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Knowledge, Attitudes, and Practices of Healthcare Workers about Health Care-Associated Infections in Saudi Arabia

Mohammed Saleh Al-Beashi[1], Reem Awad Albalawi[2], Ibtisam Hamdi Mohammed Albalawi[3], Nahed Abdurabh Albalawi[4], Wedad Abdurabh Albalawi[4], Fadia Marzouk Awad Al-Enezi[5], Maram Abdullah Mohammed Albalawi[6], Rana Mohammed Amer Alanazi[7], Aljawhraha Naïf Alosaimi6, Sultan Hassan Alasmari[8], Azoof Alqethami[9], Ahmed Obaid Alenazi[10], Nawaf Obaid Alanazi[11], Yazeed Mohammed Saleh Alsultan[12], Essam Abdulaziz Abdullah Almulhim[13], Abdulaziz Saad Alanzan[13]

1. Nursing Specialist, Ministry of Health, Kingdom of Saudi Arabia. Memoalbe2233@gmail.com
2. Nursing, Shkirat dispensary, Ministry of Health, Kingdom of Saudi Arabia
3. Nursing, Ministry of Health, Kingdom of Saudi Arabia.
4. Nursing, Public Health, Ministry of Health Kingdom of Saudi Arabia.
5. Nursing technician at Prince Abdul Mohsen Hospital in Al-Ula, Kingdom of Saudi Arabia.
6. Nursing, Ministry of Health, Kingdom of Saudi Arabia.
7. Nursing specialist, Ministry of Health, Kingdom of Saudi Arabia.
8. Physical Therapist, General directorate of medical rehabilitation and Long-Term Care, Ministry of Health, Kingdom of Saudi Arabia.
9. Senior specialist health administration, king Abdullah Medical City. Ministry of Health, Kingdom of Saudi Arabia.
10. Dental Assistant, Prince Abdulrahman Advanced Dental Institute, Ministry of Health, Kingdom of Saudi Arabia.
11. Hemodialysis Nursing, Prince Sultan Military Medical City, Ministry of Health, Kingdom of Saudi Arabia.
12. Prosthodontist, Prince Mohammed Bin Abdulaziz Hospital, Ministry of Health, Kingdom of Saudi Arabia.
13. General Dentist, Prince Mohammed Bin Abdulaziz Hospital, Ministry of Health, Kingdom of Saudi Arabia.

ABSTRACT

HAIs are a patient and HCWs concern; nevertheless, few scholars investigate the factors contributing to HAIs incidence. The rationale for this study was to determine awareness level on HAIs among HCWs in Saudi Arabia and their stance towards the issue. Inclusion criteria was being an HCWs in the hospital and exclusion criteria included having any sickness that would make them unable to do this study at the time and the study sample size was 307 HCWs who completed the self-administered questionnaire. Although majority of HCWs (87.9%) knew that they are at risk of getting HIV and HCV from patients, only a third knew they could transmit the diseases to the patients. The results on factors defining higher knowledge included less working hours, no comparable prior experience, awareness of risks related to

infections, and education based on academic courses and journal articles. Nurses, as opposed to physicians were more knowledgeable and adherent of the preventive measures. The least scored item was the ability of the HCWs to identify some of the control measures of HAI, with only 5.9 % scoring wrongly, with the option being personal protective equipment and hand hygiene. HCWs perceived themselves to be at high risk of contracting HAIs (mean score: 7.3). There was poor ad hoc Compliance with Standard precaution as 57.3% of the providers always wore gloves and 52.3% always performed hand wash before putting on gloves. The main sources of HAI information were educational courses (71%) and scientific journals (48.2%). Despite good knowledge and attitudes, adherence to standard precautions was low, emphasizing the need for immediate implementation of policies to improve compliance among all HCWs.

KEYWORDS: HCW, HIV and HCV.

1. Introduction

Health care-associated infections (HAIs) are a major issue for the healthcare system since they frequently result in hospitalized patients becoming unwell and dying. Nowadays, between 5% and 10% of patients admitted to acute care hospitals get at least one infection, and during the past few decades, both the US and Europe have seen an increase in this occurrence (Eriksen et al., 2005; Hopmans et al., 2007; Klevens et al., 2007; Pittet et al., 2005, 2008). A number of efficacious evidence-based strategies have been suggested to mitigate the incidence of healthcare-associated infections (HAIs), and the Centers for Disease Control and Prevention have formulated particular guidelines designed to impede the spread of viruses in hospital environments (Siegel et al..2007).

Healthcare systems and organizations must place a high premium on preventing healthcare-associated infections (HAIs), since they pose a serious threat to the safety of both patients and healthcare workers (HCWs) (Al-Omari et al., 2020; Umscheid et al., 2011). Between 5 and 15% of hospitalized patients and 9–37% of patients admitted to intensive care units (ICUs) are at risk for healthcare-associated infections (HAIs). In the US, 1 in every 25 hospitalized patients is impacted by a HAI at any one time (Magill et al., 2014).

In addition to having significant long-term financial implications, HAIs can cause an infected individual to have a lower quality of life or possibly have a shorter life expectancy (Allegranzi et al., 2011; Iliyasu et al., 2016; Stone et al., 2005; Umscheid et al., 2011). For instance, after receiving a needlestick injury from a patient who was infected with the source virus, the probability of HAIs was 0.3% for HIV, 3% for hepatitis C, and 6–30% for hepatitis B. Of the 35 million health care workers (HCWs) globally, 3 million were exposed percutaneously to bloodborne pathogens (BBPs) annually; 2 million of these were exposed to HBV, 0.9 million to HCV, and 0.17 million to HIV. About US$ 6.5 billion was the yearly economic impact of HAIs in the US alone(Stone et al., 2005). Serious mental health conditions such anxiety, sadness, adjustment disorder, panic attacks, and post-traumatic stress disorder have also been linked to HAIs (Wicker et al., 2014; M.-X. Zhang & Yu, 2013). The extent

and magnitude of the global burden of HAIs seem to be quite significant and significantly underestimated. There are techniques for determining the scope and type of the issue, but in situations where resources and data sources are scarce, these instruments must be modified and made more accessible. In a similar vein, preventative actions like hand cleanliness are frequently easy to put into practice. IPC needs to be prioritized more highly in national health programs, particularly in nations with limited resources.

Fortunately, between 55 and 70 percent of HAIs might be avoided (Umscheid et al., 2011). Measures like standard precautions (hand hygiene, wearing gloves and gowns, protecting one's eyes, coughing etiquette, and safely disposing of sharp objects) and isolation precautions (contact, droplet, and airborne precautions) are advised and frequently used to stop the spread of pathogens to prevent HAIs. Additional IPC strategies used to lower the rate of HAIs include vaccinations for HCWs, prophylaxis following exposure to BBPs, and prevention of infections.

Effective IPC requires an understanding of HCWs. IPC compliance is hampered by a lack of understanding of the rules for IPC as well as potential dangers of microorganism transmission to patients and preventive indications during routine patient care (Albano et al., 2014; Assefa et al., 2020; Geberemariyam et al., 2018). Poor compliance is determined by ignorance of the suitability, effectiveness, and use of IPC measures (Aloush et al., 2018; Russell et al., 2018; Smiddy et al., 2015). The cornerstones of improving IPC procedures to get past these obstacles are training and education (Safdar & Abad, 2008; Ward, 2011). Health care workers need to understand that information is power. Nonetheless, it has been consistently demonstrated that even after education and training, ignorance about IPC measures exists (Atack & Luke, 2008). Hand hygiene, donning personal protective equipment (PPE), vaccination against communicable diseases, infection modes, patient infection assessment, medical instrument decontamination, handling healthcare waste, and needle stick and sharp safety policies are all important topics that health care workers (HCWs) should be aware of. To ensure a decrease in healthcare-associated infections, it is even more crucial that healthcare workers adhere to these IPC precautions, techniques, and strategies.

Healthcare staff, especially physicians and nurses, are vital to the functioning of a country's healthcare system. It is crucial to protect them from infections while they provide care to patients, as failure to do so can have a negative impact on patient management and pose risks to their own health. Despite the World Health Organization (WHO) issuing interim guidance on infection prevention and control (IPC) strategies in March 2020, a significant number of healthcare staff (HCS) have been infected with COVID-19 in various countries, including Saudi Arabia(Bielicki et al., 2020; Z. Zhang et al., 2020). Additionally, studies have shown that the appropriate use of personal protective equipment (PPE) effectively prevents infections among HCS(Liu et al., 2020).

The hospital is the setting where there is the greatest chance of HAIs spreading to patients or the healthcare professionals (HCWs) who attend to them. These healthcare workers are on the vanguard of helping patients who are severely ill, have

life-threatening diseases, or are awaiting a diagnosis. To do this, less focus has been placed on examining the knowledge, attitudes, and actions of HCWs with relation to control policies in this context (Al-Damouk et al., 2004; Parker & Goldman, 2006; Sundaram & Parkinson, 2007). Thus, the goals of this research were to determine the factors linked to HCWs' conventional measures against HAIs and to assess their knowledge, attitudes, and compliance with them among HCWs in Saudi Arabia. HCWs who receive information from educational courses and scientific journals are more likely to be more knowledgeable, to perceive a lower risk, and to perform more appropriate behaviors. It has been hypothesized that participants who possess greater knowledge will perceive a lower risk of contracting a health-related infection (HAI) from patients and will perform their medical duties with better compliance regarding standard precautions.

However, compliance with IPC guidance among HCS has been found to be suboptimal even before the pandemic, and this trend has continued during the COVID-19 pandemic in several countries (Gammon et al., 2008). Various factors contribute to their low adherence to IPC practices, such as inadequate supply of protective resources, insufficient guidelines on their usage, increased workload, and fatigue(Houghton et al., 2020). To improve adherence to IPC practices among HCS, it is important to employ theory-based analysis of human behaviour (Kretzer & Larson, 1998).

In Saudi Arabia (KSA), infectious diseases have resulted in significant loss of life, even though most of these diseases can be treated or prevented. The Ministry of Health (MOH) reports that brucellosis, chickenpox, and amoebic dysentery are the most common chronic infections that are easily transmitted among the population in KSA. To address this issue, healthcare facilities in KSA have established IPC quality assurance departments responsible for implementing infection control programs and guidelines. IPC is an emerging discipline in KSA, and the Saudi MOH has taken the lead in establishing several centers for disease control and prevention at the national level. For instance, the Command-and-Control Centre (CCC) was established with the objectives of enhancing infection prevention and establishing infection tracking systems both in KSA and worldwide. External agencies such as the Centers for Medicare and Medicaid utilize hospital data to monitor hospital performance related to IPC (Abouzeid & Tayeb, n.d.).

In accordance with regulations, every healthcare facility in Saudi Arabia is obligated to develop, establish, and coordinate an IPC program aimed at identifying and reducing the risk of infection acquisition and transmission among patients, staff, and visitors (Colet et al., 2018). The MOH has facilitated the establishment of infection control services in all its hospitals and provides training on infection control to healthcare staff through in-house programs and field epidemiology training. Furthermore, the Saudi Council for Health Specialties has established a subspecialty training institution in infectious diseases within internal medicine and pediatrics to meet the increasing domestic demand. As a result, a substantial number of Saudi internists and pediatricians have now received national training (Ronald & Memish, 2001). Assiri et al. conducted a cross-sectional interview-based study in 2014 to describe and evaluate the status of IPC programs in KSA. The study focused on the eight core components of IPC programs that are considered crucial for enhancing

capacity in preventing healthcare-associated infections (HAIs). Each healthcare facility was assigned a combined score for these eight components, which include the organization of IPC programs, technical guidelines, human resources, HAI surveillance, microbiology lab support, environment, monitoring and evaluation, and public health links. The study's findings revealed that the combined scores of the facilities ranged from 42% to 57%.

It is critical to address the literature on HCWs' awareness of IPC to prevent such hazardous exposures, given the possible negative effects that HAIs may have on patients and HCWs, as well as the clinical, national, and psychological burdens which have been discussed. To improve the quality and safety of health service delivery as well as the health outcomes of those who utilize those services, this study will also analyse potential factors influencing HCW compliance with the IPC measures.

Research Questions:

- What is the Knowledge of healthcare workers about health care-associated infections in Saudi Arabia?
- What is the attitude of healthcare workers about health care-associated infections in Saudi Arabia?
- What is the practice of healthcare workers about health care-associated infections in Saudi Arabia?

Research Objectives:

- To determine the Knowledge of healthcare workers about health care-associated infections in Saudi Arabia.
- To determine the attitude of healthcare workers about health care-associated infections in Saudi Arabia.
- To determine the practice of healthcare workers about health care-associated infections in Saudi Arabia.

2. Methods

Study design

In this research, the descriptive approach was used, characterized by its emphasis on describing and elucidating the occurrences within a community. The descriptive approach is recognized for portraying and explaining the unfolding events in each context. Furthermore, it can be defined as a methodology employed to delineate phenomena within society, utilizing statistical methods to establish connections between variables, thereby deducing relationships among the study variables. These relationships are then leveraged to predict the occurrence of these phenomena in the future.

The primary objective of this study is to determine Knowledge, attitudes, and practices of healthcare workers about health care-associated infections to achieve this goal, the researcher opted for the descriptive approach. The descriptive approach facilitates an exploration of Knowledge, attitudes, and practices of healthcare workers about health care-associated infections by collecting pertinent data through a structured questionnaire.

Study Population and Sample

Quantitative analysis relies heavily on the use of samples since it is impractical to survey the complete population. This is particularly true when the target demographic is large, as in the case all Healthcare workers in Saudi Arabia. As a result, we decided to send our survey to a select group of people. To more confidently extrapolate our findings to the entire population, we should take a random sample from that population. This would ensure that every member of the population has an equal chance of being selected to participate in the study. Our goal in selecting this sample was to ensure that it was representative of all Healthcare workers in Saudi Arabia.

Data collection

Each hospital's medical director got a letter outlining the survey's purpose and asking for the HCWs' permission to participate. All health care workers received a letter from the medical directors outlining the survey's enrolment process and goals, along with a self-administered anonymous questionnaire and an envelope to make return easier. The letter assured respondents that participation in the survey was entirely voluntary and that the information they submitted would only be used to further the goals of the research. Returning the completed questionnaire indicated consent to participate.

Based on the nature of the data and the methodology followed in the study, the researcher found that the most appropriate tool to achieve the objectives of this study is (the questionnaire). The study tool was built by referring to the literature and previous studies related to the subject of the study, The impact of financial and moral incentives on the performance of paramedics in the Red Crescent Authority in the Makkah region. The researcher designed the initial questionnaire and distributed it to the study sample to find out the data that this tool seeks to collect. The validity and reliability procedures for this tool were verified.

The questionnaire comprised five categories of questions: (1) demographic and occupational characteristics; (2) knowledge about the risks of acquiring and/or transmitting certain HAIs for/to a patient and standard precautions for prevention; (3) attitudes toward precautionary guidelines and perception of the risk of acquiring HAI; (4) practice of standard precautions; and (5) from which sources they received up-to-date information about HAIs.

Data analysis

Stepwise logistic and linear regression approaches were used in multivariate analysis to see whether the predictor variables were independently linked to the following outcomes of interest: Knowledge of the risk that a healthcare worker (HCW) poses

for contracting both HIV and Hepatitis C (HCV) from a patient (Model 1); awareness that standard precautions (gloves, mask, protective eyewear) and hand hygiene after removing gloves are effective ways to control HAIs (Model 2); awareness of the patient's perceived risk of contracting a HAI (Model 3); frequent or constant use of gloves when in direct contact with them; and knowledge of the importance of hand hygiene after removing gloves (Model 4). The outcome variables, which were initially divided into several categories, were condensed to two levels for analytical purposes. According to questions B1a and B1c in Model 1, healthcare workers were categorized as those who knew the risk of acquiring HIV and HCV from a patient versus all others; in Model 2, they were grouped as those who knew that using standard precautions (masks, gloves, protective eyewear) and hand hygiene after removing gloves are HAIs control measures versus all others; and in model 4, health care workers were categorized based on their responses to D3 and D5, which asked about how frequently or always they used gloves when having direct patient contact and how they cleaned their hands after taking off their gloves compared to everyone else. Every model had the subsequent independent variables: The following information is provided: gender (male = 0, female = 1), age (continuous, in years), working category (physician = 0, nurse = 1), number of years in practice (continuous), number of patients seen in a workday (continuous), number of working hours in a week (continuous), knowledge about the risk of HCWs spreading HCV and HIV infections to patients (no = 0, yes = 1), and knowledge that HCV and HIV infections can be serious (no = 0, yes = 1), knowledge that healthcare workers' hands can transmit nosocomial pathogens (no = 0, yes = 1), that scientific publications and educational courses are good sources of information about HAIs (no = 0, yes = 1), and that further information about HAIs is needed (no = 0, yes = 1). The following variables were also included: knowledge that the use of standard precautions is a HAIs control measure (no = 0, yes = 1) in Model 1; knowledge about the risk for a HCW of acquiring HCV and HIV infections from a patient (no = 0, yes = 1), and knowledge that invasive procedures are a risk factor for HAIs (no = 0, yes = 1) in Models 2-4; marital status (single/separated/divorced/widowed = 0, married = 1), number of other persons in the household (0 = 0, 1 = 1, 2 = 2, 3 = 3, 4 = 4, >4 = 5), and knowledge that using standard precautions (gloves, mask, protective eyewear) and hands hygiene after removing gloves are HAIs control measures (no = 0, yes = 1). The following variables were incorporated into the models: in Model 1, knowledge that standard precautions serve as a measure to control HAIs was included (no = 0, yes = 1). Models 2-4 included knowledge about the risk of healthcare workers (HCWs) acquiring HCV and HIV infections from patients (no = 0, yes = 1), as well as knowledge that invasive procedures pose a risk for HAIs (no = 0, yes = 1). Model 3 added marital status (single/separated/divorced/widowed = 0, married = 1), the number of other individuals in the household (0 = 0, 1 = 1, 2 = 2, 3 = 3, 4 = 4, more than 4 = 5), and knowledge that standard precautions (gloves, masks, protective eyewear) and hand hygiene after glove removal are measures to control HAIs (no = 0, yes = 1). Model 4 included knowledge that hand hygiene after glove removal is a control measure for HAIs (no = 0, yes = 1), a positive attitude towards using guidelines for HAI control practices (no = 0, yes = 1), a positive attitude towards hand hygiene measures to

mitigate risks for patients (no = 0, yes = 1), a positive attitude towards hand hygiene measures to protect HCWs (no = 0, yes = 1), and the perceived risk of acquiring an HAI.

The final models comprised the variables that were substantially linked with the outcomes of interest at a p-value of less than 0.25, based on a univariate primary analysis. Following that, three multivariate logistic regression models and one stepwise multivariate linear regression model were built, with a significance threshold of 0.4 for variable removal and 0.2 for variable entry in the model. The logistic models employed odds ratios (ORs) and their 95% confidence intervals (CIs) to quantify the relationship between predictors and outcomes. Every test had two tails, and a statistically significant result was one with a p-value of 0.05 or less. Stata, a statistical program, was used to analyse the data [14].

The researcher used the statistical software SPSS for data analysis, which is the appropriate method for such types of studies. Several statistical methods were employed, including:

- Pearson Correlation coefficient: This was used to ensure the validity of internal consistency.
- Cronbach's Alpha Scale: This test was utilized to confirm the reliability of the questionnaire.
- Frequencies and percentages: of study sample responses.
- Mean and standard deviation: for each statement in the questionnaire, as well as the calculation of the mean and standard deviation for each axis of the questionnaire.
- Simple Linear Regression coefficient: This was used to determine the strength and direction of the relationship between the independent variable and the dependent variable.

3. Results

A total of 307 participants returned the questionnaire. With a mean age of 44, a mean of 11 years in practice, and an average of 30 patients seen in a day, two-thirds of the respondents were men.

Table 1 Characteristics of participant (n=309)

Demographic		Frequency	Percent
Gender	Male	205	66.3%
	Female	104	33.7%
Educational Level	Middle education	203	65.6%
	Bachelor's Degree	86	27.8%
	Postgraduate Studies (Master's - PhD)	20	6.5%
Job Title	Technician	130	41.9%
	Specialist	159	51.6%
	Administrative	20	6.5%
Years of Experience	Less than 3 years	60	19.4%
	4-10 years	150	48.4%

	11-15 years	49	16.1%
	More than 15 years	50	16.1%

Table 2 presents the responses on HCWs' level of knowledge. While most (87.9%) were aware that a healthcare worker can get HIV and HCV from a patient, fewer than one-third were aware that a healthcare worker can also infect a patient. The multivariate analysis's findings about the relationships between the various explanatory variables and the various outcomes of interest are displayed in Table 3. HCWs who worked fewer hours per week (OR = 0.9; 95% CI 0.84-0.97), had fewer years of experience (OR = 0.9; 95% CI 0.85-0.96), were aware of the possibility that an HCW could contract HIV and HCV from a patient (OR = 6.07; 95% CI 1.31-28.14), were aware that HIV and HCV infections can be serious (OR = 8.09; 95% CI 3.31-19.81), had learned about HAIs from academic courses and scientific journals (OR = 3.54; 95% CI 1.22-10.24), and did not require further information about HAIs (OR = 0.06; 95% CI 0.01-0.55)(model 1). These HCWs were more likely to be aware of the risk that an HCW could contract HIV and HCV from a patient. The usage of gloves, masks, and protective eyewear (94.1%) as well as hand hygiene procedures after taking off gloves (91.5%) were accurately identified by the vast majority as appropriate HAIs management methods. In total, 86.3% of healthcare workers knew about both preventive measures. Of these, nurses had the highest awareness (OR = 2.34; 95% CI 1.09-5.01), as did HCWs who saw fewer patients in a day (OR = 0.98; 95% CI 0.95-0.99). These workers also knew that HCWs' hands can spread nosocomial pathogens (OR = 4.64; 95% CI 1.85-11.68), those who learned about HAIs from academic courses and scientific journals (OR = 3.54; 95% CI 1.47-8.5), and those who were unaware of the possibility of an HCW passing on HCV and HIV infections to a patient (OR = 0.24; 95% CI 0.11-0.5) (model 2).

Table 2 Knowledge about health care-associated infections and control measures

Number of question	Questions (correct response)	n	%
Health care-associated infections that a healthcare worker can acquire from a patient			
B1b	Hepatitis C (true)	289	94.1
B1c	Human Immunodeficiency Virus (true)	277	90.2
B1h	Tetanus (false)	264	86
B1d	Influenza (true)	189	61.6
B1a	Hepatitis B (true)	177	57.7
B1i	Tuberculosis (true)	122	39.7
B1f	Mumps (true)	43	14
B1g	Rubella (true)	43	14
B1l	Varicella (true)	40	13
B1e	Measles (true)	35	11.4
Health care-associated infections that a healthcare worker can transmit to a patient			
B2h	Tetanus (false)	297	96.7

Number of question	Questions (correct response)	n	%
B2d	Influenza (true)	210	68.4
B2b	Hepatitis C (true)	95	30.9
B2c	Human Immunodeficiency Virus (true)	74	24.1
B2i	Tuberculosis (true)	48	15.6
B2a	Hepatitis B (true)	45	14.7
B2f	Mumps (true)	17	5.5
B2l	Varicella (true)	16	5.2
B2e	Measles (true)	14	4.6
B2g	Rubella (true)	14	4.6
Control measures			
B6	Wearing gloves, mask, and protective eyewear (true)	289	94.1
B4	Hands hygiene measures after removing gloves (true)	281	91.5
B5	Changing mask before going to another patient (true)	222	72.3
Risk factors			
B7	Invasive procedures (true)	281	91.5
B8	HCWs' hands are vehicle for transmission of nosocomial pathogens (true)	275	89.6

Table 3 Multivariate logistic (1, 2, 4) and linear (3) regression models results

Variable	OR	95% CI	p
Model 1. HCWs who know the risk of acquiring HCV and HIV infections from a patient			
Log likelihood = -81.13, $\chi^2 = 63.68$ (8 df), $p < 0.0001$			
Know that HCV and HIV infections can be serious	8.09	3.31-19.81	<0.001
Fewer number of years in practice	0.9	0.85-0.96	0.002
Fewer number of working hours in a week	0.9	0.84-0.97	0.006
Need of additional information about HAIs	0.06	0.01-0.55	0.012
Educational courses and scientific journals as sources of information about HAIs	3.54	1.22-10.24	0.02
Know the risk for a HCW of transmitting HCV and HIV infections to a patient	6.07	1.31-28.14	0.021
Older age	1.06	0.99-1.14	0.08
Fewer number of patients seen in a day	0.99	0.96-1.01	0.32
Model 2. HCWs who know that using standard precautions and hands hygiene after removing gloves are HAI's control measures			
Log likelihood = -98.84, $\chi^2 = 47.37$ (6 df), $p < 0.0001$			
Not know the risk for a HCW of transmitting HCV and HIV infections to a patient	0.24	0.11-0.5	<0.001
Know that HCWs hands are vehicle for transmission of nosocomial pathogens	4.64	1.85-11.68	0.001
Educational courses and scientific journals as sources of information about HAIs	3.54	1.47-8.5	0.005
Working as a nurse	2.34	1.09-5.01	0.029
Fewer number of patients seen in a workday	0.98	0.95-0.99	0.05
Fewer number of years in practice	0.97	0.93-1.01	0.16
Model 4. HCWs who often or always use gloves when at direct contact with a patient and performed hands hygiene measures after removing gloves			
Log likelihood = -114.73, $\chi^2 = 71.02$ (10 df), $p < 0.0001$			
Know that hands hygiene after removing gloves is a HAIs control measure	8.09	2.83-23.1	<0.001

Fewer number of patients seen in a workday	0.97	0.95-0.99	0.014
Working as a nurse	2.33	1.13-4.79	0.022
Know that invasive procedures are a risk factor for HAI	2.69	0.92-7.84	0.07
Educational courses and scientific journals as sources of information about HAIs	2.15	0.89-5.2	0.09
Know the risk for a HCW of acquiring HCV and HIV infections from a patient	2.22	0.88-5.58	0.09
Higher perceived risk for a HCW of acquiring a HAI	1.15	0.96-1.37	0.12
Beliefs that the use of guidelines for HAIs control practices do not reduce the risk	0.4	0.1-1.61	0.2
Not know the risk for a HCW of transmitting HCV and HIV infections to a patient	0.62	0.27-1.4	0.25
Younger age	0.98	0.94-1.02	0.31
Variable	Coeff.	t	p
Model 3. HCWs who perceive a risk of acquiring a HAI from a patient			
$F(10,296) = 4.88$, $p < 0.0001$, $R^2 = 14.2\%$, adjusted $R^2 = 11.3\%$			
Need of additional information about HAIs	1.23	3.86	<0.001
Working as a nurse	0.66	3.01	0.003
Educational courses and scientific journals as sources of information about HAIs	0.76	2.43	0.016
Know that HCWs hands are vehicle for transmission of nosocomial pathogens	0.72	1.98	0.049
Know the risk for a HCW of transmitting HCV and HIV infections to a patient	0.32	1.24	0.22
Fewer number of years in practice	-0.02	-1.2	0.23
Know that HCV and HIV infections can be serious	0.37	1.19	0.23
Know the risk for a HCW of acquiring HCV and HIV infections from a patient	0.38	1.06	0.29
Higher number of other persons in the household	0.07	1.03	0.3
Higher number of patients seen in a workday	0.01	0.98	0.33
Constant	3.6		

HCW = Healthcare worker; HCV = Hepatitis C Virus; HIV = Human Immunodeficiency Virus; HAI = Health care-associated infection

HCWs are regarded as being at high risk when it comes to their perceived risk of contracting a HAI, with a mean score of 7.3. The results of the multivariate linear regression analysis demonstrated that several factors were significantly independently associated with a higher level of perceived risk, including being a nurse, being aware that healthcare workers' hands can transmit nosocomial pathogens, learning about HAIs from academic courses and scientific journals, and needing more information about HAIs (Model 3). Additionally, HCWs showed very favorable views, as seen by the 94.5% and 89.2% of respondents who agreed, respectively, that hand hygiene practices taken after treating patients lower risk and that standards for preventing HAIs should be closely adhered to.

Table 4 reports the responses on the HCWs who frequently or always use practices to lower the risk of HAIs. Just 57.3% of them said they always wore gloves, and 85.2% said they changed their gloves after every patient. In contrast, 52.3% and 79% of them said they always washed their hands before and after donning gloves, respectively. Eighty-eight percent of the respondents said they used gloves frequently or always and cleaned their hands after taking them off. Nurses (OR = 2.33; 95% CI 1.13-4.79), healthcare workers who saw fewer patients (OR = 0.97; 95% CI 0.95-0.99), and those who were aware that washing their hands after taking off gloves constituted a preventative strategy (OR = 8.09; 95% CI 2.83-23.1) were the groups with higher frequency of this activity (Model 4).

Table 4 Healthcare workers who often or always adopt practice to reduce the risk of

health care-associated infections

Number of question	Practice	n	%
D10	Placing needles in sharp's containers	278	90.5
D3	Wearing gloves when at direct contact with a patient	272	88.6
D6	Changing gloves before going to another patient	267	87
D2	Hands hygiene measures before going to another patient	266	86.6
D5	Hands hygiene measures after removing gloves	264	86
D1	Hands hygiene measures before starting the working activity	240	78.2
D4	Hands hygiene measures before wearing gloves	202	65.8
D9	Recapping needles after using	151	49.2
D7	Wearing protective eyewear when at direct contact with a patient	110	35.8
D8	Wearing mask when at direct contact with a patient	109	35.5

Educational courses were the most often cited source of information about HAIs (71%), followed by scientific journals (48.2%); yet, 85.3% of respondents felt that their prior knowledge needed to be updated.

4. Discussion

Since most participants were aware of several infections that a healthcare worker (HCW) can contract from a patient and the recommended precautions, their knowledge of the many components of healthcare-associated infections (HAIs) was generally high and compatible with current scientific data. On the other hand, there are several topics about which there is less information, especially when it comes to infections that a healthcare worker can spread to a patient. This means that to lower the rate of HAIs, this particular population needs to learn more. In the hospital setting, ongoing medical benefits necessitate ongoing educational input.

The working activity was found to be a significant determinant of the participants' perceived risk of contracting a health-associated infection (HAI), their knowledge of standard precautions and hand hygiene after removing gloves as control measures for HAIs, and their use of gloves and hand hygiene practices. Nurses were shown to be more knowledgeable than physicians, to see themselves as being at a larger risk, and to utilize the proper precautions to prevent HAIs. There is a chance that these variations can be linked to the increased engagement in HAI prevention initiatives. Furthermore, sharing knowledge about HAIs affects attitudes and actions since knowledgeable healthcare workers (HCWs) can respond accurately and employ HAI management strategies when they have access to information from scholarly publications and educational courses. This demonstrates that giving HCWs the right knowledge is sufficient to guarantee understanding, particularly when it comes to a specific risk category like the study's sample.

According to the findings of this national study, the majority of participants used gloves frequently or always and cleaned their hands after taking them off to reduce the risk of healthcare-associated infections. There were no variations in the HCWs' reported adherence to the recommendations based on their age or gender. Rather, two independent indicators of compliance showed a favorable correlation: the number of patients cared for in a given day and the awareness that washing your hands after taking off your gloves is a preventive strategy. The correlation between inadequate knowledge and the underutilization of suitable control measures supports

the necessity of stepping up educational initiatives. Additionally, compared to earlier surveys, there was a significant decrease in the usage of protective barriers. For example, in a US sample of emergency care residents, 96% and 99%, respectively, utilized gloves at least 95% of the time for drainage procedures and irrigation and incision (Ellison et al., 2007). In Canada's pediatric emergency departments, doctors and nurses self-reported a high percentage of handwashing before and after every patient, scoring 4.9 and 4.5 on a 5-point scale, respectively, and 3.3 and 3.2 for using gloves during patient examinations (Parker & Goldman, 2006). In a major trauma situation, 99% of orthopedic surgeons in accident and emergency departments across England responded to a nationwide telephone survey, but only 18% and 21%, respectively, used face mask and eye protection (Sundaram & Parkinson, 2007). Finally, our values for asepsis in invasive procedures and hands hygiene between patient visits were greater than those in EDs in the UK and NZ, with values of 27% and 58% and 14% and 12%, respectively (Al-Damouk et al., 2004).

Positive global and particular beliefs were stated by a significant portion of respondents, indicating that attitudes regarding HAIs are promising. Specifically, 94.5% of respondents said that rules ought to be made and adhered to. According to the multivariate analysis, having a high perceived risk of acquiring a healthcare-associated infection (HAI) was strongly predicted by being a nurse, being aware that healthcare workers' hands can carry nosocomial germs, and needing and getting information about HAIs.

When evaluating the findings, it is important to take into account the possible limitations of the study's design and measuring techniques. As a cross-sectional study, it first only offers corroborating evidence for the haphazard character of the associations that have been noted. Although it is impossible to prove a direct correlation between variables and results, the association under discussion has been strongly supported by data. The self-administered questionnaire's potential for reporting bias is a second drawback. There is always uncertainty over the quality of these surveys, and it is challenging to say for sure if the answers accurately represent the work that HCWs do.

In particular, despite the fact that all interviews were conducted in confidence, compliance with control measures was entirely dependent on the subjective opinions of HCWs, raising the chance that they may overreport compliance. Direct observation of actual practice would be a more effective way to gauge compliance, even though being watched over might increase compliance on its own. One other drawback was the very low response rate of 55%, which could have been caused by the time restrictions that busy practitioners were under. We were unable to determine whether there was a subset that consistently did not reply since we were unable to obtain comprehensive information on non-respondents. This response rate may reduce the overall generalizability of the results to all HCWs in EDs, even though it does not reflect internal validity of the findings. However, the response rate might not have significantly contributed to non-response bias because HCWs often exhibit similar attitudes and actions.

5. Conclusion

Healthcare workers in emergency departments exhibit good knowledge and attitudes, but the low rate of adherence to standard precautions regarding healthcare-associated infections (HAIs) makes it abundantly evident that initiatives to improve healthcare policies must be implemented immediately. It also emphasizes the importance of all HCWs adopting and adhering to preventive recommendations.

Research Limitations

Despite the valuable insights gained from this study, there are some limitations that should be noted:

- Generalizability: The study focused solely on Saudi Arabia, and the results may not be fully generalizable to other regions or healthcare organizations.
- Sample Size: Although the sample was representative of HCWs in the region, a larger sample size across different regions or organizations could provide more comprehensive results.
- Self-Reported Data: The reliance on self-reported data from HCWs may introduce bias, as respondents may have provided socially desirable answers or may not have fully understood some questions.
- Limited Variables: The study focused on Knowledge, attitudes, and practices of healthcare workers about health care-associated infections.

Recommendations

Based on the findings and limitations of this study, the following recommendations are proposed for both practitioners and researchers:

- Expand Training Programs To reduce the HAIs, HCWs should be offered targeted training programs. These programs should focus on Increase their knowledge and skills.
- Organizations should encourage HCWs to pursue higher education and professional development opportunities. Scholarships or support for advanced degrees, such as Master's programs, could enhance the skillset of HCWs.
- Implementing a standardized performance evaluation system that takes into account factors like professional seniority, educational level, and job title would help in improving service quality.
- Future studies should include a larger, more diverse sample from different regions and organizations. Additionally, they could explore other potential factors influencing service quality, such as organizational structure, access to resources, or patient feedback.
- Leveraging modern technology, such as advanced communication tools and medical devices, could improve the efficiency and responsiveness of paramedic teams in emergency situations.

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