

## **The Prevalence of Stethoscopes Contamination at Tertiary Center in AL Madinah Almonawwarah Saudi Arabia 2015**

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### **ABSTRACT**

*The stethoscope is a popular instrument used to assess the health of patients and have been reported to be potential vectors for nosocomial infections in various parts of the world . Little published data are available about the prevalence of stethoscope contamination in kingdom of Saudi Arabia. The aim of this study is to shed some light on this important issue in one of tertiary health care facilities in Madinah city, Saudi Arabia.*

**Keywords:** *Prevalence, Stethoscopes Contamination, Saudi Arabia.*

### **INTRODUCTION**

The stethoscope is a popular instrument used to assess the health of patients and have been reported to be potential vectors for nosocomial infections in various parts of the world (1-3) Although clinicians are instructed about microbiology and the importance of maintaining clean medical instruments, the stethoscope may not be thought of as a potential source of nosocomial infection. Several previous studies have reported the level of bacterial contamination on stethoscopes belonging to physicians and nurses (4-11), and the majority of the stethoscopes examined in these studies were contaminated most with Gram-positive organisms, primarily *Staphylococcus species*. Little published data are available about the prevalence of stethoscope contamination in kingdom of Saudi Arabia (12). Hence we elected to perform this study to shed some light on this important issue in one of tertiary health care facilities in Madinah city, Saudi Arabia.

### **MATERIALS AND METHODS**

The present study was a tertiary hospital-based cross sectional study conducted by a group of medical students from Taibah College of Medicine, Madinah, Saudi arabia. The study , was conducted in Madinah tertiary hospital .The students' effort was self initiative, not part of their curriculum and was not funded from anywhere. They obtained permission from the head of the tertiary hospital. This tertiary health hospital with 100 beds provides adult and pediatric cardiovascular medical and surgical services. The study was carried out in February 2015 .Students were supervised by the head of laboratory in the institution.

Thirty stethoscopes (15 adult and 15 pediatric) from intensive care units and outpatient clinics were chosen randomly, each stethoscope was labeled with a serial number. The following data pertinent to each stethoscope were collected: place of use, duration of use, type, location of storage, number of users, frequency of cleaning and type of disinfectant. Immediately after gathering the data pertinent to each stethoscope, the diaphragm and the bell of the stethoscope were swabbed with a wet sterile swab. These swabs were transferred immediately into blood and MacConkey agar plates and incubated in air at 37 degrees Celsius for 24 hours. Cultures were identified by colony specific shape, gram stain morphology. Furthermore, gram positive organisms were cultured on Mannitol plates. Thereafter, they were tested by Catalase test and those coagulase positive were subjected to sensitivity test utilizing Muller-Hinton agar.

### **Statistical analysis**

Statistical analysis of the study data was done using SPSS software for windows (SPSS, version 22.0). All the study data were presented by their number and percents and compared by Fischer exact test. P. Value  $\leq 0.05$  was used as an indicator of statistically significant difference. Univariate logistic regression models were also used to estimate the risk of bacteria in the studied stethoscopes by their characteristics.

## **RESULTS**

The sample included 15 adult stethoscopes and similar number of paediatric stethoscopes. Of the studied stethoscopes, 21 (70%) stethoscopes were shared among the health workers while 30% were used by a single individual. It was also observed that 53% of the studied stethoscopes were stored inside the patient rooms while remaining 37% were stored at the nursing station or doctors rooms.

Ninety-three percent of the studied stethoscopes were regularly cleaned, while 84% of the stethoscopes were cleaned at least once a week and 94% were cleaned using alcoholic wipes. Microbiology report revealed that 21 (70%) of the studied stethoscopes did not show any bacterial growth while five out of nine affected showed moderate growth and remaining four showed heavy growth.

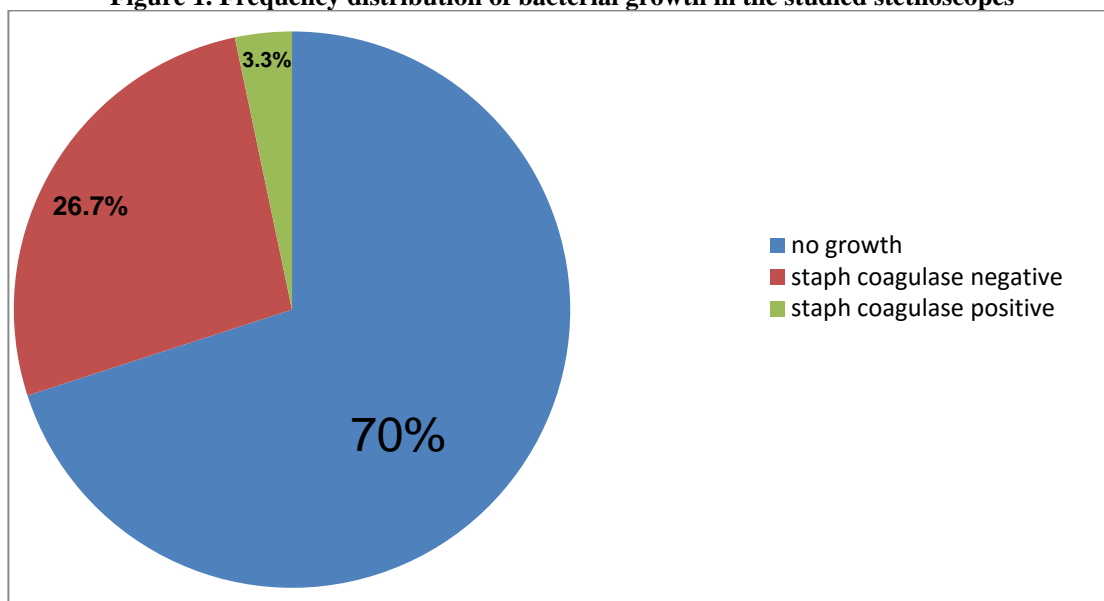
The overall prevalence of bacterial growth in the studied stethoscopes was 30% (95% CI=13.6-46.4). Table 1 showed the distribution of bacterial growth in the studied stethoscopes. Although not significant, the infected stethoscopes (showed bacterial growth) were more among those stethoscopes from OPD (50%), paediatric stethoscopes (40%), those of longer duration more than one year (40%), single individual use stethoscopes (33.3%), and stethoscopes stored inside patient's room (43.8%) and stethoscopes submitted to regular cleaning (26.8%). 1 of the infected 9 stethoscopes were Coagulase positive (*Aureus*), while the remaining 8 isolates were Coagulase negative (*Epidermides*).

Table 2 displayed the odds ratio and their 95% CI for the association of bacterial growth with the studied stethoscopes' characteristics. The highest risk of contamination and bacterial growth was detected in the stethoscopes from OPD, paediatric stethoscopes and in those of more than one year duration, where the risk was 4 and 2.7 times, respectively in these stethoscopes. On the other hand, however, the risk was reduced by 79% in stethoscope stored outside the patient room, where the odds ratio was 0.21 (95% CI= 0.5-2.35).

**Table 1. Frequency distribution of studied stethoscopes by bacterial growth and their characteristics**

Variable	Number (%)	NO bacterial growth 21(70%)	Bacterial growth 9(30%)	P value
Location	ICU: 20(60)	16(80)	4(20)	0.09
	OPD :10(40)	5(50)	5(50)	
Type	Adult:15(50)	12(80)	3(20)	0.23
	Pediatric:15(50)	9(60)	6(40)	
Duration	≤ one year:15(50)	12(80)	3(20)	0.24
	> one year: 15(50)	9(60)	6(40)	
User number	Multiple :21(70)	15(71.4)	6(28.6)	0.79
	Single: 9(30)	6(66.7)	3(33.3)	
Storage place	Inside patient room:16(53.3)	9(56.3)	7(43.8)	0.06
	Outside patient room:14(46.7)	12(81.8)	2(18.2)	
Cleaning	Yes:28 (94.4)	20(71.4)	8(28.6)	0.53
	No:2(6.6)	1(50.0)	1(50.0)	

**Figure 1. Frequency distribution of bacterial growth in the studied stethoscopes**



**Table 2. The risk of bacterial growth in the studied stethoscopes by their characteristics**

Stethoscope's characteristics	NO bacterial growth (n=21)	Bacterial growth (n= 9)	OR (95% CI)
ICU	16	4	1. (ref.)
OPD	5	5	4.0 (0.60-8.80)
Adult	12	3	1. (ref.)
Pediatric	9	6	2.70 (0.87-7.34)
≤ one year	12	3	1. (ref.)

< one year	9	6	2.70 (0.87-7.34)
Multiple	15	6	1. (ref.)
Single	6	3	1.25 (0.54-4.65)
Inside patient room	9	7	1. (ref.)
Outside patient room	12	2	0.21 (0.05-2.35)
Regular cleaning	20	8	1. (ref.)
No cleaning	1	1	2.5 (0.46- 8.12)

## DISCUSSION

Hospital environment is a reservoir of wide varieties of microorganisms. Thus medical care equipments are more likely to carry considerable number of pathogenic microorganisms (13). The present study aimed to estimate the prevalence bacterial contamination of stethoscopes at a tertiary hospital in Madinah, Saudi Arabia, and to examine for the factors increasing the risk of contamination. The overall prevalence of contamination, as known by the results of microbial examination, in the studied stethoscopes was 30% (95% CI=13.6-46.4). The highest contamination in the studied stethoscopes was in OPD stethoscopes (50%), paediatric stethoscopes (40%), those of longer duration more than one year (40%), and stethoscopes stored inside patient's room (43.8%). These results were comparable with Kilic and his colleagues reported relatively low rate of contamination of stethoscopes (26). On the other hand, however, previous studies have reported a much higher rate of stethoscopes contamination than this study results (16-17), and the reported was as high as 97 to 100% (16). In this study, the prevalence of stethoscopes contaminations was much lower than the frequency of contamination of stethoscopes observed in previous Saudi study (18).

In this study, the majority of licensed doctors in the studied centre did clean their stethoscopes after patient setting and this might explained the discrepancies found between this and other studies with high reported stethoscopes contamination. In this study, the regular cleaning and disinfection of stethoscopes was found in 28 of the studied stethoscopes ( 93.3%).The findings of Parmar et al. (19), and Wood et al. (20), in which none of the doctors disinfect their stethoscopes regularly, revealed a high rate of stethoscopes which approached 90%, and they attributed to this high rate to either work burden or ignorance of the physicians to

adhere to infection prevention protocols. Like doctors, 98.1% of Medical students reported they never disinfect the stethoscope before and after auscultating each patient in a study conducted by Uneke and his colleagues (21) among Nigerian medical student. In that study, 91% of physicians and medical students attending medical, paediatrics, gynaecology, OPD and ICU wards, none of them reported to disinfect their stethoscope regularly. However, only 4.3% from surgical ward attendants reported that they disinfect their stethoscopes regularly before and after seeing each patient. Consistent with the previous finding, the proportion of bacterial growth in the stethoscopes submitted to regular disinfection and cleaning was lower than that in stethoscopes not submitted to such regular disinfection (28.6% vs. 50%). Also, the estimated risk of bacterial growth was 2.5 times more in these unclean stethoscopes compared with those submitted to regular cleaning and disinfection also.

The univariate logistic regression analysis in this study has revealed positive associations of bacterial contamination and growth with certain characteristics of the studied stethoscopes. The highest risk was found in the stethoscopes of OPD, where it was 4 times more compared to stethoscopes from ICU units. A similar result was also obtained from a study conducted on 24 stethoscopes from ICU and there were only 5 stethoscopes showing bacterial contamination and growth, representing (20.1%) of the studied stethoscopes (22), and it was very similar to our results that out of the studied 20 ICU stethoscopes, there were 4 stethoscopes showed bacterial growth (20%). All the ICU nursing staff questioned claimed to have cleaned the bedside stethoscopes in their bed space at least once during their current shift and this work task is often used in almost all ICU units.

The higher risk of paediatric stethoscopes continuation observed in this study was also reported in a recent study conducted in children hospital (23). The most factors independently associated with disinfection in that study was the subspecialty paediatrics units vs. other general units in the studied hospital with an adjusted OR of 2.0 (95% CI, 1.2-4.1) (11).

The risk of contamination has found to greatly reduce when the stethoscopes have been stored outside the patient's room. The estimated OR was 0.21 (0.05-2.35), with a risk reduction of 79%. Accordingly, it is mandatory to train nurses in all hospital units to store the stethoscopes after each setting in clean lockers or any other clean place after disinfecting and cleaning it.

The bacterial species identified from the contaminated stethoscope diaphragms were 1 Coagulase positive *Staphylococcus Aureus* out of 9 contaminated stethoscopes (11.1%), the remaining were Coagulase negative *Staphylococcus Epidemics*. The finding of isolates of highly pathogenic organisms (*S. Aureus*) in this study can be possible to conclude that stethoscope diaphragms contamination with these pathogenic microorganisms may spread leading causative agents of hospital acquired infections. Coagulase-negative isolates of *S. Edidermides* were more frequent in this study (8 out of 9 contaminated stethoscopes than gram-positive isolates. This might be because of the direct contact of the stethoscope to human skin flora, which contains mostly *Epidermides* microorganisms (24). In previous studies, however, *S. Aureus* was the most common pathogenic organism isolated from stethoscopes, with a prevalence of 4.2–54% regardless of the difference in setup and sample size in several studies. (14, 16, 25- 27). The prevalence was rising from time to time from 0% in some studied done in 2007 (28) to 8% in a study done 2011 (29), and in this study it was reported to be 11.1% of the contaminated stethoscopes. The severity of contamination by *S. Aureus* is that it showed the highest resistance to commonly used  $\beta$ -lactam antibiotics. Also, *S. Aureus* is well documented fact that *S. Aureus* is a primary causative agent of hospital acquired infections (29).

The present study appeared to have a number of strengths. To the best of available knowledge, this study is the first to study contamination of stethoscopes at a tertiary hospital in Madinah, Saudi Arabia. The

use of logistic regression models help to examine and quantify the risk of contamination of the studied stethoscopes by a number of factors. Dissemination of study findings to health care workers at the studied centre is as important as to take an attention of the importance of disinfection of their stethoscopes before and after settings and its essential role in infection control of the centre. Because this study was conducted in only one centre, the small sample size of the included stethoscopes may affect the precision of this study results. According the future researches about this important have to stress to include a large sample size included more stethoscopes from different health care centres and hospitals to confirm these study findings.

In conclusion, although the overall prevalence of stethoscopes contamination at the studied centre is considered low compared to the results in previous studies, this prevalence is still relatively high because of highly standard precautions of infection controls taken by the centre and submitted to regular monitoring by the centre infection control committee. The findings of this study suggest the need of continuing training and education courses for health care workers at the centre and the introduction of alcohol-based disinfectants to improve stethoscope disinfection compliance and to help in preventing hospital acquired infections.

## CONCLUSION

The findings of this study suggest the need of continuing training and education courses for health care workers and the introduction of alcohol-based disinfectants to improve stethoscope disinfection compliance and to help in preventing hospital acquired infection.

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