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Prevalence and Risk Factors Associated with Nosocomial Infection among Patients Hospitalized at Masaka and Kibagabaga Hospital, Rwanda

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Key Words: Knowledge, attitudes, practices, nosocomial infection, nurses.

Abstract

Nosocomial infections are major public health concern throughout the world, contributing to increased morbidity, mortality, and healthcare cost. In Rwanda reported infection rates from 40 district hospitals were 0.8%; 0.4% and 0.2% for 2010, 2011 and 2013 respectively. The aim of this study was to assess prevalence and risk factors associated with nosocomial infection among patients hospitalized at Masaka and Kibagabaga Hospital. It was guided by the following specific objectives: To determine the prevalence of nosocomial infection among patients hospitalized at Masaka and Kibagabaga Hospital, and to identify risk factors associated with nosocomial infection among patients hospitalized at Masaka and Kibagabaga Hospital. A cross-sectional study with quantitative approach was conducted. A sample of 197 patients was selected from a population of patients who were on at least 48 hours post admission using systematic random sampling technique. Data were collected using self-administered questionnaire whereby after obtaining the approval letter, the researcher approached the participants in their respective ward. Data were analyzed using SPSS version 21. Inferential statistics, primarily correlation analysis was conducted to assess the strength and direction of relationship which may occur between occurrence and certain variables. Chi-square was used to establish if there is a prevalence of a relation and some factors of analysis. The findings of the study revealed that more than half of the study participants (54.5%) were from Kibagabaga District Hospital. More than half of the study participants (54.3%) were from Kibagabaga District Hospital. Most of the participants (38.1%) were from surgical ward. The mean age of participants was 42.3 years. More than a half of the participants (62.4%) were female by sex. More than a half of participants (56.9%) were married. It was revealed that the prevalence of nosocomial infection was 11.7%. The most frequent nosocomial infection (34.8%) was surgical site infection. After adjustment from other variables, only sex, undergoing surgical procedure, presence of invasive medical devices, and antibiotic prophylaxis were statistically significant factor associated with nosocomial infection. For instance male patients (AOR=0.093, 95%CI: 0.013-0.691, p=0.020) were less likely to have nosocomial infection. The relationship between sex and nosocomial infection is statistically significant at 5% since the p value is less than 0.05. Participant who underwent surgical procedure (AOR=8.753, 95%CI: 1.568-48.868, p=0.013) were more likely to have nosocomial infection. Participants with invasive medical devices (AOR=6.735, 95%CI: 1.220-37.176, p=0.029) were more likely to have nosocomial infection. It was concluded that the overall prevalence of nosocomial infection in selected hospitals was a little bit high (10.9%). On the other hand sex, educational level, presence of invasive medical devices, and antibiotic prophylaxis were statistically significant factor associated with nosocomial infection. It was recommended that patients with invasive medical devices should be closely monitored as they were found to be likely to have nosocomial infection.

Key words: Knowledge, Attitudes, Practices, Nosocomial Infections.

Introduction

Nosocomial infections are a significant concern in public health worldwide, leading to high morbidity, mortality and cost of health care [1]. HAI is characterized as a local or widespread disorder caused by adverse responses to the existence or toxin(s) of an infected individual and occurring 48 hours or more after hospital admission and not developing at admission[2].

Nosocomial infections are caused by pathogenic viruses, bacteria, and fungi[3]. A significant predisposing mechanism for nosocomial infections is the use of equipment or instruments for intubation, the provision of medical agents or the draining of bodily fluid during patient treatment as supportive interventions[4]. Pathogenic bacteria associated with healthcare can survive or remain on surfaces for weeks, and can thus be a consistent route of contamination if there isn't any steady superficial sanitizing is executed [5].

The prevalence of HAIs is still understated and undetermined in some underdeveloped nations [6]. In African nations, there is a scarcity of data on the prevalence of HAIs [7,8]. Despite the lack of information, evidence suggests that HAIs are significantly increasing the already heavy incidence of infections in various Sub-Saharan African nations[9]. According to a systematic analysis by Nejad et al (2019), hospital-wide HAI incidence in Africans ranged from 2.5 percent to 14.8 percent. This analysis revealed that published research were only undertaken in ten African nations, indicating that there were gaps in the demography of HAIs in many African nations. Furthermore, according to a latest study by Irek et al, studies on HAIs in Africans are scarce. Of the 35 suitable publications retrieved, more than half (n=21, 60 percent) were from Eastern Africa alone [8].

In Rwanda, the few study on point-prevalence of HAI were only done in teaching hospitals. There is a paucity of studies on prevalence and factors associated with nosocomial infections in district hospitals in Rwanda.

It is possible to implement HAI monitoring in a low-resource situation and obtain an accurate prevalence of nosocomial infection, but unfortunately to the best of my knowledge, there is no single report about the prevalence and risk factors associated with nosocomial infection from Rwanda district hospitals before particularly at Masaka and Kibagabaga Hospital. All previously published studies estimated the point prevalence of nosocomial infections based on a data collected from one or two wards of teaching hospitals[10]. The current study tried to estimate the prevalence and risk factors associated with nosocomial infection at Masaka and Kibagabaga Hospital.

The information on both prevalence and risk factors associated with nosocomial infection can inform prioritization of infection prevention efforts at Masaka and Kibagabaga Hospital.

Materials and Methods

Study design and setting

A cross-sectional survey with quantitative method study assessing prevalence and risk factors associated with nosocomial infection among patients hospitalized at Masaka and Kibagabaga Hospital was conducted using a self-administered questionnaire with closed ended questions. This study was carried out at Dibagabaga Hospital, in Gasabo District, Rwanda.

Study population and sampling techniques

The population of this study consisted of patients hospitalized at Masaka and Kibagabaga District Hospitals for 48 hours or more during data collection period. A simple random as probability sampling technique was used in selection of participants. All hospitalized patients had equal chance of being selected unless he/she is hospitalized for less than 48 hours.

Sample population

A sample is a proportion of people that is chosen to reflect the entire population so that relevant evidence has been presented. The sample size is obtained in this study using the Fisher's formula, as mentioned by Naing et al.(2016):

$$n = \frac{z^2 p(1-p)}{d^2}$$

Z: Standard normal variate at 5% type I error P<0.05, it is 1.96.

P: 15.1 % as prevalence of nosocomial infection in referral hospitals in Rwanda (Lukas et al, 2016).

d: absolute error or precision 5%

N: sample size

$$n = \frac{1.96^2 \times 0.151(1-0.151)}{(0.05)^2} = 197$$

From this formula, the sample size for this population was 197 patients in total.

Data collection method

A pretested standardized questionnaire was used to collect data for socio-demographic characteristics

and risk factors. Questionnaire forms were written in English, and converted into Kinyarwanda afterwards. The questionnaires were given in the mornings to patients when they have not been exhausted, and their attention level is high. The investigator explained the intent of the experiment to the participants orally, so that they can take the questionnaires effectively.

Data analysis Procedure

The data obtained were compiled and quantitatively analysed. All information were washed, coded and entered for review in the Social Sciences Statistical Package (SPSS), using descriptive statistics to produce descriptive statistics. Inferential statistics, primarily correlation analysis was conducted to assess the strength and direction of relationship which may occur between occurrence and certain variables. Chi-square was used to establish if there is a prevalence of a relation and some factors of analysis. Pearson Chi-Square $p<0.05$ means the relationship is statistically significant while $p > 0.05$ indicates that the relationship is not statistically significant. All variables with p value < 0.05 during bivariate analysis was further subjected to multivariable regression analysis where crude and adjusted odd ratios (ORs) were calculated with a 95% confidence interval (95% CI) in order to determine which variables are independently associated with nosocomial infection. A p value of <0.05 was considered to be statistically significant.

Results

Socio-demographic characteristics of the patients

Table 4.1 indicates that more than half of the study participants (54.3%) were from Kibagabaga District Hospital. Most of the participants (38.1%) were from surgical ward. The mean age of participants was 42.3 years where most of the participants (38.6%) were aged below 30 years. More than a half of the participants (62.4%) were female by sex.

A majority of participants (73.6%) were from urban region. Most of participants (77.7%) were employed. When it comes to educational level, most of study participant (37.1%) attained secondary level of education. More than a half of participants (56.9%) were married.

Table 4.1 Socio-demographic characteristics of the participants

		Frequency	Percent
Hospital			
	Kibagabaga	107	54.3
	Masaka	90	45.7
Ward			
	Maternity	23	11.7
	IM	62	31.5
	Surgical	75	38.1

	Pediatrics	29	14.7
	Emergency	8	4.1
Age category			
	Less than 30	76	38.6
	30-50	53	26.9
	Above 50	68	34.5
Sex			
	Male	74	37.6
	Female	123	62.4
Residence			
	Urban	145	73.6
	Rural	52	26.4
Occupation			
	Employed	153	77.7
	Unemployed	44	22.3
Educational level			
	college/university	24	12.2
	Secondary	73	37.1
	Primary	62	31.5
	None	38	19.3
Marital status			
	Married	112	56.9
	Divorced/separated	19	9.6
	widowed	8	4.1
	Single	58	29.4
Monthly income			
	less than 50000	65	33.0
	50000-150000	67	34.0
	Above 150000	65	33.0
Admission diagnoses			
	Fracture	19	9.6
	Cancer	6	3.0
	TB	2	1.0
	Advanced stage HIV	12	6.1
	Malaria	16	8.1
	C-section	2	1.0
	Erysipelas	4	2.0
	Cardiopathy	18	9.1
	Fluid and electrolyte disorders	12	6.1
	Labor	9	4.6
	Sickle cell anemia	4	2.0
	Osteomyelitis	12	6.1
	Diabetes mellitus	10	5.1
	Stroke	8	4.1
	Unknown	61	31.0
	Diabetic foot	2	1.0

Source: (Primary data, 2021)

Prevalence of nosocomial infection among hospitalized patients

Table 4.2 indicates that the prevalence of nosocomial infection (Any infection appeared 48 hours or more after admission) was 11.7%. The most frequent nosocomial infection (34.8%) was surgical site infection.

Table 4.2 Prevalence of nosocomial infection among hospitalized patients

Variables	Frequency	Percent
Any infection appeared 48 hours or more after admission		
Yes	23	11.7
No	174	88.3
Site/type (n=23)		
Surgical site infection	8	34.8
Pneumonia	2	8.7
Sepsis	1	4.3
GI infection	3	13.1
Skin and soft tissue infection	2	8.7
UTI	7	30.4

Source: (Primary data, 2021)

Risk factors associated with nosocomial infection among hospitalized patients

Table 4.3 shows that with regard to sex, 2(2.7%) of male participant had nosocomial infection and 21(17.1%) of female participant had nosocomial infection. The relationship between sex and nosocomial infection is statistically significant at 5% since the p value is less than 0.05.

When it comes to residence, 12(8.3%) of urban resident had nosocomial infection, and 11(21.2%) of rural resident had nosocomial infection. The relationship between residence and nosocomial infection is statistically significant at 5% since the p value is less than 0.05.

With regard to educational level, 2(8.3%) of university graduate, 3(4.1%) of participants who attained secondary level, 10(16.1%) of those who attained primary level, and 11(9.8%) of participants who had no level of study had nosocomial infection. The relationship between educational level and nosocomial infection is statistically significant at 5% since the p value is less than 0.05.

It was noted that 7(22.6%) of participants with urinary catheter in place had nosocomial infection. The relationship between the presence of urinary catheter and nosocomial infection is statistically significant at 5% since the p value is less than 0.05.

It was revealed that 8(44.4%) of participants with invasive medical devices had nosocomial infection. The relationship between presence of invasive medical devices and nosocomial infection is statistically significant at 0.1% since the p value is less than 0.001.

It was noted that 11(73.3%) of participants who underwent surgical procedure had nosocomial infection.

The relationship between surgical procedure and nosocomial infection is statistically significant at 0.1% since the p value is less than 0.001.

Only 8(5.4%) of those who received antibiotic prophylaxis had had nosocomial infection. The relationship between antibiotic prophylaxis and nosocomial infection is statistically significant at 0.1% since the p value is less than 0.001.

Table 4.3 Bivariate analysis of factors associated with nosocomial infection among hospitalized patients

		Presence of Nosocomial Infection			
Variables	**Indicators**	**Yes n(%)**	**No n(%)**	**Chi-square**	**P-Value**
Ward	Maternity	3(13.1)	20(86.9)	4.372	0.358
	IM	7(11.3)	55(88.7)		
	Surgical	12(16.0)	63(84.0)		
	Pediatrics	1(3.4)	28(96.6)		
	Emergency	0(0.0)	8(100.0)		
Age category	Less than 30	5(6.6)	71(93.4)	3.522	0.172
	30-50	9(16.9)	44(83.1)		
	Above 50	9(13.2)	59(86.8)		
Sex	Male	2(2.7)	72(97.3)	9.253	**0.002**
	Female	21(17.1)	102(82.9)		
Residence	Urban	12(8.3)	133(91.7)	6.155	**0.013**
	Rural	11(21.2)	41(78.8)		
Occupation	Employed	17(11.1)	136(88.9)	0.211	0646
	Unemployed	6(13.6)	38(86.4)		
Educational level	College/university	2(8.3)	22(91.7)	8.745	**0.033**
	Secondary	3(4.1)	70(95.9)		
	Primary	10(16.1)	52(83.9)		
	None	8(21.1)	30(78.9)		
Marital status	Married	11(9.8)	101(90.2)	11(9.8)	0.053
	Divorced/separated	4(21.1)	15(78.9)	4(21.1)	
	widowed	3(37.5)	5(62.5)	3(37.5)	
	Single	5(8.6)	53(91.4)	5(8.6)	
Monthly income	less than 50000	5(7.7)	60(92.3)	1.872	0.392
	50000-150000	8(11.9)	59(88.1)		
	Above 150000	10(15.4)	55(84.6)		
Previous hospitalization	Yes	9(15.0)	51(85.0)	0.925	0.336
	No	14(10.2)	123(89.8)		
Presence of up to	Yes	18(10.5)	154(89.5)	1.924	0.165

date intravenous line	No	5(20.0)	20(80.0)		
Presence of urinary catheters	Yes	7(22.6)	24(77.4)	4.243	**0.039**
	No	16(9.6)	150(90.4)		
Presence of invasive medical devices	Yes	8(44.4)	10(55.6)	20.629	**0.000**
	No	15(8.4)	164(91.6)		
Surgical procedure done	Yes	11(73.3)	4(26.7)	58.858	**0.000**
	No	12(6.6)	170(94.5)		
Antibiotic prophylaxis given	Yes	8(5.4)	140(94.6)	22.682	**0.000**
	No	15(30.6)	34(69.4)		

Source: Primary data (2021)

Table 4.4 indicates that after adjustment from other variables, only sex, undergoing surgical procedure, presence of invasive medical devices, and antibiotic prophylaxis were statistically significant factor associated with nosocomial infection.

For instance male patients (AOR=0.093, 95%CI: 0.013-0.691, p=0.020) were less likely to have nosocomial infection. The relationship between sex and nosocomial infection is statistically significant at 5% since the p value is less than 0.05.

Participant who underwent surgical procedure (AOR=8.753, 95%CI: 1.568-48.868, p=0.013) were more likely to have nosocomial infection. The relationship between undergoing surgical procedure and nosocomial infection is statistically significant at 5% since the p value is less than 0.05.

Participants with invasive medical devices (AOR=6.735, 95%CI: 1.220-37.176, p=0.029) were more likely to have nosocomial infection. The relationship between the presence of invasive medical devices and nosocomial infection is statistically significant at 5% since the p value is less than 0.05.

Table 4.4 Multivariate analysis of factors associated with nosocomial infection among hospitalized

Variables	Category	Presence of Nosocomial infection	
		AOR (95%CI)	**P-value**
Sex			
	Male	0.093(0.013-0.691)	**0.020**
	Female	Ref.	
Residence			
	Urban	0.313(0.077-1.269)	0.104
	Rural	Ref	
Education			
	College/university	2.744(0.338-22.240)	0.345
	Secondary	1.884(0.332-10.690)	0.474

Primary	1.431(0.290-7.056)	0.660
None	Ref	
Presence of urinary catheter		
Yes	2.157(0.471-9.869)	0.322
No	Ref	
Surgical procedure done		
Yes	8.753(1.568-48.868)	**0.013**
No		
Presence of invasive medical devices		
Yes	6.735(1.220-37.176)	**0.029**
No	Ref	
Antibiotic prophylaxis given		
Yes	0.113 (0.027-0.483)	**0.023**
No	Ref	**0.003**

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

Source: Primary data (2021)

Discussion of findings

Healthcare - associated infections are a leading risk factor for mortality in hospital settings, resulting in considerable increases in hospital expenses [11]. According to accumulated research, the prevalence of hospital - acquired infections in high-income nations ranged from 3.6 percent to 12.0 percent, while in low- and middle-income nations it varied from 5.7 percent to 19.1 percent [12].

The overall prevalence rate of HAIs was found to be 11.7 percent in this investigation. This figure is significantly greater than the majority of findings from high-income countries [13,14]. It's also higher than the prevalence stated in some of the country's studies [15,16]. This could be due to the study's broad scope, which included all hospitalized individuals, including those in intensive care and those with incapacitating medical conditions. These factors could have played a role in the greater prevalence found. This is due to socio-economic status of individuals and the availability of resources.

When contrasted to other African research, this study's findings are higher than those from Nigeria (2.6 percent) and Morocco (10.3 percent) [17]. The high patient load, crowding, poor infrastructure, and hospital layout design could all contribute to this. On the other hand, the prevalence of HAI recorded in this study is lower than that reported from Addis Ababa (35.8%) and Mekelle (27.6%) [18].

Surgical site infections (45.5%) were the most common nosocomial infection types identified in this investigation, which was comparable to a comprehensive study and meta-analysis of HAI in underdeveloped countries [19]. According to other investigations, the prevalence of SSI in high-income nations is between 1.2 and 5.2 percent [20].

The current study revealed that male patients (AOR=0.093, 95%CI: 0.013-0.691, p=0.020) were less likely to have nosocomial infection. This contradicts a literature review and meta-analysis of the incidence and prediction factors for hospital acquired infections in military hospitals, which found that gender (male versus female, OR: 1.45) was one of the reported risk factors for NI [21]. This is may be due to the fact that male are literally less susceptible to some infection like UTI as they have long urethra compared to female.

Conclusions and Recommendation

The current study concluded that the overall prevalence of nosocomial infection in selected hospitals was a little bit high (11.7%). On the other being male, undergoing surgical procedure, presence of invasive medical devices, and antibiotic prophylaxis were statistically significant factor associated with nosocomial infection. It was recommended that patients with invasive medical devices should be closely monitored as they were found to be likely to have nosocomial infection. Antibiotic prophylaxis should always be given to all patients who are exposed infections as this particular prophylaxis was found to be associated with decreases in rate of nosocomial infection.

Limitation

The study was conducted only at Masaka and Kibagabaga Hospital and therefore it gave a picture of those two hospitals only. It is probable that generalization to other health care facilities won't be attainable. The questionnaire used is auto-reported. Self-reporting may end in data being inaccurate because some participants may dramatize their answers, whereas others over report the data.

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Competing Interests

The authors declare that they have no competing interests.

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