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Infection Prevention and Control Practices among Staff Nurses in Hail, KSA: Basis for Improved Patient Safety

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Abstract
Aim: Hospital acquired infections are preventable with proper healthcare behavior among workers and strict compliance. This study aimed to determine the infection prevention and control practices by staff nurses. Methods: This study utilized the correlational approach in exploring the infection prevention and control practices among nurses in government hospitals in Ha'il region Kingdom of Saudi Arabia. There were 189 respondents resulting from convenience sampling. Descriptive statistics were used to represent the demographic profiles and scores of the participants while Spearman's rho was used to determine the significant relationship between the four (4) dimensions in IPC practice. Data gathering was conducted between November and December 2019. Results: The infection prevention and control guidance (89.96 ± 10.74), healthcare associated infection associated infection (84.92 ± 9.49), and built environment, material and equipment (86.23 ± 12.03) were found to have an advanced level while infection control programme is intermediate in level (29.99 ± 3.99). Meanwhile, a weak positive correlation on ($r = 0.191$; $p < .008$) found in infection and control programmed and infection prevention; and IPC programmed level and built materials and equipment ($r = 0.16$; $p < .028$). There is a medium level of correlation between the level of practice in Built materials and equipment ($r = -0.327$). Conclusion: The four dimensions, the level of practice for the Infection Prevention and Control Programme is found to be Intermediate. Whereas, the other three dimensions, Infection Prevention and Control Guidelines, Healthcare-Associated Infections Surveillance, and Built Environment, Materials and Equipment for Infection Prevention and Control at the Hospital Level, showed an Advanced level of practice by the staff nurses. overall, the IPC level of practice among nurses is described to be Advanced. The IPC core components are fully implemented according to the WHO recommendations and appropriate to the needs of the facility.

Keywords: Infection Prevention, Control Practices, Staff Nurses

1. Introduction

Health Associated Infections (HAIs) are infections that become clinically evident after 48 hours of hospitalization and have become a major concern among hospitals around the world. They contribute tremendously to issues surrounding patient safety. HAIs are infections that patients acquire and can be associated with procedures like surgeries and the various devices used in medical procedures, such as catheters or ventilators. Although some HAIs are preventable, they are considered negative indicators of quality of patient care, adverse events, and patient safety issues (Collins, 2008).

All hospitalized patients are susceptible to contracting nosocomial infections. Some patients are at greater risk than others-young children, the elderly, and persons with compromised immune systems are more likely to get an infection. HAIs are known to be due to prolonged hospital stay, long-term disabilities, and increased microbial resistance to drugs. These result in a massive additional financial burden for hospitals, high costs for patients and their families, and unnecessary deaths. Affected patients and healthcare workers suffer from decreased quality of life and sometimes death (Monegro et al., 2021).

Healthcare-associated infections (HAI) in the Kingdom of Saudi Arabia and internationally are associated with increased length of stay, mortality, antibiotics cost, and overall hospital cost. About 250,000 central line-associated bloodstream infections (CLABSI) occur in the US yearly, with a rate of 0.8 per CL-days and attributed mortality of 12%–25%. CLABSI constitutes 14.2%–38.5% of HAIs in the Kingdom, with rates varying from 2.2 to 29.7/1000 CL-days and crude device-associated mortality of 16.8%–41.9%. Similarly, a point prevalence survey was conducted among inpatients in Saudi Arabia, and the findings showed that the most common types of infections were pneumonia (27.2%), urinary tract infections (20.2%), and bloodstream infections (10.5%). Approximately 19.2% of healthcare-associated infections were device associated (Khan et al., 2019).

Literature shows that the incidence of HAIs in hospitals was often not reported. Hence, there were no evident records to suggest the exact number of HAIs, not until 2004, where many hospitals were required to report HAIs (Gastmeier et al., 2005). HAIs are considered an indicator of poor quality of patient care, an adverse event, and a patient safety issue (Collins, 2008).

HAIs are preventable with proper healthcare behavior among workers and strict compliance with evidence-based infection prevention procedures and guidelines (Collins, 2008). The primary concern of every healthcare facility is to control the spread of disease and minimize the incidence of HAIs. It becomes more critical than ever for hospitals to ensure that infectious diseases do not spread. Hence, hospitals developed Infection Prevention and Control programmes and guidelines based on the mandate of WHO to reduce the incidence of HAIs (WHO, 2020). It is therefore, the aim of this study to determine the infection prevention and control practices by staff nurses. The findings of this study will benefit the respondent hospitals to revisit existing protocols. Likewise, the results will aid in strengthening the call for a more heightened patient safety advocacy to counter the increasing incidence of HAIs among hospitals in Saudi Arabia.

2. Theoretical Background

The framework underpinning this study, the Infection Prevention and Control Assessment Framework (IPCAF), by the World Health Organization. The study of Aghdassi et al (2019) was entitled A National Survey on the Implementation of Key Infection Prevention and Control Structures in German Hospitals. The survey was conducted among 736 hospitals using the IPCAF. The results illustrated an overall median score of 690 for all hospitals, which corresponded to an advanced infection prevention and control practice. However, a small percentage of hospitals fell into the category of "Basic," and more hospitals are categorized as "Intermediate" and "Advanced" in infection prevention and control practices. The study reiterated the potentials for improvement, particularly about workload and staffing. The survey represents a successful attempt at promoting IPCAF and encouraging hospitals to utilize WHO tools for hospitals (Aghdassi et al., 2019).

The IPCAF is a tool to support the World Health Organization (WHO) Guidelines on core components of IPC programmes at the acute healthcare facility level. A framework is a systematic tool that provides a baseline

assessment of the infection prevention and control programme and activities of a healthcare facility. Likewise, it provides ongoing evaluations through repeated administration to document the progress of the healthcare facility overtime. The purpose is to continuously improve infection prevention and control measures for excellent patient safety (Aghdassi et al., 2019).

The IPCAF is a structured, close-formatted questionnaire with an associated scoring system. It is a self-assessment tool but can also be used for joint assessments. It is a global tool that is valid for the assessment of IPC standards in any country. The framework's goal is to assess the current IPC situation of the hospital and identify the strengths and gaps that will be useful for plans. It is also considered a diagnostic tool to detect relevant problems that require improvement and identify areas where international standards and requirements can be met (Aghdassi et al., 2019).

Thus, IPCAF gives a score that can be used as an indicator of the level of progress from an improvement perspective. The results can be used to develop an action plan.

3. Methodology

3.1. Research Design

This study utilized the correlational approach in exploring the infection prevention and control practices among nurses in government hospitals in Ha'il, KSA.

3.2. Locale

The four major government hospitals hospitals in Ha'il, Saudi Arabia were chosen and coded as Hospital A, B, C and D. The hospitals are under the jurisdiction of the Ministry of Health (MOH) of KSA. By way of its objectives, policies, and projects, the MOH seeks to accomplish a promising future through its vision to deliver quality integrated and comprehensive healthcare services (MOH, 2019).

3.3. Respondents

The staff nurses from the selected government hospitals of Ha'il, KSA, were formally invited to participate in the study through its Continuing Nursing Education Department. There were a total of 189 respondents as a result from convenience sampling.

3.4. Instrument

The survey questionnaire used in this study was adapted from the Infection Prevention and Control Assessment Framework (IPCAF), which supports the implementation of the WHO Guidelines on core components of IPC programmes at the acute health care facility level. The IPCAF is a systematic tool that can provide a baseline assessment of the IPC programme and activities within the health care facility, and ongoing evaluations through repeated administration to document progress over time and facilitate improvement[7].

Part 1 of the questionnaire is the respondents' demographic profile, which covers the age, gender, nationality, educational attainment, years of service in their respective hospitals, and whether they have attended seminars, training, workshops on IPC, or none at all.

Part II of the questionnaire is divided into four (4) dimensions. Each item in each dimension is appointed with a corresponding point/s based on the IPCAF. Dimension 1 is *Infection Prevention and Control Programme,* which has six items with a total score of 40 points (0 – 10.99 *Inadequate*; 11.00 – 20.99 *Basic*; 21.00 – 30.99 *Intermediate*; 31.00 – 40.00 *Advanced*). Dimension 2 is *Infection Prevention, and Control Guidelines* have 20 items and with a total of 90 points (0 – 22.49 *Inadequate*; 22.50 – 44.99 *Basic*; 45.00 – 67.49 *Intermediate;* and 67.50 – 90.00 *Excellent)*. On the other hand, Dimension 3 is *Healthcare-Associated Infections Surveillance* has 24 items with a total score of 95 points (0 – 23.74 *Inadequate*; 23.75 – 47.49 *Basic*; 47.50 – 71.24 *Intermediate*; and 71.25 – 95.00 *Excellent*). Lastly, Dimension 4 *Built Environment, Materials, and Equipment for Infection Prevention and*

Control at the Hospital Level has 16 items and with 110 points (0 – 27.49 *Inadequate;* 27.50 – 54.990 *Basic*; 55.00 – 82.49 *Intermediate;* 82.50 – 110 *Excellent).*

All the scores of the four (4) dimensions are added to determine the overall level of practice. A score of 0 – 83.74 describes the IPC level of practice to be *Inadequate*; a score of 83.75 – 167.49 means the level of practice is *Basic*; a score of 167.50 – 251.24 describes the practice to be *Intermediate*, and finally, a score of 251.25 to 335 is described to be *Advanced* level of practice.

3.5. Statistical Treatment

Descriptive statistics were employed to obtain the mean and standard deviation of each of the four dimensions and the overall mean to describe the level of practice of Infection Prevention and Control. Likewise, Spearman's rho was used to determine the significant relationship between the four (4) dimensions in IPC practice.

3.6. Data Gathering Procedure

The study commenced after clearance was issued from the Institution Review Board of the University of Ha'il. Letters were sent to the respondent hospitals to seek consent for the survey. The survey was done in close coordination with the hospitals' Continuing Nursing Education (CNE) departments. A date was set for the survey questionnaire distribution, and ample time was given for the respondents to answer the questions before the retrieval. Data was encoded and tabulated, and descriptive statistics were employed to treat the data. Data was collected between November of 2019 until January 2020.

3.7. Ethical Consideration

The conduct of the study followed strict compliance to the protocol set by the Ethics Board. Approval was sought from the hospital directors to conduct the study among its staff nurses. The questionnaires were distributed to the respondents. The respondents were asked to sign informed consent signifying their willingness to participate in the study by answering the survey questions. The informed consent indicated the purpose of the study, their role as participants, and may refuse or withdraw from participating at any point during the data collection. The participants' responses were treated with the utmost confidentiality and were only used solely for the study.

4. Results

4.1. Demographic Profile

Table 1 presents the demographic profile of the respondents. The majority (66.7%) of the respondents are within the 25 to 30 age group, and there are 182 (96.3%) female respondents, as compared to male respondents. Indians, Saudis, and Filipinos comprise the bulk of respondents, and 97.4% of the nurses are with baccalaureate degrees only. Seventy-one or 37.6% are with less than five years of work experience in their respective hospitals. Close to it are 33.3% of the respondents with five to ten years of work experience. Only two or 1.06% of the respondents have more than 25 years of work experience.

Table 1: Demographic profile of the participants. N=189

DEMOGRAPHICS	FREQUENCY	PERCENTAGE (%)
Age:		
25 – 30	120	66.7
31 – 35	44	24.4
36 – 40	18	10.0
41 – 45	2	1.11
46 - 50	5	2.87
Gender		

Male	7	3.7	
Female	182	96.3	
Nationality			
Saudi	67	35.4	
Jordanian	1	0.53	
Egyptian	8	4.23	
Filipino	30	15.9	
Indian	83	43.9	
Educational Attainment			
Baccalaureate	184	97.4	
Masters degree	4	2.12	
Doctorate degree	1	0.53	
Years of Service			
Less than 5 years	71	37.6	
5 – 10 years	63	33.3	
11 – 15 years	31	16.4	
16 – 20 years	17	8.99	
21 – 25 years	5	2.65	
More than 25 years	2	1.06	
Attended Seminars/Trainings Workshops on IPC			
Yes	136	71.96	
No	53	28.04	

In equipping the respondents in infection prevention and control, a big bulk of the respondents (71.96%) have attended seminars or training while employed in the hospitals. Nurses, upon entry to the hospital as employees, are provided with seminars and training on infection prevention and control. These seminars and training are intended to refresh the nurses on their knowledge of infection prevention and control and orient the nurses on hospital protocols.

Table 2: Level of Infection Prevention Control Practices

Dimensions	Mean	Std Dev	Interval		Skewness	Level
Infection Control Programme	29.99	3.99	21.99	37.99	-0.93	Intermediate
Infection Prevention and Control Guidelines	89.96	10.74	60.48	103.43	-1.13	Advanced
Healthcare-Associated Infections Surveillance	84.92	9.49	65.94	103.90	-1.15	Advanced
Built Environment, Materials and Equipment for IPC at the Hospital Level	86.23	12.03	62.16	110.29	-0.27	Advanced
Overall	283.10					Advanced

Total points: 335

Each of the variables is not normally distributed per statistical verification. Hence the amount of skewness was included for extensive description. Thus, by the Chebyshev rule, the total points for the *Infection Control Programme* are 40 points, and the average mean is 29.987. This further emphasizes that the total points generated by at least 75% of the staff nurses fall within 21.99 and 37.99. Moreover, due to the negative skewness (-0.93), it can be noted that at most, 11% of the staff nurses scored less than 18.

The second variable, *Infection Prevention and Control Guidelines*, has a total score of 90 points and has an average mean of 89.96. This explains that the total points generated by at least 75% of the staff nurses fall within 60.48 and 103.43. The negative skewness of -1.13 depicts that at most, 11% of the staff nurses scored less than 50.

Furthermore, the third variable is *Healthcare-Associated Infections Surveillance*, which has a total score of 95 and has an average mean score of 84.92. This signifies that the total points generated by at least 75% of the staff nurses fall within the range of 65.94 to 103.90. Since the amount of skewness is -1.55, at most, 11% of the staff nurses have scored less than 56.

Finally, the fourth variable, *Built Environment, Materials, and Equipment for IPC at the Hospital Level*, is 86.23 on the average. In contrast, the total points generated by at least 75% of the staff nurses range from 62.16 to 110.29. A negative skewness of -0.27 suggests that a total of 11% of the staff nurses score below 50.

Table 3: Correlation of Variables

		IPC Programme	IPC Guidelines	HAI Surveillance	Built environment, materials and equipment
IPC Programme	Corr Coef	1.000	.191	-.063	.160
	Sig. (2-tailed)	.	.008	.389	.028
IPC Guidelines	Corr Coef	.191	1.000	-.009	.327
	Sig. (2-tailed)	.008	.	.904	.000
HAI Surveillance	Corr Coef	-.063	-.009	1.000	-.085
	Sig. (2-tailed)	.389	.904	.	.247
Built environment, materials and equipment	Corr Coef	.160	.327	-.085	1.000
	Sig. (2-tailed)	.028	.000	.247	.

Table 3 demonstrates that *Infection Prevention and Control Programme and Infection Prevention and Control Guidelines* showed a coefficient of r = 0.191 with a p-value of .008, which means that there is a weak positive correlation between the two variables. It further explains that there is a low tendency for the practice of IPC Programme to be increased whenever the practice for IPC Guidelines increases.

Moreover, Table 3 illustrates the weak positive correlation between IPC Programme and Built environment, materials, and equipment, as reflected in the coefficient of r = 0.16 and a p-value of .028. This indicates that whenever the IPC Programme level increases, there is a low tendency for the level of practice in Built materials and equipment to increase.

Finally, the IPC Guidelines and Built materials and equipment with a coefficient of r – 0.327 demonstrate a medium level of correlation between the two variables. This implies a moderate tendency for the level of practice in Built materials and equipment to increase whenever the level of practice in IPC Guidelines increases.

5. Discussion

This study aimed to determine the infection prevention and control practices by staff nurses. In this study, the infection control programmed was found intermediate which means that the healthcare workers and other hospital employees are oriented to the IPC Programme. This can be credited from the fact that the different departments and units of the hospitals are provided with copies of the IPC Programme. Likewise, such programme is included in the hospital information technology system for easier access to employees. According to WHO (2020) because of the growing rate of healthcare-associated infections, there is a worldwide consensus for urgent action for all healthcare facilities to create an infection prevention and control programme. Every infection prevented would mean an antibiotic treatment avoided, and IPC can save millions of lives every year. Further, hospital infection control programmes can help healthcare facilities monitor and improve infection control practices and identify

risks and proactively establish policies to prevent the spread of infections (Rodak, 2012). This result indicates that it is essential for the nurses to feel part and take ownership of the Programmed to facilitate active participation. Likewise, this may mean the need to reorient the nurses on the IPC Programmed of the hospital – including the guidelines, the key individuals involved in the IPC team, the availability of the hospital microbiological laboratory, and budget allocation for the implementation of the IPC Programmed.

The IPC Guidelines was found to have an advanced level of practice, which signifies that the IPC guidelines are fully implemented according to the WHO recommendations and are deemed appropriate to the needs of the hospital. Infection Prevention and Control Guidelines refer to the policies and procedures implemented to control and minimize the dissemination of infections in the hospital and other healthcare facilities. Its purpose is to reduce the rate of infections. Creating policies and procedures in place for infection prevention and control is to ensure patients, employees, and families are protected against infectious diseases and infections by providing guidelines for the investigation, control, and prevention of infections (Habboush et al., 2021). It is important to note that regular lectures and seminars are conducted to keep all nurses updated on trends on infection prevention and control. Each unit in the hospital is also recommended to furnished with the IPC Guidelines for the nurses to review.

The Healthcare-Associated Infection Surveillance was found to have an Advanced level of practice, which means the core components of healthcare-associated infections surveillance are fully implemented according to the guidelines set by WHO, including the recommendations and appropriate needs of the hospitals concerned. The primary goal of any effective infection prevention and control program is to protect patients, healthcare workers, and all others who work in or visit the healthcare care environment. Epidemiologic Principles and methods constitute an essential aspect of infection and outbreak control that hospital IPC teams can use to improve the quality of care. Hence, infection prevention and control surveillance is crucially mandatory and must be strictly implemented to monitor its outcome (Ellis, 2022). Furthermore, infection Surveillance is essential to successful and sustained public health intervention in preventing and controlling infections. Surveillance systems must be tailored to the specific disease or injury that is to be prevented and controlled (Halperin, 2006). Infection prevention and control surveillance data are used to measure the success of infection prevention and control programs, identify areas of concern and improvements, and meet the need of the public reporting mandates and performance goals of the healthcare facility.

The score of nurses on 'Built Environment, Materials and Equipment for IPC at the Hospital Level' in this study signifies the *Advanced* level of practice. This means that this dimension is fully implemented according to the recommendations of the WHO as well as the appropriate needs of the hospitals concerned. For example, Decker and Palmore (2014) described the most waterborne pathogens that cause opportunistic infections in hospital. Some pathogens like Legionella can colonize the deep infrastructure or outlets of hospital water distribution systems. At the same time, other bacteria tend to adhere to biofilms at or near the distal points of use. Moreover, every use of water in all patient care settings must be scrutinized and evaluated for its risk to the harbor and transmit healthcare-associated pathogens (Perkins et al., 2013). Further, published guidelines recommend that each healthcare facility should develop and follow a comprehensive water management program. This includes risk assessment that will identify all water treatment systems at play and all points of water use that pose potential hazards and control strategies to mitigate any hazards (Decker & Palmore, 2014).

There found a significant correlation on the following; infection control programme, infection control guidelines, healthcare-associated infections surveillance, and built environment, materials and equipment for IPC. The results suggest a strong integration of the various components mentioned and essentially embedded in the day-to-day IPC structure and activities of the hospitals. WHO (2018) posits the integrative implementation of the IPC components is not a sole responsibility of the IPC teams, rather, it calls for a broader and continuous development of competencies, collaboration and strong engagement from the different stakeholders. Furthermore, WHO reiterates the relevance of each component to the process of improvement, though the entire process may depend on the local situation. Some hospitals may show full attainment of one or all of the components, while others may need gradual development or may revisit recommendations from previous evaluations. Additionally, the IPC manual proposes a strong collaboration of the various IPC components to strategically build the right system, teach and

check the right things, sell the right messages and ultimately living IPC throughout the entire health system (WHO, 2018).

6. Implication

Overall, the findings of this study appear positive and promising and equally beneficial to everyone desiring optimal patient safety. Infection Prevention and Control, even with all its guidelines, remains a global issue. However, proven strategies to prevent and combat healthcare-associated infections are vital drivers of successful infection control in healthcare facilities. This study recommends that hospitals continue the strict implementation of infection prevention standards and control for improved patient safety. Likewise, this study suggests that a periodic revisit of the GCC Manual based on the World Health Organization Infection Control Guidelines must be done for the hospital staff to update themselves continuously.

This assessment is likewise recommended to be conducted regularly for ongoing evaluation of infection prevention and control practices to determine the current situation and identify strengths, weaknesses, and threats to infection control. The assessment tool gives a score that can be used as an indicator of the level of progress from an improvement perspective. The results can be used to develop an action plan.

7. Conclusion

The four dimensions, the level of practice for the Infection Prevention and Control Programme is found to be *Intermediate*. Whereas, the other three dimensions, *Infection Prevention and Control Guidelines, Healthcare-Associated Infections Surveillance, and Built Environment, Materials and Equipment for Infection Prevention and Control at the Hospital Level,* showed an *Advanced* level of practice by the staff nurses. overall, the IPC level of practice among nurses is described to be *Advanced*. The IPC core components are fully implemented according to the WHO recommendations and appropriate to the needs of the facility.

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