

The Role of Computer Keyboards in spreading pathogenic Bacteria in Hospitals, teaching labs and Homes; And the Effect of Using Alcohol Wipes to Eliminate Contamination

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Abstract

As any other object, Computer keyboards can harbor many pathogenic and nonpathogenic germs and therefore can serve as a source of disease transmission. 45 samples from computer keyboards located in Hospital, teaching lab and home computers were collected, in order to study the contamination degree and bacterial diversity as well as the efficiency of using alcohol wipes to clean keyboards. Results show that 93.3% of the studied keyboards were contaminated with different types of bacteria. *Staphylococcus Spp.* Was found in 53.5% of the whole isolates, coliform bacteria which includes *E.coli* and *Klebsiella* comes next with 22.5%, while *Bacillus Spp.* and *Pseudomonas Spp.* were found in 21% and 2.8%, respectively.

The highest rate of contamination were on the keyboards of labs computers, followed by the keyboards from hospitals, while the lowest rate of contamination was on the keyboards of home computers. Alcohol wipes were showing high efficiency in cleaning keyboards and reducing contamination during the study.



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Introduction

Computer technology has become a basic necessity in the modern everyday life. It has made most of our daily activities easier, faster and more accurate, from communicating to banking to even surgeries [3]. Computers just like microbes are ubiquitous and they continue to have an increased presence in almost every aspect of our occupational, recreational, and residential environments [19]. A search of literature has revealed that microorganisms are colonizing and contaminating environmental objects in homes [17], hospitals [9], schools, day-care environments [14], and offices [7].

In hospitals and health care environments, objects are contaminated by a variety of pathogenic and nonpathogenic microorganisms that can persist on surfaces for prolonged periods [2]. This is considered a serious issue since patients are facing the risk of contracting bacterial infections from doctors and health care providers who use computers [12]. The infections caused by these microorganisms can spread to humans directly or indirectly via inanimate objects called fomites and/or living organisms called vectors [18]. Computer labs are another environment which is recently available in all categories of scientific and technological departments. This can also be a serious source of potentially hazardous or pathogenic microorganisms. The daily use of these computers by different users increases the opportunity of microbe transmission, especially in the absence of routine cleaning with disinfectants and detergent. Another source of contamination which should also be recognized and considered as a serious and dangerous root of infection and microbe transmission is home computers which exist in almost every house. Parents are usually not aware of the number of germs and pathogens present on their computer's keyboards, allowing their children and themselves to capture many microbes when using computers. The risk of transmission of pathogens from computer keyboards to the users and patients in hospitals can be prevented by compliance with current hand hygiene guidelines. Unfortunately, 34 studies have demonstrated that the mean rate of compliance with the Centers for Disease Control and Prevention guidelines on hand hygiene is approximately 40% among healthcare workers, which is a likely explanation for the frequent contamination of computer keyboards [13]. The keyboards of people at home who would never imagine the presences of any pathogenic microbes on their own keyboards were also found to be bacterially contaminated but with lower rate. Beside hand hygiene, dust can also trap moisture and enable the bacteria that are already on your keyboard to flourish. One potential cause of a keyboard that can make a person sick, is sharing it with other people, as one of them may have coughed or sneezed into his hand [6].

Objectives

This study was performed to determine the degree of bacterial contamination and bacterial diversity on keyboards of Hospitals computers, lab computers and home computers. As well as comparing the contamination degree among them, the efficacy of using Alcohol wipes to eliminate contamination was testing.

Materials and Methods

A total of 45 computer keyboards were selected from Shaqlawa hospital, computer lab of information technology department of Shaqlawa Technical Institute and random samples were taken from computer keyboards that used strictly at houses, to determine the presence of germs and pathogenic bacteria. The keyboards of these computers were swabbed with sterile cotton swab moisten with sterile normal saline. Then these keyboards were rubbed with wipers containing 70% of isopropyl alcohol. After allowing the keyboards to dry, swabbing operation was repeated from the same position. All cotton swabs were transferred immediately to the laboratory in order to culture the samples before and after rubbing the keyboards on nutrient agar [HiMediacompany], MacConkey's agar and mannitol salt agar.

Identification of various bacteria that isolated from computers keyboards was performed through the standard techniques described by Cheesbrough [2006].

Result

Out of 45 examined keyboards from Shaqlawa hospital, teaching lab and home computers, 42 computer keyboard were contaminated with different groups of bacteria, representing 93.3% of the examined keyboards. After rubbing the keyboards with isopropyl alcohol wipes, the number of contaminated keyboards was reduced to only 9.7%. Fig.1 shows the percentage of bacterial contamination before and after disinfectant with alcohol.

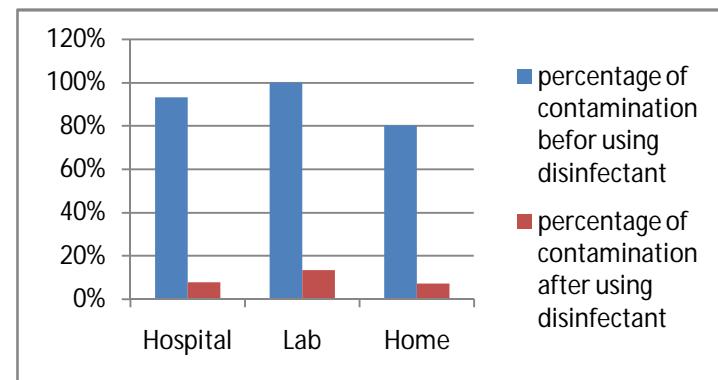


Fig. 1 The percentage of bacterial contamination before and after disinfectant with alcohol

The highest rate of contamination was found on the keyboards of teaching labs, followed by the keyboards of hospitals computers, while the lowest rate of contamination was found on the keyboards of home computers. The distribution is shown in details in Fig.1

About 46.3% of contaminated keyboards show the growth of one type of bacterial agent, 36.5% of contaminated keyboards show the growth of two types of bacterial agents, while 17% were showing the growth of three types of bacterial agents or more. Fig.2 gives the number of species found on the tested keyboards.

Number of Types of Species found on keyboards

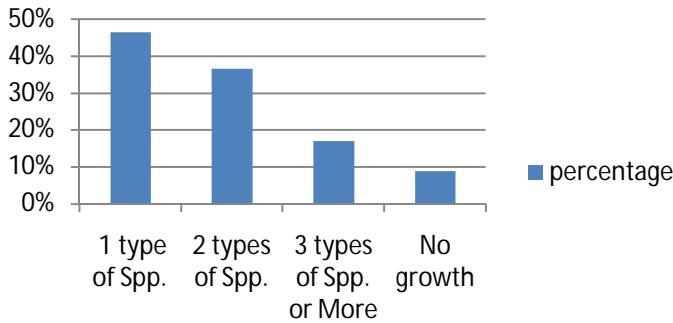


Fig.2 the number of species found on the tested keyboards

The most abundant bacteria have been observed was *Staphylococcus spp.* including [Coagulase Negative CNS and *Staphylococcus aureus*] it represented 53.5% of the whole isolates. The coliform bacterium that includes [*E. coli* and *Klebsiella spp.*] comes next with 22.5% of the isolates. *Bacillus spp.* comes next with 21.1% and *Pseudomonas spp.* represented 2.8% of the isolates. Fig.3 show the distribution of bacterial agents isolated from computer keyboards of all groups before disinfection with alcohol.

Number of bacterial agent isolates from computer keyboard before disinfectant

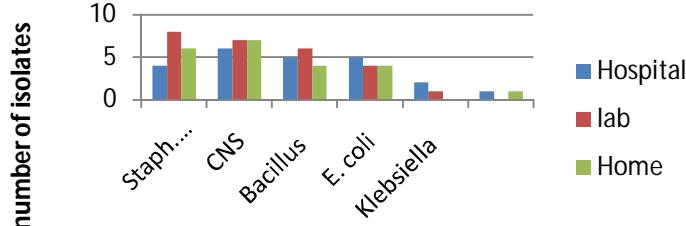


Fig.3 the distribution of bacterial agents isolated from computer keyboards of all groups before disinfection with alcohol

Discussion

The lack of knowledge about germs Presence can cause serious health problems. In fact, 80% of infections spread through the hand contact with other hands or objects [19]. Both the long contact time with computer keyboards and the low compliance rate with hand hygiene regimens with doctors and nurses which is found to be scarcely more than 50% are serving as reservoirs for the transmission of nosocomial infections [12]. The highest rate of contamination was found on the keyboards of computer labs, due to its daily use by numerous users. Add to that these computers are not routinely disinfected, thus the opportunity for the transmission of contaminating microorganisms is potentially great [2]. In addition, campus students themselves are not aware of the significant number of pathogens that computer keyboards and mice could spread [5]. The second largest rate of contamination was found on the keyboards of hospital computers. The risk of transmission from contaminated keyboards can be eliminated if staff performed hand hygiene after any contact with inanimate objects in the patient care environment. Unfortunately, 34 previous studies have demonstrated low compliance [approximately 40%] with the Centers for Disease Control and Prevention guidelines on hand hygiene [11]. Although the contamination of keyboards of home computers were very high, it's found to be less than other groups, this reduction is expected due to the limited number of users and the assumed continuous cleaning in houses [1].

The bacterial agent that had the highest percentage of isolation in the three groups was *Staphylococcus spp.* with 46% of the whole isolates; Humans are the natural reservoir for *Staphylococci*. Coagulase negative staphylococci are part of the normal skin flora and are also found in the anterior nares. The anterior nares are colonized by *S. aureus* in 20-40% of the normal population [18]. The next highest percentage of isolates was for coliform bacteria [*E. coli* and *Klebsiella*], being 35.3% of the isolates. *Escherichia coli* or *E.coli* is a type of coliform bacteria commonly found in the intestines of humans and warm-blooded animals [18]. It is not pathogen but is used as indicator organism of recent pollution with the human and animal excreta as it is found in large number in feces and able to survive for long time as compared with other coliform [22]. Most enteric bacteria, such as *E. coli*, *Klebsiella*...etc. is ubiquitous and can be shed from the body, clothing, bedding nostrils and carried in the dust particles to other surfaces [10]. The existence of *Bacillus spp.* in 16.9% of the isolates confirm the ubiquitous nature of this bacteria giving it greater colonization ability as well as the ability of its spores to resist environmental changes, withstand dry heat and certain chemicals [21]. *Pseudomonas spp.* was found in 1.5% of the total isolates.

As opportunistic pathogens, *Pseudomonas Spp.* often invade the host tissue and cause infection and bacteremia in immune compromised hosts such as HIV/AIDS, cystic fibrosis, bronchiectasis, and severe chronic obstructive pulmonary disease, burns, malignancy, or diabetes mellitus[14],[6].

The use of wipes that contain 70% of isopropyl alcohol was significantly affecting the rate of contamination on computer keyboards. Keyboards remained contaminated even after the use of alcohol were either heavily contaminated or the rubbing process was not perfect.

Depending on these results, it is recommended to clean computer keyboards routinely with wipes containing alcohol for its efficient effect in removing germs from computer keyboards. Focusing on hand hygiene is very important especially after using computers to prevent the hand transfer of waterborne pathogens. It is also recommended to use barrier precautions like gloves [20] and avoid eating while using computers in order to reduce the transmission of germs as much as possible.

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