

MOBILE PHONES— DO WE NEED DECONTAMINATION?Ketaki Prakash Ghatole¹¹Student, Ramaiah Institute of Technology, Bengaluru.**ABSTRACT****BACKGROUND**

Mobile phones have become a necessity in the present scenario. They are extensively used for communication, internet, images, education, you tube, banking, for sharing reports, X-rays in healthcare settings. On the other hand they are reported to be contaminated by micro-organisms and may act as source of infection. In our study we analysed the mobile phones of healthcare workers (HCW) and college students for microbial contamination and also efficacy of sanitizers, wet wipes for decontamination.

MATERIALS AND METHODS

A total of 220 swabs were collected from 110 mobile phones of HCWs and 110 students. Swabs were cultured on 5% sheep blood agar; MacConkey agar and isolates were identified by standard protocol.

RESULTS

91.8% of students and 89.1% of HCWs mobiles were contaminated. Organisms like Staphylococcus aureus, CONS, E. coli, Klebsiella aerogenes were isolated. HCWs mobiles showed higher number of potential pathogens.

Decontamination by absolute alcohol, alcohol-based hand sanitizers decontaminated 96% of the mobile phones. Non-alcohol-based hand sanitizers and wet wipes were able to decontaminate 88% and 96% of the mobiles respectively.

CONCLUSION

Mobile phones of healthcare workers and also students were contaminated. Absolute alcohol could clean 96% mobiles of HCWs and 92% of students. Alcohol based hand sanitizers eliminated the organisms (96%) as against non-alcohol-based sanitizers. (88%). It was also observed that wet wipes were effective in students' groups. (96%).

KEYWORDS

Mobile Phones, Contamination, Decontamination.

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BACKGROUND

A mobile phone has become an indispensable accessory for every human being. It is used for communication, gaming, imaging, texting, social networking, banking etc. The first hand held phone was demonstrated by John Mitchell & Dr. Martin Cooper of Motorola in 1973. Within a decade Dyna TAC 8000x was commercially available. Since then it has evolved to present day smart phone using fourth Generation technology (4G) with growth of bandwidth intensive applications. In India alone more than a billion people use mobile phones. Many workers have studied the adverse effects of mobile phones. It creates major electronic waste. Mobile phones generate microwave radiation, which causes dielectric heating, can induce electromagnetic field, which can heat living tissues, especially at the surface of our head. Metabolic effects in living cells are also reported. Association between long term use of mobile phone with acoustic neuroma is debated. Mobile phones are reported to delay

cognitive response. In experimental animals they are reported to induce geno-toxicity.

Mobile phone as means of communication are widely accepted in healthcare facilities. They are used to share digital X-rays and other diagnostic images, laboratory reports, ECG, skin lesions etc. So, phones are increasingly being used in every location including Intensive care units (ICU) and operation theatre (OT). HCW's mobile phones come in contact with various surfaces while HCWs are carrying out activities like examining the patients, providing nursing care, collecting various clinical samples for laboratory investigations etc. and are likely to get contaminated by spectrum of micro-organisms. These contaminated mobile phones may act as source of nosocomial infections to susceptible population.^{1,2}

An article in DAILY MAIL, UK stated that 'Mobile phones harbour more micro-organisms than toilet seat.'³ Hospital infection society of India states that 10 to 30 % of patients admitted to hospitals and nursing homes in India, acquire nosocomial infections as against only 5% in the west.⁴

A cross sectional study conducted in Turkey observed that the bacterial colonization on mobile phones used by patients, patient's companions, visitors showed significantly higher rates of pathogens (39.6%) than health care workers (20.6%). There were more multidrug pathogens on the patients' mobile phones like methicillin-resistant Staphylococcus aureus, extended-spectrum β-lactamase-producing Escherichia coli, Klebsiella spp, high-level aminoglycoside-resistant Enterococcus spp, and

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carbapenem-resistant *Acinetobacter baumannii*.⁵ Nigeria study showed that 62% of total 400 mobiles studied were contaminated. Ulger, et al. from USA has reported much higher 94.5% of mobile phones to be contaminated with various microorganisms.⁶ In India Trivedi HR et al has shown that 52% of HCW's dominant hand and 40% of their mobiles phone had bacterial contaminations.⁷ These organisms may act as potential health hazard to self and family members. Warm environment surrounding the mobile phones along with constant handling creates favourable conditions for growth of micro-organisms, hence they are called as "technological Petri – dish for thousands of worms".

Every mobile manufacturer gives Dos and Don'ts instructions to users about the mobile use. But no manufacturer gives any instruction about the surface disinfection of the mobile without any damage to the mobile.

As we cannot clean mobile phones with water, isopropyl alcohol has been used with 98% efficacy, but it is not easily available for public and is highly inflammable, so we decided to evaluate commercially easily available skin sanitizers, alcohol based, non-alcohol based and wet wipes for easy mobile disinfection and compared with absolute alcohol. Since mobile phones of health care workers are known have contamination rate, another group we chose was students as they are constantly using mobile phones.

MATERIALS AND METHODS

Study was prospective anonymous unlinked surveillance. Study was planned by enrolling the 110 HCWs of Private Nursing home, (Resident doctors -18, Nursing staff - 62, Laboratory technicians-- 11, Operation theatre (OT) assistants – 19). 110 Students attending Arts Graduation College with no connection to hospitals as Non- HCWS. First the plan of study was explained, and consent was taken from each participant. Only android touch screen mobiles were included. Each day we collected samples from 10 mobile phones. We collected the data that none of them were cleaning phones with disinfectants. We gave identification number to each phone and whole data was analysed on that number.

The mobile phones of each HCW was asked to place on the table at the end of their shift duty. Sterile swabs moistened with sterile saline were used to rub the surface of the mobile and immediately inserted into sterile test tube.

From student's mobile phones also, we collected the swab at the end of the college in the same manner. The swabs were immediately inoculated on 5% sheep blood agar, MacConkey agar and incubated overnight at 37°C. Next day the organisms were identified by colony morphology, Gram stain, biochemical tests.⁸ We noted different types of growth from each mobile. Then the isolates identified as *Staphylococcus aureus* were subjected to cefoxitin disc diffusion test to detect MRSA.

We then selected randomly 100 mobile from HCWs and students, their Identification number recorded and divided into four groups. with 25 in each group. Mobile phones of first group were cleaned with sterile cotton dipped in Absolute alcohol. Second group of mobile phones were cleaned with alcohol-based hand sanitizer (3M Hand rub). Third group was cleaned with non-alcohol-based sanitizer

(Godrej Protekt, hand sanitizer), last group was cleaned with wet wipes (Kara hand sanitizing wet wipes). After 10 minutes, we again rubbed the surface of mobile phone with sterile cotton swab for culture and processed as above.

RESULTS

	Health Care Workers. (110)	Students. (110)
Contamination rate	98 (89.1%)	101 (91.8%)

Table 1. Showing Contamination Rate of Mobile Phones in Both Groups

	HCW	Students
Mono-microbial	19 (19.4%)	34 (33.7%)
Bi-microbial	33 (33.7%)	36 (35.6%)
Three or more types	46 (46.9%)	31 ((30.7%)
Total	98	101

Table 2. Showing the Pattern of Organisms in Contaminated Mobile Phones

Name of the Organism	HCW	Students
MSSA	38 (17.0%)	39 (18.7%)
MRSA	18 (8.1%)	07 (3.3%)
CONS	51(22.9%)	59 (28.2%)
E.coli	51 (22.9%)	52 (24.9%)
Klebsiella aerogenes	37 (16.6%)	34 (16.3%)
Pseudomonas aeruginosa	17 (7.6%)	17 (8.1%)
Acinetobacter baumannii	03 (1.4%)	00 (00)
Enterococci	08 (3.6%)	01 (0.5%)
Total	223	209

Table 3. Showing Microbial Profile of Mobile Phones

Category	Absolute Alcohol (25)	Alcohol Based Hand Sanitiser (3M Handrub) (25)	Non-Alcohol Based Hand Sanitiser (Protekt) (25)	Wipes Alcohol Free. (25).
HCW (100)	24 (96%)	24 (96%)	22 (88%)	22 (88%)
Students (100)	23 (92%)	24 (96%)	23 (88%)	24 (96%)

Table 4. Effects of Disinfection

This study showed that mobile phones of students were more contaminated (91.8%) than the Health care workers (89.1%). This difference was not statistically significant. Only one type of organism (monobacterial) isolation was more from mobile phones of students (33.7%) than that of HCWs, who showed predominantly three or more type of micro-organisms (46.9%)

Microbial profile in the study showed predominantly Coagulase negative staphylococci and E. coli (22.9% each) from mobiles of healthcare workers, where as it was Coagulase negative staphylococci (28.2%) followed by E. coli (24.9%) from student's mobiles. Pathogens like MRSA were more prevalent on mobile phones of HCWs (8.1%) as

against only 3.3% from student groups. Potential pathogens like *Acinetobacter baumannii*, *Enterococci* were also more prevalent on HCW's mobiles.

With Absolute alcohol as disinfectant, 96% of mobiles of HCWs and 92% of student's mobiles showed absence of growth. Alcohol based hand sanitizers eliminated the organisms from 96% as against non-alcohol-based sanitizers. (88%). It was also observed that wet wipes were effective in students' groups. (96%).

DISCUSSION

Due to increase in functions of mobile phones at affordable prices, they are have become universally accepted accessories. It can be found in dining area, kitchen, restaurant, gym, even bathrooms. The heat generated by cell phones contribute to harbouring bacteria on the device to multiply at alarming levels. We bring the cell phones daily in contact with face, mouth, ears, and hands, We use cell phones during travelling, so may bring back unusual organisms from that place. Younger generation students seem to use it more, even while eating, walking, on bed. If they have micro-organisms on their surface, they may act as source of infection to users.

Observations in this study showing contamination of mobile phones among HCW (89.1%) is consistent with Sterling I et al (96.2%),⁹ Usha S et al (91.6%),¹⁰ Badr RI et al (93.7%),¹¹ Jeske HC et al (90%),¹² Brady RR et al¹³ has also reported similar contamination rate of 96.2%. We did not come across any study with students' mobile phones. Srikanth P et al¹⁴ has studied mobile phones of corporate personnel, which were also contaminated.

It is proposed that organisms on mobile phones come from the hands. In our study two or more type of organisms were isolated from both groups. Similar observations were made among HCWs by Kaur S et al, and Elkholy et al.^{15,16} But Badr RI et al has observed more monobacterial contamination (93.3%).¹¹

Micro-organisms on mobile phones were similar in both groups, but potential pathogens like MRSA, *Klebsiella aerogenes*, *Acinetobacter baumannii* are more prevalent in HCWs, as these organisms are associated with hospitals. Tankhiwale N et al¹⁷ has also reported CONS, *Staphylococcus aureus*, *E. coli*, *Klebsiella* and *pseudomonas* from Health care workers. Similar observations were made by Kokate SB et al. Badr RI also reported consistent findings.^{18,11} Tambe MN observed fungi also along with bacteria.⁴ In this study we observed that all disinfectants we used reduce the contamination rate. Absolute alcohol and alcohol-based disinfectants are efficient in reducing 96% of contamination. Usha S et al has reported that isopropyl alcohol showed 98% efficacy in decontaminating the mobile phones.¹⁰ Similar observations were made by Tankhiwale N et al.¹⁷ Singh A et al observed 87% reduction in bacterial contamination with 70% alcohol.¹⁹ But we did not come across any study, which reported efficacy of hand sanitizers, moist wipes for effective decontamination of mobile phones.

As now it is observed that mobile phones of Health care workers and students are highly contaminated with micro-organisms, some potential pathogens. These mobile phones are constantly in touch with our body. small children also

use these mobile phones. Cleaning with easily available alcohol based, non-alcohol bases hand sanitizers or wet wipes can easily reduce the bacterial contamination. So if mobile manufacturers study these facts in detail and recommend to the customers it will be beneficial to the mobile users and make mobile use safe.

Limitations of our Study

We have not studied the effects of disinfectants on mobiles. Manufacturers of various disinfectants claim the activity for 2-8 hours. But we have not studied the duration of decontamination activity of sanitizers or wet wipes so cannot recommend how frequently decontamination must be done.

CONCLUSION

Mobile phones of HCWs and students were contaminated. Two or more organisms were observed along with potential pathogens like MRSA, *Enterococci*, *Acinetobacter baumannii*, which may act as source of infection to patients in health care setup or family members. These mobile phones can be cleaned using alcohol based or non-alcohol-based sanitizers or wet wipes.

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