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A quasi-experimental study on stethoscopes contamination with multidrug-resistant bacteria: Its role as a vehicle of transmission

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Backgrounds

- Direct or indirect contact transmission are the most important routes of disease transmission in the hospital setting
- Diaphragms of stethoscopes are known to be the second most contaminated area after the fingertips. However, only a few studies have focused on the prevalence of contamination by multidrug-resistant (MDR) bacteria
- Stethoscope, often used by hands, has not been studied meticulously as a potential vector for transmission of nosocomial infections

Objectives

- To investigate the burden of stethoscope contamination with nosocomial pathogens and multidrug-resistant (MDR) bacteria
- To analyze habit changes in disinfection of stethoscopes among healthcare workers (HCWs) before and after education and training

Study participants and Methods

- Nov 2018 ~ Mar 2019
- Prospective pre and post quasi-experimental study
- A total of 100 HCWs (55 doctors and 45 nurses) were recruited in a single center
- HCWs were surveyed on their disinfection behavior and stethoscopes were cultured by pressing the diaphragm directly onto a blood agar plate before and after education on disinfection
- Exclusion criteria: loss or changed their stethoscope during the study period, withdrawal of their consent, or moved to other hospital during the study period

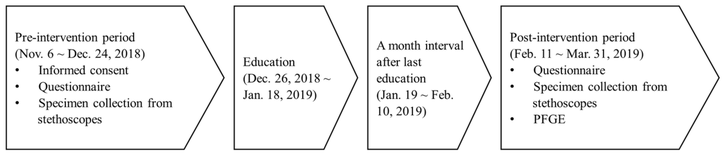

Figure 1. Study flow for pre and post quasi-experimental study

Results

Table 1. Demographic characteristics of the participants (n=100)

Characteristics	Number (%)
Sex, woman	59 (59.0%)
Subject	
Doctors	55 (55.0%)
Medical departments[§]	38 (69.1%)
Surgical departments [*]	11 (20.0%)
Intern	6 (10.9%)
Nurses	45 (45.0%)
Medical ward[§]	20 (44.5%)
Surgical ward [*]	10 (22.2%)
Intensive care unit	15 (33.3%)
Career period	
< 2 years	29 (29.0%)
2-5 years	32 (32.0%)
5-10 years	18 (18.0%)
>10 years	21 (21.0%)
Period of stethoscope use	
< 6 months	7 (7.0%)
6 months to 1 year	9 (9.0%)
> 1 years	84 (84.0%)

[§] Medical departments include internal medicine and pediatric
[*] Surgical departments include general surgery, neurosurgery, and emergency medicine

- Most of the stethoscopes were contaminated with microorganisms, 97.9% before and 91.5% even after intervention

Table 2. Contamination rate caused by nosocomial pathogens

	Pre-intervention (n=96)		Post-intervention (n=94)	
No. of stethoscope	Pathogen	MDR	Pathogen	MDR
Overall	20 (20.8%)	3 (3.1%)	18 (19.2%)	6 (6.4%)
S. aureus	13 (13.5%)	2 (2.1%)	15 (15.7%)	4 (4.3%)
Enterococcus	6 (6.3%)	0 (0.0%)	4 (4.3%)	0 (0.0%)
A. baumannii	0 (0.0%)	0 (0.0%)	1 (1.1%)	1 (1.1%)
P. aeruginosa	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
Enterobacteriaceae	3 (3.1%)	1 (1.2%)	2 (2.1%)	2 (2.1%)
K. pneumoniae	1 (1.2%)	1 (1.2%)[*]	1 (1.1%)	1 (1.1%)[§]
E. coli	0 (0.0%)	0 (0.0%)	1 (1.1%)	1 (1.1%)[*]
Enterobacter	2 (2.3%)	0 (0.0%)	0 (0.0%)	0 (0.0%)

[§] Carbapenemase-producing Enterobacteriaceae
[*] Extended-spectrum beta-lactamase producer

Results

- Stethoscope disinfection habits were improved (55.1% vs 31%; p< 0.001), and the overall bacterial loads of contamination were reduced (median CFUs 15 vs 10; p=0.019) after the intervention

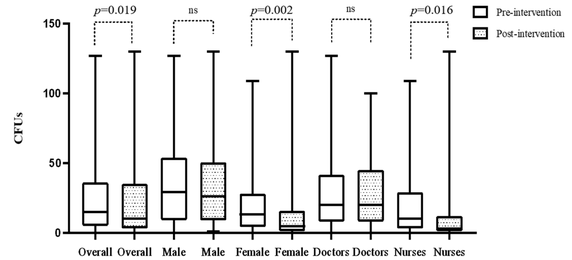

Figure 2. Changes in colony forming units of bacteria isolated

- A carbapenemase-producing Klebsiella pneumoniae from the stethoscope was closely related to isolates from the patients admitted at the same ward where the stethoscope was used

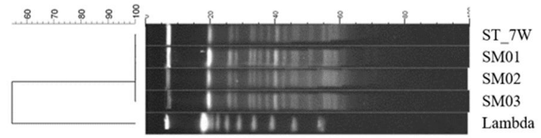

Figure 3. Result of PFGE and dendrogram of carbapenemase-producing K. pneumoniae from the stethoscope and the patients Note. ST_7W, K. pneumoniae from the stethoscope; SM 01 to 03, K. pneumoniae isolates form the patients

Conclusions

- Stethoscopes were contaminated with various nosocomial pathogens including MDR bacteria and were very likely to be a vehicle of MDR bacteria
- Continuous, consistent education and training should be done in multifaceted approach to reduce the nosocomial transmission via stethoscopes