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# Knowledge of Standard Precautions among Healthcare Professionals in Saudi Arabia: Need for filling the gaps

Microbiology

**KEYWORDS:** Standard Precautions, Healthcare Professionals, Infection Control Practices.

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## ABSTRACT

**Objectives;** The study was designed to assess knowledge of Standard Precautions (SP) among HCP of Al-Ahsa governorate in the Eastern Province of Saudi Arabia, to identify the correlates that influence it and to determine the gaps in their knowledge.

**Material and methods;** A cross-sectional study was conducted in six hospitals in Al-Ahsa. A structured, self-administered questionnaire was used as study tool to assess the knowledge. The questionnaire contained multiple statements concerning various aspects of SP.

**Results;** A total of 201 HCP were surveyed. Majority of the respondents were females (78.4%) and between 20-40 years. Nearly half were Filipinos and a third were Saudis. Correct options were chosen by a majority of the HCP in most aspects of SP. However, a considerable number did not know about crucial SP measures. The knowledge score of surveyed HCP in this study was acceptable (74%). There was no significant difference in mean awareness among male and female groups (p value 0.559) and between HCP at government and private hospitals (p value 0.699). Physicians were more knowledgeable than other HCP (p value 0.0001). Indians and the Filipinos were more aware than other nationalities. No significant difference was observed with regards to years of experience and age of the patients.

**Conclusions ;** There is a gap in the understanding of a few aspects of SP among HCP including duration of hand washing, sharp disposal and recapping of used needles, use of PPE and post exposure prophylaxis .

## Introduction

Healthcare associated infections (HAI) not only affect hospitalized patients in terms of increased morbidity and mortality but also increase financial burden on healthcare services. According to WHO, HAI affect 7.6% of hospitalized patients. [1] A prevalence survey conducted under the auspices of WHO in 55 hospitals of 14 countries representing the four WHO regions (Europe, Eastern Mediterranean, South-East Asia and Western Pacific) showed an average of 8.7% of hospital patients had nosocomial infections. At any time, over 1.4 million people worldwide suffer from infectious complications acquired in hospital. [2] Infection control(IC) is a set of practices and procedure which when implemented effectively can prevent or reduce the risk of transmission of infections in healthcare settings; among Healthcare Professionals (HCP), patients and visitors. [3] According to the WHO, the purpose of Standard Precautions (SP) is to reduce the risk of transmission of blood borne and other pathogens from both recognized and unrecognized sources. SP are minimum precautions which are to be used in the care of all patients. They include use of protective barriers, hand hygiene, sharp injury prevention, biomedical waste management, and cleaning and disinfection of hospital environment. [4] Adherence to SP by HCP is known to reduce the risk of transmission of infections through exposure to blood and body fluids. [5] Physician's knowledge of SP has been found to be insufficient. [6]

There is a lack of comprehensive knowledge of IC practices among HCP in Saudi Arabia. This includes both at primary and secondary/ tertiary healthcare levels as well medical students. [7-9] Discrepancy between knowledge and practices was also noted. [10] Nursing students in Saudi Arabia seems to be more knowledgeable than their medical counterparts. [11] However, an increasing awareness vis-a-vis infection control issues among Saudi Healthcare workforce has also been observed.[10]

Al-Ahsa is located in the eastern province of Saudi Arabia. There are several small villages in close vicinity and the entire region is known as Al-Ahsa governorate, with an estimated population of nearly 1 million. Healthcare in the region is predominantly managed by Ministry of Health of Saudi Arabia though there are many private hospitals in Al-Ahsa as well. This study was designed to assess knowledge of SP among HCP of Al-Ahsa and identify the correlates that influence it. The aim was to determine gaps in the knowledge of IC and SP. Recognition of factors that influence HCP perception and compliance of IC and SP practices can be used to devise futuristic long term intervention strategies.

## Methods

### *Study design and setting*

A cross-sectional study was conducted in six hospitals in Al-Ahsa, Saudi Arabia; three government run by Ministry of Health of Saudi Arabia (Prince Saud bin Jalawi Hospital, King Fahd Hospital and Al-Jabr Hospital) and three private hospitals (Al-Mousa Hospital, Al-Ahsa Hospital and Hussein Al-Ali Hospital). These hospitals cater to

the population of Al-Ahsa and surrounding villages. The workforce employed is multi-national in character with varied backgrounds. The study was conducted from January 2016 to June 2016. A self-administered questionnaire was designed on the basis of recommended guidelines for SP and IC practices. [4, 12] The questionnaire included general and demographic characteristics as independent variables such as sex, nationality, age of the respondent, level of education, level of profession, exposure to infection control training, work experience. The questionnaire was drafted in a structured format with fixed true and false options and was pretested in a pilot study. The study was approved by Institutional Ethics Committee and the concerned hospital administrations. The respondents were briefly informed about the objectives of the study and assured of confidentiality. Voluntary participation was emphasized and the HCP were given the choice of non-participation. The questionnaire was bilingual; in Arabic and English, to aid the Arabic speakers. The participants were requested to work individually in completing the questionnaire.

***Statistical design***

The data was coded, tabulated and analyzed using IBM statistics SPSS Version 22.

**Results**

The study was intended to cover HCP of different biographical and professional characteristics. A total of 201 HCP were surveyed (*Table 1*). Some of the HCP did not write a few aspects of the questionnaire and could not be re-approached by us again. More than three fourth of the respondents were females (78.4%). A mere 16.4% of the respondents were >40 years, the rest being between 20-40 years. As many expatriates are working in healthcare system in Saudi Arabia, we wanted to understand the differences in level of awareness among HCP of different nationalities. Nearly half were Filipinos and a third were Saudis. Majority of the HCP were from private hospitals and working at different levels. Almost one quarter were physicians (specialists and Residents, cumulative percent 24.4) and nurses constituted 14.9 cumulative percent. However the largest number was of technicians (n=65, 32.3%). A large number had less than 5 years of experience (Table 1).

***Table 1; Basic and demographic characteristics of the surveyed HCP***

| | *N* | *%* |
|---|---|---|
| ***Gender*** | | |
| Female | 156 | 77.6 |
| Male | 43 | 21.4 |
| ***Nationality*** | | |
| Saudi | 60 | 29.9 |
| Egyptian | 12 | 06.0 |
| Filipino | 90 | 44.8 |
| Indian | 06 | 03.0 |
| others | 20 | 10.0 |
| ***Hospital*** | | |
| Government | 46 | 22.9 |
| Private | 155 | 77.1 |
| ***HCP Position*** | | |
| Specialists | 35 | 17.4 |
| Residents | 14 | 7.0 |
| Health officer | 2 | 1.0 |
| Senior nursing | 28 | 13.9 |
| Junior nursing | 2 | 1.0 |
| Technician | 65 | 32.3 |
| Sanitarian | 39 | 19.4 |
| Other | 16 | 7.9 |
| ***Experience (in years)*** | | |
| < 5 | 142 | 70.6 |
| 6-10 | 34 | 16.9 |
| +10 | 24 | 11.9 |

*Tables 2* – 7 show knowledge of surveyed HCP regarding basic concepts of infection control and various aspects of SP. A few questions were not marked and such items were identified as missing system. While majority couldn't answer correctly with regards to sweat being responsible for transmission of infectious agents, most of them were aware about basic concepts of IC (Table 2).

***Table 2; Knowledge of surveyed HCP regarding fundamental concepts of infection control***

| Statement(Correct response T;True,F;False) | Response | N | % |
|---|---|---|---|
| All patients are source of infections regardless of their diagnosis (T). | True | 115 | 57.2 |
| | False | 84 | 41.8 |
| Apart from blood and all body fluids, sweat may also potentially contain transmissible infectious agent (F). | True | 115 | 57.2 |
| | False | 84 | 41.8 |
| SP must be practiced by HCP only when contact with blood or body fluid is anticipated (F). | True | 47 | 23.4 |
| | False | 150 | 74.6 |
| SP protect both the patients and HCP (T) | True | 121 | 60.2 |
| | False | 79 | 39.3 |

Overall a large number of respondents were aware of hand hygiene protocol and its implications *(Table 3).* The only noticeable deficiency of knowledge was duration of hand washing (47.8% incorrect answers).

***Table 3; Knowledge of hand hygiene among HCP***

| Statement(Correct response T;True,F;False) | Response | N | % |
|---|---|---|---|
| Hand hygiene is considered as the most important practice to reduce the risk of transmitting infectious agent in healthcare settings (T). | True | 200 | 99.5 |
| | False | 1 | .5 |
| Standard hand washing protocol includes only washing of both hands and not the wrists (F) | True | 56 | 27.9 |
| | False | 143 | 71.1 |
| According to recommended Standard hand washing protocol, hands must be washed for duration of more than 60 second (T) | True | 104 | 51.7 |
| | False | 96 | 47.8 |
| If the hands are visibly dirty/ soiled, alcohol based hand rubs are sufficient (F). | True | 15 | 7.5 |
| | False | 184 | 91.5 |
| Hand washing must be practiced after using the restroom (T). | True | 191 | 95.0 |
| | False | 9 | 4.5 |
| Alcohol hand rubs must be practiced before and after contact with patients (T). | True | 181 | 90.0 |
| | False | 17 | 8.5 |
| When medical equipment in the immediate vicinity of the patients are touched, alcohol hand rubs must be practiced (T). | True | 173 | 86.1 |
| | False | 26 | 12.9 |

*Table 4* highlights knowledge of PPE use. Generally majority responses with regards to PPE use were correct. Considerable lack of knowledge was observed in the belief that PPE use completely eliminates risk of infections and that PPE use is exclusive for laboratory and cleaning staff and the manner in which PPE are to be disposed (51.2%, 60.7% and 37.3% incorrect responses respectively).

**Table 4; Knowledge of PPE use among surveyed HCP**

| Statement(Correct response T;True,F;False) | Response | N | % |
|---|---|---|---|
| PPE like gloves, masks and head caps are also known as barriers precautions (T) | True | 197 | 98.0 |
| | False | 3 | 1.5 |
| The type of PPE chosen depends on the type of exposure and procedures (T). | True | 180 | 89.6 |
| | False | 21 | 10.4 |
| Gloves, masks and isolation gowns may be re-used after cleaning (F) | True | 8 | 4.0 |
| | False | 193 | 96.0 |
| Use of PPE completely eliminates risk of acquiring occupational infections (F). | True | 103 | 51.2 |
| | False | 96 | 47.8 |
| PPE is exclusively suitable to laboratory and cleaning staff for their protection (F). | True | 122 | 60.7 |
| | False | 78 | 38.8 |
| PPE should be used only whenever there is contact with blood (F). | True | 5 | 2.5 |
| | False | 196 | 97.5 |
| Used PPE are to be discarded through regular municipal disposal systems (F). | True | 75 | 37.3 |
| | False | 124 | 61.7 |
| Gloves should be changed between different procedures on the same patient (T). | True | 164 | 81.6 |
| | False | 37 | 18.4 |
| When putting on different PPE, gloves must be the last to be worn (T). | True | 167 | 83.1 |
| | False | 34 | 16.9 |
| Masks and gloves can be re-used if dealing with same patient (F). | True | 27 | 13.4 |
| | False | 173 | 86.1 |

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|---|---|---|---|
| Respirator masks like N-95 must be worn during aerosol generating procedure (intubation/ suctioning) with MERS-CoV suspected/ confirmed patients (T). | True | 183 | 91.0 |
| | False | 17 | 8.5 |

Awareness of sharp injury and its prevention was evaluated on different parameters *(Table 5)*. There was a noticeable ambiguity in responses concerning a few aspects of needle stick injury. 40.8% felt that needles need to be capped after use. 59.7% HCP were not aware of the need to shred needles before final disposal.

***Table 5; Knowledge of needle stick injury and sharp precautions among surveyed HCP***

| Statement(Correct response T;True,F;False) | Response | N | % |
|---|---|---|---|
| Used needles should be recapped after use to prevent injuries (F). | True | 82 | 40.8 |
| | False | 119 | 59.2 |
| Used needles should be bent after use to prevent injuries (F). | True | 51 | 25.4 |
| | False | 148 | 73.6 |
| Used needles must be placed in puncture-resistant containers (T). | True | 190 | 94.5 |
| | False | 10 | 5.0 |
| Soiled sharp objects should be shredded before final disposal (T). | True | 80 | 39.8 |
| | False | 120 | 59.7 |
| Sharps injuries should be managed without the need of reporting (F). | True | 24 | 11.9 |
| | False | 176 | 87.6 |
| Needle-stick injuries are the least commonly encountered in general practice (F) | True | 51 | 25.4 |
| | False | 150 | 74.6 |
| Immediate management of sharps injuries includes washing in running water and soap (T). | True | 156 | 77.6 |
| | False | 44 | 21.9 |
| The risk for a HCP to acquire HIV infection after needle-stick injury is <0.5% (T). | True | 112 | 55.7 |
| | False | 86 | 42.8 |
| Post exposure prophylaxis is used for managing needle stick injuries from a HIV-infected patient (T). | True | 157 | 78.1 |
| | False | 42 | 20.9 |

Regarding cleaning and disinfection of hospital environment three questions were asked *(Table 6)*. Significance of patient care facility in determining frequency of disinfection, association of transfer of infections with procedure and definition of disinfection were assessed. While a majority did know about these aspects, more than one third answered incorrectly with regards to the last two questions.

**Table 6; Knowledge of hospital environmental cleaning and disinfection among HCP**

| Statement(Correct response T;True,F;False) | Response | N | % |
|---|---|---|---|
| The frequency of cleaning and disinfecting environmental surfaces depends on the type of patient care area (post-operative, ICUs/OTs etc.) (T). | True | 152 | 75.6 |
| | False | 46 | 22.9 |
| Transferring infection from instruments is procedure-dependent (T). | True | 127 | 63.2 |
| | False | 74 | 36.8 |
| Disinfection means removal of all pathogenic microorganisms from inanimate surface but does not include elimination of bacterial spore (T). | True | 128 | 63.7 |
| | False | 73 | 36.3 |

Most of the HCP were aware of their health and the measures required to ensure this. 42.8% weren't knowing that the risk of HIV transmission after need stick injury is <0.5%. 51.7% didn't know the need of post-exposure hepatitis B virus immunization *(Table 7)*.

***Table 7; Knowledge of employee's health among HCP***

| Statement(Correct response T;True,F;False) | Response | N | % |
|---|---|---|---|
| HCP with highest risk of exposure to tuberculosis include radiologists (T). | True | 128 | 63.7 |
| | False | 71 | 35.3 |
| Immunization history of HCP should be obtained before recruitment (T). | True | 195 | 97.0 |
| | False | 6 | 3.0 |
| Routine immunizations for HCP include rubella and rabies (F). | True | 68 | 33.8 |
| | False | 133 | 66.2 |
| Annual influenza vaccine must be administered to all HCP (T). | True | 189 | 94.0 |
| | False | 12 | 6.0 |
| Tuberculin skin testing must be done for all HCP annually (T). | True | 150 | 74.6 |
| | False | 50 | 24.9 |
| Following exposure to hepatitis B infection, post-exposure immunization prevents the risk of hepatitis B infection (T). | True | 94 | 46.8 |
| | False | 104 | 51.7 |
| All HCP must receive hepatitis B immunization (T). | True | 192 | 95.5 |
| | False | 8 | 4.0 |

***Possible correlate with IC and SP awareness***

The results were also statistically evaluated using frequency of awareness, T test and ANOVA to understand the association of demographic characteristics of surveyed population with the awareness of SP. The mean awareness of our subjects was 29.6 ± 3 out of 40 with a knowledge score of 74. There was no significant difference in mean awareness among male (29.8 ± 2.5) and female (29.5 ± 3.1) groups and between HCP at government (mean 29.5 ± 2.9) and private hospital (mean 29.7± 3) and p value was not significant (p value for gender 0.559 and type of health institutes 0.699 respectively). A significant difference was observed in awareness among different level of HCP. Health officers were better informed (mean 33) and the ANOVA between the different HCP level was significant (p value 0.0001). Indians and the Filipinos were more aware than other nationalities (mean 33 and 30.9 ± 2.3 respectively) and the ANOVA between nationalities was significant (p value 0.000). No significant difference was observed with regards to years of experience and age of the patients.

***Knowledge score in basics of IC and different SP domains***

We also evaluated knowledge score of different domains of IC and SP. The questionnaire contained 40 items covering different aspects (Table 8). A very high score was obtained in hand hygiene, whereas knowledge of basic concepts of IC was not very convincing.

***Table 8; Knowledge score in IC/SP domains***

| *IC/SP Domains* | *No. of items* | *Mean* | *Knowledge score* |
|---|---|---|---|
| Basic concepts of IC | 4 | 2.23 | 55.8 |
| Hand hygiene | 7 | 5.85 | 83.6 |
| PPE use | 10 | 7.73 | 77.3 |
| Needle stick injury and sharp precautions | 9 | 6.41 | 71.2 |
| Cleaning and disinfection | 3 | 2.02 | 67.3 |
| Employee health | 7 | 5.38 | 76.9 |

**Discussion**

The Study on the Efficacy of Nosocomial Infection Control (SENIC) documented effectiveness of a hospital infection control program that applies standard surveillance and control measures. [13] There is strong evidence of correlation between effective compliance of IC practices by HCP and reduced occurrence of HAI. Saudi Arabia implemented infection control programs in all Ministry of Health (MoH) Hospitals as early as 1987 and since then MoH has been monitoring the compliance. [14] However, in Saudi Arabia the knowledge of health care workers about the risks associated with needle-stick injuries and use of preventive measures was found to be inadequate at both primary healthcare and hospital levels.[8,9]

Studies have been conducted in the past to assess HCP awareness of SP in this region. However either they were restricted to a single hospital [10] or HCP working at primary healthcare level. [8] This study was designed to assess awareness among HCP working at different hospitals both private as well as government of Al-Ahsa.

The mean awareness of our subjects was 29.6± 3 out of 40 with a knowledge score of 74. In Saudi Arabia a relatively low level of awareness of SP has been reported among HCP by Maqbool A. [9] The same study has also found inadequate knowledge of safe use of sharp. [9] Amin T and Al-Wehedy have reported a lower knowledge score of 27.8 ± 5.9 / 50 (59.2%) among Primary Healthcare level in Saudi Arabia.[8] Ghalya MHA and Ibrahim Y have reported knowledge score of 38.71± 7.02 (out of 53 points, 73%) among nursing students in Saudi Arabia. [11] Saleh AL et al have reported higher level of awareness among the doctors compared to the nurses in King Fahad Hofuf Hospital. [10]

We found that only 41.8% respondents understood that sweat is not a

source of infection, nonetheless, responses for other items of basics of IC was satisfactory.

In this study majority of HCP did know about various aspects of hand hygiene, however surprisingly 47.8% did not know about the duration of hand washing. Amin T and Al-Wehedy have reported a higher percentage (80.5%) of HCP unaware of hand washing duration. [8] The likely reason for good knowledge of hand hygiene seems to be emphasis laid down on hand hygiene protocol in hospitals of Saudi Arabia.

Nine statements were included to assess the knowledge of PPE use. In general, PPE use seems to have been mostly understood by the surveyed HCP. The proper way to dispose of used PPE was not known by more than a third of the respondents. Many believed that PPE use completely eliminates risk of acquiring infections and that PPE is exclusive laboratory and cleaning staff (51.2% and 60.7% incorrect responses respectively).

Prevention of needle stick injuries is an occupation risk to the HCP and its importance cannot be underestimated. [15] It is documented that 10%-25% injuries occurred while recapping a used needle. [16] In our study, recapping of used needles was perceived as acceptable by a considerable number of HCP (40.8%). This is one of the main reasons for pricking the finger. Similar lack of knowledge regarding needle recapping is reported in Saudi Arabia. [9] In this study 39.8% of HCP also believed that soiled sharp should be shredded before final disposal. Amin T and Al-Wehedy have noted that 35% respondents in their study approved recapping of the needles after use. [8]

More than two third of HCP were aware of cleaning and disinfection protocol and purpose. A majority were also aware of measures to be taken for hospital employee's health. 46.8% weren't knowing that post-exposure prophylaxis for hepatitis B virus include immunization against Hepatitis B Virus. Lack of awareness of post exposure prophylaxis against HIV and Hepatitis B virus was found significantly high by Amin T and Al-Wehedy as well. [8]

**Conclusion**

The overall knowledge score of surveyed HCP in this study was acceptable. There was no significant difference in mean awareness among male and female groups and between HCP at government and private hospitals. Physicians were more knowledgeable than other HCP (p value=0.0001). Indians and the Filipinos were more aware than other nationalities. No significant difference was observed with regards to years of experience and age of the patients. In most aspects of IC and SP, majority of the respondents answered correctly, however a considerable number of HCP had insufficient knowledge of certain aspects. In comparison to blood and body fluid, sweat was perceived as equally responsible for transmission of infections. Duration of hand washing wasn't known by almost half of the respondents. Proper method of PPE disposal, extent to which risk of acquiring infection with PPE use is reduced and universal use of PPE by all HCP were also not known by a considerable number. Recapping of needles was considered acceptable and so was shredding the soiled needles before disposing off. 46.8% were not aware that hepatitis B immunization must be given as a part of post-exposure prophylaxis for hepatitis B virus exposure. There is a gap in the understanding of a few aspects of SP among HCP which includes correct manner of duration of hand washing, sharp disposal and recapping of used needles, disposal of PPE and post exposure prophylaxis against Hepatitis B virus.

These matters may have a direct bearing on the HCP risk of acquiring blood and body fluid borne infectious agents as well acquisition and transmission of hospital infections in patients. The authors suggest that future education programs must aim at filling these gaps and clear the misconceived notions.

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