Short Communication

Pathogenic Flora on Mobile Phones: Microbial Diversity on Touchscreens of Clinical Laboratory Staff in Tripoli, Libya-Implications for Infection Control

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Mobile phones (MPs) are frequently handled in clinical laboratories and can act as reservoirs for bacteria. To estimate the prevalence and spectrum of bacterial contamination on MPs of laboratory staff in private facilities in Tripoli, Libya. We swabbed 60 phone screens using sterile saline-moistened swabs, cultured specimens on standard media, and identified isolates with routine bacteriological methods. 51 of 60 phones (85.0%, 95% Continuous integration CI 73.9–91.9) yielded growth. Across 75 isolates, the leading organisms were *Staphylococcus epidermidis* (20, 26.7%), *Pseudomonas aeruginosa* (16, 21.3%), *Escherichia coli* (14, 18.7%), *Klebsiella pneumoniae* (11, 14.7%), *Staphylococcus aureus* (8, 10.6%), Bacillus spp. (4, 5.3 %), and Salmonella spp. (2, 2.7%). MPs used by laboratory personnel showed a high contamination burden, including clinically relevant pathogens. Structured phone-hygiene policies should complement hand hygiene in private-sector laboratories.

Keywords: Mobile phones, Contamination, Laboratory staff, Infection prevention, Libya, Bacteria

Introduction

Mobile phones (MPs) are persistently handled, travel across clinical spaces, and are rarely subjected to routine decontamination procedures. Meta-analytic estimates indicate that a large majority of healthcare workers' (HCWs) devices carry cultivable bacteria, often including skin commensals and potential pathogens (Zenbaba et al., 2023; Otter et al., 2020). In perioperative and intensive care environments, moment-to-moment phone use can bridge otherwise separate care zones, creating opportunities for indirect transmission (Tusabe et al., 2022; Asfaw et al., 2020). Early reports from surgical and anesthesia settings demonstrated recoverable flora from devices and subsequent transient contamination of hands after a single call (Tusabe et al., 2022; Asfaw et al., 2020). Subsequent multicountry studies confirmed high pooled prevalence of contamination and emphasized inconsistent cleaning habits and limited awareness of device-related risk (Zenbaba et al., 2023; Badr et al., 2012; Weber et al., 2010; Loveday et al., 2014). Importantly, environmental survival of common healthcare-associated organisms on nonporous surfaces supports a plausible pathway for onward transmission when hand hygiene is suboptimal (Otter et al., 2020; Loveday et al., 2014; Faires et al., 2009). Despite guidance on hand hygiene and high-touch surfaces, explicit policies for MP hygiene are variably implemented in private-sector laboratories and clinics. Simple, low-level disinfection with 70% alcohol or devicecompatible wipes has been shown to reduce bioburden, yet adherence remains uneven (Faires et al., 2009; Wilson et al., 2020; Mushabati et al., 2021). Local data from private laboratories in North Africa are limited, underscoring the value of setting-specific surveillance to inform pragmatic control measures (Loveday et al., 2014; Pal et al., 2015; Kuriyama et al., 2021). The use of MPs has become ubiquitous among healthcare and laboratory personnel worldwide (Zenbaba et al., 2023). These devices are frequently handled during work, often without prior hand disinfection, creating opportunities for bacterial transfer (Pal et al., 2015; Dhayhi et al., 2023). Their warm surfaces and frequent contact with skin create ideal conditions for microbial survival (Ekrakene & Igeleke, 2007). Numerous studies across various regions have reported contamination rates between 70% and 100% (Badr et al., 2012; Ramesh et al., 2008), with both commensals and pathogenic—bacteria isolated. High-touch personal devices are now recognized as potential vectors for healthcare-associated infections (HAIs) (Otter et al., 2020). In Africa, studies in Nigeria, Ethiopia, and Egypt have documented contamination rates of 80–96% among healthcare workers (Weber et al., 2010; Loveday et al., 2014; Mushabati et al., 2021). Pathogens such as *Staphylococcus aureus*,*Klebsiella pneumoniae*, and *Pseudomonas aeruginosa* are frequently identified (Tusabe et al., 2022). These organisms are of concern due to their association with nosocomial infections and antibiotic resistance (Selim & Abaza, 2015). In Libya, limited research has been conducted on MPs in healthcare environments, with most focusing on public hospitals (Abired et al., 2024). No published data exist on private laboratory settings, where infection control protocols may differ. This study addresses that gap by estimating prevalence and describing bacterial species on MPs used by laboratory staff in private-sector facilities in Tripoli.

Materials and Methods

Study design and participants

A cross-sectional study was carried out between 6 June 2025 and 15 July 2025 across multiple private clinical laboratories in Tripoli. Inclusion criteria were laboratory staff who routinely used MPs during working hours. Participation was voluntary and anonymous.

Sample collection

Each phone screen was swabbed using a sterile cotton swab moistened with 0.85% sterile normal saline. Swabs were rotated over the entire touchscreen area with uniform pressure and then placed in transport medium.

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Culture and identification

Specimens were inoculated onto blood agar, MacConkey agar, and mannitol salt agar. Cetrimide agar was used for selective isolation of Pseudomonas. Plates were incubated aerobically at 35–37°C and examined at 24 and 48 hours. Colonies were identified using Gram staining and biochemical tests.

Data analysis

The prevalence of contamination was calculated as the proportion of phones yielding growth. 95% confidence intervals were computed using the Wilson score method. Relative frequencies of bacterial species were calculated from total isolates.

Table 1: Culture outcome of mobile phone samples

Culture outcome	Count	Percentage (%)
Contaminated	51	85.0
No growth	9	15.0
Total	60	100.0

Table 2: Bacterial species identified from contaminated mobile phones

Organism	**Count**	**Percentage (%)**
Staphylococcus epidermidis	20	26.7
Pseudomonas aeruginosa	16	21.3
Escherichia coli	14	18.7
Klebsiella pneumoniae	11	14.7
Staphylococcus aureus	8	10.6
Bacillus spp.	4	5.3
Salmonella spp.	2	2.7

Results &Discussion

The sixty phones sampled, 51 (85.0%, 95% CI 73.9–91.9) were contaminated, and 9 (15.0%) showed no growth. Multiple organisms were recovered from some phones, yielding a total of 75 isolates. Our observed contamination prevalence aligns closely with pooled estimates reported in recent syntheses and falls within the broad range described across low- and middleincome settings (Zenbaba et al., 2023; Loveday et al., 2014; Mushabati et al., 2021; Pal et al., 2015). The predominance of coagulase-negative staphylococci is consistent with skin origin flora reported elsewhere, whereas recovery of Enterobacterales albeit at lower frequency-has also been intermittently documented in comparable cohorts (Zenbaba et al., 2023) (Pal et al., 2015; Abired et al., 2024). From an infection prevention standpoint, three modifiable behaviors emerge: (i) reduce within-shift phone handling in specimen processing areas (ii) perform hand hygiene immediately before and after MP use in clinical workspaces (iii) implement scheduled, manufacturer-compatible disinfection of screens and cases (Otter et al., 2020; Selim & Abaza, 2015; Dhayhi et al., 2023; Ekrakene & Igeleke, 2007). Given our context, standardizing prompts at bench entry points and providing approved wipes at accession desks may yield measurable reductions in surface bioburden (Selim & Abaza, 2015; Dhayhi et al., 2023). While our cross-sectional design does not link device flora to clinical infections, converging evidence indicates that contaminated high-touch items can participate in transmission networks when hand hygiene falters (Otter et al., 2020) (Kuriyama et al., 2021; Selim & Abaza, 2015). Accordingly, our findings should be interpreted as a proximal process indicator of risk rather than evidence of direct causation-an interpretation consistent with prior work (Otter et al., 2020; Kuriyama et al., 2021; Abired et al., 2024). This study found a high prevalence (85.0%) of bacterial contamination on MPs among private laboratory staff in Tripoli, comparable to rates in other regions (Loveday et al., 2014; Mushabati et al., 2021; Dean et al., 2022; Brady et al., 2009). The predominance of coagulase-negative staphylococci is consistent with findings from multiple studies (Tusabe et al., 2022; Badr et al., 2012; Ramesh et al., 2008). The isolation of *Pseudomonas aeruginosa*, *Klebsiella pneumoniae*, *Escherichia coli*, and *Staphylococcus aureus* underscores the risk of HAIs associated with contaminated personal devices (Otter et al., 2020; Winn et al., 2017). The presence of *Escherichia coli* suggests possible fecal-hand contamination and lapses in hand hygiene (Asfaw et al., 2020). *Pseudomonas* and *Klebsiella* are notable for environmental persistence and multi-drug resistance potential (Kuriyama et al., 2021). These findings highlight the need for targeted interventions, including regular disinfection of MPs and hand hygiene reinforcement (ISO, 2003; Zenbaba et al., 2023; Selim & Abaza, 2015).

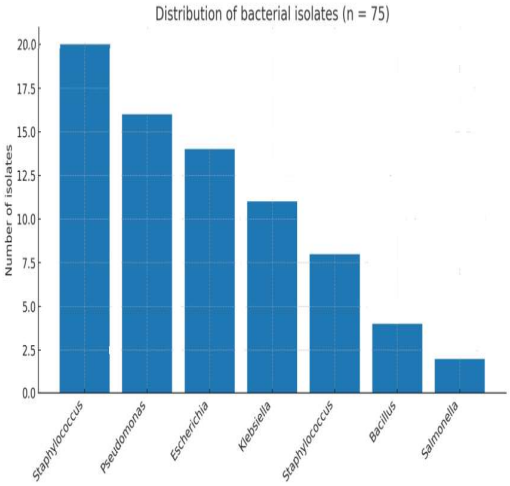

Figure 1: Distribution of bacterial isolates ($n = 75$).

Limitations

This study was limited to screen surfaces and did not include phone cases or backs. No molecular typing or antimicrobial susceptibility testing was performed. The sample was limited to private laboratories, limiting generalizability to public-sector facilities (Ekrakene & Igeleke, 2007)

Conclusions

MPs of laboratory staff in private facilities in Tripoli exhibited high bacterial contamination rates, including pathogens of clinical significance. Routine phone hygiene and adherence to infection prevention protocols should be prioritized(ISO, 2003; Selim & Abaza, 2015). Our data support implementing routine, device-compatible screen disinfection and reinforcing hand

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hygiene at MP touchpoints (Otter et al., 2020; Selim & Abaza, 2015; Dhayhi et al., 2023; Ekrakene & Igeleke, 2007).

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