

Detection of *Staphylococcus aureus* From A Sample of Healthcare Workers in Azadi Teaching Hospital Kirkuk/ Iraq

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Abstract

Background: Substances commonly touched by healthcare workers and patients in hospitals harbor probable pathogens and can produce communicable agents. This study aimed to detect the bacterial contamination (*Staphylococcus aureus*) of common hospital objects (nose and gloves) frequently touched by healthcare workers. **Methods:** A total of 70 samples were collected from different sites of the hospital the surface of the sterilized hand and swab nose from 35 healthcare, isolation, identification, and isolation was performed by standard microbiological techniques from 1st, August 2022 to the end of January 2023. The culturized ability of the *Staphylococcus aureus* isolates was tested by a microtiter plate method. The bacterial samples were diagnosed based on the phenotypic characteristics of the growing colonies, as they depended on the colonies' shape, morphology, texture, and color. Frequency percent and chi-square were used to conduct the significant analysis at P-value ≤ 0.05 . **Results:** Among 35 healthcare workers selected in the study sample the highest proportion was at age 20-29 years nearly two-thirds percent with mean \pm SD (30 \pm 9.57), working on the first floor, most of them were males. Statistically, a significant association was reported between workplace and the age group (P-value <0.001), more than four-fifth of males showed a statistically significant association (P-value=0.004) with positive infected with *staphylococcus aureus* on their gloves. **Conclusion:** More than four-fifth of the healthcare workers in this study recorded positive *Staphylococcus aureus* from the nose and sterilized hand. Male healthcare workers showed the highest proportion of positive noses infected with *staphylococcus aureus* and females showed the highest proportion of the same bacteria on the gloves. An educational program is preferred to submit for healthcare workers continually and prevention techniques are obligated to prevent this problem.

Keywords: *Staphylococcus aureus*, Healthcare workers, Isolates, Hospital, Bacteria.

Introduction

Contact with bioaerosols mutually in environmental and occupational workplaces had involved much care because of its impacts on human well-being (Kim et al., 2018). Hospital surroundings, instruments/objects, and healthcare workers are probable to receive a varied collection of infectious agents. Straight interaction with diseased or/and disease substances can be spread, consequential to illness and death (Bhatta et al., 2018). Every year, 2-4 million individuals become ill with hospital contagions. Monitoring airborne hospital pathogens is significant not even for the safety of the patient yet, also for the staff of the hospital, hospital staff exposure to bacteria has continually high fears about the occupational risk of infections for hospital staff. (Montazer et al., 2021), The main factors affecting the level of microorganisms are the activity of individuals, hospital dirtiness, and ventilation efficiency in the hospital. Biological exposure to these agents is related to an extensive range of main public health impacts (Hoseinzadeh et al., 2013), building residents' exposure to microbes also causes stimulus responses, sensitive reactions, respiratory illnesses, and other well-being problems (Montazer et al., 2021).

It has been stated that bacteria can live for mutable periods on surfaces, for instance, adhesive tape, stethoscopes, white coats, computer keyboards, mobile communication devices, elevator buttons, and ultrasound transducers. Hazard of spread is straight proportioned to the period of existence of the bacteria on the colonized substances. Survival and colonization differ regarding environmental and geographical circumstances like humidity, temperature, ability to form biofilms, presence of organic substances, and the prevalent infection regulator preparation (Bhatta et al., 2018).

A lot of studies in the field revealed this subject for instance, Jansen et al., (2019) in Brazil on

cell phones of hospital and university-based populations, Mazloomirad et al., (2021) with hospital-acquired pneumonia in southwestern Iran, and finally Mohammed and Ali (2020) from nasal swabs from Restaurants workers in Kirkuk City, and these studies yet, didn't try to work on other filed and newly updated performance in the field to make more progress and development, for that this study aimed to identify the *Staphylococcus aureus* on a sample of health workers in Azadi teaching hospital.

Subject and methods

This hospital-based prospective study was performed at Azadi Teaching Hospital in Kirkuk City, over a period of six months from the 1st of August 2022 to the end of January 2023, Azadi Teaching Hospital is a 400 bedded tertiary care hospital having departments of Medicine, Surgery, Pediatrics, Dermatology, Obstetrics and Gynecology, Ophthalmology, Orthopedics, Otorhinolaryngology, Psychiatry, Cardiology, Gastroenterology, Urology, and Oncology providing care to a variety of patients. For the reasons of there are three places had been chosen for instance ground floor, first floor, and second floor are sensitive areas and specified for surgery (operation) purposes that should be in sterilization techniques. To identify *Staphylococcus aureus* on both surfaces' gloves and nose of the healthcare workers on these floors. The bacterial samples were diagnosed based on the phenotypic characteristics of the growing colonies, as they depended on the colonies' shape, morphology, texture, and color.

Data were entered and analyzed using SPSS version 24 computer software, summarized in frequencies and percentages, and presented in tables and graphs. The chi-square test and Fisher's Exact test were calculated, P-value ≤ 0.05 was considered as statistically significant.

Inclusion criteria

Healthcare workers on the three floors (ground, 1st floor, and second floor).

Microscopic Examination

After the staining process, the bacteria appeared under the light microscope at 100x power for the bacteria positive for the gram stain in violet color, arranged in pairs or quadruples, and often in clusters that did not form spores (Figure1,2,3,4).

Figure 1: Detection of Staphylococcus aureus bacteria on mannitol medium with a golden color and no growth. Staph epidermidis on mannitol media

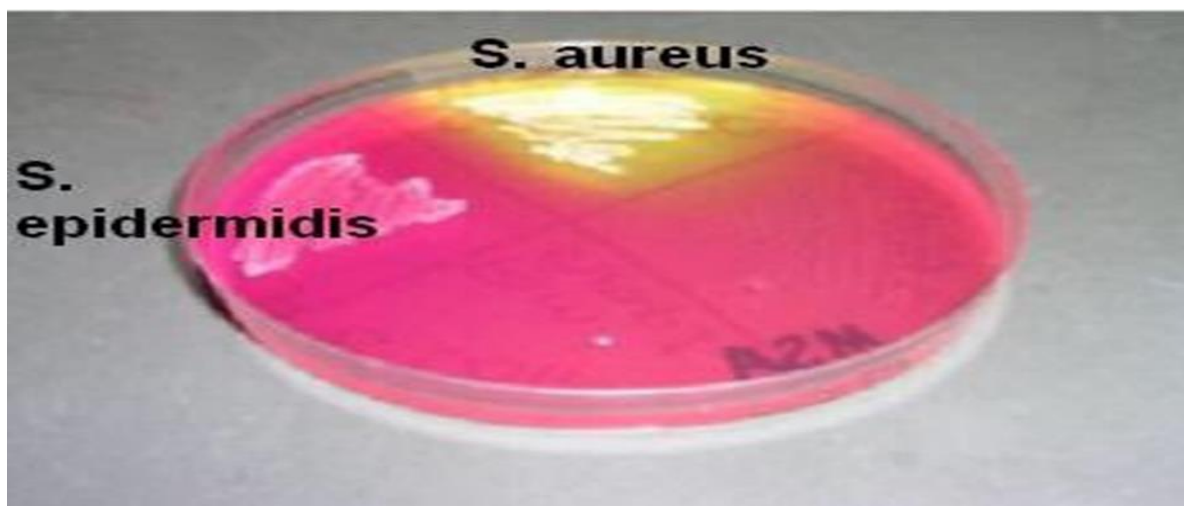


Figure 2: Appearance of Staph. aureus bacteria growth on blood agar

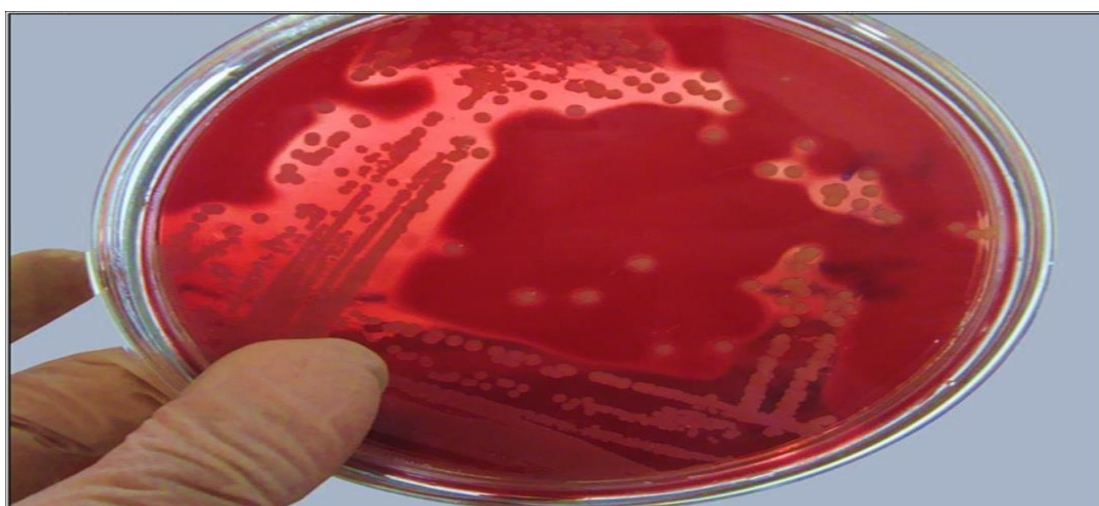


Figure 3: Selection of a plasma coagulant tube test for Staphylococci



Figure 4: Agglutination slide test for Staphylococci



Results

The results of the bacterial colonies showed that the growth of cocci on the agar medium was in the form of circular colonies with regular, smooth edges, and in a circular, shiny shape, producing pigments in different colors, some of which are pink, yellow, or White. As distinguished. Bacterial colonies appear on the medium of blood agars in a white to gray color, slightly convex and circular. Some of them are complete blood cell lysates of the type of beta hemolysis, such as *Staph. aureus*, and fermented for mannitol on the medium of mannitol salt agar, changing the color of the

medium from pink to yellow, while it showed the remaining *Staphylococcus aureus* species are not fermented for mannitol.

The present study showed that the highest proportion of health-worker 22(62.9%) involved was at age 22-29 years old with mean \pm SD(30 \pm 9.57), and the lowest proportion was between 40-49 years old by 6(17%) individuals. The highest proportion of them were males 21(60%), and the rest were females. The highest proportion of health workers who participated was on the 1st floor 15(42.8%) and equally, they were distributed on the other floors. The highest proportion of contamination

spreader from the nose swab with a percent of 91% and the lowest proportion reported positively 7(20%) on the gloves, the details illustrated in Table 1.

Table 1: Socio-demographic characteristics of the study sample.

Age group mean±SD (30±9.57)	No.	(%)
20-29 years	22	(62.9)
30-39	7	(20.0)
40-49	6	(17.1)
Gender		
Male	21	(60)
Female	14	(40)
The work location		
Ground Floor	10	(28.6)
First Floor	15	(42.8)
Emergency Ward	10	(28.6)
Nose contamination		
Positive	32	(91.4)
Negative	3	(8.6)
Gloves contamination		
Positive	7	(20)
Negative	28	(80)
Total	35	(100)

Table 2. illustrated that the highest proportion of the nose swab of health workers affected positively in the current study was between age 20-29 years old among the 22 involved and statistically there was a non-significant association between the age of health workers

and the outcome of the investigation (P-value=0.73). Besides, the highest proportion of the gloves test of the health workers showed positive between the ages 30-39 years old, and a statistically non-significant association was revealed between them (P-value= 0.58).

Table 2: The Association between the age group and outcome of pathogen

Age (years)	Positive	Negative	Total	P-value
Nose	No(100)	No(100)	No(100)	
20-29 years	19(86.4)	3(13.6)	22(100.0)	0.73
30-39 years	7(100.0)	0(0.0)	7(100.0)	
40-49	6(100.0)	0(0.0)	6(100.0)	
Total	32(91.4)	3(8.6)	35(100)	
Gloves				
20-29 years	5(22.7)	17(77.3)	22(100.0)	0.58
30-39 years	2(28.6)	5(71.4)	7(100.0)	
40-49 years	0(0.0)	6(100.0)	6(100.0)	
Total	7(20)	28(80)	35(100)	

According to Table 3, the present study showed that among 22 healthcare workers between the ages 20-29 years, the highest proportion of them (45%) were working in the emergency

ward and statistically a significant association was reported between the age group and workplace and lowest proportion reported in the other workplaces.

Table 3: Association between the age group and the occupation place

Age (years)	Place of work			Total	P-value
	Ground floor	Floor 1	Emergency Ward		
	No(%)	No(%)	No(%)		
20-29	6(27.3)	6(27.3)	10(45.5)	22(100)	<0.001
30-39	3(42.9)	4(57.1)	0(0.0)	7(100)	
40-49	1(16.7)	5(83.3)	0(0.0)	6(100)	
Total	10(28.6)	15(42.8)	10(28.6)	35(100)	

This study reported that among 21 males involved about 71% of them worked on floor one and among 14 females health workers, about 71.4% worked the ground floor had the

highest proportion of workplace and statistically a significant association between the gender factor and workplace reported (P-value=0.004) (Table 4).

Table 4. The association between the workplace and the gender factor.

Gender	Place of work			Total	P-value
	Ground floor	Floor 1	Emergency Ward		
	No(%)	No(%)	No(%)		
Male	0(0.0%)	15(71.4%)	6(28.6)	21(100.0)	0.004
Female	10(71.4%)	0(0%)	4(28.6)	14(100.0)	
Total	10(28.6)	15(42.8)	10(28.6)	35(100)	

Table 5 revealed that among 21(100%) males who participated in the present study the highest proportion (95.2%) of them reported a positive pathogen from the swab test, with statistically non-significant association reported between the gender factor and the outcome of the pathogen was (P-value=0.348),

and among 14(100%) females about 12(85%) of them were recorded positive pathogen on the gloves surface swab with a positive pathogen, with P-value=0.004 statistically a significant association reported between gloves swab and the outcomes.

Table 5: Association between gender and pathogen outcomes.

Gender	Outcomes		Total	P-value
	Positive	Negative		
	No(%)	No(%)	No(%)	
Nose				
Male	20(95.2%)	1 (4.8%)	21(100.0)	0.348
Female	12(85.7%)	2(14.3%)	14(100.0)	
Total	32(91.4)	3(8.6)	35(100)	
Gloves				
Male	4(19.0%)	17(81.0%)	21(100.0)	0.004
Female	3(21.0%)	11(78.6%)	14(100.0)	
Total	7(20)	28(80)	35(100)	

Discussion

This study showed that 22 healthcare workers in their three decades of lives involved had the

highest level of the workplace in the emergency(ground) floor and statistically a significant association was reported between

the workplace and the age of health workers recorded ($P < 0.001$).

This result was in agreement with other studies similar (Abdurrahman A .2018) The present study revealed that among 21 male healthcare workers, the highest proportion of them was reported on the 1st floor by nearly three-fourths percent, while the same percentage was recorded among females healthcare workers out of total 14 health care workers in the ground (emergency) floor, this result was in agreement with another study reported with a rate of 47 isolates, with a rate of (88.6%) out of the total (53)isolates positive of Bacteriological culture

And disagreeing with the findings (Al-AusI.2013) Our reports showed that among 21 male healthcare workers who had nose swabs the majority of them resulted in a positive *staphylococcus aureus* and among 14 female genders of healthcare workers more than four-fifths reported a positive staphylococcus aureus and statistically non-significant association (P -value=0.348) reported between the gender of the healthcare workers and the pathogens affected by, this study was in agreement with another one in with a rate of the Bacteria isolates diagnosed from the clinical and environment of Al-Diwaniyah General Teaching Hospital amounted to (18) bacteria species during the study period. were distributed among (2) species belonging to the genus *Staphylococcus*. Which included (89) bacteria (29.99%).

Another study disagrees with our findings and reports that (Hanan et al .2005),

The findings of the health care workers' gloves showed that among 21 males involved in the study, nearly one-fifth of them showed positive staphylococcus aureus, besides among 14 females more than one-fifth percent of them reported a positive outcome of the *staphylococcus aureus* and statistically a significant association recorded between the pathogen types and the gender factors.

The study results were in agreement with our finding Abdurrahman A (2018) in a study the high prevalence of staphylococcus may be attributed to the fact that it represents part of the normal flora and is always around us, it lives in the pharynx, mucous membranes, upper respiratory tract or Being from normal flora on the skin of more than 40-50% of people, but it can transform into pathogens when the appropriate conditions are available or defect occurs in the host's body defenses, as well as its ability to tolerate environmental condition as some *Staph. epidermidis* isolates it could produce a slime layer that helps the surfaces of medical and other instruments and to stay for weeks when the appropriate condition is available or present (Bresco et al., 2017; Goetz et al.,2017)

The results of the study showed that Gram-positive bacteria isolates belong to the genus *Staphylococcus*, with 19 isolates, with a rate of (46.34%), out of a total of 41 isolates taken from different environments from the hospital environment represented by beds, ventilation, surgical tools, floor, gauze, sterilizers, patient wounds, anesthesia apparatus, and baby incubators, and there were 7 isolates With a percentage of (17.0%) of *Staph. epidermidis* bacteria, as for *Staph. aureus* bacteria, it reached 12 isolates with a percentage of (29.26%). Karam amounted to (31%). As for the isolates from medical workers and cadres, they included (and the nostrils, hands) were 34 isolates and a percentage of (87.17%) out of the total of 39 positive isolates belonging to the genus *Staphylococcus*, and 20 isolates and a percentage of (51.28%) of *Staph bacteria aureus*. As for *Staph. epidermis*, reached 14 isolates with a rate of (35.89%). As for the genus *Streptococcus*, 5 isolates with a rate of (12.8%) from *Streptococcus pyogenes*, and this result was close to the results of the researcher Al-Rutab, Abu Bakr (2020) Which obtained (30) isolates, of which (75%) had bacterial growth, including what was positive for Gram-positive *Staphylococcus aureus* and

Streptococcus aureus. The study showed that the highest bacterial presence was *Staph. aureus*, with a rate of (63%). and *Streptococcus pyogenes* by (7%), and the results of this study are consistent with the findings of Al-Khalidi (2002), which indicated that *Staphylococcus* bacteria occupied the forefront when isolated from clinical and environmental samples in Al-Diwaniyah Teaching Hospital, and are consistent with all the study of Korhadi and others in India (5 (Kurahde et al, 201 and the study of Nuri Sharif in Iraq (Nuri and Sharif, 2005) as well as with the study of Khan and others in Pakistan (Khan et al, 2015) in most of the isolated species, while it contradicted the study of Togo in Mali (Togo et al, 2005 and with A study and others in Germany (Ott et al, 2013) in most of the isolated bacteria, and it agreed with some isolated bacteria in the study of Giacometti and others in Italy (Giacometti et al 2000) and also contradicted the study of Abdulrahman A (2018) in Iraq, and the study showed that the highest bacterial presence Bacterial is *Staph. epidermis*, it reached (37) isolates with a rate of (78.7%), and it reached 10 isolates with a rate of (21.3%) from *Staphylococcus aureus*, which was *Staph. aureus* skin was the highest percentage of *Staphylococcus aureus*, as well This contradicts the study of the researcher Al-Zubaidi (2012) in Iraq on bacterial contamination in the surgical operating room, where the percentage of her isolation of *Staph. epidermidis* reached (64.2%), were *Staph.* It may be due to the large spread of staphylococci because they represent part of the natural flora (Normal flora), as they live in the upper respiratory tract and the mucous membranes of the nose and pharynx and have the ability to be pathogenic when appropriate conditions are available or a defect occurs in the body's immunity, and it has the ability to withstand the conditions bacterium, as some *Staph. epidermidis* bacteria have the ability to form a sticky layer that helps adhesion to the surfaces of surgical and medical instruments and remains for weeks when

appropriate environmental conditions are available (Goetz et al., 2017; 2017; Goetz et al., 2017; Bresco et al.,). The reason for the spread of these species is also due to their resistance to antibiotics, disinfectants, and sterilizers used in hospitals. The efflux pump system is the most common mechanism in resistance to staphylococcal species Douglas, et al., (1998).

Ethical consideration

Approval was established from the Research and Ethical Committees/ Ministry of Higher Education and Scientific Research / Kirkuk University/ College of Science and Directorate of Health Kirkuk. Finally, permission was taken from the ethical committees' hospital prior to conducting fieldwork.

Conclusion

This is probably the first study in Kirkuk city, particularly Azadi Teaching Hospital, this study showed that nearly half of the health care workers in their thirty's decades of life and significant association reported between them. More than four-fifth of the healthcare workers in this study recorded positive staphylococcus aures on the nose and gloves. Male healthcare workers showed the highest proportion of positive noses infected with staphylococcus aureus and females showed the highest proportion of the same bacteria on the gloves.

Recommendation

A continuing education program should be admitted to the healthcare workers, particularly to those working in critical areas about the risks, pathogenic impacts, prevention, and complication of pathogens bacteria, and contamination on healthcare workers and patients. Aseptic technique should obligation with continuing evaluation for health staff in the hospital.

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