

Stethoscope Disinfectors

A complete Overview

 STETCLEAN  STETCUBE

Healthcare Associated Infections

HAIs are, by definition, diseases which affect patients inside hospitals and are not present or incubating at the time of admission.

HAIs could appear after discharge and besides patients, they often afflict employees in the hospital staff, too.



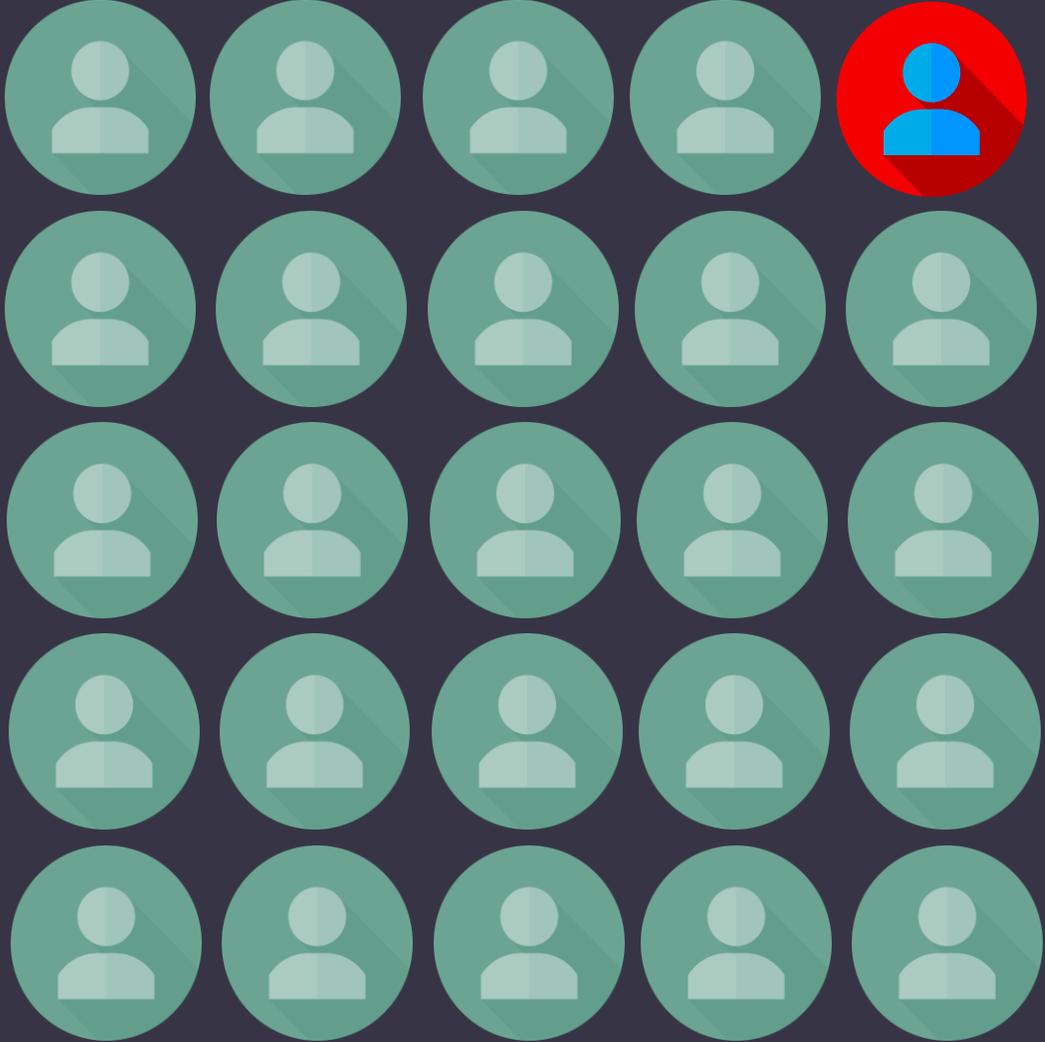
The issue:
**Healthcare
Associated
Infections**



“ No one should get sick seeking care.

Yet globally, hundreds of millions of people are affected every year by health care-associated infections (HAIs), many of which are completely avoidable and a large proportion are caused by antibiotic resistant organisms.

No country or health system, even the most developed or sophisticated, can claim to be free of HAIs.”



1 person every 25 admissions contracts HAI

increasing mortality



increasing costs



Healthcare Associated Infections

Statistics



Approximately 30% of patients in ICUs are affected by at least one episode of health care-associated infection.

Newborns are also at higher risk, especially in low income areas. Among hospital-born babies in developing countries, HAIs are responsible for 4% to 56% of all causes of death in the neonatal period.

Prevention, prevention, prevention

There is no solution that will, by itself, solve the problem. Protocols and best practices have been established by the CDC (U.S.A.), the World Health Organization, and many others.



Prevention,
prevention,
prevention



Sterilization, disinfection and cleaning represent pillars of prevention actions that must be done every day inside every hospital and clinic.

Effective infection prevention and control reduces health care-associated infections by at least 30%.

Although significant progress has been made in preventing some HAIs types, there is much more work to be done.



UltraViolet Technology is a great opportunity to exploit

UltraViolet Germicidal Irradiation (UV-C)



Light can be divided in visible, infra-red and ultraviolet rays.

Ultra-violet rays (invisible) can be classified in:

UV - A (with tanning properties)

UV - B (with therapeutic properties)

UV - C (with germicidal properties)



UV-C light penetrates inside bacteria, spores, fungi, molds, mites, and viruses.



UV-C high energy is absorbed at RNA and DNA level, damaging nucleic acids and avoiding cellular growth & proliferation.

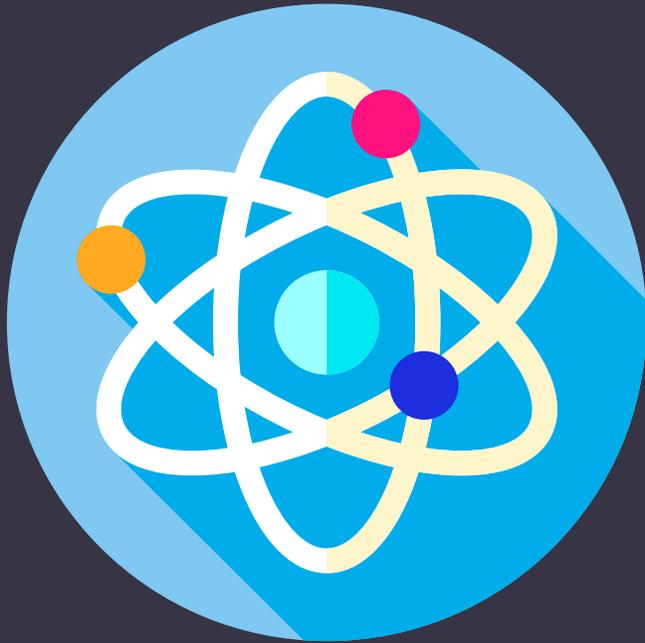


UV-C's action is effective within seconds of irradiation.



UV-C disinfects at 99,9% any surface, water and air.

UltraViolet Germicidal Irradiation (UV-C)



UVGI technology is a physic disinfection method with a great costs/benefits ratio, it's ecological, and, unlike chemicals, it eliminates every microorganisms, also multidrug-resistant (MDR) pathogens.

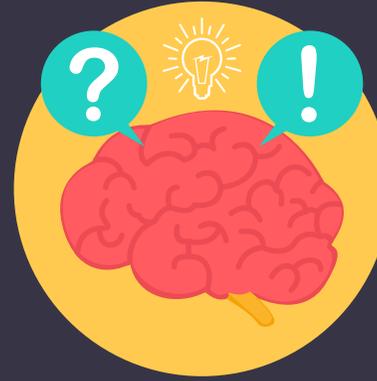
UltraViolet Germicidal Irradiation (UV-C)



UVGI is a science-proved technology.

Research is still ongoing, but there is much evidence on the efficacy of UVGI and the proper way to use it, though its application has yet to fully mature.

How could we apply UV technology to prevent HAIs in medical environments?



What is one of the most contaminated surface inside any hospital?
Hands.

For this reason there are so many campaigns to educate people to wash their hands...clean hands can save lives!

So, what is comparable to hands?
What is the most common used tool in any hospital?

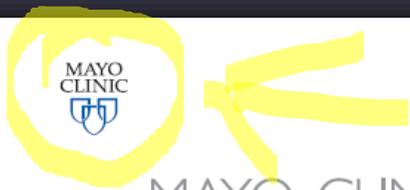
Stethoscope contamination



Stethoscope is the most widely used instruments in any medical environment.

It is used in rich countries, in poor countries, in private clinics, in field hospitals.

It is used by doctors, nurses and any other health professional.



MAYO CLINIC PROCEEDINGS

Stethoscopes and Health Care—Associated Infection

Over the past 30 years we have come to fully appreciate the enormous potential for person-to-person spread of virulent nosocomial pathogens (eg, methicillin-resistant *Staphylococcus aureus* [MRSA], vancomycin-resistant enterococcus [VRE], multidrug-resistant [MDR] gram-negative bacilli and *Clostridium difficile*, viruses such as influenza A, respiratory syncytial virus, and norovirus, and even *Candida* species) in the health care setting, with devastating infection being the most feared iatrogenic consequence and one of the greatest threats to hospital safety.^{1,2} It has long been accepted that the major reservoir of nosocomial infection is infected or colonized patients and the major mode of transmission is the transient carriage of nosocomial pathogens on the hands of noncolonized health care workers having direct physical contact with patients.³ Hand hygiene before and after direct patient contact—now most often with a waterless alcohol gel or hand rub—has become an uncompromising expectation for modern-day health care workers.⁴

Although it had long been held that microorganisms in the inanimate hospital environment do not play a significant role in the acquisition of nosocomial infection,⁵ it has become evident in recent years that surfaces in hospitals touched by patients or health care workers readily become contaminated by “environmental pathogens,” such as MRSA, VRE, *Acinetobacter baumannii*, *C difficile*, respiratory syncytial virus, and norovirus, which collectively have a unique capacity to survive desiccation in a viable, transmissible form for days to months. Compelling epidemiologic data indicate that contamination of inanimate surfaces in hospitals is an important reservoir of these pathogens and has driven a move toward more comprehensive surface decontamination

with bleach solutions, ultraviolet light, or aerosolization of hydrogen peroxide or peracetic acid.⁶

Auscultation of the heart, lungs, abdomen, and major arteries with a stethoscope has long been considered an integral part of the physical examination, and most health care providers prefer to use their own stethoscope. It has long been known that the diaphragms and bells of stethoscopes randomly sampled in a health care setting, such as a hospital, are almost universally contaminated by potential nosocomial pathogens,⁷⁻¹⁸ most often staphylococci—MRSA up to 32% of the time¹⁸—but also *C difficile*,¹⁷ resistant gram-negative bacilli, and even viruses,¹⁹ and studies have shown that stethoscope contamination by these microorganisms is commonly acquired from colonized or infected patients.^{9,10}

In this issue of *Mayo Clinic Proceedings*, Longin et al²⁰ report an innovative study of ungloved physicians who auscultated MRSA-colonized patients with presterilized stethoscopes, showing that the fingertips of the examiners or the diaphragms of their stethoscopes acquired MRSA contamination during 76% of the examinations. They found a powerful correlation between counts on examiners' hands and the quantitative level of contamination of the stethoscope with each examination, both for total bacterial counts and for MRSA. The efficiency of transmission of MRSA from the trunk of colonized or infected patients to the hands of health care workers and their stethoscopes rigorously documented in this unique real-life study is almost staggering. One can ask, why are we all not MRSA carriers?

Given that microorganisms on contaminated stethoscopes are readily transmitted

EDITORIAL

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gens.^{11-14,16} As such, health care workers should be expected to routinely decontaminate the head of their personal stethoscope between patients, logically when they do postexamination hand hygiene.

acquisition of nosocomial infection,⁵ it has become evident in recent years that surfaces in hospitals touched by patients or health care workers readily become contaminated by “environmental pathogens,” such as MRSA, VRE, *Acinetobacter baumannii*, *C difficile*, respiratory syncytial virus, and norovirus, which collectively have a unique capacity to survive desiccation in a viable, transmissible form for days to months. Compelling epidemiologic



Stethoscopes carry several different pathogens and they are usually never clean.



Doctors are focused on making diagnose and treat patients.



There is often rush between one visit and the other.



Common cleaning includes the use of disposable chemicals and the creation of special wastes.

How could we apply
UV technology to
STETHOSCOPIES?

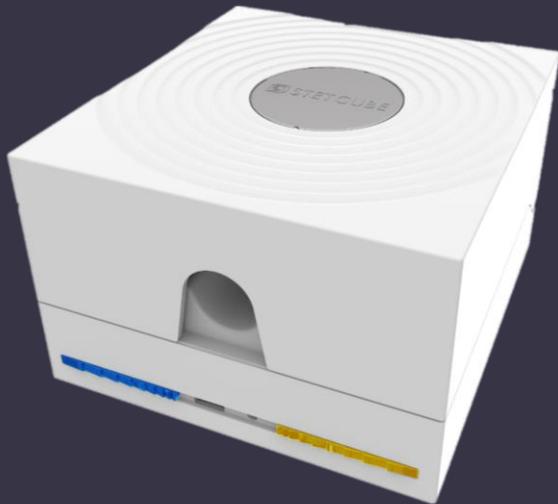


The most innovative source of ultraviolet rays are **UV-C LEDs**.

These microscopic UV light sources are able to achieve same results as standard UV lamps while offering revolutionary features in terms of portability, power and applicability.

Since their recent implementation it has been possible to design new products for the sanitation of water and surfaces that cannot even be imagined just until a few years ago.

 STET CLEAN



 STET CUBE



automatic double level of treatment: 3 minutes for standard disinfection, 2 minutes more for a deeper sanitisation.



status light indicator: blue for ongoing treatment and treatment complete, yellow for low battery, charging, malfunction.



rechargeable battery with standard micro USB cable, high battery autonomy.



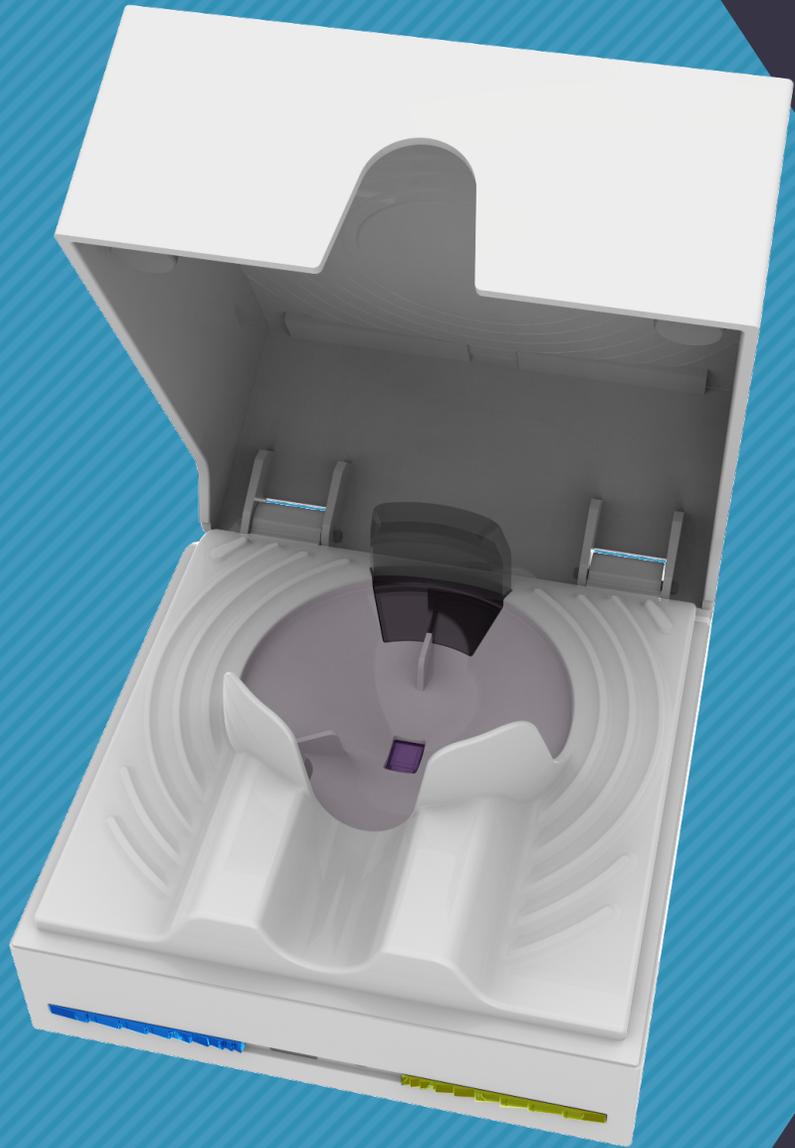
Proven results, several University tests, Scientific papers and in-vivo tests show the device's disinfection efficiency.

Wearable Disinfection



- Portable Version: designed to follow your stethoscope everywhere you go.
- double control system – optical sensor and mechanical – for use in operational safety conditions
- microprocessor for irradiation and security controls
- special polycarbonate body
- light weight (100 grams) and pocket sized (limited footprint), like a common smartphone
- fits with the most common stethoscope size (around 46 / 47 cm diameter, i.e. Littman Classic II)





Disinfection on your desk

- Desk Version: designed for “sharing”. It fits in hospital cart, desk, etc.
- With the optional supplied you can easily mount it on a wall
- double control system – infrared sensor and mechanical switch as you close the cover
- microprocessor for irradiation and security controls
- special shiny polycarbonate body
- compatible with every stethoscope type and dimension (pediatric, neonatal, cardiological...)



Doctors said...

« it's cool...definitely cooler than disinfectants! »

« it is so easy to use, the fact that works automatically makes the process very simple, fast and natural.»



« I think that wearing the device on my coat and carrying it on the medical cart act as a reminder of the need of hygiene »

« it is important to clean the stethoscope, have you ever clean it after every patient? »

Scientific papers

UNIVERSITY OF SIENA
Department of Life Science
Via A. Moro 2, 53100 Siena (Italy)

The study report was written under a Service Agreement between
University of Siena and Light Progress S.r.l.
Report (version 1.01)

Siena, 22nd July 2016

Microbiological testing of an hygienization device (Best Clean) for
stethoscope/phenoloscope

The study report was written under the Service Agreement (Reg. 1779/2014 Prot. 26528 e 1 Prot. 6002/16; Prot. 6002/16) between the University of Siena and Light Progress. Report (version 1.01)

Device 1 Device 2 Device 3 Device 4

Control (H0)

Treatment (H1)

Petri plates with CFU at 24 h. Tests made on 4 subjects (A,B,C,D) using 4 different devices. In the superior part, controls (H0); in the inferior part, treatments (H1).

Device 1 Device 2 Device 3 Device 4

Control (H0)

Treatment (H1)

Petri plates, with CFU at 48h, after 2.918 cycles (14.558 minutes), in order to simulate the LED consumption. Examples of tests made on Escherichia Coli (col), Pseudomonas aeruginosa (centra), Staphylococcus aureus (right). In the superior part, controls (H0); in the inferior part, treatments, (H1).

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Research paper
A novel approach to stethoscope hygiene: A coat-pocket innovation
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KEYWORDS
Disinfection;
UV-C;
Stethoscope;
Healthcare-associated infection

Abstract Background: The stethoscope is the most widely used instrument in healthcare. Studies have found similar rates of contamination on the stethoscope diaphragm and on physician fingertips after a single examination. Our aim was to test the effectiveness of an innovative portable device for disinfecting stethoscope membranes.
Methods: From November 2016 to May 2017, a cross-sectional study was conducted in four wards of a private clinic: General Ward (GW), Internal Medicine Ward (IMW), Post-Operative Observation Ward (POW) and Permanent Vegetative State Ward (PVS). Five wearable medical devices, designed to disinfect stethoscope membranes automatically by means of UV-C radiation, were provided to operators. Spot checks were made for microbial counts of stethoscope membranes, classified as treated or otherwise on the basis of whether they were found disinfected otherwise with the devices. The percentage reduction in colony forming units (CFU) was calculated between the two groups.
Results: The number of tests of stethoscopes treated with the device was 116 out of 272. Untreated samples had a mean contamination of 132.2 CFU versus 6.9 CFU of treated samples: a 94.8% reduction (95% CI 91.31–97.7). Highly significant statistical differences in CFU were found between untreated and treated membranes ($p < 0.001$). In particular, microbial contamination showed a reduction of 88.7% (CI 77.55–96.05%) in POW, 95.9% (CI 88.25–98.5%) in GW, 84.5% (CI 76.40–90.5%) in IMW and 95.8% (CI 90.35–98.1%) in POW.

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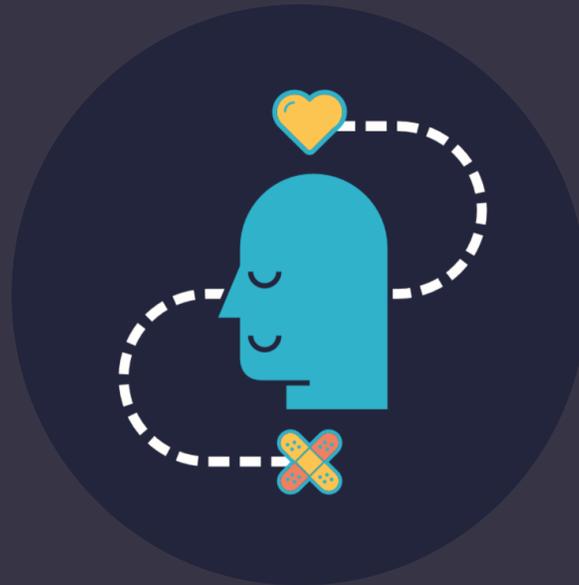
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Major article
A new UV-LED device for automatic disinfection of stethoscope membranes
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Background: Stethoscopes are widely used by doctors and nurses. Poor stethoscope hygiene is a potential source of nosocomial infection. This study aimed to propose an innovative solution, based on the latest advances in ultraviolet (UV) light-emitting diodes (LEDs), for disinfecting stethoscope membranes automatically and efficiently.
Methods: Staphylococcus aureus, Escherichia coli, Pseudomonas aeruginosa, and Streptococcus faecalis were grown on 28 stethoscope membranes and then transferred to Petri dishes. Treatment involved illuminating exposed Petri dishes with a UV-LED for 1 minute. For each membrane, the number of colony forming units (cfu) at 30°C was compared in control and treated dishes using the Wilcoxon signed rank test. The Kruskal-Wallis test was used to assess percent reductions in bacteria. Statistical significance was set at 99%.
Results: A significant reduction in cfu counts after UV treatment ($P < .01$) was found for all bacteria: 85.5% for E. faecalis, 87.5% for S. aureus, 94.3% for E. coli, and 94.9% for P. aeruginosa. No significant differences in percent reduction in cfu were found between bacteria ($P > .05$).
Conclusion: The stethoscope, symbol of professional and health care professionals, has been demonstrated to be a carrier of microorganisms. The treatment technique was effective and efficient in disinfecting the membranes; these promising results represent a step forward toward eliminating stethoscope membrane contamination with an innovative approach.
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