

## Bacterial Contamination of Cell Phone

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### Abstract

Cell phones are being extremely useful in our day to day life but they may also pose a serious risk to our health. The constant handling of cell phones by different users exposes it to an array of micro-organisms and makes it a good carrier for microbes, especially those associated with skin. These mobile phones are ideal breeding sites for microbes because of the temperature and moisture. These organisms if pathogenic can be detrimental to the health of the patients especially to those in critical care units

The study was conducted within the premises of DAV College, Jawalakhel, Nepal where cell phones were randomly sampled from teachers, students and staffs. The entire phone surface was swabbed aseptically with the help of a sterile cotton swab. Colonies that grew on the agar plate after incubation were then subjected to Gram Staining and then for further identification biochemical tests were conducted.

A total of 25 cell phones were sampled by swabbing. 100% of the mobile phones were contaminated with microorganisms. Both Gram positive and Gram negative bacteria were isolated from these samples. Among the isolated bacteria, 92% were gram positive and 8% were gram negative. *Staphylococcus aureus*, Coagulase Negative *Staphylococci* (CoNS), *Bacillus species*, *Klebsiella pneumonia*, *Escherichia coli*, *Pseudomonas aeruginosa* were among the isolated organisms.

This study shows that mobile phones are the ideal sources of modern-day contaminations. The organisms isolated by constitute the normal flora biome but are considered to be opportunistic pathogen and may cause serious health issues. People should be made aware of the fact that their mobile phones are also a carrier for pathogenic organisms.

**Keywords:** Ideal Breeding Sites; Temperature; Swab; CoNS; Opportunistic Pathogens

### Introduction

Microbial standards in hygiene are necessary for a healthy life. People believe that microbes are present only in hospitals, research facilities and where waste is piled up. Due to this reason people have a misguided concept of where microbes are present. The lack of knowledge can therefore cause serious health concerns. They do not know that bacteria are present almost everywhere in air,

water, soil, food, in plants and animals, including human beings. Even devices such as mobile phones, which they carry all the time, are sites ideal habitats for microbes.

A mobile or cellular telephone is a long-range, portable electronic device for personal telecommunication. Mobile phones have become common personal item. They have become entertainment purpose etc. Although cell phones are extremely useful in our day

to day life, they may also pose as a potential risk to our health [2]. The adult human skin has surface area of approximately 2m<sup>2</sup> which is constantly in contact with environmental microorganism and become readily colonized by microbial species of about 10<sup>12</sup> bacteria As a result there is risk of microbial contamination of these phones. The constant handling of cell phones exposes it to an array of micro-organisms and makes it an efficient carrier for microbes, especially those associated with skin. These mobile phones are ideal breeding sites for microbes because of the temperature and moisture [3].

The handling of mobile phones by individuals of different sectors/ professions brings about diversity in the nature of organisms found on those phones. While people in education sector may contain normal floras while those involved in health sector may have pathogenic microbes on their cell phones due to frequent handling of clinical samples. Similarly, the age group, how much time is spent on cell phones, the hygienic practices followed all are contributory factors. Although there are many merits of cells phones, the potential health hazard associated with these objects should not be overlooked. The mobile phones which make communication easy and accessible also form good carriers of pathogenic agents of disease transmission. If care is not taken, they could be vehicles for the transmission of biological weapons [3,4].

Being an electronic gadget, cellular phones are seldom cleaned. All these factors and the heat generated by cellular phones, has been considered as the major contributors to the harboring of microbes on the device at alarming levels. Microbes can persist on the phone's surfaces for weeks and the daily contact with face, ear and hands pose as a potential risk to our health. Touch screen cell phones may have a lower load of microbes due to the smooth surface whereas keypad phones provide good adherence to microbes, making it an ideal habitat for microbes. Even the normal flora which are found on our skin may act as opportunistic [4,5]. These cell phones may someday turn out to be one the major carriers of disease causing microbes if people are not made aware about the risks associated with these devices.

### Materials and Methods

- **Study Area:** The study was conducted within the premises of D.A.V College, Jawalakhel, Nepal. Phones were randomly sampled from individuals involved in different professions.

- **Sample Collection:** A total of 25 phones were sampled, 5 each from students, teachers, administrative staffs, manual laborers and cooks. The entire surface of mobile phone was swabbed with a sterile cotton swab.

### Laboratory techniques and procedures

The lab works was carried out in the Microbiology lab, Department of Microbiology, D.A.V College. The following steps were employed during the tests:

- **Isolation of organisms:** The Cotton part of the swab was dipped in a nutrient broth and then incubated at 37°C for 24 hours. After 24 hours, one loop full of samples was taken from the broths and then inoculated onto different medias, such as Mannitol Salt Agar (MSA), Eosine Methylene Blue Agar (EMB) and Nutrient Agar. These plates were then incubated at 37°C for 24 hours. After 24 hours the plates were observed and the different types of colonies were noted. The plates having mixed colony were then sub-cultured on another Nutrient agar plate and incubated at 37°C for 24 hours, this was done to obtain a pure culture.
- **Identification of organisms:** After obtaining a pure culture from all samples, they underwent Gram identification. For further identification, the organisms underwent Biochemical test (Catalase test, Oxidase test, Indole test, Methyl Red test, Voges Proskauer test and Citrate test).

### Result and Discussion

According to our findings, all 25 phones samples were contaminated with a varying number of bacteria. All the samples showed mixed colonies. Among the isolated bacteria Coagulase Negative *Staphylococci* was found to be most dominant followed by *Staphylococcus aureus*, *Bacillus subtilis*, *Klebsiella pneumonia*, *Pseudomonas aeruginosa* and *Escherichia coli*.

Bacterial Isolates	Number (%)
Coagulase Negative Staphylococcus	19 (31.16%)
<i>Staphylococcus aureus</i>	16 (26.23%)
<i>Bacillus subtilis</i>	15 (24.61%)
<i>Klebsiella pneumonia</i>	7 (11.46%)
<i>Pseudomonas aeruginosa</i>	3 (4.91%)
<i>Escherichia coli</i>	1 (1.63%)

**Table 1:** Total number of bacterial isolates.

This study sampled cell phones from people involved in different professions to determine which types of organisms inhabit the phones of people from different sectors. The type of environment they work in and the lifestyle they follow is the main detrimental factor for the types of organisms isolated. For example; a kitchen staff will have direct exposure to organisms found on different edible materials ranging from vegetables to rice. Also, a painter will have direct exposure to different aerobic organisms on the walls. A teacher might possess organisms generally found on books, notes and pens of himself and his students. Similarly, an accountant will have direct exposure to different species of organisms that breed in bank notes and coins.

**Figure 1:** Isolates from different profession.

Our study showed 100% contamination; all of the samples were contaminated with 3 or more types of bacteria with individuals involved in manual labor presenting the highest diversity in term of bacteria isolated. This may be because they might not follow general hygienic practices or because of the environment they have to work in. Although people keep their phones in their pockets, there is frequent contact with the skin surface; our phones also come in contact with other accessory such as wallets, money, keys etc. Due to this reason there exists a risk of cross contamination. The organism associated with these phones may enter our body or get transferred to some other object if we simply use them while eating, buying something or even while touching someone else.

Review of other studies conducted Akinyemi KO., *et al.* and Ulger F., *et al.* suggest that that the contamination rates of MPs vary from 62% to 98.1%. The reason for the large variation may be the

sampling from different types of MPs owners, sampling methods (cotton swab was moistened or not before sampling, immediate streaking of the plate or not, final placement of the cotton swab tip into culture broth or not), and where the culture plate was streaked with the cotton swab (in room air, in a cell culture hood after transportation to a microbiology laboratory, or in the OR under laminar flow conditions). We tried to optimize the culture rate and lower the possible contamination by using cotton swabs, placed the cotton swab tip into culture broth for enriched culture, immediate streaking on the culture plate under sterile conditions [6,7].

The organisms isolated from this study such as CoNS, *E. coli*, *Pseudomonas aeruginosa* etc. are all opportunistic pathogens. While they do not pose any threat during normal conditions, they may pose a risk to immune compromised patients. For instance, organism such as *K. pneumoniae* readily colonizes human mucosal surfaces, including the gastrointestinal (GI) tract and oropharynx, where the effects of its colonization appear benign. From there it gains entry to other tissues and causes severe infections such as pneumonias, urinary tract infections, bacteremias, and liver abscesses [8]. Similarly, *E. coli* is a normal flora of the gut, but they have evolved to pathogenic mechanisms to cause infections to humans and animals. They can cause enteric/diarrhogenic or extra-intestinal infections in humans which is usually urinary tract infection [9]. The highest numbers of isolates from these samples i.e. Coagulase Negative *Staphylococci* and from a lesser number of isolate, *Pseudomonas aeruginosa*, are also a normal flora but it poses a serious risk to human health. This is due to their ability to form biofilm [10,11].

## Conclusion

The use of cell phones has increased tremendously, almost everyone has a cell phone in their pocket but they do not know that their phones are inhabited by micro-organisms. People are unaware about this and use them in different setting such as in hospitals, while have a meal and even while going to the toilet. Our finding indicates that these cell phones can act as mobile carriers for both pathogenic and non-pathogenic microbes. So, to prevent the risk of acquiring infections while handling mobile phones, people should be made aware about the risks associated with them and they should be encouraged to adopt methods of disinfecting their phones. They should also be made conscious about the use mobile

phones in restricted environments. Additionally, more studies are required to assess the efficacy of the above strategies and figure out better alternatives in decreasing bacterial contamination and limiting the infection transmission by the use of cell phones.

### Conflict of Interest

The authors have no conflicts of interest and the project was not supported by any sponsor for the purpose of their benefit.

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