

RESEARCH ARTICLE

Assessment of Microbial Population on Phones of Science Laboratory Technology (SLT) Students In Captain Elechi Amadi Polytechnic Rumuola, Port Harcourt, Rivers State

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ABSTRACT

Mobile phones are widely used by students for communication, learning, and social interaction; however, they may also serve as reservoirs for pathogenic microorganisms due to frequent handling and poor hygiene practices. This study assessed the microbial population associated with mobile phones used by Science Laboratory Technology (SLT) students of Captain Elechi Amadi Polytechnic. A cross-sectional laboratory-based study was conducted using twenty (20) randomly selected mobile phone samples obtained from consenting students. Sterile swab sticks moistened with normal saline were used to collect samples from different phone surfaces. Standard microbiological methods, including serial dilution, spread plate technique, cultural characterization, Gram staining, and biochemical tests, were employed for the isolation, enumeration, and identification of microorganisms. The total bacterial counts ranged from 2.6×10^4 to 4.3×10^4 CFU/mL, while fungal counts ranged from 7.0×10^2 to 1.5×10^3 CFU/mL. Bacterial contamination was generally higher than fungal contamination. The bacterial isolates identified included *Staphylococcus* species (32%), *Escherichia coli* (20%), *Bacillus* species (16%), *Salmonella* species (16%), *Pseudomonas* species (12%), and *Klebsiella* species (4%). Fungal isolates included *Aspergillus* species (42%), *Penicillium* species (25%), *Candida* species (17%), and *Rhizopus* species (16%). Out of the twenty phones examined, eighteen (90%) were contaminated with microorganisms. The study revealed that mobile phones used by students harbor diverse microorganisms of public health importance. Regular hand hygiene, routine phone disinfection, and increased awareness of infection prevention practices are recommended to reduce microbial contamination and possible disease transmission.

KEYWORDS

Mobile phones, microbial contamination, bacteria, fungi, students, public health, SLT students

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1. Introduction

Mobile phones have become an essential part of modern life and are now widely used for communication, education, entertainment, business, and social interaction. Among students, mobile devices are frequently handled throughout the day for academic activities such as online learning, internet research, note-taking, and communication with classmates and lecturers. The increasing dependence on smartphones has greatly improved access to information and digital learning opportunities. However, the constant handling of these devices also raises important public health concerns because mobile phones can serve as reservoirs for microorganisms, including bacteria, fungi, and viruses. Recent studies have shown that mobile phones are among the most contaminated personal items regularly used by humans (Dubljanin et al., 2022).

Unlike many personal belongings that are cleaned regularly, mobile phones are often touched repeatedly without proper disinfection. They are commonly used in classrooms, laboratories, toilets, cafeterias, public transportation, and even healthcare environments, exposing them to different sources of microbial contamination. Continuous contact between the hands, face, and phone surfaces allows microorganisms to accumulate and spread easily from one surface to another. The warm temperature generated during phone operation, combined with moisture, sweat, oils from the skin, and environmental dust, creates a suitable condition for microbial survival and growth. As a result, phones may act as fomites that contribute to the transmission of infectious agents within the community (Olsen et al., 2021).

Several studies conducted in different parts of the world have reported high levels of microbial contamination on mobile phones used by students and healthcare workers. Common bacterial isolates identified include *Staphylococcus aureus*, coagulase-negative *Staphylococcus*, *Escherichia coli*, *Bacillus* species, *Pseudomonas aeruginosa*, and other opportunistic pathogens capable of causing infections in humans. In addition, fungal organisms such as *Aspergillus* and *Penicillium* species have also been isolated from mobile phones, indicating that these devices can support a wide diversity of microorganisms. Some of these organisms are associated with skin infections, respiratory infections, gastrointestinal diseases, urinary tract infections, and hospital-acquired infections, especially in individuals with weakened immune systems (Nwachukwu & Nnagbo, 2024).

The problem becomes more concerning in laboratory and educational settings where students frequently interact with biological materials, laboratory benches, shared equipment, and contaminated surfaces. Inadequate hand hygiene practices, infrequent cleaning of mobile phones, and poor awareness of infection prevention measures further increase the risk of microbial transfer between phones and users. A recent Nigerian study also reported that undergraduate students' mobile phones harbored bacterial pathogens with varying antibiotic resistance patterns, highlighting the growing concern of antimicrobial-resistant organisms on personal devices. This suggests that contaminated mobile phones may not only contribute to the spread of microorganisms but may also serve as carriers of antibiotic-resistant bacteria within the community (Musa et al., 2021).

Furthermore, the emergence of infectious disease outbreaks in recent years has increased global awareness regarding the role of contaminated surfaces in disease transmission. Although direct person-to-person transmission remains the major route for many infections, contaminated objects such as mobile phones can still contribute significantly to microbial spread when proper hygiene practices are neglected. Studies have therefore emphasized the importance of regular hand washing, routine phone disinfection, and increased public awareness as effective measures for reducing microbial contamination and preventing infections (Neely & Sittig, 2017).

Investigating the microbial contamination of students' mobile phones is important because it provides useful information about the types of microorganisms present on commonly used devices and the potential health risks associated with them. Understanding the microbial load and diversity on mobile phones can help institutions develop effective hygiene policies, promote infection prevention practices, and improve public health awareness among students. Such studies also contribute to scientific knowledge regarding environmental contamination and microbial transmission in academic environments (Khan et al., 2020).

Therefore, this study aims to evaluate the microbial contamination associated with mobile phones used by students and to determine the possible public health implications of these contaminants. The findings from this study may help encourage better hygiene practices, improve awareness of infection control, and reduce the spread of potentially harmful microorganisms within educational institutions and the wider community.

2. Materials and Methods

2.1 Study Area

This study was carried out at the Science Laboratory Technology (SLT) Department of Captain Elechi Amadi Polytechnic. The institution is located in Rumuola, Port Harcourt, Rivers State, Nigeria. The study environment included classrooms, laboratories, and student practical areas where mobile phones are frequently used during academic and laboratory activities.

2.2 Study Design

A cross-sectional laboratory-based study was conducted to assess the microbial population present on mobile phones used by SLT students. The study focused on determining the types and frequency of microorganisms associated with students' phones and evaluating their possible public health significance.

2.3 Sample Collection

A total of twenty (20) mobile phone samples were collected randomly from consenting SLT students. Sterile cotton swab sticks moistened with sterile normal saline were used to collect samples from the surfaces of the phones, including the screen, back surface, sides, and keypad areas where applicable. The swabbing procedure was carried out aseptically to avoid external contamination. Each swab stick was immediately transferred into sterile test tubes containing peptone water and properly labeled before transportation to the microbiology laboratory for analysis (Olaitan et al., 2025).

2.4 Preparation of Culture Media

Nutrient agar, MacConkey agar, Mannitol Salt agar, and Sabouraud Dextrose agar were prepared according to the manufacturer's instructions. The media were sterilized using an autoclave at 121°C for 15 minutes and allowed to cool before pouring into sterile Petri dishes. These media were used for the isolation and enumeration of bacterial and fungal organisms.

2.5 Isolation and Enumeration of Microorganisms

The inoculated peptone water samples were serially diluted using sterile distilled water. Aliquots of the diluted samples were inoculated onto prepared culture media using the spread plate technique. Nutrient agar and MacConkey agar plates were incubated aerobically at 37°C for 24–48 hours for bacterial growth, while Sabouraud Dextrose agar plates were incubated at room temperature for 3–5 days for fungal isolation (Zenbaba et al., 2023).

After incubation, visible colonies were counted and recorded as colony-forming units per milliliter (CFU/mL). Distinct colonies were subcultured repeatedly to obtain pure isolates for further identification.

2.6 Identification of Isolates

Bacterial isolates were identified based on their colonial morphology, Gram staining characteristics, and standard biochemical tests such as catalase test, coagulase test, citrate utilization test, indole test, oxidase test, and sugar fermentation reactions. Fungal isolates were identified based on their macroscopic appearance and microscopic features using lactophenol cotton blue staining (Dubljanin et al., 2022).

2.7 Data Analysis

The data obtained from microbial counts and identification of isolates were analyzed descriptively using tables and percentages. The frequency of occurrence of each microorganism isolated from the mobile phones was calculated and presented appropriately.

3. Results

A total of twenty (20) mobile phone samples collected from Science Laboratory Technology (SLT) students of Captain Elechi Amadi Polytechnic were analyzed for microbial contamination. The results revealed the presence of different bacterial and fungal organisms on the phone surfaces, indicating that mobile phones can serve as reservoirs of potentially pathogenic microorganisms.

3.1 Microbial Counts from Mobile Phones of SLT Students

The total bacterial counts ranged from 2.6×10^4 to 4.3×10^4 CFU/mL, while fungal counts ranged from 7.0×10^2 to 1.5×10^3 CFU/mL. Higher bacterial contamination was generally observed compared to fungal contamination.

Table 1: Total Microbial Counts from Mobile Phones of SLT Students

Sample code	TBC(CFU/mL)	TFC(CFU/mL)
MP1	3.2x10 ⁴	1.1 x10 ³
MP2	2.8 X10 ⁴	9.0 x 10 ²
MP3	4.1 x 10 ⁴	1.3 x 10 ³
MP4	3.5 x 10 ⁴	1.0 x 10 ³
MP5	2.9 x 10 ⁴	8.5 x 10 ²
MP6	4.3 x 10 ⁴	1.5 x10 ³
MP7	3.7 x 10 ⁴	1.2 x 10 ³
MP8	2.6 x 10 ⁴	7.0 x 10 ²
MP9	3.9 x 10 ⁴	1.4 x 10 ³
MP10	3.1 x 10 ⁴	9.5 x 10 ²

Keys: TBC= Total Bacterial Count, TFC=Total Fungi Count, CFU= Colony Forming Unit, MP= Mobile Phone.

3.2 Frequency of Occurrence of Bacterial Isolates

Staphylococcus showed the highest frequency of occurrence with 32%, followed by *Escherichia coli* with 20%. The presence of these organisms suggests contamination from human handling and environmental exposure.

Table 2: Frequency of Occurrence of Bacterial Isolates

Bacterial Isolates	Frequency	Percentage
<i>Staphylococcus</i>	8	32
<i>Escherichia coli</i>	5	20
<i>Bacillus</i>	4	16
<i>Pseudomonas</i>	3	12
<i>Salmonella</i>	4	16
<i>Klebsiella</i>	1	4

3.3 Frequency of Occurrence of Fungal Isolates

Among the fungal isolates, *Aspergillus* species had the highest occurrence (42%), while *Candida* and *Rhizopus* species showed lower frequencies.

Table 3: Frequency of Occurrence of Fungal Isolates

Fungal Isolates	Frequency	Percentage (%)
<i>Aspergillus</i>	5	42
<i>Penicillium</i>	3	25
<i>Candida</i>	2	17
<i>Rhizopus</i>	2	16
Total	12	100

Out of the twenty mobile phones examined, eighteen (90%) showed microbial contamination, while only two (10%) showed no detectable microbial growth.

Table 4: Distribution of Contaminated Mobile Phones

Result	Number of Phones	Percentage (%)
Contaminated Phones	18	90
Non-Contaminated Phones	2	10
Total	20	100

4. Discussion

The findings of this study revealed that mobile phones used by Science Laboratory Technology (SLT) students of Captain Elechi Amadi Polytechnic were contaminated with different bacterial and fungal organisms. The total bacterial counts obtained ranged from 2.6×10^4 to 4.3×10^4 CFU/mL, while the fungal counts ranged from 7.0×10^2 to 1.5×10^3 CFU/mL. The high microbial counts observed indicate that mobile phones can serve as reservoirs for microorganisms due to frequent handling, poor hand hygiene, and continuous exposure to contaminated surfaces.

The present study showed that bacterial contamination was higher than fungal contamination on the mobile phones examined. This finding agrees with the report of Olaitan et al. (2025), who observed high bacterial contamination on students' mobile phones in a Nigerian university. Similarly, Zenbaba et al. (2023) reported that mobile phones commonly harbor bacteria because they are frequently touched with contaminated hands and are rarely disinfected regularly. The warm temperature generated during phone usage, together with moisture and skin secretions, may also promote bacterial survival and multiplication.

Among the bacterial isolates identified, *Staphylococcus* species showed the highest frequency of occurrence (32%), followed by *Escherichia coli* (20%). The predominance of *Staphylococcus* species in this study agrees with previous studies conducted by Olsen et al. (2021) and Olaitan et al. (2025), who also identified *Staphylococcus aureus* as one of the most common bacterial contaminants of mobile phones. The high occurrence of *Staphylococcus* species may be associated with their presence as normal flora on human skin and hands, making transfer to mobile phones easy through repeated contact.

The isolation of *Escherichia coli*, *Salmonella*, and *Klebsiella* species in this study suggests possible fecal contamination resulting from poor hygiene practices such as inadequate hand washing after toilet use. This observation agrees with the findings of Nwachukwu and Nnagbo (2024), who reported the presence of enteric bacteria on students' mobile phones and linked it to poor sanitary practices. However, the frequency of *Klebsiella* species observed in the present study was lower compared to some previous studies, possibly due to differences in environmental exposure, sampling techniques, and personal hygiene levels among the study population.

The presence of *Pseudomonas* and *Bacillus* species further indicates environmental contamination because these organisms are commonly found in soil, water, dust, and laboratory environments. Their occurrence may also be related to the frequent use of phones during laboratory practical sessions and exposure to contaminated surfaces within the academic environment.

Fungal isolates identified in this study included *Aspergillus*, *Penicillium*, *Candida*, and *Rhizopus* species. *Aspergillus* species had the highest frequency of occurrence (42%). This finding is consistent with the work of Dubljanin et al. (2022), who reported that *Aspergillus* species were among the most common fungal contaminants isolated from mobile phones. The presence of fungal organisms on phones may be associated with exposure to airborne fungal spores, dusty environments, and improper cleaning of mobile devices.

The study further revealed that 90% of the mobile phones examined were contaminated with microorganisms, while only 10% showed no detectable microbial growth. This high contamination rate agrees with several recent studies that reported contamination rates above 80% among mobile phone users (Zenbaba et al., 2023; Olaitan et al., 2025). However, the contamination rate observed in this study was slightly higher than some earlier reports, which may be attributed to increased phone usage, poor awareness of phone hygiene, and frequent handling of phones within laboratory environments.

Overall, the findings of this study demonstrate that mobile phones used by students can serve as important carriers of potentially pathogenic microorganisms and may contribute to the spread of infections if proper hygiene practices are not maintained.

5. Conclusion

This study assessed the microbial population present on mobile phones used by Science Laboratory Technology students of Captain Elechi Amadi Polytechnic. The findings revealed that most of the phones examined were contaminated with different bacterial and fungal organisms, including *Staphylococcus*, *Escherichia coli*, *Bacillus*, *Pseudomonas*, *Salmonella*, *Klebsiella*, *Aspergillus*, *Penicillium*, *Candida*, and *Rhizopus* species. The high level of contamination observed indicates that mobile phones can act as reservoirs and possible sources of microbial transmission among students. The study also showed that poor hygiene practices, constant handling of phones, and environmental exposure contribute significantly to microbial contamination. Therefore, regular cleaning and proper handling of mobile phones are important in reducing the spread of potentially harmful microorganisms within academic environments.

5.1 Recommendations

We therefore recommend the following crucial measures:

1. Students should practice regular hand washing with soap and water, especially before and after handling mobile phones.
2. Mobile phones should be disinfected frequently using suitable alcohol-based disinfectants or antimicrobial wipes.
3. The use of mobile phones during laboratory practical sessions should be minimized to reduce contamination.
4. Awareness programs should be organized within educational institutions to educate students on phone hygiene and infection prevention practices.
5. Regular microbiological monitoring of frequently used personal devices should be encouraged to reduce the risk of disease transmission.
6. Further studies should be conducted using larger sample sizes and molecular techniques for more detailed identification of microbial contaminants.

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