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Research Article

Bacteriological Assessment of Stethoscopes and Mobile Phones Used by Healthcare Workers in a Tertiary Care Centre of Goa

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ABSTRACT

Background: Stethoscopes and mobile phones are potential vectors for nosocomial infections due to their frequent use and contact with both healthcare workers and patients. Despite recognized risks, the standard and frequency of disinfection practices vary, potentially contributing to microbial transmission in healthcare settings. **Aims and Objectives:** This study aims to evaluate the bacteriological contamination of stethoscopes and mobile phones used by doctors in a tertiary care center. Objectives include: assessing the antibiogram patterns to determine resistance to drugs, examining the frequency and methods of disinfection for both devices, investigating hand hygiene practices, and identifying factors influencing adherence to infection control protocols. The study also seeks to evaluate the impact of infection prevention training on the maintenance of hygiene standards. **Materials and Methods:** A cross-sectional, hospital-based study was conducted in November 2022 at the Department of Microbiology, Goa Medical College. Fifty doctors from various departments participated, providing samples from their stethoscopes and mobile phones. Microbial cultures were grown from samples collected with sterilized cotton swabs, followed by incubation in Blood Heart Infusion broth and subsequent analysis. **Results:** The findings are expected to reveal significant microbial contamination and variability in the resistance profiles, highlighting critical lapses in current disinfection practices among healthcare workers**. Conclusion:** By mapping the bacteriological landscape of these everyday tools in a healthcare setting and correlating it with hygiene practices, this study aims to reinforce the necessity for stringent disinfection protocols and targeted infection control training to mitigate the risk of hospital-acquired infections.

INTRODUCTION

Stethoscope is a medical device universally used by health care workers (HCW). Stethoscope may transmit pathogens among patients and health care workers if it is not disinfected. Stethoscopes frequently come in contact with many patients. During such contacts, microorganisms can colonize on the stethoscopes which could further spread to other patients if proper disinfection practices are not followed by health care workers[1]. Since, routine disinfection practice of stethoscopes are not followed by HCWs, there is high risk of transmission of multidrug antibiotic resistant microorganisms in the hospital settings[2]. Stethoscope wiping using alcohol pads is the current gold standard method for disinfection of stethoscopes[3]. Medical device like stethoscopes should be evaluated for microbial colonization frequently and HCWs should be sensitized about the regular disinfection practices to control nosocomial infections[4].

In addition to stethoscopes, a mobile phone is a long-range personal telecommunication device, easy to handle and affordable to everybody[5]. It is the most indispensable accessory of professional and social life throughout the world[6]. Health care professionals' mobile phones can be easily and quickly contaminated by microorganisms from the hospital environment, patients and medical devices, since they use it for a medical dictionary, hand reference for drugs, laboratory reports, imaging results and other

work-related issues, as they deal with patients having different illnesses[7,8] Health care professionals constantly handle mobile phones without disinfection in their bags and pockets or in their hands in a clinical setup. Patients are more vulnerable to nosocomial infections from a mobile phone which is often used near patients in hospital areas. Contaminated hands and mobile phones of health care professionals can also play an important role in spreading infections to self, family member and others outside the hospital[9].

The objective of this study is to determine the level of stethoscope contamination used by health care workers, survey the practices of disinfecting the stethoscope, identify various microorganisms and assess their role as potential pathogens and determine the effectiveness of disinfecting agents. The study also aims to assess the occurrence of bacterial contamination of mobile phones of healthcare workers. The antibiogram pattern of the isolates will be determined as also the factors associated with bacterial contamination.

Aims and Objectives

a) For bacteriological evaluation of contamination of stethoscopes and mobile phones used by healthcare workers

b) To assess the antibiogram pattern to find out the resistance towards drugs.

c) To assess the frequency of disinfection of stethoscopes and mobiles.

d) To assess factors associated with contamination of stethoscopes and mobile phones as well as lack of following disinfection protocols.

d) To assess methods practiced by HCW for cleaning of stethoscopes and mobiles

e) To assess frequency of hand washing.

F) To assess frequency of use of mobiles during work.

g) To know whether they had undertaken infection prevention training.

h) To find out ways for the prevention of such hospital infections.

Materials and Methods

This cross-sectional hospital based study was undertaken in the Department of Microbiology, Goa Medical College, Bambolim, Goa. The study was conducted during the month of November 2022. Stethoscopes and mobiles phones of 50 healthcare workers (only doctors) from different departments was included in this study. Bacteriological evaluation was undertaken in the department of microbiology.

Inclusion criteria

a)Males and females

b)All age groups

c)Healthcare professionals, only doctors

d)Different wards

Exclusion criteria

Healthcare workers other than doctors

Collection of subject variables

Information will be obtained regarding the following

a)Age

b)Gender

c)Ward

d)Designation

Evaluation of factors associated

Before sample collection all the participants were given a preformed questionnaire regarding HCWs routine stethoscope and mobile disinfection practices and hand hygiene.

QUESTIONAIRE

1) Designation:

2) Age/ Gender:

3) Stethoscopes and mobiles can transfer microorganisms..... **Y/N**

4) Disinfection of stethoscope and mobile has to be done on regular basis.....**Y/N**

5)Do you disinfect your stethoscope and mobile regularly?.....**Y/N**

6) How frequently do you disinfect stethoscopes?.....After contact with every patient/after OPD or ward rounds/everyday/weekly/monthly/never/others_____

7) How frequently do you disinfect your mobile?.....Everyday/weekly/monthly/never/ others:_____

8) Which method of disinfection do you follow? 70% ethanol/hand sanitizer/soap and water/others:_____

9) Do you wash/sanitise your hands before and after contact with every patient?.....**Y/N**

10) How frequently do you use mobile during work?In between rounds or OPD/after rounds or OPD/never

11) Barriers to cleaning of stethoscope/mobile.....lack of time/forgetfulness/laziness/lack of knowledge regarding disinfection practices/concern of damaging ones device / others:_____

12) Have you undertaken any infection prevention training?.....**Y/N**

13) Whether there is a manual on disinfection protocol in the wards?..... **Y/N**

Sample collection and transport

Samples were collected from the diaphragms of stethoscopes as well as surface of mobile phones. Sterilized cotton swabs moistened with sterile normal saline were rotated to Wipe diaphragm of stethoscope and mobile from screen, sides and back areas of the mobile phone. The swabs were immediately taken to the Department of Microbiology for further processing.

Processing of samples

In the laboratory, the swabs were inoculated in Blood Heart infusion broth (BHI) and incubated overnight at 37° C. The next day these Blood Heart infusion broth (BHI) were inoculated on Blood agar and MacConkey agar for bacteriological evaluation. Plates were incubated aerobically at 37 °C for 48 hrs. Microorganisms were identified by conventional phenotypic methods[10]. Antibiotic sensitivity test (ABST) of the microorganisms was performed by Kirby-Bauer disk diffusion method[11].

Consent from study subjects

Informed consent was taken from the subjects.

Privacy and confidentiality

Privacy and confidentiality of subject information was maintained.

RESULTS

Stethoscopes and mobiles of 50 doctors were sampled in the study from medicine wards 32%, surgical wards 26%, gynaecology ward 14%, paediatric ward 14% and intensive care unit (ICU) 14%. This included 24 (48%) males and 26 (52%) females. All subjects belonged to 23-33 years age group. Among these 64% were interns, 24% were junior residents and12% were senior residents. The result of the study was based on questionnaires which were filled by all the doctors. It revealed that 100 % doctors were aware that stethoscopes and mobiles could transfer microorganisms and that disinfection of stethoscopes a well as mobiles is needed. Only 40% doctors reported to have attended training sessions on infection prevention. Whereas 32% reported non availability of disinfection protocol manual in the wards.

80% of the doctors reported regular disinfection of stethoscopes and mobiles out of which 62 % had contamination of either stethoscopes or mobiles, whereas 20% of doctors who denied regular disinfection showed 100% contamination. Among, 50 diaphragms, 39 (78%) were colonized and out of 50 mobiles 41 (82%) were contaminated. *MRSA* (22%) was the most commonly isolated organism. Table 1 shows the organisms isolated from the study. No growth was seen on 11(22%) stethoscopes and 9 (18%) mobiles; all of these doctors

TABLE 1: ORGANISMS ISOLATED FROM STETHOSCOPES AND MOBILES

ORGANISMS	STETHOSCOPES (50)	MOBILES (50)
MRSA	11	10
MSSA	3	1
CONS	7	7
Micrococcus	1	0
Klebsiella pneumoniaea	1	0
Pseudomonas aeruginosa	1	1
Diphtheroids	16	14
Enterobacter species	1	2
Escherichia coli	0	1
Acinetobacter species	0	3
TOTAL	39 (78%)	41 (82%)
NO GROWTH	9(18%)	11(22%)

Table 2 depicts that majority subjects reported cleaning of stethoscopes and mobiles by one method or the other, but 8 (16%) had never cleaned stethoscopes and 11 (22%) had never cleaned mobile. Out of 50, only 2 (40%) doctors reported disinfection of stethoscopes after contact with every patient. On comparing frequency of stethoscope disinfection practices among doctors highest 100 % colonization was fou--nd among 8 stethoscopes which were never cleaned and had highest ie. 92% contamination seen in 11 mobiles which were never disinfected. Lowest colonization ie. 38% was seen amongst 13 stethoscopes cleaned everday and lowest ie. 66 % contamination in 12 mobiles cleaned everyday. No contamination was seen in the 2 stethoscopes cleaned after contact with every patient.

TABLE 2: FREQUENCY OF DISINFECTION OF STETHOSCOPE AND MOBILE

FREQUENCY	NO. (%) STETHOSCOPES		NO. (**%)** MOBILES	
	Examined	Contaminated	Examined	Contaminated
After contact with every patient	2	0(0%)	--------	-------
Everyday	13	5(38 %)	12	8(66%)
Once a week	15	15(100%)	16	13(81%)
Once a month	12	11(92%)	10	9(90%)
Never	8	8(100%)	12	11(92%)
Total	50	39(78%)	50	41(82%)

Table 3 depicts the frequency of use of mobile during work. About 36 (72%) reported using mobile during OPD/ ward rounds and rest used only after the rounds or OPD.

TABLE 3 : FREQUENCY OF USE OF MOBILE DURING WORK

FREQUENCY	NO. (%)
In between rounds/OPD	36 (72%)
After rounds/OPD	14 (28%)
Never	0

Hand sanitizer was the most commonly used cleaning agent (78%). When the methods practiced by doctors for cleaning of stethoscopes and mobiles was related to the stethoscope contamination results showed highest 90-100 % colonization among stethoscope which were never cleaned and no colonization was seen in devices which were cleaned using disinfectants. Nearly 80% of stethoscopes and mobiles which showed no growth were cleaned by hand sanitiser regularly and 20% by ethanol.

TABLE 4 : METHODS OF DISINFECTION

METHOD	NO. (%)	CONTAMINATION
Handsanitizer	39(78%)	33(84%)
70% Ethanol	07(14%)	5(71%)
Soap and water	4(8%)	3(75%)
Others	0	------

The most common barrier to cleaning of stethoscope among doctors were lack of time (58%), forgetfulness (42%),laziness (20%), and concern for damaging one's device (28%).

TABLE 5 : BARRIERS OF DISINFECTION

BARRIERS	NO. (%)
Lack of time	29 (58%)
Forgetfulness	21 (42%)
laziness	10 (20%)
Concern of damaging device	14 (28%)
others	0

Out of total 50, 42 (84%) reported washing/sanitizing their hands after touching every patient and 8 (16%) denied washing/sanitising after touching every patient. Lower bacterial contamination ie 78% was found on stethoscopes of doctors who practice hand washing after touching every patient compared to 100% in those who did not .

TABLE 6 : HAND WASHING/SANITISATION BEFORE/AFTER CONTACT WITH EACH PATIENT

HANDWASHING/SANITISATION	NO. (%)	CONTAMINATION OF MOBILE NO. (%)
YES	42 (84%)	33 (78%)
NO	8 (16%)	8 (100%)

Antibiotic susceptibility testing (AST) of 21 isolates of coagulase positive Gram positive bacteria on both devices showed resistance to cefoxitin indicating growth of MRSA. Most gram negative bacteria showed resistance to cotrimoxazole and ampicilin.

TABLE 6 : ANTIBIOTIC RESISTANCE PATTERN OF GRAM POSITIVE AND GRAM NEGATIVE ISOLATES.

	E	**CIP**	**CTR**	**CX**	**GEN**	**COT**	**CD**	**AMP**	**IPM**	**AK**	**VA**
Staph aureus	46	15	25	84	22	---	40	----	30	15	10
CONS	45	25	30	70	34	---	60	-----	28	15	8
Klebsiella pneumoniae	---	100	100	---	0	100	---	100	---	0	---
Enterobacter	---	33	66	---	33	100	---	100	---	0	---

Escherichia coli	---	100	100	---	0	100	---	100	---	0	---
Pseudomonas aeruginosa	---	50	50	---	50	100	---	100	---	0	---
Acinetobacter species	---	33	33	---	33	66	---	100	---	0	---

Above figures depict % ,E Erythromycin,CIP Ciprofloxacin,CTR Ceftriaxone, CX cefoxitin, GEN Gentamicin, COT Cotrimoxazole, CD Clindamycin, AMP Ampicillin, IPM Imipenem, AK Amikacin, VA Vancomycin

DISCUSSION

Mobile phones of male and female health professional had nearly same percentage of contamination. A study conducted earlier in India which showed higher contamination rate in males[12]. The current study showed that 62 % stethoscopes and mobiles were contaminated by different microorganisms which is similar to the contamination rates observed in previous studies by various investigators in india[13,14]. Out of 50 stethoscopes, 39 (78%) were colonized .This finding is comparable to the result of previous study, which reported 71–100% stethoscopes colonized by different bacteria[15]. Gram negative bacilli and methicillin resistant *Staphylococcus aureus* (MRSA) were isolated from stethoscope which was a matter of concern[16]. *MRSA* (22%) was the most commonly isolated organism[17].The *S. aureus* isolation rate (18%)from mobiles were similar to two studies conducted in India[18]. Previous study also reported that these bacteria were isolated from contaminated stethoscopes of HCWs[19].

The current study conducted in the hospital revealed that these pathogenic microorganisms are most common cause of nosocomial infection[20]. Most of this bacteria isolated were resistant to commonly used antibiotics[21]. The emergence of antibiotic resistance by bacterial pathogens is a major public health concern[22]. One of the cause for emergence of Multi drug resistant (MDR) bacterial strains is dur to irrational and unnecessary use of antibiotics[23].

n this study no contamination was seen in two stethoscopes cleaned after contact with every patient. Previous studies also, have proved that regular disinfection of stethoscope substantially reduces transmission of bacterial pathogens[24]. Health professionals who did not regularly clean/disinfect their mobile phone had higher bacterial contamination than those who regularly cleaned their mobile phone. This was supported by other studies[25].

Majority of the doctors (78%) used hand sanitizer for disin--fection. Mehta et al. have previously demonstrated the efficacy of alcohol-based hand rubs in the disinfection of stethoscopes[26]. Around 28% Professionals although being aware of phone contamination did not clean their phones because they were afraid that contact with water or liquid disinfectant might damage the phones[27]. Other reasons for not following practices of disinfection were forgetfulness,lazyness and lack of time due to their busy schedule.

100 % contamination was found on stethoscope of HCWs who did not practice hand washing after touching each patient demonstrating importance of hand hygiene. Recently, the WHO reported that hand hygiene should be performed regularly in a effective manner which is fundamental in ensuring patient and HCWs safety[28].

This proves that mandatory guidelines and measures must be taken regarding the use and cleaning of phones/mobiles in a health care setting. This can to some extent curtail the spread of nosocomial infections in the hospitals. The difference on antimicrobial susceptibility compared to other studies might be due to different bacterial strains, hospital environment, empirical treatment practice, use of antibacterial as a prophylactic, easy availability of some drugs without a prescription, dose of the drug, and indiscriminate/prolonged use of common antibiotics. Hence awareness among the masses and protocols/guidelines for rational use of antibiotics must be enforced in all health care centres.

LIMITATION OF THE STUDY

This is a cross-sectional study, hence the effect of period variations have not been adressed. It is difficult to understand the actual practice of health professionals regarding practices of disinfection and also to perform further multivariable analysis to identify the effect of specific factors on contamination due to small sample size.

CONCLUSION

From the above study stethoscopes and mobile phones have proved to be the potential carriers of infection. Aslo, regular disinfection of these devices and hand washing can lower the risk. Hence, strict adherence of protocols for disinfecting of these devices by health care doctors must be followed and disinfection must be carried out regularly, to prevent transmission of pathogens and reduce nosocomial infections among patients in the hospitals

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