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RESEARCH ARTICLE

BACTERIAL CONTAMINATION OF DOOR HANDLES IN MURANG'A DISTRICT HOSPITAL, MURANG'A COUNTY, KENYA

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Abstract

Background: Door handles are documented as breeding grounds for pathogens and presents as focal point of high risk common contact surfacing which facilitates transmission of pathogens within the hospital buildings. Hand hygiene has been singled out as the most important and one of the most effective means of preventing pathogens associated with health care services.

Broad objective: The objective of the study was to determine the type of bacterial contaminants on door handles within Murang'a District Hospital.

Methods: In this cross-sectional study, 122 door-handles of buildings within Murang'a District Hospital were tested for presence of bacteria.

Results: The findings showed that 68 doors did not indicate disease causing bacteria. The highest frequencies of disease causing bacteria were *E. coli* and *Citrobacter* _{ssp} at a frequency of 11 each. The lowest disease causing bacteria was *P. aeruginosa* at a frequency of 6. The department had no significance on the type of pathogens identified because Pearson chi-square value was 47.784 at $P = 0.923$ (value of $P > 0.05$ then the null hypothesis is accepted). The type of door handle had a high significance on the pathogens identified. This is because the Pearson chi-square value was 58.954 at $P = 0.001$ (value of $P < 0.05$ then the null hypothesis is rejected).

Conclusion: The most contaminated door handles in MDH were in the morgue followed closely by those in OPD and ward 6/7. Majority of the bacterial isolates were nonpathogenic. Pathogenic bacteria were Gram negative while the nonpathogenic were Gram positive.

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Introduction:-

Hospital acquired infections (HAI) are an important focus of infection prevention in all countries but in developing countries they are a major cause of preventable diseases (Abdelraouf, 2015). Monitoring and evaluation of hospital door handles is necessary for infection control because there is a possibility that contaminated door handles may increase the risk of acquiring infections that often result from contact with door handles contaminated by people who do not practice hand hygiene. Door handles may also get contaminated by gloves and other cross contaminated objects and subjects found within the hospital environment (Abdelraouf, 2015). The hospital infection control committee has employed various standard precautions to prevent the hospital acquired infections (MOH, 2015). This

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study therefore aimed at generating data on the level of bacterial contamination, as well as identify bacterial contaminants in door handles of buildings in Murang'a District Hospital since generally this data is lacking.

Materials and Methods:-

This was a cross sectional study carried out on all door handles of buildings within Murang'a district hospital, the main referral hospital for the entire Murang'a County and its environs, Murang'a County, Kenya. A total of 122 door handles were conveniently sampled. Door handles of buildings that were not in use during sampling were excluded from the study.

Ethical approval of the study protocol was obtained from Murang'a district hospital infection prevention committee. Door handles from selected frequently touched door handles in all departments, that is offices, pharmacy, wards, theatre, laboratory, toilets, clinics, outpatient, x-ray and comprehensive care clinic were swabbed with sterile cotton wool swabs and inoculation done on both MacConkey and Blood Agar media within one hour of collection. The plates were incubated aerobically at 37 degree Celsius for 24 hours. Gram stain was done and appropriate biochemical tests performed for bacterial identification.

Results:-

The study intended to study the prevalence of pathogenic causing bacteria among door surfaces in Murang'a District Hospital. The following were the frequencies of the doors in each department that were involved in the study.

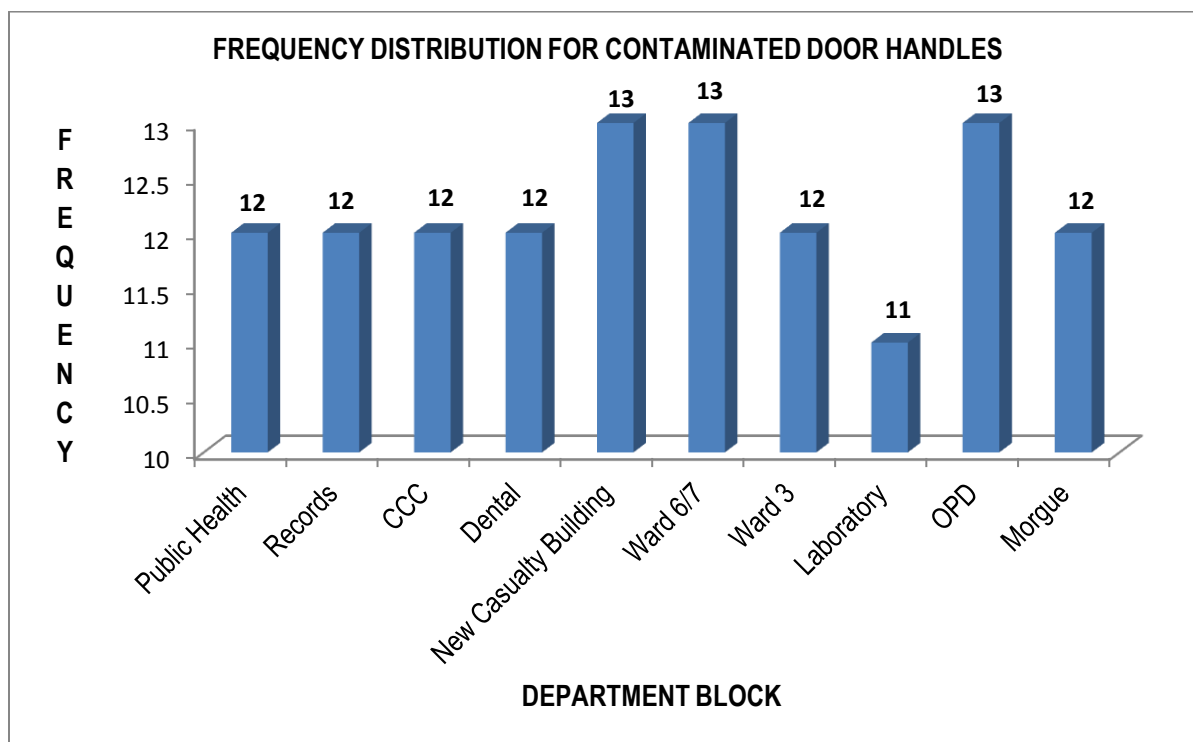


Figure 1:- Demographics. There were 122 doors that were tested for presence of bacteria in Murang'a County Referral Hospital.

The following were the frequencies of doors that were tested for presence bacteria:

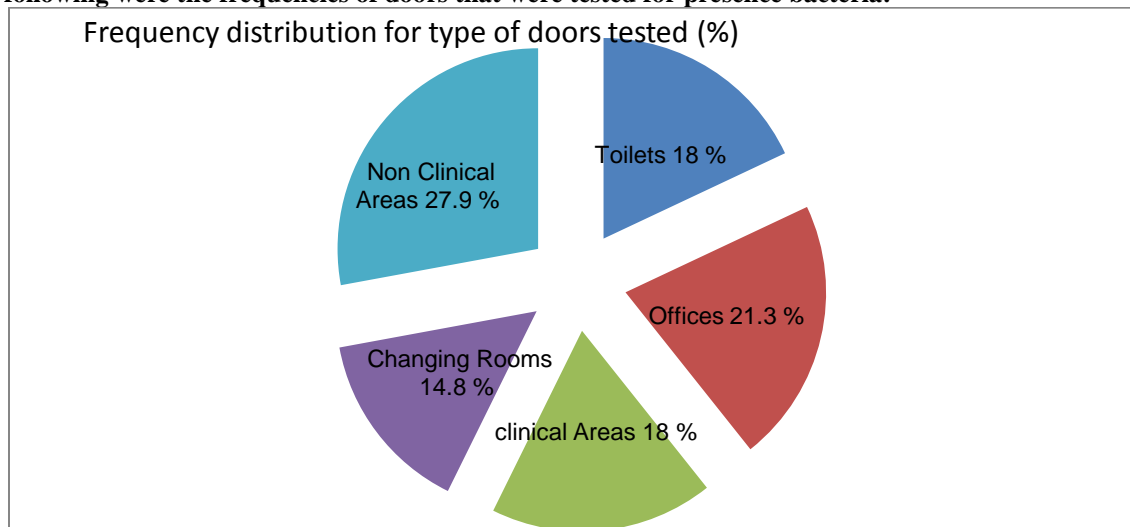


Figure 2:- Type of Doors Tested. There were 22 door handles from the toilets, 26 from the offices, 22 from clinical areas, 18 from the changing rooms while 34 were from non-clinical areas.

After each door was tested for bacteria, the following were the findings

Table 3:- Frequency of Bacteria found in doors in Murang'a District Hospital.

		Frequency	Percent
	Coagulase Negative Staphylococci	68	55.7
	Escherichia coli	11	9.0
	Streptococcus pyogenes	9	7.4
	Citrobacter _{spp}	11	9.0
	Proteus mirabilis	9	7.4
	Staphylococcus aureus	8	6.6
	Pseudomonas aeruginosa	6	4.9
	Total	122	100.0

The findings revealed that of the doors tested, 68 had coagulase negative Staphylococci bacteria. These findings showed that 68 doors did not indicate disease causing bacteria. The highest frequencies of disease causing bacteria were E. coli and Citrobacter _{spp} at a frequency of 11 each. The lowest disease causing bacteria was P. aeruginosa at 6 doors.

Cross-tabulation Analysis of the Findings:

It was important for the study to identify the departments and their prevalence of bacteria in their door handles. Thus a cross-tabulation analysis was done between the departments and the bacteria identified. The following were the findings.

Table 4:- Bacterial Isolate Tabulation.

Bacterial Isolate cross tabulation		Bacterial isolate							
Department		Coagulase Negative Staphylococci	E.coli	S.pyogenes	Citrobacter _{spp}	P. mirabilis	S. aureus	P. aeruginosa	Total
Department	Public Health	9	0	2	0	0	1	0	12
	Records	9	0	1	0	1	0	1	12

	CCC	7	2	0	2	0	1	0	12
	Dental	7	2	0	0	2	1	0	12
	New Casualty Building	8	0	0	1	2	2	0	13
	Ward 6/7	6	2	1	2	1	0	1	13
	Ward 3	6	2	2	1	0	0	1	12
	Laboratory	7	1	1	1	0	0	1	11
	OPD	6	1	1	1	1	2	1	13
	Morgue	3	1	1	3	2	1	1	12
Total		68	11	9	11	9	8	6	122

From the above findings, *E. coli* was the most predominant pathogenic bacteria in CCC, Dental Ward, Ward 6/7 and Ward 3, while *Streptococcus pyogenes* was most predominant in Public Health and Ward 3. *Citrobacter*_{spp} was predominant in CCC, Ward 6/7 and Morgue, while *Proteus mirabilis* was predominant in Dental Department and New Casualty Department. *Staphylococcus aureus* was predominant in New Casualty building and OPD.

When a chi square analysis was conducted on the above data, the following were the findings. To determine whether there is a relationship between the department and the pathogens identified (H_0 = department has no relationship on the pathogens), a chi-square analysis was done on the data.

Table 5:- Chi-Square Tests.

Chi-Square Tests			
	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	47.784 ^a	63	.923
Likelihood Ratio	62.888	63	.480
Linear-by-Linear Association	.274	1	.601
N of Valid Cases	122		

a. 80 cells (100.0%) have expected count less than 5. The minimum expected count is .54.

The findings showed that The Pearson chi-square value was 47.784 at $P = 0.923$. Now since the value of $P > 0.05$ then the null hypothesis was accepted. Thus the two variables were not significantly related and department had no significance on the type of pathogens identified.

The study then strived to determine the relationship between the type of door handle and the identified bacteria. The door handles tested were as shown in table 6 below.

When a cross-tabulation analysis was conducted to determine the relationship between the two variables, the following were the findings:

Table 6:- Relationship between Type of Door Handle and Bacteria Identified.

Bacterial Isolate * Type of Door Handle Cross tabulation							
		Type of Door Handle					Total
		Toilet	Office	Clinical Areas	Changing Rooms	Non Clinical Areas	
Bacterial Isolate	Coagulase Negative Staphylococci	0	20	14	10	24	68
	<i>E. coli</i>	4	2	2	1	2	11
	<i>S. pyogenes</i>	2	1	2	2	2	9
	<i>Citrobacter</i> _{spp}	3	1	1	3	3	11
	<i>Proteus mirabilis</i>	5	2	1	1	0	9
	<i>S. aureus</i>	6	0	1	1	0	8

	P. aeruginosa	2	0	1	0	3	6
Total		22	26	22	18	34	122

From the above findings, 0 toilet door handles (TDH) had coagulase negative Staphylococci, 4 TDH had E. Coli, 2 TDH had Streptococcus pyogenes, 3 TDH had Citrobacter_{spp}, 5 TDH had Proteus mirabilis, 6 TDH had Staphylococcus aureus and 2 TDH had Pseudomonas aeruginosa. 20 Office door handles (ODH) had coagulase negative Staphylococci, 2 ODH had E. coli, 1 ODH had Streptococcus pyogenes, 1 ODH had Citrobacter_{spp}, 2 ODH had Proteus mirabilis, while no ODH was found to contain either S. aureus or Pseudomonas aeruginosa.

To determine the relationship between the type of door handles and the pathogens identified (h_0 = type of door handles has no relationship with pathogens), a chi-square analysis was done on the data.

The following were the findings:

Table 7:- Chi-Square Tests.

Chi-Square Tests			
	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	58.954 ^a	28	.001
Likelihood Ratio	69.587	28	.000
Linear-by-Linear Association	.105	1	.746
N of Valid Cases	122		
a. 31 cells (77.5%) have expected count less than 5. The minimum expected count is .89.			

The findings show that The Pearson chi-square value is 58.954 at $P = 0.001$. Now since the value of $P < 0.05$ then the null hypothesis was rejected. Thus the two variables here were highly significantly related and type of door handles had a high significance on the pathogens identified.

Discussion:-

The study revealed that of the 52 door handles with pathogenic bacteria, the highest number was in toilet door handles with 22 (42.3%), followed by non-clinical areas which had 10 (19.2%), changing rooms and clinical areas each had 8 (15.4%) while office door handles accounted for only 4 (7.7%). This compared to a similar study done by Nworie et al (Nworie, 2012) which revealed more positive samples from female toilet handles/knobs (41.7%) and bathroom door handles/knobs (11.5%) than males. The study also found that toilet door handles/knobs in markets, motor parks and restaurants had higher rate of contamination compared to Government offices, and banks. Contamination was also higher in toilet door handles/knobs (87.2%) than in bathroom door handles/knobs (85%). The high rate of contamination on toilet door knobs can be attributed to availability of water and no soap

The study demonstrated that of the 122 bacterial isolates obtained in the study, a significant majority of them were coagulase negative Staphylococcus 68(55.7%), while the rest were Escherichia coli 11(9.0%), Citrobacter_{spp} 11(9.0%), Streptococcus pyogenes 9(7.4%), Proteus mirabilis 9(7.4%) Staphylococcus aureus 8(6.6%) and Pseudomonas aeruginosa 6(4.9%). This compared vaguely to a study done by Nwankwo and Afuruobi (Nwankwo, 2015) in which out of a total of 130 bacteria isolated in the study, the distribution of the isolates was as follows; Enterococcus faecalis 6(4.8%), Coagulase negative Staphylococcus(CoNS)28(21.2%), Streptococcus spp 22(16.6%), Klebsiella spp 3(2.2%), Bacillus spp 22(16.6%), E. coli 4(3.0%), Proteus mirabilis 4(3.0%), Proteus vulgaris 6(4.6%), Pseudomonas aeruginosa 2(1.5%) and Staphylococcus aureus 33(25.0%).

Conclusion:-

The most contaminated door handles in MDH were in the morgue followed closely by those in OPD and ward 6/7. There were no contaminated door handles found in some blocks like kitchen, stores and the resource centre.

Both pathogenic and nonpathogenic organisms were isolated with majority of the isolates being nonpathogenic. Most pathogenic bacteria were found to be Gram negative while the nonpathogenic were Gram positive.

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