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Knowledge, attitudes and practices regarding nosocomial infections prevention among nurses at King Faisal Hospital, Rwanda

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Abstract

The prevalence of bloodstream pathogens worldwide also causes problems such as significant mortality leading to many deaths. As nosocomial infections are avoidable by using suitable precautionary measures, up to date knowledge and skills of Nurses in different hospitals is highly needed because it is very important. In order to avoid infectious diseases, people spent most of their time dealing with ill people. This study is about knowledge, attitudes and practices regarding nosocomial infections prevention among Nurses at King Faisal Hospital, Kigali. The study used a descriptive cross-sectional. The population of the study had comprised Nurses of King Faisal Hospital January-March 2021. A sample of 191 respondents was randomly selected from a total of 355 nurses. Data were collected using questionnaires and were analysed using SPSS version 21, along with excel and inferential data was analyzed using frequency distribution and percentage tables. The findings of this study indicated that most of participants (65.8%) were female. Most of participants (42.4%) were aged between 21 and 29 years. It was noted that most of participants in this study were holders of advanced diploma. It was noted that that all participants 184(100.0%) were able to correctly define hospital acquired infection. There were 17.9% of participants who had a good attitude concerning nosocomial pathogens, 18.5 percent who had a neutral attitude, and 63.6 percent who had a negative view. A majority of participants (75.5%) had poor practices regarding nosocomial infection prevention and control. The level of knowledge ($P < 0.05$) and attitudes towards nosocomial infection prevention ($(P < 0.001)$) were significant factors associated with practices regarding nosocomial infection prevention and control. It was concluded that the participants' knowledge was high, with the overwhelming of them having sufficient knowledge of healthcare associated patient safety. The nurses' attitudes regarding hospital-acquired infection control were mostly good. However, there is a relatively low level of adherence with healthcare associated personal protective equipment. As a result, a study advises health-care facilities to provide current information to nursing staff in informing and impact their actions and attitudes towards the preventive measures of healthcare facility illnesses.

Introduction

The so called nosocomial infection or simply HAIs (Hospital acquired infections) are infection that occur at least 48 hours after patients' admission, the infections that were neither present during patient's admission nor in incubation period. Hospital acquired infections are critical issues for the safety of patients, healthcare providers and healthcare systems in general (1).

The nosocomial infections may occur in patient during medical care. World widely the health care associated infections occurs in developing nations and even in developed nations. The research reported that developed countries count 7% of nosocomial infections while developing counties account 10%. The Hospital acquired infections occur during hospital stay. The increase mortality, disability, period to stay in hospital and economic burden (2).

The ECDC estimates that put in action the implementation of hygiene and infection control programmes could prevent 20-30% of infections (3). Another study done in Bangladesh reported that the hospital acquired infections South East Asia and Mediterranean regions are 10.0% and 11.8% respectively (4).

The way to control Nosocomial infections is to practicing the infection control programs such as; adopting antibiotics control policy, Maintain antibacterial use and its susceptibility under control. Effective monitoring systems can play their part at global level. All stakeholders are required to put the efforts to prevent and control hospital acquired infections (5). Hospital acquired infections is affecting huge number of patients on global perspective and therefore significantly it is increasing the mortality rate and financial losses (6).

Despite much has been done to improve the health care delivery in Rwanda, according to a study done in Rwanda found that the prevalence of nosocomial infection is highest in ICU at a rate of 50.0% of admitted patients, with overall 15.1% of hospitalized patients (1).

So as nurses are the pillar of health care professions, the present study, identified the nursing role in preventive measures of hospital acquired infections. However there is limited data regarding nursing practice about prevention of hospital acquired infections in hospitals, therefore A researcher had chosen King Faisal hospital as one of the hospitals that receive many patients from different local areas and even from outside of the country especial neighboring nations who are at risk of being transferred in ICU and they are more at risk of getting nosocomial infections due different cultural background and environments as well as nurses who treat them. That is the reason why this research will assess the nurse knowledge, attitudes and practices regarding Nosocomial infections prevention among Nurses at King Faisal Hospital

Materials and Methods

Study design and setting

The study was a cross sectional using quantitative approach in order to obtain the detailed information regarding knowledge, attitudes and practices regarding Nosocomial infections prevention among Nurses at King Faisal Hospital. This study was carried out at King Faisal Hospital, in Gasabo District, Rwanda.

Study population and sampling techniques

The target population of this study is Nurses at King Faisal hospital. Population size is 355 nurses from Human Resources documents. This population is chosen because Nurses are more likely vulnerable to Nosocomial infections and this can bring adverse health impacts. The sampling technique which was used is random sampling. Meaning that every individual will have an equal chance of taking part in the study; During data collection a researcher used the list of 355 Nurses at King Faisal hospital from January to March 2021. To select participants, researcher used excel random sample calculation and random number or coding.

Sample population

The correct sample size, depend on both population and research questions. Sample size must be considered in relation to the number of categories required.

Due to limitations of resources and time, the entire study population could not be covered that why sample size was taken.

According to Yamane (1968), the sample size is calculated as follows:

$$n = \frac{N}{1 + N(e)^2}$$
$$n = \frac{355}{1 + 355(0.05)^2} = 188$$

N is a number of total population, (e) is a marginal error. At a desired level of 95 percent, a marginal error (e) is equal to 5 percent or 0.05. The total population is 355 nurses

N: Total population

n: sample size

e: marginal of error

Data collection method

Primary data was collected from participants using semi-structured questionnaire. This type of study which investigates sensitive issues, it is advisable to use questionnaire which provides anonymity. In addition to this, a questionnaire allows to work with a higher number of respondents. Participants were approached by the researcher in person, and then the researcher explained them the nature and the purpose of the study. He asked them if they were willing to participate on the study, he asked them to sign a written consent form. As the questionnaire didn't take approximately ten to fifteen minutes to be completed, there was no incentive that was given to the participants.

Data analysis Procedure

The collected data were cleaned and variables were re-coded into descriptive analysis by SPSS version 21. The technique which was used is descriptive statistics using statistical package for social science (SPSS21) and Microsoft Excel. The text treatment was done through Microsoft word. The study's findings were presented in statistical analysis and bar graph, with data analysis employed to provide a complete image of baseline characteristics such as age, sex, and other variables in a well-structured survey. Both the direct and indirect variables' frequency distributions were employed. The chi-square test was used to examine and evaluate the relationship among variables. In all instances, a p-value of less than 0.05 was considered statistically significant. The data was coded and transferred to a computer using Statistical Package for Social Scientists (SPSS) in order to analyze and interpret the system in the form of the study results aims.

Results

Socio-demographic characteristics of the nurse

Table 4.1 indicates that most of participants (65.8%) were female. Most of participants (42.4%) were aged between 21 and 29 years. When it comes to area of specialty, most of participants (41.8%) were from surgery. It was noted that most of participants in this study were holders of advanced diploma. A good number of participants (40.8%) had one to five years of working experience.

Table 1 Socio-Demographic characteristics of the participants

Characteristics	Frequency	Percent
Gender		
Female	121	65.8
Male	63	34.2
Age		
<20 years	31	16.8
21-29years	78	42.4
30-39 Years	39	21.2
40-49 Years	21	11.4
> 50years	15	8.2
Specialty area		
Surgery	77	41.8
Pediatrics	41	22.3
Accidents and emergency	35	19.0
Medical	31	16.8
Educational level		
Enrollement	54	29.3
Diploma	83	45.1
Degree	47	25.5
Working experience		
<1year	42	22.8
1 year	28	15.2
1-5 years	75	40.8
>5years	39	21.2

Source: Primary data (2021)

Knowledge of the Nurses on prevention and control of Nosocomial Infections

Table 2 indicates that all participants 184(100.0%) were able to correctly define hospital acquired infection. A majority of participants 154(83.7%) correctly stated organisms that commonly cause infections in hospital. A good number of participants 163(88.6%) correctly stated three contagious items from individuals that might cause inpatient illnesses. It was also noted that on nurses' understanding about how to prevent healthcare facility infections Washing hands is the single greatest method of reducing Healthcare Associated Infectious diseases, according to 161 (87.5%) of participants.

Table 2: Knowledge of the Nurses on prevention and control of Nosocomial Infections

Knowledge items	Reponses	Frequencies (N=184)	Percentage (%)
Definition of hospital acquired infections			
	Correct	184	100.0
Organisms that commonly cause infections in hospital			
	Incorrect	30	16.3
	Correct	154	83.7
Three contagious items from individuals that might cause inpatient illnesses			
	Correct	163	88.6
	Incorrect	21	11.4
If yes in above, can you name them			
	Correct	165	89.7
	Incorrect	19	10.3
The universal precautions to observe			
	Correct	136	73.9
	Incorrect	48	26.1
Measure for preventing HAI is hand washing			
	Correct	161	87.5
	Incorrect	23	12.5
Causative agents for HAIs			
	Correct	172	93.5
	Incorrect	12	6.5
Mode of transmission HAIs			
	Correct	157	85.3
	Incorrect	27	14.7
Gloves do not protect the health workers from acquiring the infections			
	Correct	4	2.2
	Incorrect	180	97.8
Immunization is not a universal precaution			
	Correct	157	85.3
	Incorrect	27	14.7
Sterilization is a process of killing microorganisms' spores			
	Correct	163	88.6
	Incorrect	21	11.4
Sterile technique is not necessary in nasogastric feeding			
	Correct	163	88.6
	Incorrect	21	11.4
HAI is synonymous to nosocomial infection			
	Correct	157	85.3
	Incorrect	27	14.7
Moisture enhances the transmission of microorganisms			
	Correct	169	91.8
	Incorrect	15	8.2
Alcohol is an effective disinfectant when rubbed in skin			

Correct	167	90.8
Incorrect	17	9.2

Source: Primary data (2021)

Figure 1 indicates that there were 48 participants (26.1%) who had a good level of expertise about nosocomial pathogens, 42 (21.4%) who had a moderate level of understanding and 94 (51.1%) who had a low level of knowledge about nosocomial infections.

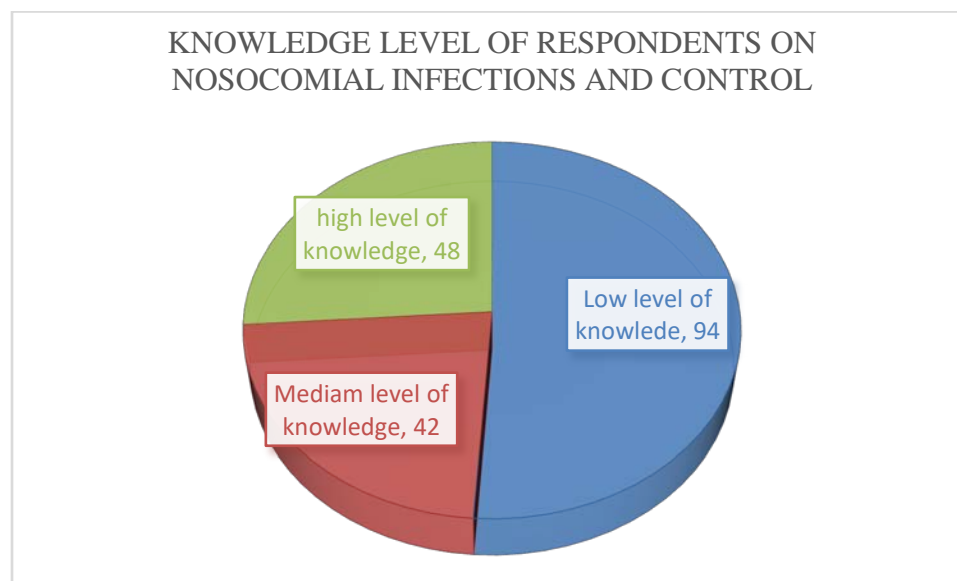


Figure 1: Knowledge level of Respondents on nosocomial infections and control

Attitude of the respondents towards prevention and control and control of Hospital Acquired Infections

The findings of the study on participants' attitudes about the prevention and treatment of healthcare facility infections are presented in Table 4.5. When it comes to recognizing the danger of contracting communicable diseases 109(59.1%) of the respondents perceived high risk of getting infectious disease, 50(27.3%) stated moderate risk while 25(13.6%) of the respondents stated no risk of getting infectious disease in the hospital. Of the participants, 151 (81.8%) agreed with the statement that every patient should be managed as if they are infected with blood-borne infections, whereas 33 (18.2%) stated that every client should be handled as if he or she is infected with blood-borne pathogenic organisms.

Table 3: Attitude of the respondents towards prevention and control of Hospital Acquired Infections

Attitude of the respondents towards control and prevention of HAIs	Response	Frequency	Percentages (%)
Perception on risk of getting infectious disease	Negative perception	75	40.9
	Positive perception	109	59.1
Every patient should be treated as if he/she carries blood born disease	Strongly agree	151	81.8
	Agree	33	18.2
Perception on risk of transmitting an infectious disease	Negative perception	88	63.6
	Positive perception	67	36.4
I am comfortable with the infection control in this facility	Very much	67	36.4
	somehow	86	46.6
	No	31	17.0
I observe these practices	Always	153	83.0
	Sometimes	31	17.0

Source: Primary data (2021)

Figure 2 indicates that there were 17.9% of participants who had a good attitude concerning nosocomial pathogens, 18.5 percent who had a neutral attitude, and 63.6 percent who had a negative view.

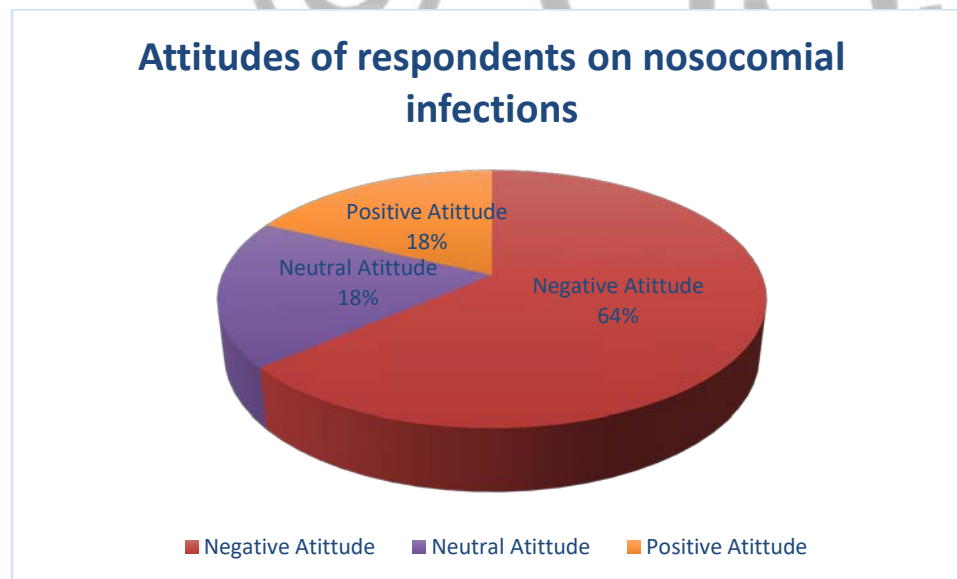


Figure 4. 2: Attitudes of respondents on nosocomial infections

Practices of nurses on prevention and control of hospital acquired infecions

Table 4 displays the outcomes of the participants' procedures for controlling and preventing healthcare facility infections. 167 people (90.9%) said they don't recap syringes after each usage, while 9.1% said they do. 165 (89.8%) of the survey participants said they classify health facility waste products prior to actually dumping, while 10.2% said they do not classify the waste materials prior to actually disposal. Only waste segregation is used to dispose of infectious material from clients, according to 123 (67.0%) of participants, 15.9% of participants said they use both waste separation and reprocessing to dispose of infected materials from healthcare professionals, 10.2% disinfect first before dumping, 6% (3.4%) dispose infected components from healthcare professionals solely by incineration, and 6% (3.4%) said they were unsure of the methodologies they use to dispose highly contagious materials from sick people.

Table 4: Practices of nurses on prevention and control of hospital acquired infections.

Practices items	Response	Frequency	Percentage
Recap a needle after use	Yes	17	9.1%
	No	167	90.9%
It is necessary to categorise hospital wastes before disposal	Yes	165	89.8%
	No	19	10.2%
Ways of waste disposal	Waste segregation	20	16%
	Waste Incineration	129	70.4%
	Disinfect before disposal	29	10.2%
	Uncertain	6	3.4%
If you accidentally touch patient's blood, I do	Wipe with cotton wool	31	17.0%
	Wash with soap and water	126	68.2%
	Wash under running water	27	14.8%
Wash hands within hospitals	Yes	146	79.5%
	No	38	20.5%
Always use personal protective equipment	Yes	157	85.5%
	No	37	12.5%
Place disposable sharps in safety box immediately after use	Sometimes	6	3.4%
	Always	178	96.6%
Use gloves when doing procedure	Sometimes	6	3.4%
	Always	178	96.6%

Source: Primary data (2021)

Figure 4.3 Indicates that a majority of participants (75.5%) had poor practices regarding nosocomial infection prevention and control.



Figure 4. 3 Practices regarding nosocomial infection

Factors associated with practices regarding nosocomial infection prevention

Table 5 indicates that age, specialty area, educational level, work experience, level of knowledge and attitudes were significantly associated with practice regarding nosocomial infection prevention and control.

Table 5: Bivariate analysis of factors associated with practices regarding nosocomial infection prevention

Variables	Indicators	Practice		Chi-square	P-Value
		Poor practice n(%)	Good practice n(%)		
Gender	Female	25(20.7)	96(79.3)	2.755	0.097
	Male	20(31.7)	43(68.3)		
Age	<20 years	9(29.1)	22(70.9)	15.545	<0.05
	21-29years	12(15.4)	66(84.6)		
	30-39 Years	7(17.9)	32(82.1)		
	40-49 Years	11(52.4)	10(47.6)		
	> 50years	6(40.0)	9(60.0)		
Specialty area	Surgery	19(24.7)	58(75.3)	13.961	<0.05
	Pediatrics	5(12.2)	36(87.8)		
	Accidents and emergency	6(17.1)	29(82.9)		
	Medical	28(50.0)	28(50.0)		
Educational level	Enrollment	7(12.9)	47(87.1)	28.340	<0.001
	Diploma	13(15.7)	70(84.3)		
	Degree	25(53.2)	22(46.8)		
Work experience	<1year	7(16.7)	35(83.3)	28.094	<0.001
	1 year	6(21.4)	22(78.6)		

	1-5 years	10(13.3)	65(86.7)		
	>5 years	22(56.4)	17(43.6)		
Level of knowledge	Low	18(19.1)	76(82.9)	35.445	<0.001
	Moderate	1(2.4)	41(97.4)		
	high	26(54.2)	22(45.8)		
Level of attitude	Negative Attitude	19(16.2)	98(83.8)	39.065	<0.001
	Neutral attitude	4(11.8)	30(88.2)		
	Positive attitude	22(66.7)	11(33.3)		

Table 6 indicates that after adjustment from other variable, only level of knowledge and attitudes towards nosocomial infection prevention and control remained significantly associated with practices regarding nosocomial infection prevention and control.

It was noted that the odd of having good practices increases with knowledge. For instance participants with moderate level of knowledge [AOR=181.785, 95%CI: 5.498-6010.666, p<0.05] were more likely to have good practices.

It was noted that the odd of having good practices increases with attitudes. For instance, participants with neutral attitudes [AOR=15.000, 95%CI: 4.214-53.399, p<0.001] were more likely to have good practices.

Table 6: Multivariate analysis of factors associated with practices regarding nosocomial infection prevention and control

	Practice score	
	AOR (95%CI)	P-value
Age group		
<20 years	0.148(0.010-2.094)	0.157
21-29years	0.243(0.018-3.318)	0.289
30-39 Years	2.928(0.240-35.775)	0.400
40-49 Years	0.732(0.136-3.923)	0.715
> 50years	Ref	
Area of specialty		
Surgery	0.678(0.109-4.231)	0.678
Pediatrics	0.803(0.092-7.045)	0.843
Accidents and emergency	0.632(0.074-5.422)	0.676
Medical	Ref	
Educational level		
Enrollment	2.316(0.570-9.418)	0.241
Diploma	1.311(0.348-4.934)	0.689
Degree	Ref	
Working experience		
<1year	0.497(0.069-3.601)	0.489
1 year	0.505(0.066-3.885)	0.511
1-5 years	1.268(0.234-6.878)	0.783
>5 years	Ref	
Level of knowledge		

Low	38.569(1.835-810.783)	<0.05
Moderate	181.785(5.498-6010.666)	<0.05
high	Ref	
Level of attitude		
Negative Attitude	10.316(4.301-24.741)	<0.001
Neutral attitude	15.000(4.214-53.399)	<0.001
Positive attitude	Ref	

AOR: Adjusted odd ratio, 95% CI: 95% confidence interval

Table 7 indicates that 36.4 percent believe that healthcare associated infectious diseases can be avoided by isolation, 23.9 percent believe that healthcare associated infectious diseases can be avoided by appropriate sharp disposal, 21.6 percent believe that healthcare associated infectious diseases can be avoided by proper bed distance, and 20.5 percent assume that healthcare associated infections can be prevented by proper ward air conditioning. Finally, based on the findings, the participants' degree of practice in terms of hospital infection prevention and control acquired infections is good.

Table 7: Ways to reduce transmission of Hospital acquired infections

Items	Responses		Percentages if cases
	N	Percent	
Hand hygiene	130	23.0%	70.5%
Adequate protective gear	82	14.4%	44.3%
Proper sterilization	69	12.2%	37.5%
Proper shard disposal	42	7.8%	23.9%
Safe waste management	96	17.0%	52.3%
Proper bed spacing	40	7.0%	21.6%
Proper ward Ventilation	38	6.7%	20.5%
Isolation	67	11.9%	36.4%
Total	564	100.0%	306.8%

Source: Primary data (2021)

Discussion

In this study, 51.1 percent of participants were extremely informed about healthcare - associated infections, defined as handedness by a patient within 48 hours of admission to the hospital. 37.5 percent of respondents were well-informed, whereas 5.4 percent had no idea what surgery center infections were. Nursing staff, on the other hand, were found to be lacking in expertise in a comparable study conducted in Kawait by Raka et al, (2012). The discrepancy between the two studies could be attributable to the nurses' educational levels, as this study included nurses with greater levels of education (diploma, 48.9%, and bachelor, 21.6%) than those in the subsequent

research.

This is in line with research by (7), which found that the education cadre and numerous themes covered in ongoing professional development boosted nurses' awareness of HAI prevention and control. Although official nurse schooling provides the required knowledge on the prevention and management of Healthcare Associated Infectious diseases, ongoing education programs and conversation among nursing staff on the prevention and management of Healthcare Associated Infectious diseases is required to reevaluate and strengthen preventive measures.

Moreover, according to a study conducted among 65 nursing staff and some doctors in icu and surgery divisions of five hospitals of different sized in the Netherlands, hand hygiene was performed only when health workers suspected they had previously come into contact with the client and was done solely for personal safeguard. Top management also ignored it because there were no role models in the clinic and no clear proof that hand hygiene prevents cross contamination (8).

In this research, 83.0 percent of respondents said they always follow infection control procedures, while 17.0 percent said they follow them occasionally. This is in line with a research conducted by (9), which found that 96-99 percent of nurses wear gloves for at least 95 percent of their work time.

Though its majority of nurses (90.9%) answered that they do not recap syringes after use, 9.1 percent of the respondents indicated that they do. This is in contrast to a study undertaken by (10) in Arua district to assess the application of preventing infection in public hospitals and investigate determinants of hand hygiene among health professionals, which found significant levels of needle recap (34.4%) at public hospitals (10). .

As per the report's results, 85.5 percent of respondents claimed that they always wear safety equipment during practice, whereas 12.5 percent stated that they do not wear protective gear during practice. This is consistent with a nationwide study done in England by Sudaram and (11), which indicated that 99 percent of HCWs habitually wore gloves in trauma situations, while only 18-22 percent utilized face masks and safety glasses(11).

Conclusions and Recommendation

The participants' knowledge was high, with the majority of them having adequate knowledge of how to prevent and control hospital-acquired infections. The nurses were well-versed in the prevention and treatment of hospital-acquired infections. Health-care facilities should issue

infection-control standards to all nurses and closely oversee them to ensure that they follow them. Health-care institutions should provide sufficient disposal materials for nurses, as well as opportunities for nurses to enhance their skills. Males should also be incentivized to teach nursing courses.

Limitation

The results of this study reflected the overview about the Knowledge, Attitudes and practices towards Nosocomial Infections prevention among Nurses who work at King Faisal Hospital. Thus the findings cannot be generalized to other universities.

Competing Interests

The authors declare that they have no competing interests.

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References

1. Lukas S, Hogan U, Muhirwa V, Davis C, Nyiligira J, Ogbuagu O, et al. Establishment of a hospital-acquired infection surveillance system in a teaching hospital in Rwanda. *Int J Infect Control*. 2016;12(3):1–9.
2. Choudhuri AH, Chakravarty M, Uppal R. Epidemiology and characteristics of nosocomial infections in critically ill patients in a tertiary care Intensive Care Unit of Northern India. *Saudi J Anaesth*. 2017;11(4):402–7.
3. Geberemariam BS, Donka GM, Wordofa B. Assessment of knowledge and practices of healthcare workers towards infection prevention and associated factors in healthcare facilities of West Arsi District, Southeast Ethiopia: a facility-based cross-sectional study. *Arch Public Health*. 2018;76:69.
4. Shahida SM, Islam A, Dey BR, Islam F, Venkatesh K, Goodman A. Hospital Acquired Infections in Low and Middle Income Countries: Root Cause Analysis and the Development of Infection Control Practices in Bangladesh. *Open J Obstet Gynecol*. 2016;06(01):28–39.
5. Khan HA, Baig FK, Mehboob R. Nosocomial infections: Epidemiology, prevention, control and surveillance. *Asian Pac J Trop Biomed [Internet]*. 2017;7(5):478–82. Available

from: <https://www.sciencedirect.com/science/article/pii/S2221169116309509>

6. Shirol SS, Nimbaragi G, Prabhu M, Ratkal J. Abductor digiti minimi muscle flap in reconstruction of diabetic foot ulcers: A case series. *Eur J Plast Surg*. 2018;37(4):227–32.
7. Negley K, Ness S, Kokal J, Fee-schroeder K, Voll J, Hunter C, et al. Oncology Nursing Society 31st Annual Congress. 2016;33(2):394–491.
8. Shobowale EO, Adegunle B, Onyedibe K. An assessment of hand hygiene practices of healthcare workers of a semi-urban teaching hospital using the five moments of hand hygiene. *Niger Med J* [Internet]. 2016;57(3):150–4. Available from: <https://pubmed.ncbi.nlm.nih.gov/27397953>
9. Wilson J, Bak A, Whitfield A, Dunnett A, Loveday H. Public perceptions of the use of gloves by healthcare workers and comparison with perceptions of student nurses. *J Infect Prev* [Internet]. 2017/01/13. 2017 May;18(3):123–32. Available from: <https://pubmed.ncbi.nlm.nih.gov/28989516>
10. Wasswa P, Nalwadda CK, Buregyeya E, Gitta SN, Anguzu P, Nuwaha F. Implementation of infection control in health facilities in Arua district, Uganda: a cross-sectional study. *BMC Infect Dis* [Internet]. 2015;15(1):268. Available from: <https://doi.org/10.1186/s12879-015-0999-4>
11. Chughtai AA, Stelzer-Braid S, Rawlinson W, Pontivivo G, Wang Q, Pan Y, et al. Contamination by respiratory viruses on outer surface of medical masks used by hospital healthcare workers. *BMC Infect Dis* [Internet]. 2019;19(1):491. Available from: <https://doi.org/10.1186/s12879-019-4109-x>