Original Research Article

ASSESSMENT OF MITIGATION MEASURES IN PREVENTING BACTERIAL INFECTIONS IN SELECTED PUBLIC HEALTH CENTRES IN AKURE, ONDO STATE.

ABSTRACT

Introduction: Hospital acquired infection (or nosocomial) is an infection whose development is favored by an hospital environment. They are usually acquired by either a patient during a hospital visit (or when hospitalized), hospital staff or patients' relatives that visit when the patient is on admission in the hospital. Nosocomial infections can cause severe pneumonia and infection of the urinary tract, wounds, blood stream and other parts of the body. Nosocomial infections are commonly encountered in Africa and in Nigeria in particular. Factors such as hospital hygiene / cleanliness, personal hygiene of patients, overcrowding hospital wards and illiteracy increases the risk of nosocomial.

Methods: The assessment of mitigation measures put in place to reduce bacteria present in surfaces of facilities (pillow, bed sheets, door handles, toilet seats and the floor) in wards of selected basic health centres (Arakale, Aule, Ayedun, Isolo, Oba-Ile and Orita-Obele) in Akure was evaluated using both questionnaire and on-sight assessment techniques.

Results: The results showed that there was a direct relationship between the hand washing or sanitizer used and the bacterial load present in the various surfaces examined.

Conclusion: Therefore, adequate ward hygiene in these health centres is necessary to reduce the risk of nosocomial infections for both patients and visitors.

INTRODUCTION

Hospital acquired infection or nosocomial is an infection whose development is favored by a hospital environment. They are usually acquired by patient, hospital staff or patients' relatives [1]. Nosocomial is responsible for 1.7 million hospital-associated infections in the United States and about 25,000 deaths in Europe annually from all types of microorganisms including bacteria

[2]. Nosocomial infections can cause severe pneumonia and infection of the urinary tract, blood stream and other parts of the body.

Nosocomial infections are commonly encountered in Africa and in Nigeria in particular. According to Cheesebrough [3], factors such as hospital hygiene / cleanliness, personal hygiene of patients, overcrowding hospital wards and illiteracy can increase the spread of nosocomial infection. These infections are usually difficult to attack with antibiotics. Equally, antibiotics resistance is fast spreading to more Gram positive and Gram negative bacteria that can infect people within the hospital environment [4].

Nosocomial infections occur worldwide and affect both developed and resource-poor countries. Infections acquired in health care settings are among the major causes of death and increased morbidity among hospitalized patients. They are a significant burden both for the patient and for public health. A prevalence survey conducted under the auspices of WHO in 55 hospitals of 14 countries representing 4 WHO Regions (Europe, Eastern Mediterranean, South-East Asia and Western Pacific) showed an average of 8.7% of hospital patients had nosocomial infections. At any time, over 1.4 million people worldwide suffer from infectious complications acquiredin hospital [5]. The highest frequencies of nosocomial infections were reported from hospitals in the Eastern Mediterranean and South-East Asia Regions (11.8 and 10.0% respectively), with a prevalence of 7.7 and 9.0% respectively in the European and Western Pacific Regions [6]. The most frequent nosocomial infections are infectionsof surgical wounds, urinary tract infections and lower respiratory tract infections. The WHO study, and others have also shown that the highest prevalence of nosocomial infections occurs in intensive care units and in acute surgical and orthopaedic wards. Infection rates are higher among patients with increased susceptibility because of old age, underlying disease, or chemotherapy

Hospital-acquired infections add to functional disability and emotional stress of the patient and may, in some cases, lead to disabling conditions that reduce the quality of life.

Nosocomial infections are also one of the leading causes of death [7]. The economic costs are considerable [8]. The increased length of stay for infected patients is the greatest contributor to cost. One study showed that the overall increase in the duration of hospitalization for patients with surgical wound infections was 8.2 days, ranging from 3 days for gynaecology to 9.9 for general surgery and 19.8 for orthopaedic surgery. Prolonged stay not only increases direct costs to patients or payers but also indirect costs due to lost work. The increased use of drugs, the need

for isolation, and the use of additional laboratory and other diagnostic studies also contribute to costs. Hospital-acquired infections add to the imbalance between resource allocation for primary and secondary health care by diverting scarce funds to the management of potentially preventable conditions. The advancing age of patients admitted to healthcare settings, the greater prevalence of chronic diseases among admitted patients, and the increased use of diagnostic and therapeutic procedures which affect the host defense will provide continuing pressure on nosocomial infections in the future. Organisms causing nosocomial infections can be transmitted to the community through discharged patients, staff, and visitors [9]. If organisms are multi-resistant, they may cause significant disease in the community.

In Akure, Ondo State, several communities which are densely populated have primary health centres to cater for the immediate health need of the people. According to Ondo State Health/Hospital Management report [10], Government has taken some steps to improve on the hygiene status of these primary health centres to minimize nosocomial infections. However, there is no constant evaluation of the hygienic status of these primary health centres.

In our previous study, antibiotic sensitivity assay on pathogenic microorganisms isolated from selected areas in some primary health centres in Akure metropolis, Nigeria was reported in which six different primary health centres were visited. A total of 720 swab samples were collected from bed sheet, door handles, floor, pillow and toilet; it was noted that the highest bacterial counts ranged from 53.33 ± 1.86 to 1.67 ± 0.33 cfu/ml from toilet in maternity and pillows in pediatric wards respectively. The bacterial isolated include; *Escherichia coli, Staphylococcus aureus, Staphylococcus epidermidis, Proteus mirabilis, Bacillus subtilis, Pseudomonas aeruginosa, Klebsiella pneumonia*, while the fungi were*Candida albicans* and *Candida dubliensis*.The bacterial isolates were mostly resistant to tetracycline and streptomycin, *Pseudomonas aeruginosa* and *Staphylococcus aureus* were the most resistant bacteria isolates many antibiotics used. However, ofloxacin exerted the highest inhibitory effect against all the bacteria [4].

There is currently no study or records of the relationship between contaminated facilities as reported by Omoya and Afolabi [4] in these primary health centres, the spread of infections and the safety of the public that visit these health centres. Such records will in turn help prevent the spread of nosocomial infections from formites to patients, staff and visitors or the general public from the health centres. Hence, there is need to evaluate the mitigation measures put in place

91 both by the government and the health centres to reduce nosocomial infections within and

92 outside these health facilities for safety of the populace, patient and staff of the health centres.

93 **MATERIALS AND METHODS**

94 **Description of study area**

95 The study area is Akure South Local Government Area. Akure South Local Government Area

96 was carved out of Ondo Municipal Government of Akure central in 1996 after the creation of

97 Ekiti State. It covers a land area of 15, 500 square kilometers. It has a population density of 3,

98 300 persons per square kilometer. The Akure South Local Government Area shares boundaries

99 with Akure North Local Government Area and Akure East Local Government Area respectively.

100 Akure South Local Government Area has a total population of 360, 268; comprising of 173, 153

101 males and 187, 115 females according to the 2006 national population with 2010 estimated

102 population of 459,164 using a growth rate of 3.2% from 2006 census. It is an urban area and

103 therefore, no major farming activities take place. Yoruba and other tribes dominate the area. The

104 residents are engaged in various economic activities such as trading, transportation business,

105 civil service and education.

106 The symbol of tradition is evident in Akure South Local Government Area. The official resident

107 of the Oba Adesida is situated in the area. There are twelve primary Health care centres in the

108 area, fifty-nine registered private health facilities, two public secondary health care facilities and

109 no tertiary health facilities in the area. There are four mission (private) hospitals that provide

110 secondary health care for the people. The surrounding Local Government areas have public

111 secondary health centres.

112 **Study design**

113 This study was a descriptive cross sectional survey.

114 **Study population and study subjects**

115 All consenting primary health centers' facilities in Akure metropolis of Akure South Local

116 Government area were included in the survey regardless of size and location.

117 **Sample size determination**

118 A total of six primary health centres in Akure metropolis were evaluated/visited:

119   1.   Primary health centre, Aule;

120   2.   Primary health centre, Ayedun;

121   3.   Primary health centre, Isolo;

122   4. Primary health centre, Arakale;

123   5. Primary health centre, Oba-ile and

124   6. Primary health centre, Orita-Obele.

125   They were analyzed using questionnaire and physical surveillance of the hospitals to ascertain

126   their hygienic status. A total of one hundred and twenty (120) questionnaires (twenty in each

127   health centre) were administered to staff of the health centres as check list to assess their

128   facilities.

129   **Data collection**

130   This was done using two (2) different instruments. The first survey instrument was physical

131   surveillance of the health centre environment to evaluate the hygienic status of the basic

132   primary health centre. The second instrument was a structured questionnaire administered to

133   staff of the basic primary health centres to assess their health facilities available to the health

134   centres and the public to maintain a hygienic status.

135   **Ethical consideration**

136   Consent: Approval for the study was obtained from the Ondo State Hospital Management

137   Board. Respondents were told of their right to decline the questionnaire without any

138   consequences but appealed to not to decline it.

139   Confidentiality: Data collected was used only for research purpose and kept confidential on a

140   password protected computer. Names and addresses were not included in the data collection

141   questionnaires and thus data collected cannot be linked with any person.

142   Beneficence: Data obtained in this study can be useful in policy making and to identify

143   appropriate areas requiring attention to improve health care service delivery in Ondo State.

144   **Limitation of the study**

145   The following were limitations to this study:

146   Information on monthly average internally generated revenue of the basic primary health

147   centre was not used. Quality of the monthly take-home of the staff, especially the cleaners and

148   health attendants was not included in the questionnaires because these staff is likely not to be

149   contented with such. Information on the monitoring of the hygienic status was included as the

150   basic primary health centres are likely to be cleaner within such period of visitation of the

151   monitoring team.

152 **RESULTS**

153 The availability of the facilities assessed is shown in table 1. The result of the availability of the

154 facilities in the basic primary health centres selected in Akure metropolis showed that they all

155 have toilets in their wards; they all equally have beddings (bed sheets and pillow cases) materials

156 in their wards, the wards were well tiled and the doors have good handles. However, only Aule,

157 Ayedun and Oba-Ile basic primary health centres have bore-holes for water supply. Of these

158 three basic primary health centres, only Aule and Oba-Ile basic primary health centres have tap

159 water system while only Oba-Ile basic primary health centre had washing hand basins situated in

160 strategic locations. All the basic primary health centres selected for this study have well water.

161 **Table 1: The availability of facilities assessed in this research**

Centre	Toilets	Bed sheets / pillows	Tiled Floor	Door handles	Bore hole	Taps	Washing hand basin	Well water
Arakale	+	+	+	+	-	-	-	+
Aule	+	+	+	+	+	+	-	+
Ayedun	+	+	+	+	+	-	-	+
Isolo	+	+	+	+	-	-	-	+
Oba-Ile	+	+	+	+	+	+	+	+
Orita-Obele	+	+	+	+	-	+	-	+

162 Keys: + = Present; - = Absent

163 The condition of the facilities assessed in the basic primary health centres showed that Isolo

164 basic primary health centre had bad toilets and bed sheets. The bore hole in Ayedun was bad,

165 only the tap water system in Oba-Ile health centre was in good working condition. Their floor

166 was very neat while their well was fine and well situated as seen in Table 2

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169

170 **Table 2: Conditions of the facilities assessed in basic health centres**

Centre	Toilets	Bed sheets	Floor	Door handles	Bore hole	Taps	Washing hand basin	Well water
Arakale	G	A	N	G	-	-	-	G
Aule	G	N	N	G	G	B	-	G
Ayedun	G	N	N	G	B	-	-	G

Isolo	B	B	A	G	-	-	-	G
Oba-Ile	G	N	N	G	G	G	G	G
Orita-Obele	G	N	A	G	-	B	-	G

171 Keys: A= Averagely neat/ok; B= Bad; G= Good; N= Neat; - = Not present.

172 Other assessment of the equipment for hygienic purpose in the basic primary health centres
173 showed that there was no hand washing basins in the toilets of five health centres except that of
174 Aule whose own was in bad condition and not in use. Isolo health centre lack hand towel for
175 hand cleaning. All the basic primary health centres however had hand sterilizer for staff after
176 work. They all have good foot-mats at their entrance to reduce the carriage of dirty materials by
177 shoes into the wards.

178 The assessment of the environmental hygiene level of the basic health centres using
179 questionnaire for the staff of the centres showed that of the twenty questionnaire distributed in
180 each centre, a total of 65% of the staff in each of the basic health centre were females and 35%
181 were males. They all had secondary and tertiary education and have been working in the basic
182 health centres for more than five (5) years. They all agreed that the wards were cleaned once
183 daily using antiseptic mopping. They all use hand sanitizers without hand washing sink and the
184 available disposable hand towels were for the staff only. The questionnaire also showed that the
185 Arakale and Isolo basic health centres records more than 50 patients visiting the centres for one
186 treatment or the other and admits less than twenty patients daily, while the other 4 basic health
187 centres had less than 30 patients daily and admits less than 10 patients daily. Table 3 shows the
188 scores for the questionnaire given to the staff of the basic health centres and the total score for
189 each health centre respectively. A copy of the questionnaire is also attached to the appendix I.

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191
192

193 **Table 3: Scores / rating of the questionnaire distributed to staff of basic health centres.**

S/N	Point considered	Arakale	Aule	Ayedun	Isolo	Oba-Ile	Orita-O
1	Staff strength	4	3	3	4	3	3
2	Cleaning method employed	2	3	3	1	4	3
3	Cleaning of wards daily	2	3	3	2	3	3
4	Washing of beddings	3	4	4	3	4	3
5	Modern washing of beddings	2	2	2	2	2	2

6	Water supply	3	3	3	3	4	3
7	Waste disposal	3	3	3	3	3	3
8	Hand washing sink	2	3	2	2	3	2
9	Disposable hand towels	1	2	1	1	2	2
10	Washing of toilets	2	2	2	2	2	2
11	Cleaning agent used	3	3	3	3	3	3
12	No. of visitors to centre	4	3	3	4	3	3
13	No. of patients admitted	4	3	2	4	2	3
14	Overall hygiene strength	2	3	3	2	3	3
15	**Total score/70**	**34**	**37**	**35**	**34**	**39**	**36**

Keys: Very adequate/very high= 5; Adequate/high= 4; Average= 3; Inadequate/few/low/poor= 2;

Very poor/low/few= 1

Table 4 shows the waste management mechanism and the environmental cleaning method put in place by each of the health centre to curtail the spread of communicable diseases via wastes. Most of the centres do not have bushes around them. However, Oba-Ile and Orita-Obele that have both control it with the use of mower and manually respectively. Only Oba-Ile health centre spray insecticide occasionally to control insects especially on their flower. They also treat their gutter with germicide to control communicable diseases as well as burn their generated waste in an incinerator every week.

Table 4: Environmental and waste management assessment of basic health centres.

Centre	Clearing of bushes	Insect control	Mosquito nets in wards	Available incinerator	Destruction of wastes	Use of germicide in gutters
Arakale	No bush	No	No	No	Empty in waste van	No
Aule	No bush	No	Ye	Yes	Yes	Yes
Ayedun	No bush	No	No	No	Empty in waste van	Yes
Isolo	No bush	No	No	No	Empty in waste van	No
Oba-Ile	Uses mower	Spray insecticide	Yes	Yes	Yes	Yes
Orita-Obele	Manually	No	No	Yes	Empty in waste van	No

Discussion

The results obtained from this work have shown that many of the facilities in our basic health centres need attention to reduce nosocomial infections. According to Plowman [11], the major reason for high bacterial load of pillows and beddings in the hospitals is basically due to the fact that patients under critical conditions may not be able to bath for days and most hospitals in developing countries may not have enough of these beddings for daily change [4]. Hence there is need for proper cleaning methods such as surface sterilization of all the facilities in these basic health centres should be adopted for reducing the microbial loads.

213   The absence of flowing tap water and bore holes could hinder high level of hygiene standard as
214   seen in the results of these assessments, from these basic health centres. The basic primary health
215   centres without tap water or bore hole are likely to have high bacterial load isolated from them
216   and promote the spread of nosocomial infections because well water used could have been
217   contaminated. Therefore, the level of hygiene maintenance in these health centres is directly
218   related to the availability of water for laundry purpose in such centre.

219   The condition of the facilities assessed in the basic primary health centres showed that Isolo
220   basic primary health centre had bad toilets and bed sheets. The bore hole in Ayedun was bad,
221   only the tap water system in Oba-Ile health centre was in good working condition. According to
222   Omeleke [12], the lack of maintenance of the available facilities in our health centres have
223   contributed to the increased nosocomial infections often acquired from these health centres.
224   Equally, the fact that the low income earners in the society are the major patronage of these
225   health centres make their hygiene level low as they are often involve in overcrowding and use of
226   dirty water for cooking and cleaning [1].

227   Many factors contribute to the frequency of nosocomial infections: hospitalized patients are often
228   immune-compromised, they undergo invasive examinations and treatments, and patient care
229   practices and the hospital environment may facilitate the transmission of microorganisms among
230   patients. Cowman *et al*. [13] stated that most of the health centres in Africa have only doors
231   without nets to prevent mosquito and this often lead to re-infection of patients in wards with
232   malaria. The selective pressure of intense antibiotic use promotes antibiotic resistance [14], and
233   while progress in the prevention of nosocomial infections has been made, changes in medical
234   practice continually present new opportunities for development of infection. The information
235   obtained from the questionnaire given to the staff of these basic health centres have shown the
236   relationship between the questionnaire and the physical surveillance assessment done.

237   According to Prescott *et al*. [1], the number of patients visiting a hospital is a pointer to the
238   number of visitors that will visit such hospital. Mansouri *et al*. [15], stated that this point is well
239   abused in developing countries were a patient has multiple visitors coming daily when they are
240   on hospital admission. Due to this reason, Tikhomirov [16], concluded that the floor, door handle
241   as well as the chairs which these visitors have direct contact with cannot be devoid of bacteria,
242   especially pathogenic ones.

243 The absence of flowing tap water and bore holes could hinder high level of hygiene standard as
244 seen in the results of bacterial isolations from these basic health centres. The basic primary
245 health centres without tap water or bore hole had high bacterial load isolated from their wards,
246 beddings and toilets respectively. Therefore, the level of hygiene maintenance in these health
247 centres is directly related to the availability of water for laundry purpose in such centre.

248 The regular treatment of the drainage system of hospitals with germicides as well as use of
249 mosquito nets in wards have been noted to help reduce nosocomial infection from series of
250 studies [14, 15, 17] this habit was only seen to be practiced by one health centre (Obal-Ile) out of
251 the six health centres studied. This probably was made possible by the contributory effort of the
252 elites in the estate in which the health centre was situated.

253 Therefore, there is need for adequate water supply to these health centres and constant ward
254 hygiene in these health centres to reduce the risk of nosocomial infections for both the patients
255 who are already admitted for different infection and for the visitors who previously may be free
256 of certain infection before coming to the health centres. Equally, though the mitigation measures
257 seen in these health centres are good, they should be improved upon.

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298

299   **appendix I.**

300   **Questionnaire**

301   Basic Health Centres in Akure metropolis

302   Environmental Hygiene of Basic Health Centres and Influx of Patients and Visitors Assessment

303   QUESTIONAIRE

304   Please, tick box or underline where applicable

305   Sex / Gender: M ☐   F ☐

306

307   Age: Less than 20 years ☐   20-30 years ☐   30-Above ☐

308   Educational Status of Respondent: Primary / Secondary / Tertiary

309   Religion: Christianity / Islam / Others

310   Number of Years in the Health Centre: Less than 1year/ Less than 5years / More than 5 years.

311   Are the wards cleaned daily? Yes / No

312   The mode of cleaning employed: Antiseptic mopping / Just mopping / Sweeping

313   How often are the wards cleaned daily: Once / Twice /Three times daily

314   How often are the beddings (Pillows and bed sheets) washed: Daily/Twice a week/Once a

315   week/After the discharge of an admitted Patient.

316   Mode of washing: By hand / By washing machine

317   Number of toilet in wards: One / Two / Three / More than three

318   Source of water supply: Well / Over head tanks / Borehole / Pipe borne water

319   Method of waste disposal in the wards: Use of waste basket / Dust bin / Covered trash can

320   Provision of hand sanitizers in wards: Yes / No

321   Provision of hand washing sink in wards: Yes / No

322   Provision of disposable hand towels in wards: Yes / No

323   How often are the toilets washed: Always / Twice daily / Daily / After use / Weekly

324   Do you clean the door handle? Yes / No

325   If yes, how often: Daily /Every other day/Weekly

326   The cleaning agent(s) employed: Liquid soap only /Liquid soap and Izal /Liquid soap and detol /

327   Powdered soap and other disinfectants.

328   The estimated number of patients that visit your centre: Less than 10 daily / Less than 20 daily /

329   Less than 30 daily / Less than 40 daily / Less than 50 daily / More than 50 daily /More than 100

330   daily.

331   Estimated number of patients admitted: Less than 10 daily / Less than 20 daily / Less than 30

332   daily / Less than 40 daily / Less than 50 daily / More than 50 daily /More than 100 daily.

333　Estimated number of visitors to the wards: Less than 10 daily / Less than 20 daily / Less than 30

334　daily / Less than 40 daily / Less than 50 daily / More than 50 daily /More than 100 daily.