | | |
| Physician | 8(42.1%) | 11(57.9%) | .304 | 1 | 1(5.3%) | 18(94.7%) | .051 | 1 | 2(10.5%) | 17(89.5%) | .727 | 1 |
| Non physician | 31(35.2%) | 57(64.8%) | | 1.75(.60-5.11) | 28(31.8%) | 60(68.2%) | | .13(.02-1.01) | 8(9.1%) | 80(90.9%) | | 1.35(.25-7.28) |
| **Received training** | | | | 1 | | | | 1 | | | | 1 |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Yes<br>No | 36 (38.7%)<br>3 (21.4 %) | 57 (61.3%)<br>11 ( 78.6 %) | .200 | 2.46(.62-9.75) | 25(26.9 %)<br>4(28.6%) | 68(73.1 %)<br>10(71.4 %) | .721 | .78(.21-2.97) | 8(8.6%)<br>2(14.3%) | 85(91.4 %)<br>12(85.7 %) | .395 | .48(.09-2.62) |

**Table 6: Mean score of knowledge, attitude, and practice with respect to personal characteristics (n = 107).**

| Variable | Mean score, Knowledge | Knowledge p-value | Mean score, Attitude | Attitude p-value | Mean score, Practice | Practice p-value |
|---|---|---|---|---|---|---|
| **Sex** [a] | | | | | | |
| Male | 53.02 | .204 | 52.79 | .153 | 52.85 | .162 |
| Female | 66.13 | | 69.00 | | 68.25 | |
| **Age** [b] | | .964 | | .861 | | .152 |
| < 30 | 51.10 | | 49.30 | | 36.50 | |
| 30 - 40 | 53.94 | | 53.51 | | 52.54 | |
| > 40 | 54.81 | | 56.56 | | 62.38 | |
| **Experience** [a] | | | | | | |
| ≤ 5 years | 54.87 | .684 | 52.68 | .575 | 50.62 | .139 |
| > 5 years | 52.60 | | 56.12 | | 59.44 | |
| **Profession** [b] | | | | | | |
| Physician | 49.03 | | 77.47 | | 57.71 | |
| Nurse | 54.15 | .183 | 50.44 | **.002*** | 55.82 | .922 |
| Pharmacist | 50.33 | | 40.58 | | 47.17 | |
| Health inspector | 52.23 | | 45.79 | | 52.02 | |
| Public health specialist | 77.00 | | 65.06 | | 52.94 | |
| **Received training** [a] | | | | | | |
| Yes | 52.85 | .277 | 53.82 | .875 | 53.05 | .397 |
| No | 61.61 | | 55.21 | | 60.32 | |

| | | | | | | |
|---|---|---|---|---|---|---|
| **Qualification** [b] | | | | . | | |
| Diploma | 53.42 | . | 45.70 | | 52.70 | |
| Bachelor | 53.65 | 911 | 58.59 | **023*** | 54.57 | .896 |
| Higher education | 56.90 | | 67.93 | | 56.60 | |

a= Mann-Whitney U test b=Kruskal-Wallis test *= significant at level 0.05