Microbial Contamination of Mobile Phone Screens Among Clinical Laboratory Staff in Private Facilities in Tripoli, Libya: Prevalence, Bacterial Spectrum, and Infection Control Implications

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Abstract: Mobile phones (MPs) are frequently handled in clinical laboratories and can act as reservoirs for bacteria (1, 2). 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 (3, 4). 51 of 60 phones (85.0%, 95% 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.*

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I. 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 (5, 6). In perioperative and intensive care environments, moment-to-moment phone use can bridge otherwise separate care zones, creating opportunities for indirect transmission (7, 8). Early reports from surgical and anesthesia settings demonstrated recoverable flora from devices and subsequent transient contamination of hands after a single call (7, 8). Subsequent multi-country studies confirmed high pooled prevalence of contamination and emphasized inconsistent cleaning habits and limited awareness of device-related risk (5, 9, 10, 11). Importantly, environmental survival of common healthcare-associated organisms on non-porous surfaces supports a plausible pathway for onward transmission when hand hygiene is suboptimal (6, 12, 13). 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 device-compatible wipes has been shown to reduce bioburden, yet adherence remains uneven (13, 14, 15). Local data from private laboratories in North Africa are limited, underscoring the value of setting-specific surveillance to inform pragmatic control measures (11, 16, 17). The use of MPs has become ubiquitous among healthcare and laboratory personnel worldwide (5). These devices are frequently handled during work, often without prior hand disinfection, creating opportunities for bacterial transfer (16, 18). Their warm surfaces and frequent contact with skin create ideal conditions for microbial survival (19). Numerous studies across various regions have reported contamination rates between 70% and 100% (9, 20), with both commensals and pathogenic bacteria

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isolated. High-touch personal devices are now recognized as potential vectors for healthcare-associated infections (HAIs) (6). In Africa, studies in Nigeria, Ethiopia, and Egypt have documented contamination rates of 80–96% among healthcare workers (10, 11, 21). Pathogens such as *Staphylococcus aureus*, *Klebsiella pneumoniae*, and *Pseudomonas aeruginosa* are frequently identified (7). These organisms are of concern due to their association with nosocomial infections and antibiotic resistance (22). In Libya, limited research has been conducted on MPs in healthcare environments, with most focusing on public hospitals (23). 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.

II. 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.

➢ *Culture and Identification*

Blood agar, MacConkey agar, and mannitol salt agar were all inoculated with specimens. Pseudomonas was selectively isolated using cetrimide agar. Plates were analysed after 24 and 48 hours of aerobic incubation at 35–37°C. Biochemical assays and Gramme staining were used to identify colonies.

➢ *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.

III. RESULTS

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.

Table-1 Contamination and Growth of Microorganism Count in Percentage

S. no.	Culture Outcome	Count	Percentage (%)
1	Contaminated	51	85.0
2	No growth	9	15.0
	Total	60	100.0

Table-2 Number of Bacterial Species Identified in Culture

S. no.	Organism	Count	Percentage (%)
1.	Staphylococcus epidermidis	20	26.7
2.	Pseudomonas aeruginosa	16	21.3
3.	Escherichia coli	14	18.7
4.	Klebsiella pneumoniae	11	14.7
5.	Staphylococcus aureus	8	10.6
6	Bacillus spp.	4	5.3
7	Salmonella spp.	2	2.7

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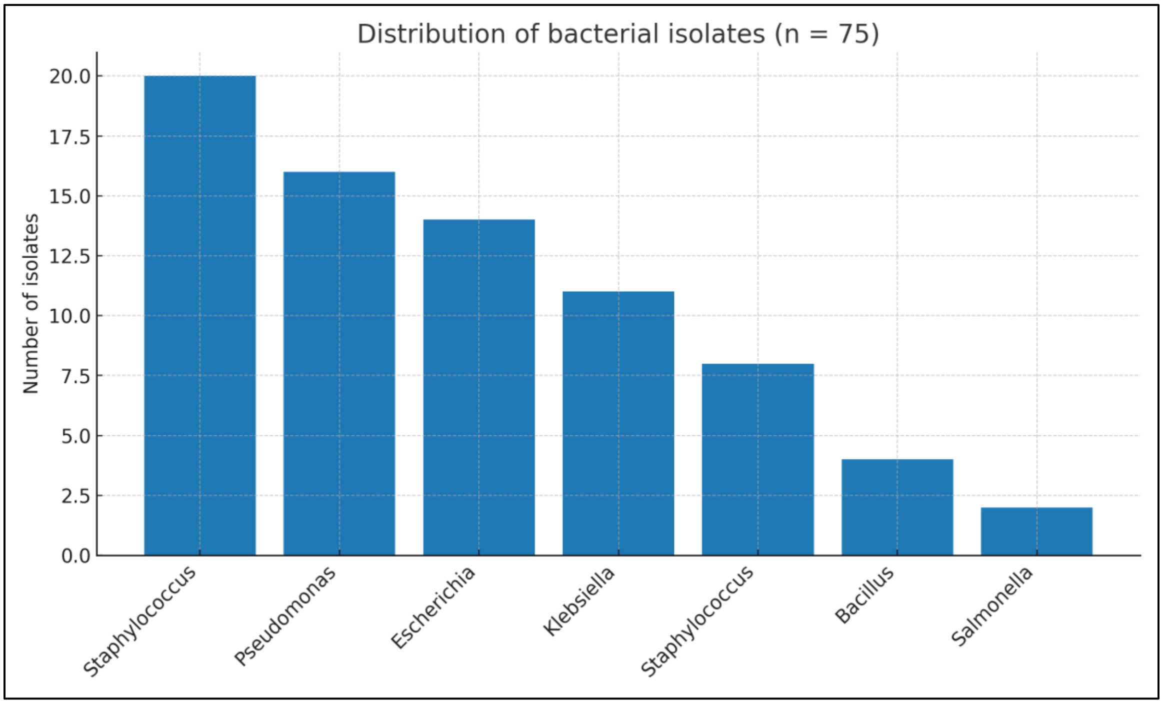

Fig 1. Distribution of Bacterial Isolates (n=75)

IV. DISCUSSION

Our observed contamination prevalence aligns closely with pooled estimates reported in recent syntheses and falls within the broad range described across low- and middle-income settings (5, 10, 11, 16). 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 (5, 16, 17).

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; and (iii) implement scheduled, manufacturer-compatible disinfection of screens and cases (6, 13, 14, 15). Given our context, standardizing prompts at bench entry points and providing approved wipes at accession desks may yield measurable reductions in surface bioburden (13, 14).

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 (6, 12, 13). 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 (6, 12, 17).

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 (10, 11, 21, 28). The predominance of coagulase-negative staphylococci is consistent with findings from multiple studies (7, 9, 20). The isolation of *Pseudomonas aeruginosa, Klebsiella pneumoniae, Escherichia coli,* and *Staphylococcus aureus* underscores the risk of HAIs associated with contaminated personal devices (6, 22).

The presence of E. coli suggests possible fecal-hand contamination and lapses in hand hygiene (8). Pseudomonas and Klebsiella are notable for environmental persistence and multi-drug resistance potential (12). These findings highlight the need for targeted interventions, including regular disinfection of MPs and hand hygiene reinforcement (1, 5, 13).

V. 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 (15).

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VI. 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 (1, 13). Our data support implementing routine, device-compatible screen disinfection and reinforcing hand hygiene at MP touchpoints (6, 13, 14, 15).

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