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*Full Length Research Paper*

# Bacterial contamination of public telephones in the downtown area of Sarajevo

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**Public telephones are handled by many people and can serve as vehicle of disease transmission. Our study involved the microbiological analysis of public telephones. We analysed 60 telephones from the downtown area of Sarajevo and they were all positive for bacterial contamination. The analysis used microbiological, biochemical and serological methods. More Gram-positive than Gram-negative bacteria were isolated, and the most common bacteria were *Staphylococcus epidermidis.* Beside this, we also found pathogenic and opportunistic bacteria such as *Staphylococcus aureus, Escherichia coli* and *Pseudomonas aeruginosa.* The hygiene of the environmental surfaces and public objects is to be considered as various opportunistic bacterial pathogens were isolated.**

**Key words:** Public phones, bacteria, surface, contamination, opportunistic pathogen.

## INTRODUCTION

Contact is one of the most common modes of transmission of infective agents. Pathogen microorganisms can be spread through direct physical contact among people or through contact with contaminated inanimate objects (fomites) and surfaces. Numerous studies have demonstrated that the contaminated fomites play a role in the spread of infectious diseases (Scott and Bloomfield, 1990; Snelling et al., 1991; Aitken and Jeffries, 2001; Barker et al., 2001; Rusin et al., 2002; Hota 2004; Romano et al., 2006). Pathogenic microorganisms present on the fomites can survive for a long period of time depending on microbial characteristics, fomites characteristics, and environmental factors such as relative air humidity and temperature (Abad et al., 1994; Boone and Gerba 2007). Recent literature review reveals concern about the hygiene of the frequently handled objects in hospital settings (Namias et al., 2000; Desikan et al., 2003; Nelson et al., 2006). During the last few years, we have witnessed spreading of infections such as severe acute respiratory syndrom (SARS) (Duan et al., 2003; Sampathkumar et al., 2003) and H1N1 (Olsen, 2002; CDC, 2009). Therefore, there is increasing public interest in examination of microbiological contamination of fomites in community settings. Some microorganisms can be pathogenic at low concentrations and survive on nonporous surfaces such as telephones, taps, doorknobs and toilet bowls (Goldmann, 2000; Abad et al., 2001; Rusin et al., 2002; Reynolds et al., 2005). There are few data available concerning the investigation of bacterial pathogens from public telephones (Ferdinandus et al., 2001; Tunç and Olgun, 2006; Annand et al., 2009; Brooke et al., 2009). Having in mind that public phones are in constant use by a wide range of people, the purpose of our research was to isolate and identify the most common bacterial contaminants present on the

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**Table 1.** Microorganisms isolated from public telephones in Sarajevo

| Microorganism | Number of telephones positive for bacteria | Percentage of isolated bacteria (%) |
|---|---|---|
| *Staphylococcus epidermidis* | 44 | 73.3 |
| *Bacillus subtilis* | 24 | 40 |
| Coryneforms | 15 | 25 |
| *Streptococcus alpha haemolyticus* | 3 | 5 |
| *Enterococcus faecalis* | 2 | 3.3 |
| *Staphylococcus aureus* | 2 | 3,3 |
| *Pseudomonas aeruginosa* | 2 | 3.3 |
| *Escherichia coli* | 1 | 1.6 |
| *Acinetobacter calcoaceticus* | 1 | 1.6 |

public phones in the central region of the city of Sarajevo. That region represents an administrative centre of the city, with the variety of public schools and hospitals where more than 300 people passes through on a day to day basis.

## MATERIALS AND METHODS

Sixty (60) samples from different public phones in downtown area of Sarajevo were randomly chosen for the study, covering high, medium and low traffic areas. High traffic areas were characterized as places with more than 15 people coming in and out of the location per hour, medium traffic areas were designated as sites were 10 people coming in and out of the tested location, and low traffic areas were characterized as places where fewer than 10 people visiting the tested location per hour.

Samples were collected on the same day, on April the 4th 2010, between 10 am and 2 pm, from the hand contact area and mouthpiece from each tested phone. Sites were swabbed with a sterile cotton swab (COPAN, Italy) moistened with sterile saline. After collection, samples were immediately transported in the refrigerator to the laboratory, and then analyzed. Every sample was inoculated in Glucose broth (Sigma-Aldrich, Switzerland) and then incubated for 24 h at 37°C. Typical well-isolated colonies were selected for further inoculation on Trypticase Soy Agar plates (Sigma-Aldrich, Switzerland) and blood broth culture (Sigma-Aldrich, Switzerland), and incubated for 24 h at 37°C. For the detection of fungi, Sabouraud's Dextrose Agar (Sigma-Aldrich, Switzerland) was used.

Isolation and identification of microorganisms residing on the surface of telephones was performed using standard microbiological methods: Gram staining, Oxidase, Catalase, Coagulase, Oxidation-Fermentation, Indole, Blastase, Bacitracin susceptibility, Bile-Esculin, Citrate utilisation, Methyl Red, Voges-Proskauer, Novobiocin susceptibility, Urease, Durham Tube Sugar Fermentation and Penicillin disk tests and Motility determination by Soft Agar Plate Method (Murray et al., 2003).

## RESULTS AND DISCUSSION

Bacteria were recovered from all 60 telephone samples. The results of microbiological analysis are presented in Table 1. More Gram-positive bacteria than Gram-negative were found on the public telephones. *Staphylococcus epidermidis* was the most commonly isolated microorganism (73.3 %), and *B. subtilis* was also isolated in great numbers (40 %) (Table 1). In our study, only three species of Gram-negative bacteria were recovered. *Pseudomonas aeruginosa* was detected in two samples (3.3 %), while *Escherichia coli* and *Acinetobacter calcoaceticus* were each detected in one sample, respectively (1.67 %). One tested sample was positive for the presence of fungus *Candida albicans* (Table 1).

Public phones harbour many microorganisms including pathogens. On the surfaces of 60 tested public telephones, we found the following bacteria: *S. epidermidis, S. aureus, S. alpha haemolyticus, E. faecalis, B. subtilis,* coryneforms*, P. aeruginosa, E. coli* and *A. calcoaceticus*.

Our results are in concordance with reports of other authors who also investigated microbial contamination of public phones (Ferdinandus et al., 2001; Yalowitz and Brook, 2003; Tunç and Olgun, 2006). According to Rusin et al. (2003), Gram-positive bacteria are transmitted most readily from environmental surfaces followed by viruses and Gram-negative bacteria. Recently, most investigations have focused on microbial contamination of mobile phones. Brady et al. (2006) isolated coagulase-negative staphylococci, *S. aureus* (MRSA and MSSA), *Bacillus spp.*, *Enterococcus faecalis,* diphtheroids*,* as well as *Micrococcus* spp*., Streptococcus viridans, Clostridium perfringens* and *coliforms*. Goldblatt et al. (2007) recovered *S. aureus* (MRSA and MSSA), *Pseudomonas* spp*., E. coli, Acinetobacter lwolffii, Klebsiella pneumoniae*, *Enterobacter agglomerans, Alcaligenes* spp*.* and *Aspergillus* spp. from mobile phones of the medical staff, while Ramesh et al. (2008), also investigating mobile telephones of medical staff, found the following bacterial contaminants: *S. epidermidis*, *Pseudomonas* spp., coliforms, Gram-negative non-fermentative bacilli, *Acinetobacter baumannii, A. lwolffii, Klebsiella* spp. and *Enterobacter agglomerans.*

The most frequently isolated bacterial species in tested samples was *S. epidermidis* (44 out of 60 tested samples)

which is a commensal of the human skin, but can cause severe infections in immune suppressed people. Annand et al. (2009) reported that most of the public telephones in the large urban USA University contained bacteria commonly found on the human skin such as coagulase-negative staphylococci and coryneforms. Because *S. epidermidis, S. alpha haemolyticus*, *E. faecalis, E. coli, P. aeruginosa,* coryneforms and *C. albicans* are part of normal physiological human microbiota, we can suppose that the source of the contamination of public phones is of human origin. Two tested phones were contaminated with *S. aureus*. This bacterium is known to cause skin infections (Iwatsuki et al., 2006) and certain strains can also become resistant to multiple antibiotics as in the case of MRSA (Młynarczyk et al., 1999). In our study, we isolated *P. aeruginosa* twice and *E. faecalis* once. These bacterial species are associated with skin and soft tissue infections (Armour et al., 2007; McBride et al., 2007). The presence of *E. coli* in one sample indicates a possible faecal contamination of the tested public telephone. *E. coli* is known to be an opportunistic pathogen, particularly in urinary tract infections (Faro and Fenner, 1998). *B. subtilis* and *A. calcoaceticus* are the only bacteria we found on surface of public telephones which are not of human origin. Members of the genus *Acinetobacter* are implicated in various infections such as bacteraemia, secondary meningitis or urinary tract infection (UTI) (Towner, 1997) in immunosuppressive patients, while *B. subtilis* is rarely implicated in infections. These bacteria are widely present in nature, and they can be found in soil, air and plants. Therefore, they may have settled onto telephones via dust particles.

We believe that more studies regarding the hygiene of commonly used surfaces such as public telephones are required in the future, since phones can act as vehicles of infectious diseases and may have a significant impact on the general health of the population. Also, we suggest good hygienic practices after using telephones as an important step in stopping further contamination and possible infections. The most important way to reduce the spread of microorganisms is regular hand washing with soap and water if available, or using alcohol-based hand sanitizers.

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