Tanning the bugs – a pilot study of an innovative approach to stethoscope disinfection

Letter to the Editor

Tanning the bugs – an innovative approach to stethoscope disinfection: an Italian pilot study.

Gabriele Messina[a,b,*], Daniele Rosadini[b], Sandra Burgassi[a], Daniele Messina[c], Nicola Nante[a,b], Marco Tani[d], Gabriele Cevenini[e].

[a] Department of Molecular and Developmental Medicine, University of Siena, Italy
[b] Post Graduate School of Public Health, University of Siena, Italy
[c] Monte dei Paschi Foundation of Siena, Italy
[d] FeT Elettronica S.n.c., via A. Volta 28, Poggibonsi (Siena), Italy
[e] Department of Medical Biotechnology, University of Siena, Italy

Corresponding Author: Gabriele Messina, Department of Molecular and Developmental Medicine, University of Siena, via Aldo Moro, 2 - 53100 Siena, Italy. Phone: (+39) 0577-234139 – Fax: (+39) 0577-234090 – Mobile: (+39) 3396699422. E-mail address: gabriele.messina@unisi.it

Sir,

Healthcare-associated infections (HCAIs) are a major public health problem and up to 32% of HCAIs could be prevented.[1] Possible causes of HCAI transmission are medical devices not properly disinfected after their use; in particular the stethoscope, a symbol of medicine, has received particular attention: 85% of stethoscopes have been reported to be reservoirs of bacteria, including pathogens.[1] There is also evidence that two-way transfer of microorganisms is possible between skin and stethoscope.[1-7] Our study aimed to evaluate the effectiveness of an innovative device for the disinfection of stethoscope membranes, contaminated by chest auscultation in a real setting.

A pilot study with pre/post design was performed between March - April 2015 in the Department of Molecular and Developmental Medicine, University of Siena, Italy. Ten resident students were enrolled as volunteers. We used a device emitting UV-C (255-280) through a light-emitting diode (LED). UV-C has a biocidal effect on microbes, altering their DNA/RNA.[8] When the head of stethoscope is placed on the device, a micro switch activates the UV-C LED, whose irradiation along five minutes disinfects the stethoscope membrane. When the head of the stethoscope was removed, the LED automatically switched off. This prevents any possible harm to person due to UV-C light.

The test stethoscope was used to auscultate ten points on the chest of the ten volunteers; each volunteer was examined twice. After the first auscultation the head of the stethoscope was disinfected with the device for 5 minutes and then the membrane was cultured on plate count Agar (PCA); after the second auscultation, the stethoscope head was placed directly onto the culture plate without treatment. Between every treatment and control the stethoscope was disinfected with alcohol, in order to standardize the baseline level. Plates were incubated at 36°C for 48 hours after which numbers of colony forming units (CFU) were determined. Descriptive and inference analysis were performed. Sign test for matched pairs was used to compare the number of CFU after culture of treated and untreated stethoscopes. Stata® SE, version 12.1 (StataCorp, College Station, Texas, USA) was used to perform the analysis. A statistical significance level of 95% was used.

Table I shows CFUs recorded for stethoscope membranes, treated and not treated (controls) with the UV-C device after auscultation. For the controls, the mean number of CFU was 75.9 (SD 125.7), compared to 9.5 CFU (SD 18.8) for treated membranes. The median for the controls was 38 CFU with an interquartile range (IQR) of 12.5-68.75; the median for the treated stethoscopes was 2.5 CFU (IQR 0-10.5). No CFU were detected in five of ten cultures from treated stethoscopes. The other five cases had a mean of 132.6 (SD 165.1) CFU on untreated tests and a mean of 19 (SD 23.8) CFU on treated tests. The average CFU reduction between the two groups was 85.7% (p=0.002).

The first point stemming from this study is confirmation that bacteria transfer from skin to stethoscopes. Second, a device taking advantage of the well-known biocidal activity of UV-C,[7] can be miniaturized through the use of a UV-C LED sources. The adoption of a physical approach for disinfection may be an advantage because of lack of resistance to UV-C for microorganisms involved in HCAIs, which is mot the case for chemical disinfectants. Our device was found practical to use. It has been designed to automatically turn on and off; its small size makes it attachable to users uniforms or clothing so that stethoscope users can always have a device at their immediate disposal. One of the possible reasons for lack of compliance with current stethoscope hygiene

procedures is the inconvenience of finding disinfectant and/or cleaning materials. Finally, very important could be the continuous reminder that a wearable device would provide to decontaminate stethescopes.

Some precautions would need to be considered before adopting the device: i) treated surfaces should be dry to make UV-C most effective: ii) UV-C treatment could cause faster deterioration of stethoscope membranes, although exposures are brief and radiant power is relatively low; moreover, other methods of disinfection are also likely to damage membranes; iii) five minutes of irradiation may be a long time between patients in a busy hospital and in emergency settings; iv) not in all cases there was a complete inactivation of microorganisms, however LED technology is improving and higher performance diode are almost ready for the market. In any case, a reduction in bacterial load, rather than absolute sterility, may be all that is required. The main limitation of this pilot study was the low number of samples tested; however, we believe that the aims of the pilot study to assess both the effectiveness and the feasibility of the device were achieved. Larger studies in real healthcare settings, such as a hospital ward or general practitioner's office, and involving patients rather than volunteers are our next goal.

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Conflict of interest statement

Gabriele Messina, Sandra Burgassi, Daniele Messina, and Gabriele Cevenini are co-founders of a Start-up company named "egoHEALTH", which is currently trying to put into application and practice the innovative approach developed in years of research about the issues described in the article. Marco Tani reports personal fees from egoHEALTH ltd, during the conduct of the study.

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TABLE

Table I. Numbers of CFU from cultures of control and UV-C treated stethoscope membranes

Case no.	CFUs Controls	CFUs Treated
1	15	0
2	3	0
3	5	0
4	57	5
5	38	0
6	38	15
7	427	61
8	35	0
9	74	5
10	67	9