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Risk Factors and Bacteriological Assessment of Patients on Prolonged Hospital Admission at Murtala Muhammad Specialist Hospital Kano State, Nigeria

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Abstract: Background: *Prolonged hospital admissions of patients remain a challenge to healthcare providers and seekers, particularly in resource-limited settings. Bacterial infections contribute significantly to prolonged stay despite numerous advances in research updates on nosocomial bacterial infections, including many suggestions on associated risk factors. This study aimed at evaluating the risk factors and bacteriology of patients on prolonged hospital admission at Murtala Muhammad specialist hospital Kano state (MMSH), Nigeria.* ***Methods****: A descriptive cross-sectional and retrospective study design was used to determine the prevalence of healthcare-associated infections (HCAIs) and prolonged hospital stay, respectively. One hundred and forty (140) swabs and urine samples were collected from the medical, surgical, and accident/orthopedic wards at MMSH. Samples were processed using standard microbiological methods. Prolong hospital stay and its associated factors were assessed using health records and closed-ended questionnaires, respectively.* ***Result:*** *The prevalence of healthcare-associated infections (HCAIs) and prolonged hospital stay were 41.43% and 50.50%, respectively. The prevalence of HCAIs, according to the site of infection, showed that urinary tract infections (UTIs) had the highest prevalence of 58.89%. The distribution of bacterial pathogens showed E. coli was having the highest distribution of 22.40%. Lack of qualified staff, training, equipment, essential drugs, and quality assurance statistically linked with risk factors associated with a prolonged hospital stay in the studied hospital.* ***Conclusion:*** *This study reported a high prevalence of HCAIs and prolongs hospital stays in the MMSH and has indicated some risk factors associated with the findings with E. coli being the most frequently isolated bacteria.*

Keywords: *Risk factors, Bacteriology, prolonged hospital stay, MMSH, Kano.*

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I. Background

Healthcare-associated infections (HCAIs), also referred to as nosocomial infection, are infections occurring after exposure to health care. Often, this exposure may be endogenous or exogenous from health care professionals and hospital environments. These infections cause prolonged hospital stay, and account for a significant risk factor leading to morbidity, mortality, treatment failure, and high cost for the caregiver (1). The global burden of HCAIs seems to be unknown, but literature has shown that 7% of people in developed and 10% in developing countries acquired one HCAI in their lifetime. In a developing country like Nigeria, the risk of acquisition of HCAIs was as high as 20 times. Beside, patients other hospital staff, visitors and family of the patient could be affected which lead to transmission of these infections within the community (2). Asymptomatic patients may considered infected if these pathogens are found in the body fluids or at a sterile body site, such as wound/soft tissue, urine, invasive devices and blood (3). The sites which are typical for pathogens include urinary tract infections (UTI), surgical and soft tissue infections, nasal intubation, catheter-associated urinary tract infections, gastroenteritis, meningitis, and respiratory infections (2).

The bacterial pathogens involved in hospital-acquired infections include Streptococcus spp, Acinetobacter spp, Enterococci, Pseudomonas aeruginosa,coagulasenegative Staphyl ococci, Staphylococcus aureus, Bacillus cereus, Legionella and Enterobacteriaceae familymembers, Proteus mir

abilis, Klebsiella pneumonia, Escherichia coli, Serratia marcescens (2). The prevention and control of HCAIs are closely related to the quality of health care. Therefore, these infections are a significant public health threat in Sub-Saharan Africa due to the lack of proper healthcare facilities (4). Hospital infection control practices remain essential in the developing world, mostly due to the lack of resources (5). Most African countries lack information or data about these HCAIs, which hindered the efforts of knowing the magnitude of these infections in the regions. Therefore, this study investigates the prevalence of HCAIs; prolong hospital stayed and its associated risk factors in Murtala Muhammad specialist hospital (MMSH) Kano state, Nigeria.

II. Materials And Methods

Ethical Clearance

Ethical approval was obtained from health Service Management Board Kano (HMB/GEN/488/VOL.1) Ministry of Health Kano state, Nigeria. Written informed consent was prepared in Hausa language for participants or guardians. The patient details remained confidential.

Study area

The study was carried out at MMSH in the Kano State metropolis, Nigeria. The Hospital has 500-bed capacity and attended by over 15% of the patients within Kano State. The Hospital receives referral cases from other hospitals in the State.

Study design

This study used two designs: firstly, cross-sectional descriptive study which involved collection of urine, wound/pus, urine-catheter, nasal feed tube and ventilator catheters from patients who were eighteen years. Patients must be admitted in medical, surgical, accident/orthopedics wards that meet the inclusion criteria involved using systematic random sampling. Secondly, retrospective analysis of health records used to determine the length of stay of patients on admission during the period of study.

Prolonged hospital admission study

Patients admitted in the medical, surgical, accident/orthopedic wards during the study period (July 2018) and more than 18years of age and 14 days admission were included in this study. Hospital records with complete information needed for this study was also included. Hospital records of patients with incomplete information were excluded from this study. Prolonged hospital stays was calculated from the day of admission to the day of discharge of the patient.

Socio-demographic and bacteriological analysis study

A structure close-ended questionnaire was used to record the study participant's details such as age, sex, occupation, level of education, and marital status. Potentials risk factors associated with prolong hospital stay in the study area also assessed. One hundred and forty samples were collected from patients with prolong stay from MMSH hospital Kano. Samples were collected according to the method described by Vandepitte et al. (7). A sterile swab stick and sterile open urine contain was used to collect the wound/pus swab, urine catheters, nasal intubation, feed tube, ventilator catheters and urine samples. Samples were categorized and conveyed to the Microbiology laboratory of the Hospital for further study. Swab samples transported in Stuart transport media. When the samples were not processed on the collected day, they were kept in the refrigerator at 4°C.

Isolation and identification of nosocomial bacterial pathogens

Nosocomial bacterial pathogens were isolated according to the method described by Vandepitte et al. (7) and Ibrahim et al. (8). Samples were inoculated on to Leeds Acinetobacter medium, MacConkey medium, Chocolate medium, Blood agar medium, and CLED. Inoculated plates were incubated aerobically and anaerobically (under 10% reduced oxygen) at 35±2oC to ensure the growth of both non-fastidious and fastidious organisms, respectively.

Bacteria isolated from urine, urine catheter, wound/pus, and nasal intubation were morphologically identified using standard microbiological techniques and biochemical test. These are Gram's staining, catalase, coagulase, indole, citrate utilization, urea activity, oxidase, methyl red, Voges-Proskauer, motility, and sugar fermentation tests (9,10). Suspected Acinetobacter spp further were confirmed using API 20NE, and analysis done according to the manufacturer's instruction. Isolates were preserved in 30% glycerol at -80°C.

Statistical analysis

Statistical analysis was carried out by descriptive statistics and regression using SPSS version 20. Descriptive statistics used to determine the prevalence of HCAIs, Prolong hospital stay, and the proportion of pathogens. To explore the independent factors associated with the infection, bivariate analysis performed to

identify factors significantly associated with HCAIs. One way study of Variance (ANOVA) was used to determine the prevalence of prolonged hospital stay between the wards. The variable that were logically related had a p-value of < 0.005 in the univariate investigation were comprised in the stepwise logistic regression to study the factors potentially associated with HCAIs (Age, length of hospital stay, invasive device and bed sheet marking and change) Odds (OR) ratio and 95% confidence intervals(CI)were calculated. P ≤0.05 was considered the significance.

III. Results

Demographic characteristic of studied participants

The age of the studied participants ranged from 18-78years. They involved males and females, with the female having the highest distribution of 55%. The majority of the participants were unemployed (57.9%). Fifty percent (50%) of the studied participants were married, with the highest percentage (37%) having a non-formal education (Table 1). For the prolonged hospital study, a total of 277 health records were checked and assessed accordingly.

Prevalence of healthcare-associated infections

The current study established the prevalence of HCAIs and prolongs hospital stay of 41.43% and 28.00% from Murtala Muhammed Specialist Hospital, Kano, respectively. The prevalence of HCAIs, according to the age of the studied participants, showed that age groups was between 69-78years had the highest prevalence of 58.80% while aging groups between 49-58 had the lowest 27.30%, though not statistically significance (p=, 0.061). The results of HCAIs, according to gender, showed that males had the highest prevalence (42.90%) compared to their female counterpart (p=0.782). The prevalence of HCAIs according to occupations of studied participants showed that self-employed had the highest prevalence (75.00%) while salary earners had the lowest (18.2%) (p=0.039). Prevalence of the HCAIs, according to the marital status of the studied participants, showed that widow had the highest prevalence (100%) while the unmarried had the lowest prevalence (27.8%) (p=0.040). HCAIs prevalence among the studied participants according to their level education showed that those with primary education had the highest prevalence of 76.90%, while those with tertiary education had the lowest 8.30% (p= 0.024) (Table 1)**.**

Distribution of HCAIs based on the site of infections

Dissemination of HCAIs according to the location of infections showed that urinary tract infections had the highest distribution (56.89%), while nasogastric intubation had the lowest (6.90%) (Fig.1). E. coli was the most prevalence with 22.40%, while S. pyogene was the lowest with 6.80% (Table 2). The distribution of bacterial isolates according to the sites of infection from the studied participants showed that wound/pus had the highest distributions of the bacterial isolates of 36.21% while nasogastric tube had the lowest distribution 6.90% (Table 2).

Prolonged hospital stay

A total of 277 patients admitted in medical, surgical, accident/orthopedic wards of Murtala Muhammed Special Hospital Kano during July 2017. Out of which 50.5% stayed more than 14 days. The results showed that the accident/orthopedic ward had a higher prevalence of prolonged hospital stay. The prolonged hospital stays between the wards showed no statistical significance (p = .04566) (Table 3). The bivariate logistic regression model showed that length of hospital stay >14 days, mechanical ventilator, surgical site, intubation, and bed sheet making and change after every 2 days were statistically associated with HCAIs at (p≤ 0.05). The multi bivariate logistic regression model showed that length of hospital stay, bed sheet making and change, salary earning, self-employed, married and unmarried, were statistically associated with HCAIs (p≤ 0.05) (Table 4). The potential risk factors that increased the likelihood for prolonged hospital stay in MMSH included; lack of qualified staff (p=0.030, aOR; 4.27, 95% CI; 2.78-7.68) and lack of training (p=0.017, aOR; 6.82, 95% CI; 5.01-9.83), absence of data to show the impact of training (p=0.041, aOR; 3.32, 95% CI; 1.78-4.10), lack of enough equipment in the laboratory, theatre and wards (p=0.032, aOR; 1.87, 95% CI; 1.17-3.78), absence of quality assurance system (p=0.038, aOR; 1.67, 95% CI; 1.94-3.67), lack of essential drugs/consumables during cases of prolonged stay (p=0.007, aOR; 2.10, 95% CI; 1.53-4.26) and absence of health personnel in ICU (p=0.017, aOR; 3.57, 95% CI; 1.79-5.12) (Table 5).

IV. Discussion

In this study, we reported 50.50% prevalence of overstay among patients admitted for one reason or the other in the Hospital. This report is higher than that of Macharia et al. (11), who reported 43.4% in Nairobi, Kenya. Gedamu et al. (6) also reported a lower prevalence of prolonged hospital stay of 49% in Ethiopia among hospitalized patients at felegehiwot referral hospital, Bahir Dar, Ethiopia. The fact that different reports are

coming from different regions of Africa underscores the fact that the length of hospital stay is increasingly becoming a healthcare dilemma that deserves as much attention as the disease itself.

The present study revealed the prevalence of 41.43% of HCAIs from the studied population of hospital attendees in MMSH Nigeria. The prevalence found in this study was relatively higher compared with the previous studies in Benin, Iran, and India (12,13,14), which reported the prevalence of HCAIs at 8.5%,19.1%, and 17.7%, respectively. It is not clear why a specialist hospital in the metropolitan city of Kano will record high HCAIs higher than India, Iran, and Benin. The global emergence and re-emergence of new pathogens with total resistance to conventional antimicrobial agents, economic impacts of patients meeting to financial responsibilities of prolonged Hospital stay in a private hospital setting, and the pattern of bacteria related co-infections from many sample types might give insight on the observed infections among the studied group.

On the other hand, the reported intra-country difference in the prevalence of HCAIs between Delta state 55.6% by Oli et al. (15) and the Kano state in our study might be connected to seasonal variation between the desert climate in Kano and rainforest Delta regions in Nigeria. Although there may be other underlying factors behind this discrepancies, the fact that infection is a crucial issue in prolonged hospital admissions in the study area cannot overemphasized and warrants more in-depth study to increase our indices of suspicion vis-a-vis management of patients with the identified health problems.

The prevalence of HCAIs, according to the gender of the studied participants, showed that females had the highest prevalence compared to their male counterparts. This was contrary to the findings of Mythri and Kashinath (14); Datta et al. (16) reported a higher prevalence of HCAIs in males than the females. There may not be any particular epidemiological rule that defines gender preference for disease distribution. However, a closer look at the health-related demographic and geographic factors may point out some unusual health-related characteristics of patients studied in Kano Nigeria compared to the two Indian reports (12 and 16).

It has been demonstrated that self-employed (75.0%), widow (100%), Males (42.9%), primary education (76.9%) topmost affected population. Therefore the prolonged duration of hospital admission may have been significantly impacted by socioeconomic factors of occupation, marriage, educational status, and gender issues. Unemployment may mean patients overstayed for lack of money to pay hospital bills. Married ladies in a cultural setting like Kano metropolis subjected to some mythical rules which healthcare serves providers must comply with if they must operate. Such rules may include female doctors attend to female patients; drug components must not make of religiously prohibited components like pigs and the fact that the husband has the final say about anything concerning his wife, even when husbands are not physically available.

The prevalence of HCAIs, according to the age groups of the studied participants, showed that patients whose aged 69-78 had the highest prevalence of 58.80%. This was in line with finding Mythri and Kashinath (14), who reported a higher prevalence of UTIs in patients aged 40-60 years old in India. While we are not aware why older people in the Indian study had high HCAIs, the reason for their elderly Nigerian counterparts to be associated with HCAIs may arise due to socioeconomic factors. There is no national insurance that guarantees healthcare for senior citizens in Nigeria. Everyone, therefore, goes to affordable hospitals even with inadequate facilities, thereby impacting on the duration of hospital admission in the studied population. The distribution of HCAIs, according to the site of infection, showed that the most frequent HCAI in the present study was UTIs (56.89%). This was in line with the findings of Oli et al. (15); Theodora et al. (13) who reported urinary tract infection as the most prevalent HCAIs with 61.4%, and 48.2% from their studied areas, respectively. Though Oli et al. (15) studied, participants involved patients only from government hospitals. This was contrary to the finding of Durlach et al. (17); Oli et al. (15) reported Pneumonia infection as the most prevalent HCAIs with 3.3% and 33.3% from Argentina and South Africa respective.

Though Oli et al. (15) studied patients from private hospitals; his finding showed that E. coli was the most prevalent with 22.41%. This agrees with the results of Hamza et al. (18), who reported E. coli as the most common organism responsible for UTI with 29 (14.5%). This was contrary to the finding of Theodora et al. (13), who reported S. aureus as the most prevalent isolated bacteria involved in HCAIs from their studied area. Acinetobacter species detected in all samples studied including wounds, urine, urinary catheter,

The prevalence of other risk factors (Prolong hospital stay, urinary tract catheters, mechanical ventilation, and an operation) found was associated with HCAIs were similar to the previous studies (19, 20, 21) The risk of HCAIs among medical ward was higher on patients with prolong hospital stay, urinary catheters, mechanical ventilator, and those with underlying diseases. This result suggests most of the HCAIs in this group of patients associated with contamination of the medical procedures by bacteria. This can be due to improper management and storing, and insufficient application of sterile techniques during handling, insertion, and removal of the medical devices. This situation might also further fuelled by the existence of one or more underlying medical conditions.

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Competing Interests
The authors declare no competing interest.

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Table 1: Prevalence of HCAIs and prolonged hospital stay among studied participants in MMSH Kano State, Nigeria

Variables/Characteristics	Number of patients examined, n(%)	Prevalence n (%)	p-value
HCAIs	140	58(41.43)	-
Age groups (year)			
18-28	25(17.9)	10(40.0)	
29-38	19(13.6)	10(52.6)	
39-48	27(19.3)	12(44.4)	0.061
49-58	22(15.7)	6(27.3)	
59-68	30(21.4)	10(33.3)	
69-78	17(12.1)	10(58.8)	
Gender			
Male	63(45.0)	27(42.9)	
Female	77(55.0)	31(40.3)	0.782
Occupation			
Salary earner	11(9.2)	2(18.2)	
Self employed	40(28.6)	30(75.0)	
Unemployed	8(5.7)	2(25.0)	0.039*

Retired	81(57.9)	24(29.6)	
Marital status			
Married	70(50)	42(60.0)	
Unmarried	36(25.7)	10(27.8)	0.040*
Divorced	33(23.6)	15(45.5)	
Widow	1(0.7)	1(100)	
Level of education			
Non formal education	75(53.6)	30(40.0)	
Primary	13(9.3)	10(76.9)	
Secondary	32(22.2)	12(37.5)	0.024*
Tertiary	12(8.6)	1(8.3)	
University	8(5.7)	5(62.5)	

*Statistically significant (p≤ 0.05) and were considered for inclusion in Multivariate analysis

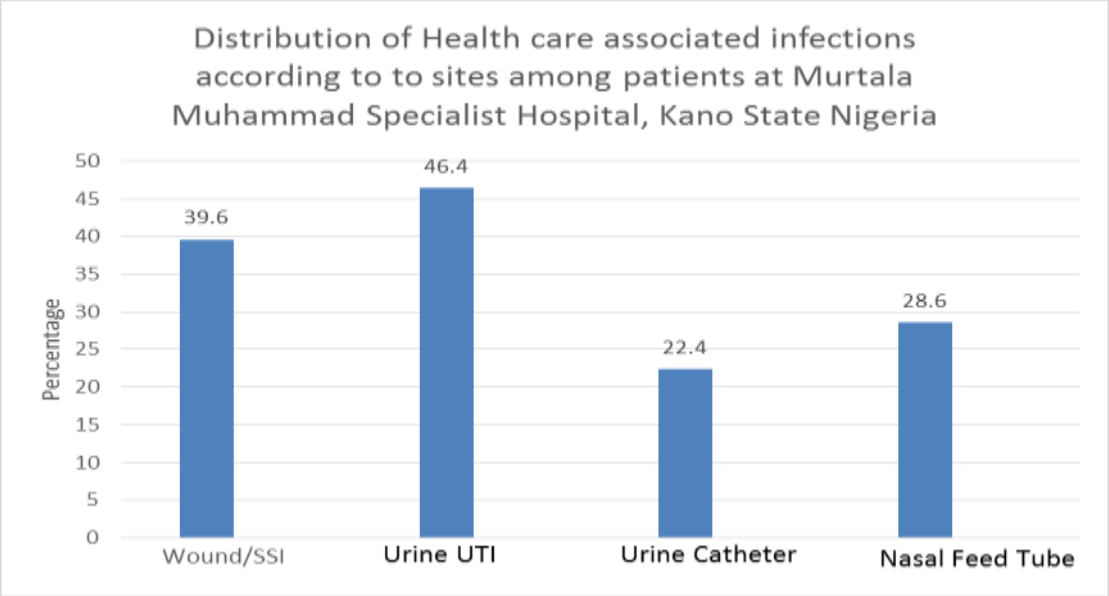

Fig 1: Distribution of health care associated infections according sites of infection among studied participants at Murtala Muhammad specialist hospital, Kano state, Nigeria.

Table 2: Frequency of distribution of isolated bacterial pathogens based on site of infection in Murtala Muhammad Specialist Hospital Kano State Nigeria, N = 140

Organism	**Type samples**				**Total (%)**
	Wound/pus, n(%)	**Urine, n(%)**	**Urine Catheter, n(%)**	**Nasal feed tube n(%)**	
Acinetobacter species	2 (1.43)	2(1.43)	1(0.71)	1(0.71)	6(4.29)
Klebsiella species	1(0.71)	6(4.29)	3 (2.14)	0 (0)	10(7.14)
Escherichia coli	5(3.57)	6(4.29)	2(1.43)	0 (0)	13(**9.29**)
Proteus species	2(1.43)	2(1.43)	2(1.43)	2(1.43)	8(5.71)
Staphylococcus aureus	4(2.86)	2(1.43)	2(1.43)	1(0.71)	9(6.43)
Streptococcus pyogen	2(1.43)	0 (0)	2(1.43)	0 (0)	4(**2.86**)
Pseudomonas species	5(3.57)	2(1.43)	1(0.71)	0 (0)	8 (5.71)
Total	**21 (15.00)**		**20 (14.29)**	**13 (9.29)**	**4(2.86)**	**58**

	(41.43)

Table 3: Bivariate analysis of potential risk factors for health care associated infections in MMSH Kano State, Nigeria

Variable	Number of patients examined, n(%)	Patients with pathogens, n(%)	Crude OR (95% CI)	P-value
Length of hospital stay*				
14 days	38(27.1)	2(5.3)	0.61(0.55, 3.23)	0.019
>14 days	102(72.9)	56(54.9)	1.00	
Disease co-morbidity				
Surgical site	68(48.6)	27(39.7)	1.96 (0.47, 2.76)	0.054*
Urinary catheterization	29(20.7)	11(37.9)	1.58 (0.65, 2.97)	0.126
Nasogastric intubation	20(14.3)	12(60.0)	2.21 (0.82, 3.87)	0.062
Surgical site and urinary catheterization	10(7.1)	7(70.0)	2.62 (0.79, 3.85)	0.240
Urinary catheterization and nasogastric intubation	13(9.3)	1(7.7)	1.00	
Invasive device				
Ventilation	70(50.0)	11(15.7)	1.31 (1.27, 4.07)	0.043*
Catheterization	42(30.0)	29(69.0)	1.94 (1.18, 3.49)	0.026*
Intubation	28(20.0)	25(89.3)	1.00	
Frequency of bed making and bed sheet change *				
1 day	3(2.1)	1(33.3)	0.87 (0.35, 1.07)	0.456
2 days	10(7.1)	6(60.0)	2.16 (1.15, 4.56)	0.021*
3 days	127(90.7)	51(40.2)	1.00	

*Statistically significant risk factor

Table 4: Multivariate analysis of risk factors for occurrence of health care associated infections in MMSH Kano State, Nigeria

Variable	Adjusted OR	95% CI	P-value
Occupation			
Salary earner	0.34	0.21, 0.80	0.045 *
Self employed	1.43	1.23, 3.52	0.023*
Unemployed	0.34	0.19, 2.06	0.147
Retired	1.00		
Marital status			
Married			
Unmarried	2.71	1.67, 3.31	0.024 *
Divorced	1.34	0.67, 1.89	0.078
Widow	1.25	1.13, 2.08	0.037 *
Level of education			
No formal education	1.87	0.76, 2.78	0.065
Primary	1.52	0.81, 2.53	0.217
Secondary	1.34	0.72, 2.81	0.078
Tertiary	0.37	0.11, 1.21	0.895
University	1.00		
Length of hospital stay			
14 days	0.59	0.30, 0.82	0.031 *
>14 days	1.00		
Disease co-morbidity			
Surgical site	1.41	1.20, 3.04	0.171
Urinary catheterization	1.28	0.95, 2.87	0.376
Nasogastric intubation	1.36	0.98, 6.74	0.217
Surgical site and urinary catheterization	1.57	0.34, 3.21	0.791
Urinary catheterization and nasogastric intubation			

How frequent is your bed making and bed sheet change			
1 day	0.62	0.31, 1.27	0.642
2 days	1.75	1.23, 2.12	0.037 *
3 days	1.00		

*Statistical significance considered at p≤ 0.05

Table 5: Risk factors associated with HCAIs and prolonged hospital stay in MMSH Hospital Kano State, Nigeria

Variables	Crude OR	95% CI	Adjusted OR	95% CI	p-value
Are there qualified staff?					
Yes	1.00		1.00		
No	6.67	2.08-11.46	4.27	2.78-7.68	0.030*
Do they receive training?					
Yes	1.00				
No	7.46	4.42-16-24	6.82	5.01-9.83	0.017*
Any data to show the impact of training to reduction of hospital stay?					
Yes	1.00		1.00		
No	4.79	2.83-6.24	3.32	1.78-4.10	0.041*
Are there equipment in the labs, theater and wards?					
Yes	1.00		1.00		
No	3.81	1.21-4.08	1.87	1.17-3.78	0.032*
Are those equipment used in cases of prolonged stay?					
Yes	1.00		1.00		
No	5.12	4.22-8.91	3.04	0.77-5.37	0.237
Are SOPs available and used?					
Yes	1.00		1.00		
No	4.18	2.79-5.71	1.97	0.92-2.56	0.611
Are there quality assurance system?					
Yes			1.00		
No	2.93	1.34-4.67	1.67	1.94-3.67	0.038*
Are essential drugs/consumables available during case of prolonged stay?					
Yes	1.00		1.00		
No	4.81	2.01-7.78	2.10	1.53-4.26	0.007*
Are health personnel always available in ICU facilities?					
Yes	1.00		1.00		
No	5.78	4.71-8.73	3.57	1.79-5.12	0.017*

Alkali Bashir,etal. "Risk Factors and Bacteriological Assessment of Patients on Prolonged Hospital Admission at Murtala Muhammad Specialist Hospital Kano State, Nigeria." *IOSR Journal of Nursing and Health Science (IOSR-JNHS)*, 9(2), 2020, pp. 12-19.