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## BACTERIAL CONTAMINATION OF DOOR HANDLES/KNOBS IN SELECTED PUBLIC CONVENIENCES IN ABUJA METROPOLIS, NIGERIA: A PUBLIC HEALTH THREAT

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### ABSTRACT

The increasing incidence of epidemic outbreaks of certain diseases and its rate of spread from one community to the other has become a major public health concern. Door handles/knobs of public conveniences of selected public offices, motor parks, and markets in Abuja metropolis were investigated for bacteria contamination. Out of the 180 swab samples cultured, 156 (86.7%) were positive. They were 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%). Most of the bacteria contaminants were Coliforms. The isolated bacterial contaminants were *Staphylococcus aureus* (30.1%), *Klebsiella Pneumoniae* (25.7%), *Escherichia coli* (16 community health superintendents, sanitary officers and Environmental Protection Board as well as private organizations to educate the populace on personal and environmental hygiene. 1%), Enterobacter species (11.2%), Citrobacter species (7.1%), *Pseudomonas aeruginosa* (5.9%), and Proteus Species (4.5%). This shows that the city's convenient places harbours highly pathogenic bacteria which have the potentials of causing epidemics in the near future. Therefore, community health superintendents, sanitary officers and Environmental Protection Board as well as private organizations should educate the populace on personal and environmental hygiene.

**KEYWORDS:** Public conveniences, Door handles/knobs, Bacterial contamination, Pathogenic bacteria, Epidemics, Environmental hygiene.

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### INTRODUCTION

Microorganisms are found everywhere and constitute a major part of every ecosystem. In these environments, they live either freely or as parasites (Sleigh and Timbury, 1998). In some cases, they live as transient contaminants in fomites or hands where they constitute a major health hazards as sources of community and hospital-acquired infections (Pittet *et al.*, 1999). The increasing incidence of epidemic outbreaks of certain diseases and its rate of spread from one community to the other has become a major public health concern (Scott *et al.*, 1982; Galtelli *et al.*, 2006). Although it is accepted that the infection risk in general community is less than that associated with patients in hospital, the yearly increases in food poisoning cases in which household outbreaks are a major factor, requires an assessment of the probable causes and sources (Scott *et al.*, 1982).

Besides the day to day interaction of people, which constitute one way of spreading disease, the major source of and spread of community acquired infections are fomites (Prescott *et al.*, 1993; Li *et al.*, 2009). Fomites when in constant contact with humans or natural habitats of pathogenic organism constitute a major source of spread of infectious diseases (Osterholm *et al.*, 1995). Such fomites include door handles of conveniences, showers, toilet seats and faucets, sinks, lockers, chairs, and tables, especially those found in public offices, hospitals, hotels, restaurants and restrooms (Bright *et al.*, 2010). One of the most implicated probable sources of infections is door handles of toilets and bathroom (Reynolds, 2005). Public toilets and bathrooms have large traffic of users who throng in with their own microbial flora and other organisms they have picked elsewhere and deposit them on door handles/knobs while going into the convenience and on their way out (Goldhammer *et al.*, 2006).

However, the risk of disease transmission through fomites is determined by the frequency of site contamination and exposure; level of pathogen excreted by the host; likelihood of transfer of the infectious agent to a susceptible individual; virulence of the organism; immuno-competence of the persons in contact; the practice of control measure

such as disinfectant use and personal hygiene (Reynolds, 2005). Unfortunately, majority of public toilets found in parks and markets, especially Nigeria, lack water system and where they have such systems, water are never available. Consequently, users can hardly wash their hands after usage, carrying them contaminants from such conveniences (Giannini *et al.*, 2009) and such could result to community-associated methicillin resistant *Staphylococcus aureus* (CA-MRSA) outbreak in high prevalence areas and cholera outbreak Giannini *et al.*, 2009).

This study was therefore designed to determine the level of bacterial contamination of door handles/knobs of public toilets and bathrooms, as well as, identify the bacterial contaminants in selected public places in Abuja metropolis, the capital of Nigeria in order to provide scientific information that would have policy relevance, and which will aid the hand washing programmes in Nigeria.

#### MATERIALS AND METHODS

Abuja is the capital territory of Nigeria. It is made up of civil servants, public servants and traders with a population of 776,298 ([www.wikipedia.com](http://www.wikipedia.com)). Samples were obtained from the toilet door handles/knobs in selected public places in Abuja metropolis using full aseptic precaution. Samples were collected using the swab-rinse technique of the American Public Health Association as described by Reynolds, (2005). Door handles/knobs were swabbed with sterile, cotton-tipped applicator (swab stick) moistened with sterile peptone water. It was then introduced into bijoux bottles containing sterile peptone water, shaken, and loosely capped. The bijoux bottles were covered with cellophane and transported in ice pack from Abuja to Jos University Teaching Hospital where the samples were analysed. The peptone water, in which the swab samples from door handles/knobs were rinsed into, were thawed, gently shaken and poured on MacConkey agar, Blood agar, and Chocolate agar plates, and spread evenly over their entire surfaces using a sterile bent-glass rod. This was to allow quick recovery of all organisms picked up in the swab. Then, the plates were incubated aerobically for 24 hours at 37° C (Angelotti and Foter, 1958).

#### Identification and characterisation of bacterial contaminants

Bacterial isolates were first differentiated by macroscopic examination of the colonies. The colonies were differentiated based on size, colour, pigmentation, elevation, surface texture, margin, haemolysis on blood and chocolate agar plates, and lactose fermentation on MacConkey agar. Several biochemical tests were also carried out to further identify the various bacterial isolates as described by Barrow and Feltham, (1993).

#### RESULTS

Both toilet and bathroom door handles/knobs of selected public places in Abuja metropolis were sampled for bacterial contamination. One hundred and eighty (180) swab samples; 70 were from male toilets, 70 from female toilets, 20 from male bathrooms, and 20 from female bathrooms respectively. Out of the 180 samples, 156 (86.7%) showed positive for bacterial contamination (table 1). Out of the 140 samples collected from toilet door handles/knobs, 122 (87.1%) showed bacterial contamination while 34 (85%) of the 40 samples collected from bathroom door handles/knobs showed bacterial contamination (Table 2). Among the bacteria contaminants isolated, *Staphylococcus aureus* had the highest prevalence 30.1%, followed by *Klebsiella pneumoniae* 25.7%, *Escherichia coli* 15.6%, Enterobacter species 11.2%, Citrobacter species 7.1%, and *Pseudomonas aeruginosa* 5.9% while Proteus species had the least prevalence, 4.5% as shown in table 4.

Table 1: Distribution and percentages of positive samples of male and female toilets and bathrooms door handles/knobs.

Door handles/knobs	Total samples Examined	Number positive	% of positive samples
Male toilets	70	57	36.5
Female toilets	70	65	41.7
Male bathrooms	20	16	10.3
Female bathrooms	20	18	11.5
Total	180	156	86.7

Table 2: Distribution of bacterial contamination on toilets and bathroom door handles/knobs swabbed.

Toilets		Bathrooms	
Number of samples	Culture positive (%)	Number of samples	Culture positive (%)
140	122 (87.1)	40	34 (85)

Table 3: Distribution and percentage bacterial contamination of toilets and bathroom door handles/knobs in relation to the establishments sampled.

	Banks	Markets/parks	Churches	Restaurants	Government establishments
Number of samples	8	80	4	4	84
Number of positive samples	5	72	3	4	72
Percentage of positive samples	62.5	90	75	100	85.7

Table 4: Prevalence and degree of growth of bacteria isolated from contaminated door handles/knobs.

Bacteria	Number isolated	Degree of growth	Prevalence (%)
<i>Staphylococcus aureus</i>	81	++++	30.1
<i>Klebsiella pneumoniae</i>	69	+++	25.7
<i>Escherichia coli</i>	42	++++	15.6
<i>Enterobacter spp.</i>	30	+++	11.2
<i>Citrobacter spp.</i>	19	+++	7.1
<i>Pseudomonas aeruginosa</i>	16	++	5.9
<i>Proteus spp.</i>	12	+++	4.5

## Key:

+	One or few colonies
++	Scanty growth
+++	Medium growth
++++	Full and luxuriant growth

## DISCUSSION

Bacterial, fungal, and viral contamination of door handles and knobs are well documented and these formites in turn serve as vehicles for cross-infections and recontamination of washed hands (Monarca *et al.*, 2000; Otter and French, 2009; Bright *et al.*, 2010). Some of the contaminants can be highly pathogenic and can be transferred from one person to another or may result in auto-inoculation (Kennedy *et al.*, 2005; Li *et al.*, 2009).

In this study, door handles and knobs of toilets and bathrooms in churches, markets/parks, banks, restaurants and government establishments in Abuja metropolis, Nigeria were evaluated to determine the level of bacteria contamination and to identify the bacteria contaminants. Out of the 180 samples assessed, 156 (86.7%) showed bacterial contamination. This is slightly lower than that obtained by Otter and French, (2009) who reported 95% positive cultures in similar environments. This may be attributed to the use of water system in these conveniences, especially in the public offices examined. It could also be due to constant cleaning of these toilets by cleaning companies engaged by these institutions.

This study also shows that the level of contamination of toilet door handles/knobs (87.1%) were slightly higher than on bathrooms door handles/knobs (85%). This difference in the level of contamination of the two may be attributed to a larger population usage of toilets than bathrooms. It is a common knowledge that fewer people take their baths in public bathrooms as compared to those that walk into the toilets to ease themselves. Furthermore, this work shows that female toilets and bathroom door handles/knobs had higher bacterial contamination (41.7% and 11.5% respectively) compared to male toilet and bathroom door handles/knobs (36.5% and 10.3% respectively). This is similar to the findings of Kennedy *et al.*, (2005). This may be due to certain habits of women which tend to enhance contamination. For instance, women carry a lot of artifact of beauty (hand creams and lotions, eye pencils, papers, mirrors, make-ups, and a lot more) in their bags which they use each time they enter public conveniences. The consequences of this life style are that contaminants from those items are left on doors, a situation rarely seen in male lavatories.

In this study, it was also discovered that toilet and bathroom door handles/knobs of markets/parks and restaurants were highly contaminated (90% and 100% respectively) compared to banks, churches and government establishments

(62.5%, 75% and 85.7% respectively). This is in tandem with findings of Boone and Gerba, (2010) who reported that the levels of contamination of conveniences vary depending on traffic, exposure and environment. The traffic level in the use of lavatories in the later group is quite higher than in the former comprising banks, churches and public establishments. In the former, usage is often restricted to staff and/or is constantly cleaned by contract staff who clean and wipe the door handles/knobs after few usages thereby reducing bacterial contaminants on the surfaces while in the later, the traffic to their toilets and bathrooms are always higher, but there are few of these facilities in such places. This is similar to the report of Kennedy *et al.*, (2005) who reported that there was more contamination in high traffic restrooms such as airports, bus terminals, educational institutions, and restrooms with one or fewer urinals. Apart from these, restaurants, motor parks and markets lack cleaners and a few that are available are neither trained nor have the equipments and disinfectants to do their job resulting to high level of contamination in these places.

Previous works have shown that frequently or heavily used formites are most likely contaminated and therefore carry higher heterotrophic bacterial loads (Bright *et al.*, 2010). In this study, the most common bacterial contaminants are *Staphylococcus aureus* (30.1%), followed by *Klebsiella Pneumoniae* (25.7%), and *Escherichia coli* (15.6%). *Pseudomonas aeruginosa* was also isolated (5.9%) which portends a great health hazard to the ever growing population of Abuja metropolis. This report is similar to that of Kennedy *et al.*, (2005) and Rusin *et al.*, (2002). Most of the positive samples examined had more than one type of bacterial isolate, but majority of the cases are from the samples collected from parks and markets. The fact that these contaminants were at high level in these environments is of great concern, especially with the increasing number of immuno-compromised patients and transplantation cases.

#### CONCLUSION

In conclusion, it is important to note that there is high level of bacterial contamination as well as high level of prevalence of the bacterial contaminants. This may lie as a time bomb because of its potential to cause epidemics. Forestalling this will require community health superintendents, sanitary officers and Environmental Protection Board as well as private organizations to educate the populace on personal and environmental hygiene.

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