

***Staphylococcus aureus* colonization of nursing professionals' cell phones at a Brazilian hospital: a preliminary study**Colonização de *Staphylococcus aureus* em telefones celulares de profissionais de enfermagem de um hospital brasileiro: um estudo preliminarColonização de *Staphylococcus aureus* em telefones celulares de profissionais de enfermagem de um hospital brasileiro: um informe preliminarLissandra Chaves de Sousa Santos¹, Ingrid Raquel Lima Vieira¹, Roniel Barbosa da Silva¹, Glícia Cardoso Nascimento¹, Fabiana de Moura Souza¹, Daniela Reis Joaquim de Freitas¹, Maria Eliete Batista Moura¹.

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RESUMO

Objetivo: avaliar a colonização por *Staphylococcus aureus* em telefones celulares de profissionais de enfermagem. **Método:** estudo transversal realizado com 35 profissionais de enfermagem entrevistados sobre conhecimentos e práticas relacionados à contaminação do celular. Além disso, todos os celulares de profissionais foram amostrados para análise microbiológica. **Resultados:** a maioria dos profissionais relatou ter conhecimento sobre contaminação de telefones celulares (91,3%) e que limpam seus celulares (74,28%). No entanto, 68,86% dos profissionais de enfermagem afirmam que não lavam as mãos após o uso de telefones celulares. Análises microbiológicas demonstraram que 40% dos celulares desses profissionais obtiveram cultura positiva e 28,57% dessas amostras foram identificadas como contaminadas por *S. aureus*. **Conclusão:** telefone celular dos profissionais de saúde estavam contaminados e pode ser uma fonte de contaminação do paciente caso medidas de prevenção não sejam tomadas. **Descritores:** contaminação de equipamentos; celular; microbiologia.

ABSTRACT

Objective: to evaluate *Staphylococcus aureus* colonization on nursing professional's cell phones. **Method:** cross-sectional study performed with 35 nursing professionals interviewed on their knowledge and practices regarding cell phone's contamination. **Results:** the majority of the professional reported to have knowledge on cell phones contamination (91.3%) and that clean their mobiles (74.28%). However, 68.86% of the nursing professionals claim that do not wash their hands after using cell phones. Microbiological analysis demonstrated that 40% of these professional's cell phones were culture positive and 28.57% of these samples were identified as contaminated by *S. aureus*. **Conclusion:** healthcare professional's cell phone were contaminated and could be a source of patient contamination if prevention measures are not taken. **Descriptors:** equipment contamination; cell phone; microbiology.

RESUMÉN

Objetivo: obtener una colonización por *Staphylococcus aureus* en teléfonos celulares de profesionales de enfermería. **Método:** Estudio transversal realizado con 35 profesiones de enfermería entrevistadas sobre conocimientos y prácticas relacionadas con la contaminación celular. Además, todos los teléfonos de profesionales son expertos en análisis microbiológico. **Resultados:** a maioria dos profissionais relatou ter conhecimento on contaminação de telefones celulares (91,3%) y que limpam seus celulares (74,28%). Sin embargo, el 68,86% de los profesionales de enfermería aseguran que no tienen acceso a teléfonos móviles. Análises demostraciones microbiológicas que el 40% de los datos celulares son profesionales de la cultura positiva y el 28,57% de las fuentes de salud identificadas como contaminadas por la naturaleza. **Conclusión:** el teléfono celular o la red de asistencia técnica de la salud y la seguridad de la salud en el caso de los pacientes. **Descritores:** contaminación de equipos; teléfono celular; microbiología.

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INTRODUCTION

The indiscriminate and frequent use of cell phones by healthcare professionals at hospital settings can contribute as part of the infection transmission chain given that this devices can be easily contaminated by the hands of the healthcare professionals or hospitals surfaces and not appropriately cleaned¹⁻³. Akinyemi et al. (2009)⁴ reported a 62% rate of contamination on 400 cell phone samples and the most frequent bacteria isolated were *E.coli*, *Enterococcus spp.* and *Staphylococcus spp.* A study conducted in Brazil also reported cell phones contamination, where a 6.7% rate by *S.aureus* was reported, with all samples presenting resistance to penicillin and 3.57% to oxacillin⁵.

In addition, the presence of potential pathogenic bacteria on healthcare professional cell phones can aggravate the scenario, especially on hospital critical areas, such as, intensive care unit and operating room/recovery area, given the patient's susceptibility at these areas. Nursing professionals are frequently in contact with patients during their work shift and should be extremely careful with the use of cell phones before and/or after having their contact with patients, given that, if not adopted precautions measures they could facilitate the equipment/patient contamination. Reducing bacteria reservoir in healthcare services can be an easy and effective approach to reduce contamination and infections and improve patient safety.

Staphylococcus aureus is an important human pathogen responsible for different types of serious infections acquired from community and/or healthcare settings. The Rev Pre Infec e Saúde.2018;4:7285

adoption of simple manners such as hand hygiene and wiping the cell phones with 70% alcohol can reduce surface contamination and therefore possible patient contamination. Considering the spread of infections caused by multidrug resistant *S.aureus* in hospitals worldwide, this study had performed a preliminary study on evaluating the presence of *S.aureus* contamination on cell phones of nursing professionals that work on different areas of an emergency hospital.

METHOD

Cross-sectional study performed with 35 nursing professionals at their workplace unit. It was used a convenience sample including all the professionals approached at August 31, 2018 who accepted to participate at the study. Initially, all study participants were questioned regarding their habit for cleaning their cell phones and the products used for performing cell phones cleaning. Subsequently, a sample for microbiologic analysis was taken from the participant's cell phone by sterile swabs, previously wet in 1 mL of sterile solution present in a sterile falcon tube, with concentric circular movements rotating the swab over the surface of both sides of the cell phones for improved bacteria recovery.

After identified, the samples were transported for microbiological analysis. For microbiological culture, after 10 minutes sonication, 1 µL of each sample was spread in Mannitol Salt Agar by streaking technique and incubated at 36°C for 48 h. In addition, the sample with culture growth had their isolated

bacteria identified by Gram staining (Newprov®) and coagulase (+) test using Staphclin® kit, according to the manufacturer's instructions. The catalase (+) test was done by adding 25 µL of 10 volume hydrogen peroxide in 25 µL of bacterial suspension and observing the result.

For positive results, the sensibility profile was tested by disc diffusion method according to Kirby-Bauer method. The antibiotic tested were: ciprofloxacin, tetracycline, chloramphenicol and oxacillin. Results were analyzed by measuring the halo of inhibition in millimeters around the antibiotic disc with a halometer and reported as susceptible, intermediate and resistant according to manufacturer instructions.

Study participants were not previously informed about the sample collection and ethical principals were respected. The Study was approved by Federal University of Piauí Ethics Committee.

RESULTS

Thirty-five professionals from intensive care unit and other hospitalization units were interviewed and had their cell phones sampled for microbial analysis. The medium age of nursing professionals were 36 years old and the majority were females (91.4%). Seventeen (48.6%) of the professionals work at the intensive care unit and eighteen (51.4%) at other hospitalization units.

Most of the professionals (91.3%) claim to have knowledge regarding cell phones contamination. However, according to data presented in Table 1, 20% of the professionals answered that don't clean their cell phones, 80% said that use their cell phones after washing their hands and 62.8% do not wash their hands after using their cell phones. In addition, 80% of the participants use alcohol to clean their mobiles.

Table 1- Nursing professional's knowledge and practices on cell phones cleaning, n=35. Teresina, 2018.

Items	Sample (%)			
	Yes	No		
Knowledge on cell phones contamination	32 (91.43%)	3 (8.57%)		
Perform cell phone's cleaning	Yes	No	Sometimes	
	26 (74.28%)	7 (20%)	2 (5.71%)	
Quantity of cell phone's cleaning procedure per day	One time	Two times	Three times	Do not clean
	21 (60%)	6 (17.14%)	1 (2.86%)	7 (20%)
	Alcohol	None		
	28 (80%)	7 (20%)		
Use cell phone after hand washing	Yes	No	Sometimes	
	28 (80%)	2 (5.71%)	5 (14.28%)	
	Yes	No	Sometimes	
Wash hands after cell phone use	6 (17.14%)	22 (62.86%)	7 (20%)	

Source: authors

For performing microbiological analysis on nursing professionals' cell phones, samples from cell phone's surfaces of all participants were collected. After culture incubation period, fourteen (40%) of the samples presented bacterial growth on gram positive selective culture media. The samples were also cultivated on enrichment broth (Tryptic Soy Broth) at 36 °C for 48 hours for testing other bacteria recovery. All samples (100%) had positive bacteria growth

when incubated with nonspecific culture media (unshown data).

Bacterial growth quantification was realized on positive culture results (n=14) by counting colony forming unit (CFU). Twelve (85.7%) of the positive samples presented a moderate growth up to 500 CFU/mL and one (7.1%) sample had high bacterial growth (over 10³ CFU/mL) (Table 2).

Table 2- Quantitative analysis of bacterial growth on nursing professional's cell phones. n=14. Teresina, 2018.

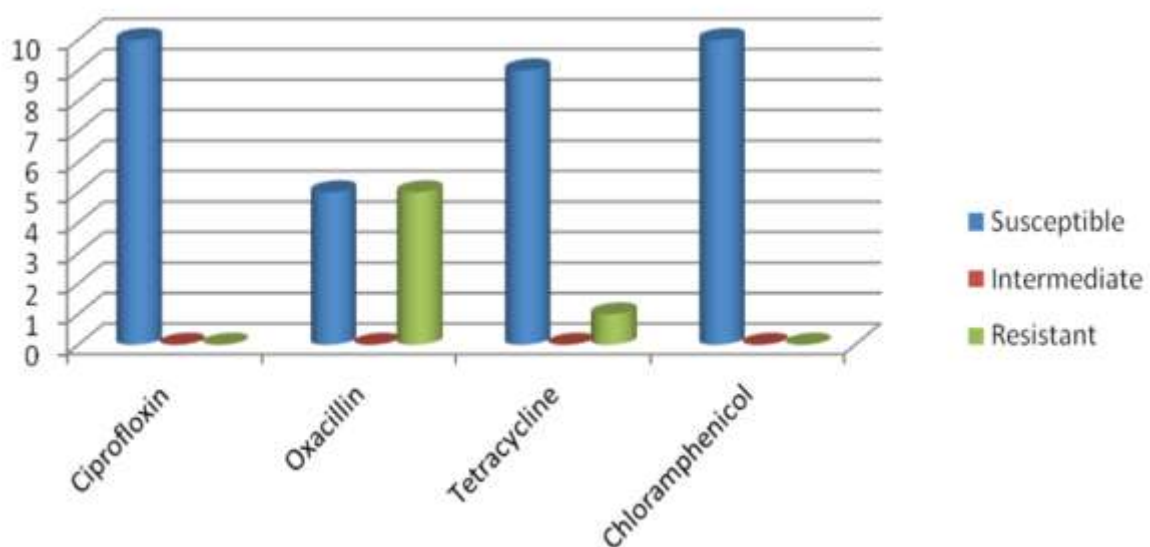
Bacterial contamination	Samples (%)
<500 CFU/ML	12 (85,71 %)
500-1000 CFU/mL	1 (7,14 %)
>1000 CFU/mL	1 (7,14 %)

Source: authors

Comparing the positive results rates and hospital areas, the majority of the positive samples were

from intense care unit nursing professional's cell phones (64.28%) (Unshown data).

Table 3- Antibiotic resistance profile of *S. aureus* isolates from nursing professional's cell phones, 2018.



Source: authors

From all culture positive result (n=14) it was realized three identification tests on bacteria isolated, in order to confirm *S.aureus* detection. Four isolated samples were negative for *S.aureus* in all performed test. Therefore, in ten samples was performed antibiotic sensibility test. From the analyzed samples, 50% (n=5) presented resistance to oxacilin (Table 3).

DISCUSSION

Healthcare infections represent an important problem, which affects directly the quality of care services and patient safety. Cell phones can be potential contamination vectors so prevention measures are crucial for rational mobiles use on healthcare settings, once prohibiting their use could be impracticable given their great use in information spreading worldwide.

In order to reduce potential risk on cell phones' contamination is necessary not only make healthcare professionals aware of these risks but also guide correct approach for device cleaning and rational use during patient's care, by washing hands before and after patient's manipulation, for example.

High rates of healthcare infections continue to be a challenge for healthcare professional, administrator and researchers⁶. Contamination by various microorganisms of different devices used by healthcare professionals, such as, pen, cell phones and medical coat, was reported previously⁷. In cell phones, not only the surface in contact with bacteria on hospital setting but also the heat produced in the device could facilitate bacteria

Staphylococcus aureus colonization of cell phones proliferation and attachment, which is the ideal scenario for skin flora bacteria⁶.

In this study, 40% of nursing professional's cell phones were contaminated with culture positive bacteria and 28.5% of the isolated were *S.aureus*. The findings also demonstrate that most of the professionals are aware that cell phones can be possible infection vectors. However, this knowledge is not enough for preventing the irrational use of cell phones and device lack of cleaning. The presence of MRSA isolated from two cell phones was reported in a study⁸ performed with intensive care unit medical staff's cell phones.

Most of the nursing professionals interviewed, had claimed to perform cell phone cleaning at least once a day, using alcohol. Study performed on a Thailand hospital revealed that alcohol cleaning could eradicate microorganism from cell phone devices⁹.

Is well established that intensive care units' surfaces and equipments are potential source of contamination and/or infection, not only for patient but also for healthcare professionals¹⁰. In this study, most of the cell phones contaminated were from intensive care unit's nursing professionals, when compared with other hospitalization units.

CONCLUSION

Considering the spread of multiresistant microorganism and the frequent use of cell phones by healthcare professionals, not only for personal use but also for working purposes, at the digital era, more and more this device should be included as a potential contamination

source in healthcare settings. In this study, 40% of nursing professional's cell phones were contaminated with *S.aureus* while the majority of the participant professionals claimed to have knowledge on cell phone contamination (91.4%) and clean their cell phones (74.5%). One sample isolate was multidrug resistant, presenting resistance to oxacillin and tetracycline.

One of the study limitations is the reduced sampling, which has limited the analysis. We suggest that this study is performed on a more robust sample, and testing for additional bacteria isolation. We also suggest additional studies on evaluation of preventions measures impact on reducing contamination and evidences of patient infection related to contaminated cell phones. Overall, this study allows not only to demonstrate nursing professional's cell phones contamination by *S.aureus* but to compare the knowledge and practices on cell phones contamination and cleaning process reported by nursing professionals with the microbiological analysis of their cell phones. The presence of potential pathogenic microorganism on professional's cell phones is a alarming reality that should be further investigated for building scientific background and improving possible patient's infection prevention measures.

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COLLABORATIONS

Santos LCSS, Vieira IRL, Nascimento GC, Souza FM, Freitas DRJF and Moura MEB contributed to the design and design, collection, analysis and interpretation of data. Santos LCSS, Souza FM, Freitas DRJF and Moura MEB contributed to the writing of the article, critical review of the intellectual content and final approval of the version to be published. We emphasize that all the authors were involved in the process of collecting, processing and analyzing the samples.

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INTEREST CONFLICTS

There are no conflicts of interest to report.

AVAILABILITY OF DATA

Available upon request to the authors.

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