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Research

Isolation of Bacterial Pathogens from Selected Door Handles in a Southwestern University in Nigeria

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Abstract

Background: One major cause of concern in public health is the increase in epidemic outbreaks and its spread through several communities. In time past, door knobs among other fomites has posed as one significant route of transfer of the causal organism epidemic outbreaks.

Methodology: Door knobs of toilets, offices and rooms in Babcock University were evaluated to determine the level of bacterial contamination and to identify the bacteria contaminants. Eighty (80) swab samples were obtained from various doorknobs of offices, halls of residence and toilets. The swab samples were inoculated, pure cultures were obtained, Gram stained and biochemical tests were carried out on the isolates for identification.

Result: Seven bacterial contaminants were isolated. These organisms includes P. aeruginosa which had the highest prevalence 32.1%, followed by K. pneumoniae (20.5%), Bacillus species (11.6%), Proteus species (11.6%), Neisseria species (9.8%), while E. coli (7.1%) and S. aureus (7.1%). This shows that door handles are potential carriers of pathogenic bacteria which are capable of causing epidemics.

Conclusion: Therefore, a combined effort of governmental, private organizations and individuals to educate the populace on personal and environmental hygiene is necessary to prevent spread of disease through door handles.

KEY WORDS: Door Handles/knobs, formite, Bacterial contamination, Epidemics, Pathogenic bacteria.

Introduction

Microorganisms, which refers to forms of life of microscopic dimensions, are ubiquitous and constitutes a major part of every ecosystem. In such environment/ habitat, they could exist freely or as parasites. In some cases, they live as transient contaminants in formites or hands where they constitute a major health hazard as sources of community and hospital acquired infections (Sleigh and Timbury, 1998; Pittet *et al.*, 1999). The increasing incidence of epidemic outbreaks of certain disease 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).

Beside the day to day interaction/contact of people which constitutes one way of spreading disease (from the infected person to the healthy person), the major source of spread of community acquired infections are formites (Prescott *et al.*, 1993; Li *et al.*, 2009). Formites (also known as fomies) refer to an object that is not in itself harmful but is able to harbor and transmit pathogenic organisms to people that come in contact with such object (Oxford English Dictionary 2005).

They also refer to inanimate objects or materials that act as intermediate carriers of microbial contamination e.g. utensils, pen, door knobs, tables, towels, money, clothing's, dishes, books, toys, lockers, chairs etc. This is possible when they are in constant contact with humans or natural habitats of pathogenic organisms (Osterholm *et al.*, 1995).

Door knob is one of the most common formite that serves as route for contamination (Reynolds, 2005). It has been shown that hard, non-porous surfaces, such as door handles, have the highest bacterial transfer rates to hands (Rusin *et al.*, 2002). This is so because not much attention is given to door knobs; Utensils, towels and some others are regularly cleaned, washed or in some cases not shared, but this is not always the case with door knobs.

Also, our environment as it is, supports opening doors before one can gain entrance into almost everywhere; for instance, one needs to open a door in order to walk into his/her office, room or toilet and so many places. When you touch a doorknob handled by someone ill with the flu or some sort of contamination for example, you can pick up the germs he or she left behind. 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). Because of the mere insignificance of opening a door, it is not considered necessary by many to wash hands used in opening doors. If you then touch your

eyes, mouth, nose or an open wound with such hands you may become infected.

An infection is the result of an interaction between a host and a microorganism or some of its products. An infection leads to disease in organisms; therefore a disease is any condition that causes pain, dysfunction, distress, social problems or death. However, the risk of disease transmission through formites 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 susceptible individual, virulence of the organism, immune-competence of the person in contact, the practice of control measure (Prescott *et al.*, 1993).

Bacterial pathogens that have been isolated from doorknobs in previous studies includes *S. aureus*, *K. pneumonia*, *E. coli*, *Enterobacter spp*, *Citrobacter spp*, *P. aeruginosa*, *Proteus spp*, *Streptococcus*, *Salmonella*, *Shigella*, *Campylobacter* (Nworie *et al.*, 2012; Itah and Ben, 2004). These organisms have been known to cause one or more diseases that are mild and could be sometimes serious, examples are but not limited to pimple, impetigo, scalded skin syndrome, pneumonia, meningitis, osteomyelitis, rhinoscleroma, kidney failure, septicemia etc (Clauditz *et al.*, 2006).

This study was therefore designed to determine the abundance and diversity of door handles/knobs of selected doors in Babcock University and their harmful implication to human health.

Materials and methods

This was an institution based prospective study conducted between January and April 2014 at Babcock University (located equidistant between Ibadan and Lagos) Ilishan-Remo, South West Nigeria. In this study, 80 door knobs were swabbed from halls of residence, offices [University Science Complex (USC) and Education and Humanity (EAH)], male and female toilets using a sterile swab stick. The samples were transported in a transport medium (peptone water) to the Microbiology Laboratory of the Biosciences and Biotechnology department and incubated for 24 hours after which they were cultured on nutrient agar and then subcultured to obtain pure isolates. Several biochemical tests were carried out for identification of the organisms isolated. This includes oxidase test, catalase test, indole test etc.

Results

From these doors, 7 bacterial contaminants were isolated. These organisms include *Staphylococcus aureus*, *Klebsiella pneumoniae*, *Escherichia coli*, *Pseudomonas aeruginosa*, *Proteus* species, *Bacillus* species and *Neisseria* species. Among the bacteria

contaminants isolated, *P. aeruginosa* had the highest prevalence 32.1% followed by *K. pneumoniae* (20.5%), *Bacillus* species (11.6%), *Proteus* species (11.6%), *Neisseria* species (9.8%), while *E. coli* (7.1%) and *S. aureus* (7.1%) as shown in Table 1.

Table 1: Diversity and abundance of bacteria spp isolated from door handles/knobs

Bacteria	No of Isolates	% Prevalence
<i>Staphylococcus aureus</i>	8	7.14
<i>Klebsiella pneumonia</i>	23	20.54
<i>Escherichia coli</i>	8	17.4
<i>Pseudomonas aeruginosa</i>	36	32.14
<i>Proteus speices</i>	13	11.61
<i>Bacillus species</i>	13	11.61
<i>Neisseria species</i>	11	9.82
	112	100

Table 2: Percentage of organisms isolated from different door handles

Location	Sample Size (%)	No. of Isolates (%)
Offices	30 (37.5)	33 (29.4)
Halls of Residence	30 (37.5)	35 (31.2)
Toilets: Male	10 (12.5)	19 (16.9)
Female	10 (12.5)	25 (22.3)
	80 (100)	112 (100)

Discussion

Microbial contamination of door knobs are well documented and this could 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).

From these doors, seven bacterial contaminants were isolated. These organisms include *Staphylococcus aureus*, *Klebsiella pneumonia*, *Escherichia coli*, *Pseudomonas aeruginosa*, *Proteus* species, *Bacillus* species, *Neisseria* species. This is similar to the work done by Nworie *et al.*, (2012) which indicated *S. aureus*, *K. pneumoniae*, *E. coli*, *Pseudomonas aeruginosa*, *Proteus* species, *Citrobacter* species, and *Enterobacter* species as the contaminating bacterial species. It is also similar to the work of Itah and Ben, (2004) where organisms such as *S. aureus*, *K. pneumoniae*, *E. coli*, and *Citrobacter* species were found on contact surfaces.

The contamination on door handles of offices were low (29.4% of the entire contamination as compared to 37.5% of the sample size) (Table 2). This may be due to handling mainly by staff and constant cleaning by cleaners on a daily basis (less traffic), while the door handles of toilets were heavily contaminated (39.3% of the entire contamination as compared to 25% of the sample size); this may be due to handling by both staff, students and cleaners (large traffic). This is consistent with the findings of Boone and Gerba, (2010) who reported that the levels of contamination of conveniences vary depending on traffic exposure and environment.

In Table 2, it is clear that female toilets (21.7%) showed higher level of contamination than the male toilets (16.7%). This is also similar to the findings of Nworie *et al.*, (2012), Kennedy *et al.*, (2005). Nworie *et al.*, (2012), further reported that this may be as a result of certain feminine habits e.g. females carry lots of beauty artifacts (eye pencils, hand creams and lotions, mirrors, make-ups, and a lot more) in their hand bags and use them when they enter the convenience. The consequence of this is that contaminants from those items are left on doors.

In general, *P. aeruginosa* was the most prevalent bacterial contaminant on doors of offices in USC, male rooms, female rooms and female toilets. This implies that people who come in contact frequently with these doors are likely to pick up *P. aeruginosa* from these doors and become infected. These infections may include septic shock, urinary tract infections, gastrointestinal infections etc. as they have long been associated with *P. aeruginosa*. This can be attributed to the fact that *P. aeruginosa* is a versatile organism which can utilize a variety of substrate for growth, it can also survive a variety of harsh environment.

Similarly, *K. pneumoniae* was the most prevalent bacterial contaminant on doors of male toilets. This can be attributed to the fact that *K. pneumoniae* is present in stool (Ryan and Ray, 2004) this indicates that most male students do not wash their hands with soap and water properly after a bowel movement. Hence, those who come in contact frequently with these doors are likely to pick up *K. pneumoniae* from these doors and become infected. These infections

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- may include pneumonia, infections in the urinary tract, lower biliary tract and surgical wound sites. Also, *Bacillus* species was the most prevalent bacterial contaminant on doors of offices in EAH building. Therefore implying that those who handle this doors may likely be subject to ropiness, anthrax, food poisoning etc (Farrar, 1963; Pepe *et al.*, 2003) as a result of infection with *Bacillus* species..
- ## Conclusion
- The data from this study indicates that there is a high level of bacterial contamination on door handles and this is of tremendous clinical significance because of its potential to cause epidemics in Babcock University. This problem is not limited to this area of study alone, therefore curbing this will require combined effort of governmental, private organizations and individuals to educate the populace on personal and environmental hygiene. Regular disinfection of door handles as well as frequent washing of hands could also go a long way. Also, alcohol hand rub/sanitizers may be used where water and soaps are not available.
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