Bacterial Contamination of Mobile Phones: When Your Mobile Phone Could Transmit More Than Just a Call

Corresponding Author:
Dr. Daniel N Tagoe,
Lecturer and Researcher, University of Cape Coast, PMB - Ghana

Submitting Author:
Dr. Daniel N Tagoe,
Lecturer and Researcher, University of Cape Coast, PMB - Ghana

Article ID: WMC002294
Article Type: Research articles
Article URL: http://www.webmedcentral.com/article_view/2294
Subject Categories: MICROBIOLOGY
Keywords: Contamination, Bacillus species, Coagulase Negative Staphylococci, Mobile Phone, Gentamicin, Ampicillin

How to cite the article: Tagoe D N, Gyande V K, Ansah E O. Bacterial Contamination of Mobile Phones: When Your Mobile Phone Could Transmit More Than Just a Call . WebmedCentral MICROBIOLOGY 2011;2(10):WMC002294

Source(s) of Funding:
None

Competing Interests:
None
Bacterial Contamination of Mobile Phones: When Your Mobile Phone Could Transmit More Than Just a Call

Author(s): Tagoe D N, Gyande V K, Ansah E O

Abstract

Background: Mobile phones have become one of the most indispensable accessories of professional and social life. However, several researches have indicated the potential colonization of surfaces and their ability to transmit diseases (fomites) of which the mobile phone is no exception. Thus this present study investigates bacterial contamination of mobile phones and their antibiotic susceptibility patterns.

Methodology: Surfaces of 100 mobile phones of randomly selected university students were aseptically swabbed. Serial dilution was used in quantification of bacterial with blood and MacConkey agars used in bacterial isolation. Gram reaction and biochemical reactions were applied in identification and the Kirby Buaer method employed in Antibiotic Sensitivity Testing.

Results: There was 100% contamination of all the mobile phones surfaces with a mean bacterial count of 9.915x107cfu/ml with a total of 11 bacteria spp. isolated. The higher isolates include Bacillus cereus (23%) and Proteus mirabilis (19%), whilst the least isolate were Salmonella spp. (3%) and Shigella. spp. (2%). Pathogenic isolates made up 81.8% of all isolates 18.2%. Salmonella spp. and Shigella spp. showed the most resistance to the antibiotics (87.5%) each whilst Escherichia coli was the most susceptible bacteria to the antibiotics (75%). Amikacin (71.4%) and Gentamicin (63.6%) were the most effective antibiotics whilst Ampicillin, Penicillin, Cloxacillin showed the least effectiveness with 100% bacteria resistance.

Conclusion: Thus mobile phones can be heavily colonized by high quantities of pathogenic bacteria and thus potential sources of disease transmission requiring application of sound personal hygiene as preventive methods.

Introduction

The global system for mobile telecommunication (GSM) was established in 1982 in Europe with a view of providing and improving communication network. Today, mobile phones have become one of the most indispensable accessories of professional and social life. In addition to the standard voice function of a telephone, mobile phones can support many additional services such as SMS for text messaging, email, pocket switching for access to the Internet, and MMS for sending and receiving photos and video. With all the achievements and benefits of the mobile phone, it is easy to overlook the health hazard it might pose to its many users. The constant handling of the mobile phones by users (in hospitals, by patients, visitors and health care workers, etc.) makes it open breeding place for transmission of microorganisms, as well as Hospital-Associated Infection (HAIs). This is especially so with those associated with the skin due to the moisture and optimum temperature of human body especially our palm, axillaries and other parts of the body. Previous studies of bacterial contamination of mobile phones had been conducted in a teaching hospital in Turkey [1] and New York were One-fifth of cellular telephones examined were found to harbour pathogenic microorganisms [2]. In Ghana as in several areas of the world mobile phone usage has increased dramatically, and in such environments where the percentage presence of bacteria is likely high, such as in hospitals, abattoirs, market places and places-of-convenience. This could enhanced pathogen transmission and intensified the difficulty of interrupting disease spread [3] with now growing evidence that contaminated fomites or surfaces play a key role in the spread of bacterial infections with antimicrobial resistance [4]. Antimicrobial resistance is a global phenomenon that has resulted in high morbidity and mortality as a result of treatment failures and increased health care costs [5]. Inappropriate use of antibiotics exerts a selective pressure that acts as a driving force in the development of antibiotic resistance. The association between increased rates of antimicrobial use and resistance has been documented for nosocomial infections as well as for resistant community acquired infections [6]. This study focuses on determining the presence, quantum and type of bacteria that contaminate mobile phones of students in the University of Cape Coast, Ghana and their antibiotic susceptibility.
Materials and Methods

Study Area and Design: The study was conducted on the campus of University of Cape Coast where Mobile phones were randomly sampled from students between December, 2010 to May, 2011.

Sampling: A total of 100 Mobile phones were randomly sampled from students both in the halls as well as in the faculties aseptically swabbing the entire phone using a dry sterile cotton.

Laboratory Methods and Procedures:
Laboratory analysis were undertaken in the laboratories of the Department of Laboratory Technology of the University, Cape Coast, Ghana

Inoculation: The cotton end was cut off and soaked in 10ml peptone water and incubated aerobically over-night at 37°C.

Quantification of Bacteria: Serial dilutions from the resulting growth from the peptone water medium were pour-plated on count agar (PCA) and incubated for 24hrs at 37°C under aerobic condition. The number of estimated Colony Forming Units (CFU) for each sample was then counted using the Quebec colony counter (Reichert, USA).

Isolation of Organisms: All pure isolated colonies were sub-cultured onto blood agar plates (for growth of heterotrophic bacteria) and MacConkey agar plates (for coliforms) for 24hrs at 37°C for colony isolation and morphological identification.

Identification of Organisms: Pure isolated colonies were Gram differentiated and then biochemically identified using Indole, Catalase, Citrate, Oxidase, Coagulase, and Urease test

Antibiotic Susceptibility Test (AST): Antibiotic susceptibility were determined by the agar diffusion technique on Mueller-Hinton agar (Kirby-Bauer NCCLS modified disc diffusion technique) using 8 antibiotic discs (Biotec Lab. UK) corresponding to the drugs most commonly used in the treatment of human and animal infections caused by bacteria; Ampicillin (Amp) (10?g), Tetracycline (Tet) (10?g), Gentamicin (Gen) (10?g), Cotrimoxazole (Cot) (25?g), Cefuroxime (Crx) (30?g), Cefixime (Cxm) (30?g), Cefotaxime (Ctx) (30?g), Penicillin (Pen) (10IU), Cloxacillin (Cxc) (5?g), and Erythromycin (Ery) (5?g), Amikacin (Amk) (30?g).

Statistical Analysis: Data from this study was analyzed descriptively using Minitab 15 software. One – way analysis of variance (ANOVA) was used to determine significant difference where (P?0.05) is significant and (P>0.05) is not significant.

Results

All 100 mobile phones sampled were contaminated with varied numbers of bacteria (Mean 9.915×105 CFU/phone). Nine (9%) had a single bacteria contamination whilst 65% had >3 bacterial contamination (Figure I). Bacteria isolates include Klebsiella pneumonia (10%), Citrobacter spp. (2%), Staphylococcus aureus (4%), Coagulase Negative Staphylococci (CNS) (15%), Pseudomonas aeruginosa (4%), Salmonella spp. (3%), Shigella spp. (2%), Proteus mirabilis (19%), Escherichia coli (8%), Bacillus cereus (23%), Streptococcus pneumonia (10%), Salmonella spp. (3%) and Shigella spp. (2%) with Bacillus cereus being the highest (23%) followed by Proteus mirabilis (19%), Coagulase Negative Staphylococci (15%). The least organisms sampled were Citrobacter spp. and Shigella spp. (2%) (Figure II). Antimicrobial susceptibility testing showed that isolated bacteria were 100% resistant to Ampicillin, Penicillin, Cloxacillin and Cefuroxime whilst the more effective antibiotics include Gentamicin (27.3%), Cotrimoxazole (27.3%), and Amikacin (14.3%) resistance (Figure III).

Discussions

Mobile phones due to their personal nature and proximity to sensitive part of our bodies in usage such as faces, ears, lips and hands of users could become veritable reservoirs of pathogens that could result in infections.

Results from this study showed high levels of bacterial contamination of mobile phones used by students in the University of Cape Coast with an overall mean viable bacteria count of 9.915×105 CFU/phone. This conforms work by [2] who found that One-fifth of the cellular telephones examined in New York harbour pathogenic microorganisms. Depending on environmental conditions, pathogens may remain infectious on surfaces for weeks after being contaminated. In humid conditions, pathogens may actively colonize surfaces, transforming a passive reservoir into an active one. Furthermore, formation of biofilm by one bacterial agent can affect the survival of other pathogens on the same surface [7]. In general; the greater the concentration of the microbe, the longer it survives and survival can range from minutes to months. This is a cause for concern since these pathogenic isolates are capable of causing diseases in anyone who gets contaminated whilst using the mobile phone.
Bacteria isolates include Bacillus cereus (23.0%), which was the dominant isolate, followed by Proteus mirabilis (19.0%), Coagulase Negative Staphylococci (15.0%), Klebsiella pneumoniae (10.0%), Streptococcus pneumoniae (10.0%), Escherichia coli (8.0%), Pseudomonas aeruginosa (4.0%) and Salmonella spp (3.0%), Shigella spp (2.0%) and Citrobacter spp (2.0%). The broad spectra of bacteria isolated here is indicative of the potential of the mobile phone to act as a fomite, which is similar to other fomites such as paper currency, which has been extensively researched on [8,9,10,11]. The frequent handling of both the mobile phone and the money makes for easy transfer of bacterial and thus cross contamination. The high isolation of Bacillus cereus confirms the ubiquitous nature of the Bacillus spp. giving it greater colonization ability as well as the ability of its spores to resist environmental changes, withstand dry heat and certain chemical disinfectants for moderate periods [12]. The presence of E. coli and Salmonella spp. suggests faecal contamination of these phones, which can result in community-acquired infections and disease outbreaks.

Antibiotic Susceptibility Testing (AST) indicates marked resistances of bacterial isolates to commonly used antibiotics such that only 41.67% of the tested antibiotics had susceptibility 50% or less. As much as 33.33% of the antibiotics i.e. Ampicillin, Penicillin, Cloxacillin and Cefuroxime were 100% infective on the isolated bacteria. These findings were similar to resistant pattern of bacterial isolates in sachet water sold in the streets of Cape Coast [13]. Resistances (100%) of isolates to Ampicillin, Cloxacillin, Penicillin and Cefuroxime commonly used antibiotics have been observed in previous studies presenting a public health problem [13,14]. The observed high antibiotic resistances could be attributed to the abuse of antibiotics as observed in a study in Cape Coast on antibiotic use which showed that majority of the populace sampled purchases antibiotics in the open market without any medical prescription and use them for the wrong diseases and infections [15].

Conclusions

All sampled mobile phones were highly contaminated with various types of bacteria with high resistances to commonly used antibiotics. This suggests the potential of the mobile phone as a fomite, which can result in community-acquired infections with possible public health implications. Periodic cleaning of mobile phones with disinfectants or hand cleaning detergents as well as frequent hand-washing should be encouraged as a means of curtailing any potential disease transmission.

Acknowledgement

The authors acknowledge the profound contributions of Mr. Emmanuel Birikornag and Mr. Yarquah (Laboratory Assistants) of the Department of Laboratory Technology, University of Cape Coast, Ghana in setting up the laboratory for this research work.

References

11. Tagoe, D.N.A; Baidoo, S.E; Dadzie I. & Ahator, D.S. A study of Bacterial Contamination of Ghanaian
Currency Notes in Circulation. The Internet Journal of Microbiology. 2010, 8(2).


Illustrations

Illustration 1

Figure I: A Chart showing the percentage of phones with different Bacteria colonies

- 65% No growth
- 26% 2 types
- 9% 1 type
- 0% 3 types or more
Illustration 2

Figure II: A Graph showing the Percentage of Phones colonized by the isolated Bacteria
Illustration 3

Figure III: A graph showing the Antibiotic Resistance Pattern of the Isolated Bacteria
Reviews

Review 1

Review Title: Bacterial Contamination of Mobile Phones: When Your Mobile Phone Could Transmit More Than Just a Call

Posted by Dr. Shilpakala Sainath Rao on 21 Dec 2011 03:24:44 PM GMT

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Is the subject of the article within the scope of the subject category?</td>
</tr>
<tr>
<td>2</td>
<td>Are the interpretations / conclusions sound and justified by the data?</td>
</tr>
<tr>
<td>3</td>
<td>Is this a new and original contribution?</td>
</tr>
<tr>
<td>4</td>
<td>Does this paper exemplify an awareness of other research on the topic?</td>
</tr>
<tr>
<td>5</td>
<td>Are structure and length satisfactory?</td>
</tr>
<tr>
<td>6</td>
<td>Can you suggest brief additions or amendments or an introductory statement that will increase the value of this paper for an international audience?</td>
</tr>
<tr>
<td>7</td>
<td>Can you suggest any reductions in the paper, or deletions of parts?</td>
</tr>
<tr>
<td>8</td>
<td>Is the quality of the diction satisfactory?</td>
</tr>
<tr>
<td>9</td>
<td>Are the illustrations and tables necessary and acceptable?</td>
</tr>
<tr>
<td>10</td>
<td>Are the references adequate and are they all necessary?</td>
</tr>
<tr>
<td>11</td>
<td>Are the keywords and abstract or summary informative?</td>
</tr>
</tbody>
</table>

Rating: 1

Comment:
The manuscript by Gyande et al reports about the contamination of mobile phones. There are lot of studies reported in pubmed on this aspect. There is nothing new. However only difference I can see is that it was conducted in a University campus. Hence the title should reflect that.

1. The manuscript is of poorly written and not suitable for publication. There are lot of typos and errors.

2. There is no mentioning of the consent form in the study. Was the consent taken from the students for the above study.

3. What was the age group of the students from whose mobiles the samples were collected.

4. Any report about the anaerobic bacteria?

5. Klebsiella pneumonia should be written as Klebsiella pneumoniae.

6. Bacterial names are not written in italics

I do not recommend to publish this article in it's current state.

Competing interests: I have no competing interest to declare

Invited by the author to make a review on this article? : No

Experience and credentials in the specific area of science:
Microbiologist with 11 years of experience

Publications in the same or a related area of science: No

How to cite: Sainath Rao S.Bacterial Contamination of Mobile Phones: When Your Mobile Phone Could Transmit More Than Just a Call[Review of the article 'Bacterial Contamination of Mobile Phones: When Your Mobile Phone Could Transmit More Than Just a Call ' by ] WebmedCentral 1970;2(12):WMCRW001290
Review 2

**Review Title:** Bacterial contamination of mobile phones: when your mobile phone could transmit more than just a call

**Posted by:** Dr. Balendra Pratap P Singh on 17 Oct 2011 06:39:20 AM GMT

1. Is the subject of the article within the scope of the subject category?  Yes
2. Are the interpretations / conclusions sound and justified by the data?  Yes
3. Is this a new and original contribution?  No
4. Does this paper exemplify an awareness of other research on the topic?  Yes
5. Are structure and length satisfactory?  Yes
6. Can you suggest brief additions or amendments or an introductory statement that will increase the value of this paper for an international audience?  No
7. Can you suggest any reductions in the paper, or deletions of parts?  No
8. Is the quality of the diction satisfactory?  Yes
9. Are the illustrations and tables necessary and acceptable?  Yes
10. Are the references adequate and are they all necessary?  Yes
11. Are the keywords and abstract or summary informative?  Yes

**Rating:** 4

**Comment:**
there should be different groups for this study and respective tables.

**Competing interests:** no

**Invited by the author to make a review on this article?** No

**Experience and credentials in the specific area of science:**
no

**Publications in the same or a related area of science:** No

**How to cite:** Singh B. Bacterial contamination of mobile phones: when your mobile phone could transmit more than just a call [Review of the article 'Bacterial Contamination of Mobile Phones: When Your Mobile Phone Could Transmit More Than Just a Call ' by J]. WebmedCentral 1970;2(10):WMCRW001016
Review 3

Review Title: Bacterial Contamination of Mobile Phones

Posted by Dr. Thomas Herchline on 11 Oct 2011 12:05:04 PM GMT

<table>
<thead>
<tr>
<th></th>
<th>Question</th>
<th>Answer</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Is the subject of the article within the scope of the subject category?</td>
<td>Yes</td>
</tr>
<tr>
<td>2</td>
<td>Are the interpretations / conclusions sound and justified by the data?</td>
<td>Partly</td>
</tr>
<tr>
<td>3</td>
<td>Is this a new and original contribution?</td>
<td>Yes</td>
</tr>
<tr>
<td>4</td>
<td>Does this paper exemplify an awareness of other research on the topic?</td>
<td>Yes</td>
</tr>
<tr>
<td>5</td>
<td>Are structure and length satisfactory?</td>
<td>Yes</td>
</tr>
<tr>
<td>6</td>
<td>Can you suggest brief additions or amendments or an introductory statement that will increase the value of this paper for an international audience?</td>
<td>No</td>
</tr>
<tr>
<td>7</td>
<td>Can you suggest any reductions in the paper, or deletions of parts?</td>
<td>Yes</td>
</tr>
<tr>
<td>8</td>
<td>Is the quality of the diction satisfactory?</td>
<td>No</td>
</tr>
<tr>
<td>9</td>
<td>Are the illustrations and tables necessary and acceptable?</td>
<td>No</td>
</tr>
<tr>
<td>10</td>
<td>Are the references adequate and are they all necessary?</td>
<td>Yes</td>
</tr>
<tr>
<td>11</td>
<td>Are the keywords and abstract or summary informative?</td>
<td>Yes</td>
</tr>
</tbody>
</table>

Rating: 5

Comment:
This is an interesting article which mostly confirms the results of other published studies.

There are grammatical errors throughout the article. In particular, it seems that some sentence fragments have been retained after editing occurred. As an example, in the abstract it is stated "Pathogenic isolates made up 81.8% of all isolates 18.2%.”

The authors conclude that periodic cleaning of mobile phones and frequent handwashing should be encouraged, but present no data on how these would impact the colonization of phones.

The authors make no comparison of the organisms found in the current study to the organisms found in other similar studies.

The first figure could be deleted with the data presented in the results text.

The second figure would be more useful if the organisms were grouped (eg. gram negatives shown together and gram positives shown together).

Competing interests: None

Invited by the author to make a review on this article? : No

Experience and credentials in the specific area of science:
Infectious Diseases Physician; academic interest in Public Health

Publications in the same or a related area of science: No

How to cite: Herchline T. Bacterial Contamination of Mobile Phones[Review of the article 'Bacterial Contamination of Mobile Phones: When Your Mobile Phone Could Transmit More Than Just a Call' by ].WebmedCentral 1970;2(10):WMCRW001004
Review 4

**Review Title:** Bacterial Contamination of Mobile Phones: When Your Mobile Phone Could Transmit More Than Just a Call.

Posted by Dr. Guadalupe García on 05 Oct 2011 03:39:14 PM GMT

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Is the subject of the article within the scope of the subject category?</td>
</tr>
<tr>
<td>2</td>
<td>Are the interpretations / conclusions sound and justified by the data?</td>
</tr>
<tr>
<td>3</td>
<td>Is this a new and original contribution?</td>
</tr>
<tr>
<td>4</td>
<td>Does this paper exemplify an awareness of other research on the topic?</td>
</tr>
<tr>
<td>5</td>
<td>Are structure and length satisfactory?</td>
</tr>
<tr>
<td>6</td>
<td>Can you suggest brief additions or amendments or an introductory statement that will increase the value of this paper for an international audience?</td>
</tr>
<tr>
<td>7</td>
<td>Can you suggest any reductions in the paper, or deletions of parts?</td>
</tr>
<tr>
<td>8</td>
<td>Is the quality of the diction satisfactory?</td>
</tr>
<tr>
<td>9</td>
<td>Are the illustrations and tables necessary and acceptable?</td>
</tr>
<tr>
<td>10</td>
<td>Are the references adequate and are they all necessary?</td>
</tr>
<tr>
<td>11</td>
<td>Are the keywords and abstract or summary informative?</td>
</tr>
</tbody>
</table>

**Rating:** 5

**Comment:**
It is a good paper.

**Invited by the author to make a review on this article?** : No

**Experience and credentials in the specific area of science:**
I worked for 19 years in a Hospital Health Microbiology.

**Publications in the same or a related area of science:** No

**How to cite:** García G. Bacterial Contamination of Mobile Phones: When Your Mobile Phone Could Transmit More Than Just a Call.[Review of the article 'Bacterial Contamination of Mobile Phones: When Your Mobile Phone Could Transmit More Than Just a Call ' by ].WebmedCentral 1970;2(10):WMCRW00990
Disclaimer

This article has been downloaded from WebmedCentral. With our unique author driven post publication peer review, contents posted on this web portal do not undergo any prepublication peer or editorial review. It is completely the responsibility of the authors to ensure not only scientific and ethical standards of the manuscript but also its grammatical accuracy. Authors must ensure that they obtain all the necessary permissions before submitting any information that requires obtaining a consent or approval from a third party. Authors should also ensure not to submit any information which they do not have the copyright of or of which they have transferred the copyrights to a third party.

Contents on WebmedCentral are purely for biomedical researchers and scientists. They are not meant to cater to the needs of an individual patient. The web portal or any content(s) therein is neither designed to support, nor replace, the relationship that exists between a patient/site visitor and his/her physician. Your use of the WebmedCentral site and its contents is entirely at your own risk. We do not take any responsibility for any harm that you may suffer or inflict on a third person by following the contents of this website.