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# Prevalence, Antibiotic Susceptibility, And Plasmid Profile of Bacteria Isolated from Door Handles of Washrooms of A JK Hospital in Bhopal, Madhya Pradesh

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**List of Abbreviations:**

CFU—Colony Forming Unit
MDR—Multi-drug Resistant
DNA—Deoxyribonucleic Acid
PCR—Polymerase Chain Reaction
SXT—Sulfamethoxazole–TrimethoprimAbstract

**Abstract**

**Objectives:**

Door handles are frequently touched surfaces that may harbor pathogenic bacteria capable of transmitting infectious diseases. This study aimed to determine the prevalence, antibiotic susceptibility patterns, and plasmid profiles of bacteria isolated from door handles of washrooms from a hospital in Bhopal, Madhya Pradesh.

**Methods**

Sixteen (16) door-handle swab samples were collected from washrooms located in four hospital wards. Samples were cultured on nutrient agar, MacConkey agar, blood agar, and selective media. Isolates were identified through colony morphology, Gram staining, and biochemical tests. Antibiotic susceptibility testing was performed using the Kirby–Bauer disc diffusion method. Plasmid extraction was conducted using a modified hot alkaline method, and bands were analyzed on agarose gel electrophoresis.

**Results**

All 16 (100%) samples showed bacterial contamination. *Staphylococcus aureus*, *Escherichia coli*, *Pseudomonas spp.*, *Klebsiella spp.*, and *Proteus spp.* were isolated. Antibiotic resistance was highest against amoxicillin (65.12%) and SXT (74.42%). Lower resistance was observed for gentamycin (2.33%), chloramphenicol (4.65%), streptomycin (6.98%), ciprofloxacin (23.26%), tetracycline

(18.60%), and rifampicin (55.81%). Several isolates carried one or more plasmids with varying molecular weights, suggesting plasmid-mediated resistance.

**Conclusions**

The high prevalence of pathogenic and antibiotic-resistant bacteria on washroom door handles indicates inadequate hygiene practices and a potential risk of nosocomial disease transmission. Regular disinfection, proper hand hygiene, and antimicrobial stewardship are essential to reduce contamination risks.

**Key Words:** Door handle contamination; Bacterial prevalence; Antibiotic susceptibility; Plasmid profile; Hospital hygiene

## 1. Introduction

Door handles serve as important fomites in the transmission of infectious diseases within hospital settings. They are frequently touched by healthcare workers, patients, and visitors, thus acting as reservoirs for pathogenic organisms. Contaminated surfaces contribute to the spread of nosocomial infections, especially when hand hygiene compliance is low.

Previous studies have reported bacterial species such as *Staphylococcus aureus*, *E. coli*, *Pseudomonas spp.*, *Klebsiella spp.*, and *Enterobacter spp.* as common contaminants on hospital surfaces. These organisms often possess antibiotic resistance, including plasmid-mediated multidrug resistance.

This study was undertaken to evaluate the contamination of washroom door handles in a hospital in Bhopal and assess the bacterial isolates' antibiotic susceptibility patterns and plasmid profiles.

## 2. Methods

### Study Area & Sample Collection

Sixteen swab samples were collected using sterile cotton swabs moistened with saline from door handles of washrooms in four different wards. Samples were transported immediately to the microbiology laboratory.

### Isolation and Identification

Samples were inoculated onto:

- Nutrient agar
- MacConkey agar
- Blood agar
- Mannitol salt agar

Plates were incubated at 37°C for 24 hours. Bacteria were identified through:

- Colony morphology
- Gram staining
- Biochemical tests (TSI, citrate, catalase, oxidase, urease, IMViC tests)

**Antibiotic Susceptibility Testing**

The Kirby–Bauer method was used following CLSI guidelines. Antibiotics tested included:

- Amoxicillin
- SXT
- Rifampicin
- Tetracycline
- Ciprofloxacin
- Chloramphenicol
- Gentamycin
- Streptomycin

Zones of inhibition were measured and interpreted.

**Plasmid Extraction**

Plasmids were extracted using the modified hot alkaline method:

- Cell lysis
- Neutralization
- Plasmid separation
- Ethanol precipitation

Plasmid DNA was analyzed by agarose gel electrophoresis.

## 3. Results

- **Prevalence of Contamination**
- All 16 samples (100%) showed bacterial growth.
- **Bacterial Isolates Identified**
- The most common isolates were:
- *Staphylococcus aureus*
- *Escherichia coli*

- *Pseudomonas spp.*
- *Klebsiella spp.*
- *Proteus spp.*
- **Antibiotic Susceptibility Patterns**
- Percentage resistance:
- SXT: **74.42%**
- Amoxicillin: **65.12%**
- Rifampicin: **55.81%**
- Ciprofloxacin: **23.26%**
- Tetracycline: **18.60%**
- Streptomycin: **6.98%**
- Chloramphenicol: **4.65%**
- Gentamicin: **2.33%**
- **Plasmid Profile**
- Several isolates carried **1–3 plasmids**.
- Molecular weights varied, indicating multiple plasmid types.
- Presence of plasmids correlates with observed multidrug resistance.

## 4. Discussion

This study confirms a high level of bacterial contamination on hospital washroom door handles. The isolates included organisms known to cause urinary tract infections, skin infections, gastrointestinal illness, and opportunistic bloodstream infections.

Antibiotic resistance patterns indicate frequent resistance to commonly used antibiotics such as amoxicillin and SXT. Low resistance to gentamycin and chloramphenicol suggests these remain effective options.

The observation of plasmids indicates that resistance genes may be horizontally transferred, increasing the risk of MDR outbreaks. Proper sanitation, regular disinfection, and improved hand hygiene practices are critical.

## 5. Conclusion

This study demonstrates that hospital washroom door handles are vectors for pathogenic and antibiotic-resistant bacteria. The presence of plasmid-mediated resistance highlights an urgent need for infection-control practices.

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## AI USE STATEMENT

ChatGPT was used for language editing, formatting, and structuring the manuscript. All scientific interpretations and data originate from the authors.

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