

## Original Research Article

# THE STUDY ON EVALUATION OF BACTERIAL CONTAMINATION OF MOBILE PHONES USED BY HEALTHCARE WORKERS IN A TERTIARY CARE HOSPITAL, RAICHUR, KARNATAKA

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## ABSTRACT

**Background:** Mobile phones are extensively used by healthcare workers (HCWs) for communication, accessing medical information, and clinical coordination. However, frequent handling of mobile phones in hospital settings increases the risk of contamination with pathogenic microorganisms. These devices can act as fomites and contribute to the transmission of hospital-acquired infections (HAIs). The aim is to assess bacterial contamination of mobile phones used by healthcare workers in a tertiary care hospital. The objective is to determine the prevalence of bacterial contamination of mobile phones among healthcare workers. To identify the bacterial isolates obtained from contaminated phones

**Materials and Methods:** Eighty health-care workers (20 doctors, 30 nurses, 20 technical staff, and 10 other employees) were included in a cross-sectional study. Study design is Hospital-based cross-sectional study. Study setting is Tertiary care teaching hospital. Sample size is 80. Study Population: Doctors, nurses, interns, and laboratory technicians. Sample Collection and Processing Sterile swab moistened with sterile saline. Swab rolled over the screen and back surface of the mobile phone. Inoculation onto Blood agar and MacConkey agar. Incubation at 37°C for 24 hours. Identification by colony morphology, Gram staining, and biochemical tests.

**Results:** Out of 80 MPs sampled, 60 (75%) showed microbial growth, and 20(25%) were free of microbial growth. Out of the total 60 positive samples, 25 (41.6%) were Gram-positive bacilli (which was considered as airborne contamination), 17 (28%) were GPC, 11 (18%) were Gram-negative bacilli (GNB), 5 (8%) were mixed growth, and 2 (1.6%) were yeasts.

**Conclusion:** The findings emphasise the urgent need for regular disinfection of mobile devices, strict adherence to hand hygiene practices, and awareness programs to minimise the risk of cross-transmission in healthcare settings. Incorporating mobile phone hygiene into infection control protocols can significantly reduce contamination and improve patient safety.

**Keywords:** Mobile phones, Health care workers, Hospital-acquired infections, Bacterial pathogens, Yeasts

## INTRODUCTION

Mobile phones are extensively used by healthcare workers (HCWs) for communication, accessing medical information, and clinical coordination.

However, frequent handling of mobile phones in hospital settings increases the risk of contamination with pathogenic microorganisms.<sup>[1]</sup> These devices can act as fomites and contribute to the transmission of hospital-acquired infections (HAIs).<sup>[2]</sup>

Several studies have reported high rates of bacterial contamination on mobile phones used by HCWs, ranging from 40% to 100%.<sup>[3]</sup> Commonly isolated organisms include *Staphylococcus aureus*, coagulase-negative staphylococci, *Escherichia coli*, *Klebsiella* spp., and *Pseudomonas* spp.<sup>[4]</sup> Of particular concern is the isolation of methicillin-resistant *Staphylococcus aureus* (MRSA) and multidrug-resistant Gram-negative bacilli, highlighting the growing problem of antimicrobial resistance (AMR).<sup>[5]</sup>

Despite established infection control measures, mobile phones are rarely included in routine disinfection protocols.<sup>[6]</sup> In developing countries, limited awareness and adherence to infection control practices further increase the risk of cross-contamination.<sup>[7]</sup>

**Need for study:** Therefore, assessing bacterial contamination and antibiotic susceptibility patterns in isolates from mobile phones among healthcare workers is essential to strengthen infection prevention strategies.

**Aim:** To assess the bacterial contamination of mobile phones among healthcare workers & identify the Bacterial Isolates associated with them

#### Objectives:

1. To determine the prevalence of bacterial contamination of mobile phones among healthcare workers.
2. To identify the bacterial isolates obtained from contaminated phones.

## MATERIALS AND METHODS

**Study Design:** Hospital-based cross-sectional study.

**Study Setting:** Tertiary care teaching hospital.

**Sample Size:** 80

**Ethical Approval:** Ethical approval obtained from the institutional review board of Navodaya Medical College, Raichur, before initiation of the study.

**Study Population:** Doctors, nurses, interns, and laboratory technicians.

#### Sample Collection and Processing:

- Sterile swab moistened with sterile saline.
- Swab rolled over the screen and back surface of the mobile phone.
- Inoculation onto Blood agar and MacConkey agar.
- Incubation at 37°C for 24 hours.
- Identification by colony morphology, Gram staining, and biochemical tests.

#### Mobile Phone Usage Patterns:

- Less than 10 times/day: 39% of participants
- 10–20 times/day: 36%
- More than 20 times/day: 12%
- No usage at work: 13%

#### Disinfection Practices:

- Occasional cleaning: 49 participants (61%)
- Never cleaned: 21 participants (26%)
- Regular disinfection: 18 participants (18%)

**Interpretation:** Most healthcare workers either cleaned their phones irregularly or not at all, leaving them vulnerable to bacterial contamination.

#### Methods of Disinfection

- Following manufacturer guidelines: Commonly reported practice.
- 70% alcohol solution: Preferred disinfectant.
- Alcohol wipes: Recommended over sprays to avoid liquid pooling and internal damage.

#### Sample Size Calculation:

Using the formula:

$$n = \frac{Z^2 pq}{d^2}$$

#### Assuming:

- Expected prevalence (p) = 80%<sup>3</sup>
- Z = 1.96
- Allowable error (d) = 10%

Calculated sample size ≈ 65

Final sample size: 80 healthcare workers

#### Statistical Analysis:

- Prevalence expressed as a percentage.
- Chi-square test for association.
- p < 0.05 considered statistically significant.

## RESULTS

#### Distribution of study participants

**Doctors:** 20 participants

**Nurses:** 30 participants

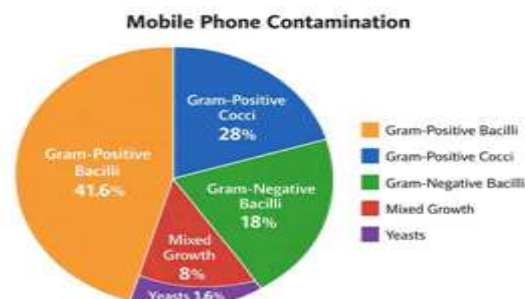
**Technical staff:** 20 participants

**Other employees:** 10 participants

Eighty health-care workers (20 doctors, 30 nurses, 20 technical staff, and 10 other employees) were included in a cross-sectional study.

Disinfection and mobile phone usage by the study participants.

Out of 80 MPs sampled, 60 (75%) showed microbial growth, and 20(25%) were free of microbial growth. Out of the total 60 positive samples, 25 (41.6%) were Gram-positive bacilli (which was considered as airborne contamination), 17 (28%) were GPC, 11 (18%) were Gram-negative bacilli (GNB), 5 (8%) were mixed growth, and 2 (1.6%) were yeasts.



This chart makes it easy to see that Gram-positive bacilli (41.6%) were the most common, followed by Gram-positive cocci (28%), Gram-negative bacilli (18%), mixed growth (8%), and yeasts (1.6%).

**Table 1: Microorganisms Identified in Mobile Phones**

| Category                        | Number of Samples | Percentage (%) |
|---------------------------------|-------------------|----------------|
| Phones with microbial growth    | 60                | 75%            |
| Phones without microbial growth | 20                | 25%            |
| Gram-positive bacilli           | 25                | 41.6%          |
| Gram-positive cocci (GPC)       | 17                | 28%            |
| Gram-negative bacilli (GNB)     | 11                | 18%            |
| Mixed growth                    | 5                 | 8%             |
| Yeasts                          | 2                 | 1.6%           |

**Table 2: Classification of Microbial Contaminants According to Organism Type**

| Contamination Category      | Description                                                           | Example Organisms                                        |
|-----------------------------|-----------------------------------------------------------------------|----------------------------------------------------------|
| Gram-positive cocci (GPC)   | Common skin flora, but can include pathogenic strains                 | Staphylococcus aureus, Coagulase-negative Staphylococcus |
| Gram-positive bacilli       | Often considered airborne contaminants; spore-forming rods            | Bacillus species                                         |
| Gram-negative bacilli (GNB) | Opportunistic pathogens, often linked to hospital-acquired infections | Pseudomonas aeruginosa, Acinetobacter species            |
| Mixed growth                | Presence of more than one bacterial type in a single sample           | Combination of GPC + GNB                                 |
| Yeasts                      | Fungal contamination, less common but possible                        | Candida species                                          |

Out of 80 mobile phones, three-fourths (75%) showed microbial contamination. Gram-positive bacilli were the most common, often linked to airborne contamination.

Gram-positive cocci (*Staphylococcus aureus*) are clinically significant, associated with hospital-acquired infections.

Gram-negative bacilli and mixed growth highlight poor hygiene and cross-contamination risks. Along with bacterial growth, yeasts were also isolated, though they are rare, indicating fungal colonisation.

## DISCUSSION

**Comparison of the Present Study with Previous Studies:** The present study found that 75% (60/80) of mobile phones were contaminated with microbes, while 25% showed no detectable microbial growth. This contamination rate is comparable to the 60.8% reported among medical students in Libya<sup>8</sup> but lower than the 95% contamination reported among healthcare workers in Ethiopia.<sup>[9]</sup> The higher contamination observed in healthcare workers may be attributed to more frequent exposure to patients, hospital environments, and inadequate disinfection practices. These findings reinforce the view that mobile phones serve as important reservoirs of microbial contamination in both healthcare and educational settings.

Among the contaminated phones in the present study, Gram-positive bacilli (41.6%) were the most commonly isolated organisms, followed by Gram-positive cocci (28%). In contrast, the Libyan study reported *Staphylococcus epidermidis* as the predominant isolate (72%), while other international studies have consistently identified coagulase-negative staphylococci as the most common contaminants. These organisms are part of the normal skin flora and are easily transferred to mobile phones through repeated hand contact.

**High contamination rate:** Three out of four phones in our study were contaminated. This aligns with

global reviews where contamination rates often exceed 60–95%<sup>8,9</sup>.

**Dominance of Gram-positive organisms:** Our study found bacilli and cocci together, making up ~70%. Other studies also report Gram-positive staphylococci as the most frequent isolates<sup>8,10</sup>

**Gram-negative bacilli:** Though less frequent (18%), their presence is concerning because species like *E. coli* and *Klebsiella* are linked to hospital-acquired infections.<sup>9</sup>

**Mixed growth and yeasts:** Detected in smaller proportions, but other studies confirm fungi and mixed flora are not uncommon.<sup>8,10</sup>

**Our contamination rate (75%)** is higher than the Libyan student study (60.8%) but lower than Ethiopian healthcare workers (95%).<sup>9</sup>

## CONCLUSION

The study highlights that mobile phones of healthcare workers serve as potential reservoirs for bacterial contamination, including pathogenic organisms that may contribute to hospital-acquired infections. The findings emphasise the urgent need for regular disinfection of mobile devices, strict adherence to hand hygiene practices, and awareness programs to minimise the risk of cross-transmission in healthcare settings. Incorporating mobile phone hygiene into infection control protocols can significantly reduce contamination and improve patient safety.

### Limitations

- ✓ Single hospital: Results limited to one tertiary care centre.
- ✓ Cross-sectional: Snapshot design, no causal link proven.
- ✓ Generalizability: Findings may not apply to other regions/settings.

### Future Prospective

- Multi-centre studies: Extend research to other hospitals for wider applicability.
- Long-term tracking: Monitor contamination trends over time.

- Intervention trials: Test effectiveness of cleaning protocols and awareness programs.

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