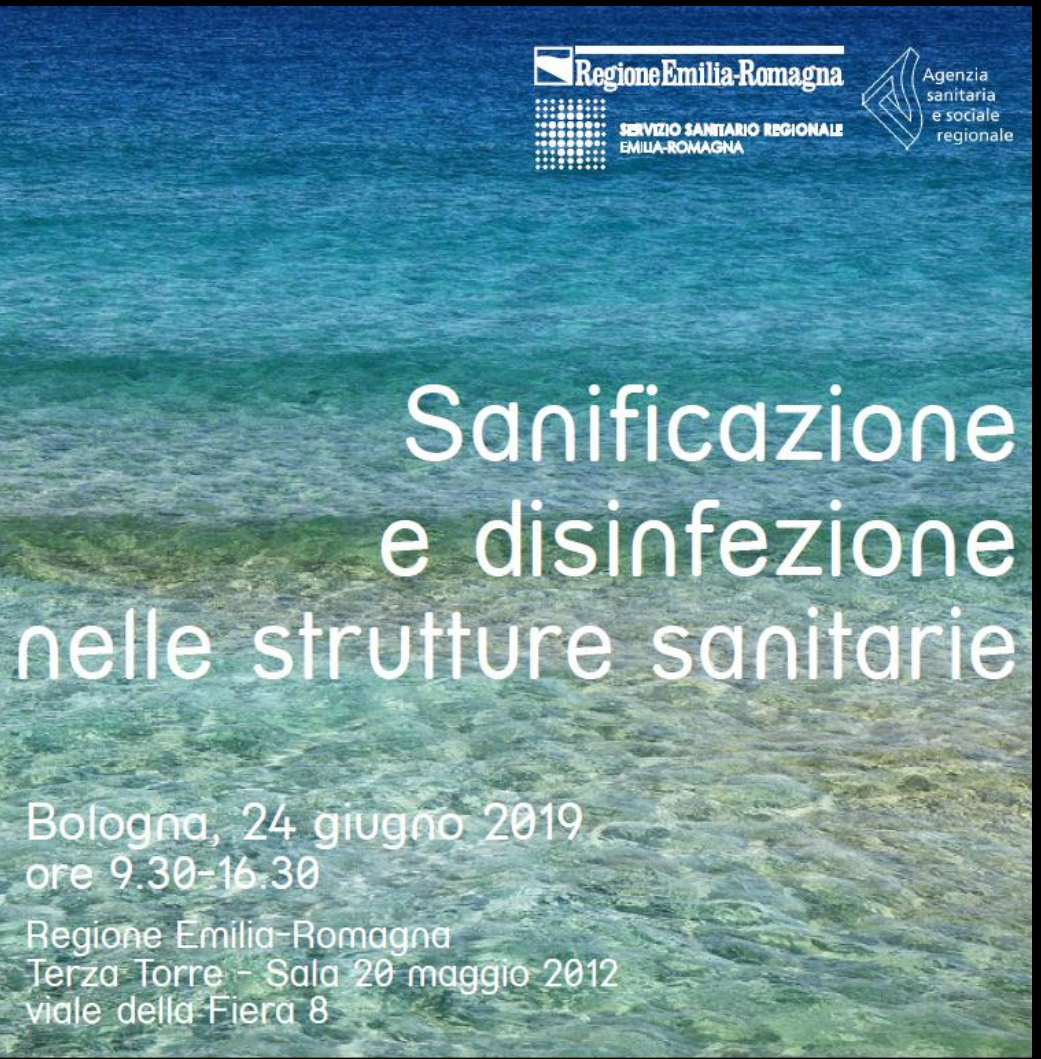
Sistemi di sanificazione *no-touch* a base di raggi UV



Matteo Moro

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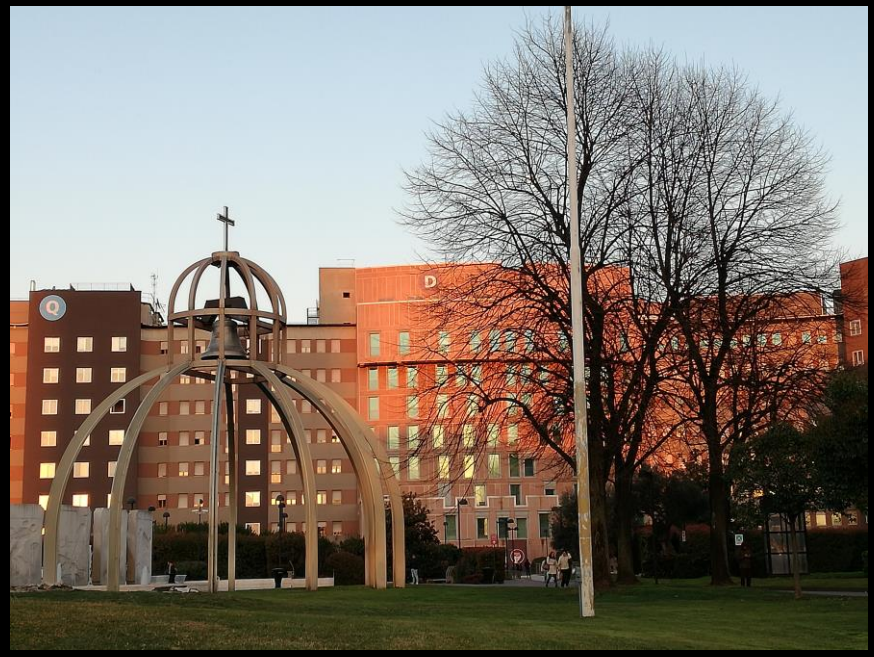

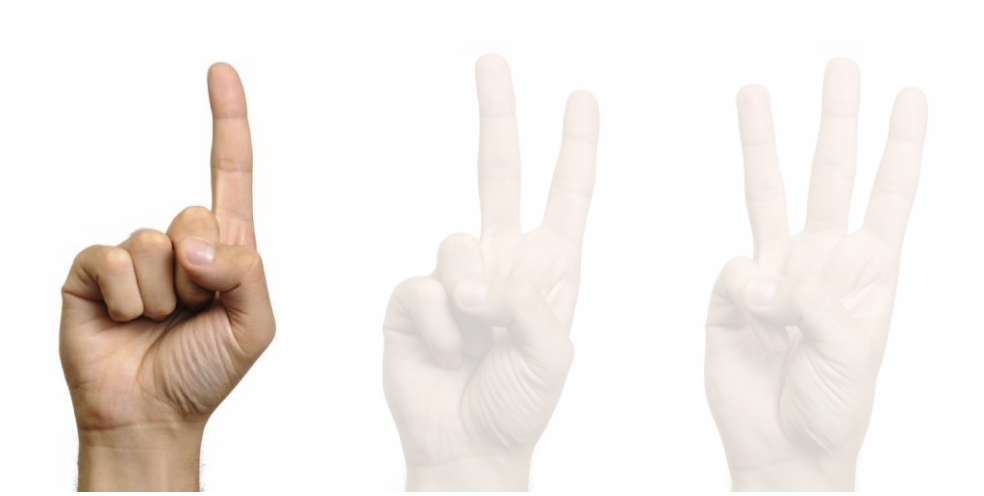

1. INTRODUZIONE

2. Raccomandazioni

3. Dalla letteratura

Journal of Hospital Infection 89 (2015) 287–295

Available online at www.sciencedirect.com

Journal of Hospital Infection

How to eradicate *Clostridium difficile* from the environment

F. Barbut [a,b,*]

[a] National Reference
Paris, France
[b] Infection Control U

Come eradicare *C. difficile* dall'ambiente

Ultraviolet (UV) light or hydrogen peroxide systems are most widely used. In-vitro studies suggest that hydrogen peroxide vapour (from 30% hydrogen peroxide) methods achieve a >6 $\log_{10}$ reduction in *C. difficile* spores placed on carriers, and that aerosolized hydrogen peroxide systems (from 5% to 6% hydrogen peroxide) achieve ~4 $\log_{10}$ reduction, whereas UV-based methods achieve ~2 $\log_{10}$ reduction. Very few studies have assessed the impact of these devices on the transmission of *C. difficile*. Major limitations of these devices include the fact that they can only be used after the patient's discharge, because patients and staff must be removed from the room. The new no-touch methods for room disinfection supplement, but do not replace, daily cleaning.

Introduction

Clostridium difficile is the leading cause of healthcare-associated infections in many developed countries worldwide. *C. difficile* infection (CDI) accounts for almost 4% of all healthcare-associated infection in Europe, although this proportion varies between countries.[1] The incidence and severity of CDI have been increasing in many countries, and the estimated number of cases in Europe, 124,000 per year, is likely to be an underestimate owing to underdiagnosis.[1,2] In the USA, a recent multistate prevalence survey concluded that *C. difficile* was the most frequently reported pathogen, causing 12% of all healthcare-associated infection.[3] The US Centers for Disease Control (CDC) recently categorized CDI in the highest priority category of antimicrobial resistance threats, based on an estimated annual burden of 250,000 cases resulting in 14,000 deaths.[4]

Clostridium difficile has a considerable impact on healthcare systems. In a recent critical review of costs attributable to

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http://dx.doi.org/10.1016/j.jhin.2014.12.007
0195-6701/

JHI 2015

SUMMARY

During the last decade, *Clostridium difficile* has emerged as a major cause of healthcare-associated diarrhoea and death. Transmission of this spore-forming bacterium is thought to occur via the hands of healthcare providers or via the contaminated environment. Therefore, enhanced environmental cleaning/disinfection of the rooms housing

"The new no-touch methods for room disinfection supplement, but do not replace, daily cleaning"

UV-based methods achieve ~2 $\log_{10}$ reduction. Very few studies have assessed the impact of these devices on the transmission of *C. difficile*. Major limitations of these devices include the fact that they can only be used after the patient's discharge, because patients and staff must be removed from the room. The new no-touch methods for room disinfection supplement, but do not replace, daily cleaning.

Accessible version: https://www.cdc.gov/infectioncontrol/guidelines/disinfection/

Guideline for Disinfection and Sterilization in Healthcare Facilities, 2008

Update: May 2019

William A. Rutala, Ph.D., M.P.H.[1,2], David J. Weber, M.D., M.P.H.[1,2], and the Healthcare Infection Control Practices Advisory Committee (HICPAC)[3]

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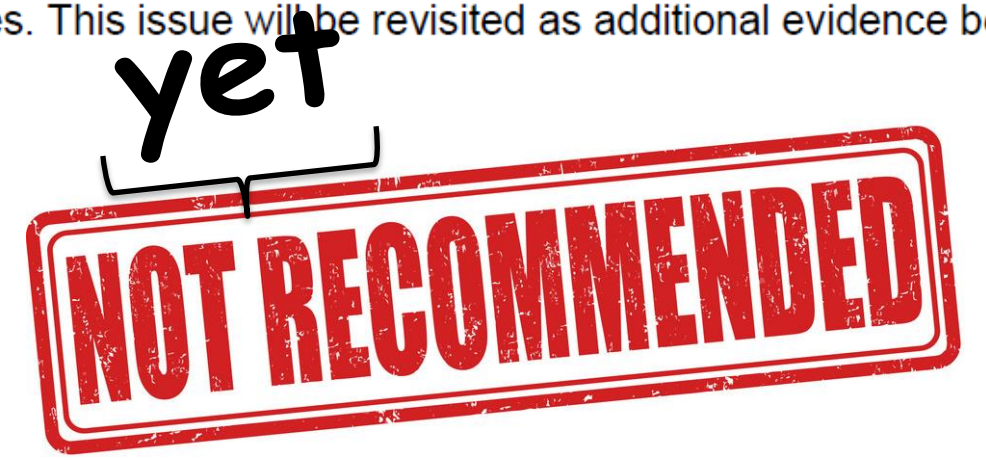
6. Disinfectant Fogging

These recommendations do not apply to newer technologies involving fogging for room decontamination (e.g., ozone mists, vaporized hydrogen peroxide) that have become available since the 2008 recommendations were made. These newer technologies were assessed by CDC and HICPAC in the 2011 Guideline for the Prevention and Control of Norovirus Gastroenteritis Outbreaks in Healthcare Settings, which makes the recommendation:

"More research is required to clarify the effectiveness and reliability of fogging, UV irradiation, and ozone mists to reduce norovirus environmental contamination. (No recommendation/ unresolved issue)"

The 2008 recommendations still apply; however, CDC does not yet make a recommendation regarding these newer technologies. This issue will be revisited as additional evidence becomes available.



Received: 4 February 2019 | Accepted: 5 February 2019
DOI: 10.1111/myc.12903

ORIGINAL ARTICLE

WILEY mycoses

Killing of *Candida auris* by UV-C: Importance of exposure time and distance

Killing of *Candida auris* by UV-C: Importance of exposure time and distance

Theun d... 3,4

"*Killing*" di *C. auris* da UV-C:
Importanza di durata esposizione e distanza

Future studies should aim to determine the effect and place of UV-C on surface decontamination in hospital setting.

KEYWORDS
Candida auris, decontamination, distance, exposure time, outbreak, ultraviolet-C, yeast

1 | INTRODUCTION

Candida auris is a globally emerging yeast, only recognised in the last 10 years causing severe infections.[1] This yeast has been reported to cause hospital outbreaks in various healthcare facilities across the globe.[2-5] Skin colonisation and inanimate surface contamination in close vicinity of infected and colonised patients is likely an important factor in patient to patient transmission.[6,7] Rapid identification of *C auris*, skin decolonisation of patients, and decontamination of hospital surfaces are essential steps in controlling *C auris* outbreaks.

Although there are no established guidelines for decontaminating surfaces contaminated by *C auris*, healthcare organisations have issued different recommendations. The Center for Disease Control and Prevention (CDC) suggests the use of Environmental Protection Agency (EPA)-registered hospital grade disinfectant effective against *Clostridium difficile* spores, while Public Health England

Mycoses 2019

Raggi UV

Maslo et al. BMC Infectious Diseases (2019) 19:540
https://doi.org/10.1186/s12879-019-4137-6

RESEARCH ARTICLE Open Access

The efficacy of pulsed-xenon ultraviolet light technology on Candida auris

Caroline Maslo[1*†] Moira du Plooy[2†] and Jennifer Coetzee[3†]

Efficacia di PX-UV su *C. auris*

areas outside the room where the patient received care. Further studies are needed in hospital environment, to assess the cumulative impact of repeated sessions.

Keywords: Candida spp., Pulsed-xenon ultraviolet light, Disinfection

Background

Candida auris is an emerging, often multi-resistant, yeast that causes invasive infections in healthcare settings [1, 2]. *C. auris* has the ability to cause large healthcare outbreaks [3, 4]. Patients may be colonized for months [3, 5] and *C. auris* has been shown to remain viable on surfaces for at least 14 days [6, 7]. It is widely considered that the environment may be a reservoir for transmission of *C. auris*. The Centre for Disease Control and prevention (CDC) recommends post discharge terminal cleaning and disinfection of patients' rooms and cleaning and disinfection of areas outside the rooms where patients received care [8]. It has been demonstrated that conventional cleaning and disinfection often lacks consistency and that additional disinfection, using non-touch technologies such as hydrogen peroxide vaporisation or germicidal ultraviolet (UV-C) light can further reduce the surface bioburden and transmission of microorganisms [9]. However, a recent publication by Cadnum and colleagues showed a relative resistance of *C. auris* and other candida species to UV-C and that extended exposure time (20 to 30 min) might be needed [10]. In their experiment, Cadnum and colleagues (2018) used a mobile device that emits 254-nm continuous UV-C light. We tested the hypothesis that the pulsed-xenon ultraviolet (PX-UV) system that emits broad spectrum UV-C (200–280-nm) in short pulses could reduce the exposure time needed to decrease *C. auris*. As a comparison, we also tested the PX-UV system

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BMC ID 2019

Raggi UV

American Journal of Infection Control 47 (2019) 474–476

Contents lists available at ScienceDirect

American Journal of Infection Control

Commentary

Wet contact time directly impacts antimicrobial efficacy of Environmental Protection Agency–registered disinfectants

Peter J. Teska MBA *, Xiaobao Li PhD, Jim Gauthier MLT, CIC

Diversey, Charlotte, NC

La durata del contatto "umido" impatta l'efficacia dei disinfettanti

AJIC 2019

by the EPA.

As testing methods evolved and carrier tests were developed, there were legitimate concerns, raised by Sattar et al[4] and Best et al,[5] that suspension tests were generally easier to pass. Side-by-side testing often showed that suspension tests yielded results with better antimicrobial efficacy.[5] There has been significant work by the EPA (with academic and industry collaboration) to develop and validate microbiological testing methods based on the use of carriers, with quantitative log reduction requirements for passing the test. This has led to test methods such as the germicidal spray test,[7] the quantitative carrier test, and the quantitative Petrifilm (3M Corp, St Paul, MN) method for premoistened disinfectant wipes.[6] In carrier tests, inoculum is dried on a glass or stainless steel carrier, and the disinfectant is applied to the carrier by dropping, spraying, or wiping with a

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Conflicts of interest: The authors are all employed by Diversey, a commercial company.

manufacturers do not provide detailed data to show what efficacy is achieved at time points shorter than the stated label contact time. Therefore, as a general rule in healthcare, it is advised to keep the disinfected surface wet for the label contact time to ensure that efficacy is achieved.

Recent work from Rutala and Weber[8] challenges this by stating that the surface does not need to stay wet for the full contact time. Instead, the surface can be wet for a portion of the contact time and then remain "undisturbed" for the remainder of the time, which is referred to as "treatment time." However, we find that such statements are inconsistent with a number of previous studies that highlight the importance of wet contact time and are not supported by systematic laboratory or field studies:

1. Wet contact time is a key attribute of disinfectant performance and the time that a surface is wet directly impacts the amount of efficacy achieved. Multiple studies have shown that the amount of time the disinfectant keeps the surface wet improves the disinfection efficacy on the surface. Hong et al[9] showed that a quaternary

https://doi.org/10.1016/j.ajic.2018.10.005

Raggi UV

Journal of Hospital Infection 100 (2018) 236–241

Available online at www.sciencedirect.com

An international survey of cleaning and disinfection practices in the healthcare environment

N. Kenters [a,b,*], T. Gottlieb [c], J. Hopman [b], S. Mehtar [d], M.L. Schweizer [e], E. Tartari [f], ISAC working group Infection Prevention and Control, E.G.W. Hui[illegible]

Survey su sanificazione nelle strutture sanitarie

- 110 ospedali (HCW)
- 23 paesi

JHI 2018

practices and monitoring of these practices varied.

Conclusions: The survey enabled assessment and recognition of widely differing global practices in approaches to environmental cleaning and disinfection. Development of guideline recommendations for cleaning and disinfection could improve practices and set minimum standards worldwide.

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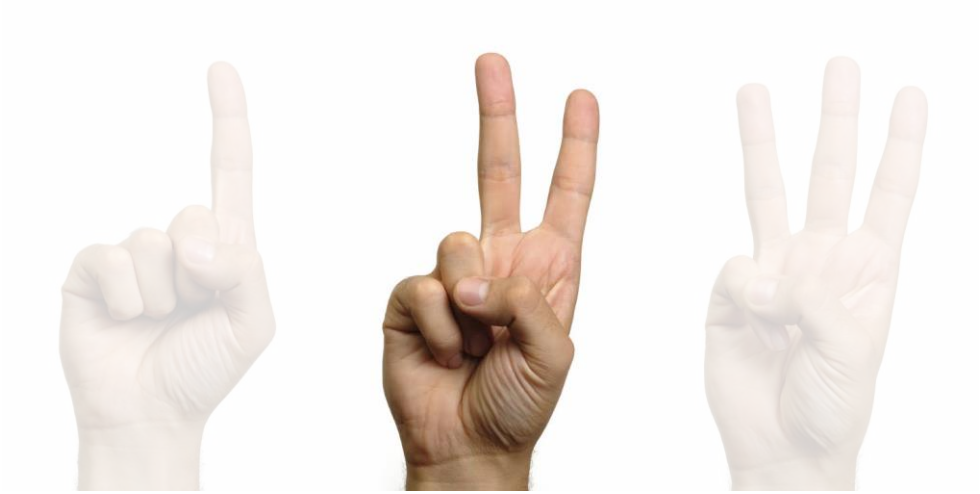
https://doi.org/10.1016/j.jhin.2018.05.008
0195-6701/



1. Introduzione
2. **RACCOMANDAZIONI**
3. Dalla letteratura

Accessible version: https://www.cdc.gov/infectioncontrol/guidelines/disinfection/

Guideline for Disinfection and Sterilization in Healthcare Facilities, 2008

Update: May 2019

William A. Rutala, Ph.D., M.P.H.[1,2], David J. Weber, M.D., M.P.H.[1,2], and the Healthcare Infection Control Practices Advisory Committee (HICPAC)[3]

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"More research is required to clarify the effectiveness and reliability of fogging, UV irradiation, and ozone mists to reduce norovirus environmental contamination. (No recommendation/ unresolved issue)"

Health Protection Scotland

NHS National Services Scotland

Literature Review and Practice Recommendations: Existing and emerging technologies used for decontamination of the healthcare environment

Ultraviolet Light

HPS
NHS
2016

Version: 1.1

Date: December 2016

Review: December 2019

Conclusion

The contribution of environmental contamination in healthcare settings to the cross-transmission of nosocomial infections has been thoroughly demonstrated: firstly, by interventional studies in which improved surface cleaning has reduced the incidence of HAIs;[1] and secondly, by observational studies which have evidenced the higher risk of pathogen acquisition in patients admitted to rooms where the prior occupant was known to be infected or colonised.[2] Ultraviolet (UV) light decontamination systems provide an example of a novel technology that may supplement standard cleaning practices and potentially further reduce the transmission of nosocomial pathogens. This review aimed to provide a concise evidence summary outlining: the evidence of effectiveness for, the practical and safety considerations of, and the costs associated with, the use of UV light

Sistemi di decontaminazione a UV sono esempio di nuova tecnologia che può integrare SCP e potenzialmente ridurre la trasmissione nosocomiale dei patogeni

The review found that there was a larger quantity of evidence supporting the use of pulsed-xenon ultraviolet (PX-UV) light systems than ultraviolet-C (UV-C) light systems, although this evidence was of low- to moderate-quality. Seven of the studies demonstrated that using UV light systems after standard cleaning was more effective than standard cleaning alone. Two of the studies showed tha
s
often lacke
interventior
always reflect current best practice recommended for use in NHSScotland.

Più prove per PX-UV che per UV-C, benché di bassa-moderata qualità

To achieve maximal efficacy, it is suggested that UV light devices should be utilised in multiple locations within a room and that manual cleaning should be completed prior to operation. To ensure staff and patient safety, it is recommended that all personnel should be cleared from the room before use and that the room should be closed to entry for the duration. The use of UV light

Per massimizzarne

- l'**efficacia**: usare il dispositivo in più sedi della stanza e solo dopo pulizia manuale
- **sicurezza**: nessuno in stanza e porta chiusa

The Rapid Review Panel (RRP) has evaluated five UV-C light disinfection systems, which have all been assigned a recommendation grade of either 4, 4a or 4b. These classifications advise that the product has the potential to be useful, but that insufficient evidence has been presented to advocate its use within the NHS. No PX-UV light disinfection systems have been reviewed by the RRP. If NHS Boards wish to adopt UV light decontamination systems, they must be aware if the s

Sistemi **UV-C**: utilità potenziale, ma prove insufficienti per raccomandarne l'uso

Nessuna revisione per sistemi **PX-UV**

Health Quality Ontario

ONTARIO HEALTH TECHNOLOGY ASSESSMENT SERIES

Portable Ultraviolet Light Surface-Disinfecting Devices for Prevention of Hospital-Acquired Infections: A Health Technology Assessment

HTA su apparecchi a UV e prevenzione delle ICA

HQO

Published February 2018
Volume 18, Number 1

2018

Ontario
Health Quality Ontario

CONCLUSIONS OF THIS HEALTH TECHNOLOGY ASSESSMENT

On the basis of very low to low quality of evidence, we are uncertain whether the use of portable ultraviolet light (UV) disinfecting devices as an adjunct to standard hospital cleaning and disinfection further reduces hospital-acquired infections.

Evidence di qualità
da bassa a molto bassa:
incertezza sull'uso di UV come
complemento della sanificazione
standard per la riduzione delle ICA

Public Health Ontario | Santé publique Ontario

Best Practices for Environmental Cleaning for Prevention and Control of Infections in All Health Care Settings, 3rd Edition

Best Practices for Environmental Cleaning for Prevention and Control of Infections in All Health Care Settings, 3rd Edition

April 2018

PIDAC Provincial Infectious Diseases Advisory Committee
Infection Prevention and Control

PHO 2018

Raggi UV

- Moro

8. New and Evolving Technologies for Environmental Cleaning

8.1 Background

Uso di tecnologia *no-touch* NON sostituisce pulizia manuale delle superfici

There is insufficient evidence to recommend for or against the use of hydrogen peroxide vapour or ultraviolet disinfection technologies for room or ward disinfection following manual cleaning and disinfection.

Prove insufficienti per vapori di H2O2 e **UV**

The use of no-touch disinfection systems does not replace the need for routine manual cleaning of environmental surfaces.

Progetto linea guida sulla sanificazione ambientale per la gestione del rischio clinico ed il contenimento delle infezioni correlate all'assistenza

Ottobre 2017

Autori: GF. Finzi, L. Lanzoni, C. Sid[illegible]

Indice

Nessun riferimento a raggi UV

ANMDO 2017

LINEE GUIDA PER LA VALUTAZIONE DEL PROCESSO DI SANIFICAZIONE AMBIENTALE NELLE STRUTTURE OSPEDALIERE E TERRITORIALI PER IL CONTROLLO DELLE INFEZIONI CORRELATE ALL'ASSISTENZA (ICA)

ANMDO 2018

Raggi UV

COID
2016

Raggi UV

REVIEW

Dos and don'ts for hospital cleaning

Stephanie J. Dancer[a,b]

Purpose of review
More evidence is emerging on the role of cleaning and decontamination for reducing hospital-acquired infection. Timely and adequate removal of environmental pathogens leads to measurable clinical benefits for patients. This article considers studies published from 2013 examining hospital decontamination technologies and evidence for cost-effectiveness.

Recent findings
Novel biocides and cleaning products, antimicrobial coatings, monitoring practices and automated equipment are widely accessible. They do not necessarily remove all environmental pathogens, however, and most have yet to be comprehensively assessed against patient outcome. Some studies are confounded by concurrent infection control and/or antimicrobial stewardship initiatives. Few contain data on costs.

Summary
As automated dirt removal is assumed to be superior to human effort, there is a danger that traditional cleaning methods are devalued or ignored. Fear of infection encourages use of powerful disinfectants for eliminating real or imagined pathogens in hospitals without appreciating toxicity or cost benefit. Furthermore, efficacy of these agents is compromised without prior removal of organic soil. Microbiocidal activity should be compared and contrasted against physical removal of soil in standardized and controlled studies to understand how best to manage contaminated healthcare environments.

Keywords
decontamination, detergent, disinfectant, environment, hospital cleaning

INTRODUCTION

Hospital cleaning has provoked much debate on its importance in controlling healthcare-associated infection (HAI) [1,2]. Hospital pathogens survive in the hospital environment until removed through some cleaning process but the best way to achieve this remains elusive [1,3,4]. Many studies have demonstrated persistent contamination following domestic attention, including high-risk hand-touch sites beside the patient [5–9,10▪]. If a patient is admitted into a room previously occupied by a patient colonized or infected with a specific pathogen, then the new admission has an increased risk of acquiring the same organism [11–15]. Although this much needed evidence has silenced the cleaning sceptics, it has encouraged commercial interest in a wide range of decontamination strategies. These tend to be expensive, and can be disruptive to hospital routine. Some have become popular despite lack of evidence for cost benefit, prompting a request for an evidentiary hierarchy to assess clinical impact of all environmental disinfection technologies [16]. This piece summarizes a selection of new products, equipment and practices and offers comments on published evidence for environmental impact and cost effectiveness.

NOVEL DISINFECTANTS

Detergent-based cleaning might reduce surface bioburden, but will not necessarily eliminate pathogens. There are numerous examples of contaminated cleaning cloths and equipment that spread microbes across surfaces rather than removing them [17–22]. This has encouraged disinfectant use, which kills pathogens but can be expensive and environmentally unfriendly [23,24]. Products may also incite tolerance among habitually exposed pathogens, itself linked with antimicrobial resistance [25,26]. Most formulations persist unchanged

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Curr Opin Infect Dis 2016, 29:415–423
DOI:10.1097/QCO.0000000000000289

CONCLUSION

DO value traditional cleaning

DO monitor cleaners; cleaning; or what is left behind (however you like)

DO keep your cleaners in-house!

Don't prioritise hand hygiene over cleaning

NON sprecar soldi su robot o superfici antimicrobiche

Don't waste money on robots or antimicrobial paint

Don't believe everything that salesmen tell you!

NON credere a tutto quello che ti dicono i rappresentanti

1. Introduzione
2. Raccomandazioni
3. Dalla **LETTERATURA**

American Journal of Infection Control 43 (2015) 1350-3

Contents lists available at ScienceDirect

American Journal of Infection Control

Brief report

Utilization and impact of a pulsed-xenon ultraviolet room disinfection system and multidisciplinary care team on *Clostridium difficile* in a long-term acute care facility

Renee Miller RN, MSN [a], Sarah Simmons BS, MPH, DrPH [b,*], Charles Dale BA [b], Julie Stachowi

Uso e impatto di PX-UV e di un team multidisciplinare su CDI in LTCF

of studies have linked this environmental contamination to an increased risk of health care–associated infections (HAIs).[2,3] For example, a positive culture for *Clostridium difficile* from a prior room occupant has been found to put the subsequent patient at 2.35 times greater risk of acquiring the same infection.[4] Because there is no direct contact between the 2 patients, this prior room occupancy risk can is attributable to environmental acquisition.[5]

Interventions to address HAIs in long-term acute care (LTAC) facilities have posed unique challenges for infection prevention, specifically in the area of enhanced environmental hygiene. Long-term care patients have more compromised immune function than traditional acute care patients and are more likely to be

patients and asymptomatic carriers can shed pathogens onto environmental surfaces.[9] If these surfaces are not properly disinfected, infection can be spread by direct contact or cross-contamination by health care workers. This is especially relevant with *C difficile* infection, which is the leading cause of health care–associated diarrhea.[10] This issue can be compounded in LTAC facilities, where the average length of stay is close to a month, and the communal design of the facilities enhances the interaction among patients.

As a result of the well-described link between environmental contamination and HAI acquisition, health care facilities are now exploring new methods of interrupting transmission. Many of these methods are based on the multidisciplinary approaches recommended in infection prevention best practice guidelines. An additional consideration has been enhancing the effectiveness of environmental disinfection. No-touch disinfection technologies have been developed as an adjunct to manual cleaning practices. The goal of these devices is to complete disinfection of surfaces that

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Conflicts of interest: Authors Simmons, Dale, Stibich, and Stachowiak are employees and shareholders of Xenex Disinfection Services, LLC.

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AJIC 2015

Raggi UV

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Pp. 666–671
DOI: 10.1089/pho.2017.4298

Original Research

Manual Operated Ultraviolet Surface
Decontamination for Healthcare Environments

Manual Operated Ultraviolet Surface Decontamination for Healthcare Environments

Thaila Quatrini Corrêa, MSc,[1,2] Kate Cristina Blanco, PhD,[2] Natalia Mayumi Inada, PhD,[2]
Maisa de Fátima Hortenci, BSc,[3] Angela Aparecida Costa, MSc,[3] Evaine da Silveira Silva, BSc,[3]
Patricia Pereira da Costa Gimenes, BSc,[3] Soraya Pompeu, BSc,[3] Raphael Luiz de Holanda e Silva, MSc,[3]

Sanificazione con UV manuale in ambiente sanitario

Keywords: UV-C light, surface decontamination, microorganisms, healthcare environments

Introduction

HOSPITAL INFECTION IS a serious problem arising mainly due to poor working conditions and the lack of cleaning procedures in surfaces and instruments. Public hospitals are the most affected places. Although the hospital environment is not the primary factor in the infection transmission, it can be considered a potential reservoir of harmful multidrug-resistant microorganisms. The rise of antimicrobial resistance can lead to an increase in mortality associated with hospital infections.[1]

The lack of conditions for health assistance to the population and the inadequate cleaning procedures of hospital surfaces accent the dissemination of potentially pathogenic microorganisms, allowing the occurrence of contamination. The possibility of failures in the hygiene of health professionals and processes of material sterilization are factors that contribute to inefficiency of infection control in general healthcare environments.[2–4]

According to ANVISA (National Agency of Health Surveillance) in Brazil, the environmental contamination by bacteria, fungi, and viruses is a substantial safety risk to patients and professionals. The surface decontamination is a primary and obligatory element to assure the security of patients and health professionals. Such procedures act directly in prevention and control of infections, reducing the high

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IJIC 2016

American Journal of Infection Control 44 (2016) 299-303

Contents lists available at ScienceDirect

American Journal of Infection Control

journal homepage: www.ajicjournal.org

Major article

Impact of pulsed xenon ultraviolet light on hospital-acquired infection rates in a community hospital

Pedro G. Vianna DrPh [a], Charles R. Dale Jr [b], Sarah Simmons DrPh [b,*], Mark Stibich PhD,

Impatto di PX-UV sui tassi di ICA in un ospedale

Conclusion: Implementation of pulsed xenon ultraviolet disinfection is associated with significant decreases in facility-wide and ICU infection rates. These outcomes suggest that enhanced environmental disinfection plays a role in the risk mitigation of hospital-acquired infections.

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Conflicts of interest: As employees of Xenex Disinfection Services, LLC, C.R.D., S.S., and M.S. identify both financial and intellectual competing interests. P.G.V. and C.M.L. have not identified a competing interest regarding the study beyond working for the institution in which this study took place at (South Seminole Hospital, Orlando Health).

Author contributions: All authors made an effective contribution to this article. P.G.V. and C.M.L. implemented the intervention, collected data during the intervention period, and contributed to manuscript preparation. C.R.D., S.S., and M.S. all participated in statistical analysis and contributed to the manuscript. All authors read and approved the final manuscript.

BACKGROUND

The Centers for Disease Control and Prevention estimated a national burden of 722,000 hospital-acquired infections (HAIs) occurring within acute care hospitals in 2011.[1] This estimation is house-wide, with over half of these infections occurring outside of the intensive care unit (ICU). Approximately 4% of all patients that are admitted will contract at least 1 HAI. Because >70% of gastrointestinal infections were caused by *Clostridium difficile*, the Centers for Disease Control and Prevention have recently changed their focus to understanding the factors that may contribute to HAIs beyond

0196-6553/
http://dx.doi.org/10.1016/j.ajic.2015.10.009

AJIC 2016

Raggi UV

International Journal of Infection Control
www.ijic.info ISSN 1996-9783
SHORT REPORT

Analyzing the process of implementing pulsed-xenon ultraviolet light for environmental disinfection

Analisi del processo di applicazione della sanificazione con PX-UV

Orlando, Florida, May 2015

Key words: Ultraviolet light; Xenon; Infection control; Clostridium difficile; Human factors engineering

Introduction

Many system level factors impact whether an intervention is successfully implemented.[1,2] Human factors engineering principles can help to identify and manage complex interactions among technology, health care workers and health care systems in infection prevention and control practice.[3,4]

The Systems Engineering Initiatives for Patient Safety (SEIPS) model is an innovative human factors engineering approach that allows us to understand structures, processes and outcomes, and how they interact in health care.[5] The SEIPS model focuses on five interacting elements of the work system and how they interact to affect processes and the resulting patient and organizational outcomes.

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American Journal of Infection Control

Brief report

Influence of pulsed-xenon ultraviolet light-based environmental disinfection on surgical site infections

Angela Catalanotti BSN, RN [a], Dudley Abbe BA [b], Sarah Simmons MPH, DrPH [c], Mark S

Influenza di PX-UV sulle ISC

AJIC 2016

contaminated after standard disinfection practices. Approximately 50% of surfaces are not adequately disinfected during between-case or terminal cleaning, and can harbor pathogenic organisms such as *Pseudomonas* spp, *Acinetobacter* spp, and *Klebsiella* spp.[1,2] If these surfaces are not appropriately disinfected, the residual pathogens can cause the environmental surfaces to be a reservoir for pathogens.[3] We sought to determine whether increased environmental disinfection in the OR would have an influence on surgical site infection (SSI) rates.

Recent advances in environmental disinfection have yielded "no touch" disinfection systems that use ultraviolet (UV) light to reduce residual microbial contamination in patient environments after manual cleaning. We investigated the use of pulsed-xenon UV (PX-UV) (Xenex Disinfection Services, San Antonio, TX). The PX-UV system uses intense, broad-spectrum pulses of germicidal UV to disinfect surfaces.[4] The use of PX-UV disinfection has been reported to have reduced the hospital-acquired infection rates of *Clostridium difficile*, methicillin-resistant *Staphylococcus aureus*, and multidrug-resistant organisms within the acute care setting by 57%, 53%, and 20%, respectively.[5] Recent international OR consensus guidelines suggest that the use of portable UV disinfection systems should be considered as an adjunct to traditional cleaning practices.[6] New research to preventing SSIs has been effective in reducing orthopedic SSI rates.[7]

The influence of UV disinfection on SSIs is likely to be correlated with the characteristics of the surgical case, primarily the prior contamination risk associated with the procedure.[8] A measure for this contamination risk is the wound classification assigned post-operatively. Surgical wounds are divided into 4 classes: I = clean, II = clean-contaminated, III = contaminated, and IV = dirty-infected. The influence of UV disinfection would be expected to decrease as wound class increases, due to the pre-existing intrinsic contamination present during surgery. To control for the influence of wound class, the data were stratified in this study by wound class before analysis.

METHODS

This study was conducted at an independent, not-for-profit community hospital in the northeastern United States that has more than 200 beds and 13 ORs. Institutional review board exemption was obtained. The analysis compares a baseline period that involved standard terminal cleaning and disinfection of the ORs to an intervention period during which an enhanced disinfection method using a PX-UV room disinfection system as well as dedicated personnel for terminal cleaning was implemented.

During the baseline period (January 2012-March 2013), OR staff performed thorough terminal disinfection of the ORs nightly as well as standard between-case cleaning. The OR staff received on-the-job training regarding appropriate techniques for disinfection of the

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Conflicts of Interest: DA is an employee of Sodexo. SS and MS are employees and shareholders in Xenex Disinfection Services.

http://dx.doi.org/10.1016/j.ajic.2015.12.018

CURRENT OPINION

'No touch' technologies for environmental decontamination: focus on ultraviolet devices and hydrogen peroxide systems

Tecnologie "no touch" per la sanificazione ambientale: focus su **UV** & H2O2

COID 2016

INTRODUCTION

Healthcare-associated infections (HAIs) remain an important source of patient morbidity and mortality. Based on a large sample of U.S. acute care hospitals, ~4% of patients on any given day has at least one HAI [1]. Based on this study, it was estimated that 722 000 HAIs occurred in 2011 in U.S. acute care hospitals which resulted in ~75 000 deaths. The total annual costs for the five major HAIs have been estimated to be $9.8 billion (2012 US dollars) [2]. Dr Weinstein estimated that the source of pathogens causing an HAI in the intensive care unit was the patients' endogenous flora, 40–60%; cross-infection via the hands of healthcare personnel (HCP), 20–40%; antibiotic-driven changes in flora, 20–25%; and other (including contamination of the environment), 20% [3]. Further, contamination of the hands of HCP could result directly from patient contact or indirectly from touching contaminated environmental surfaces [4]. It has been shown that the gloves or hands of HCP are just as likely to become contaminated from touching a patient as touching an environmental surface in a patient's room [5,6].

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Raggi UV

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Kovach et al. BMC Infectious Diseases (2017) 17:186
DOI 10.1186/s12879-017-2275-2

BMC Infectious Diseases

RESEARCH ARTICLE Open Access

Evaluation of an ultraviolet room

Evaluation of an ultraviolet room disinfection protocol to decrease nursing home microbial burden, infection and hospitalization rates

Valutazione di un protocollo con UV-C per ridurre carica microbica, infezioni e tassi di ricovero

in long-term care facilities may decrease nursing home acquired infections.

Keywords: Nursing home, Long-term care, Infection, Pneumonia, Prevention, Environment

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American Journal of Infection Control

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Major Article

Effect of automated ultraviolet C–emitting device on decontamination of hosp… termi…

Katie P…

Impatto clinico, operativo ed economico di disinfezione terminale con UV-C

BACKGROUND

Hospital environment has gained importance as one of the major factors in occurrence of hospital-acquired infections. Microorganisms can persist in the environment for several days to weeks.[1,2] Hospital transmission of microorganisms from prior inhabitants of a patient room to a new patient admitted to the same room via the environment is quite well known.[3-5] Hospital-acquired infections such as central line–associated bloodstream infections may occur because of persistent contamination of hospital rooms.[6] Monoclonal and polyclonal outbreaks also occur because of environmental transmission.[7-9]

Standard approaches to environmental cleaning may not be very effective in eliminating environmental contamination in hospital rooms.[2,10,11] Many adjuncts to standard methods of environmental cleaning have been described in the literature and are in market for use. One of these adjunct methods is use of ultraviolet (UV) radiation. Varieties of devices have shown efficacy in killing microorganisms in simulated experiments.[12-16] Ultraviolet C (UV-C) emitters are automated devices using UV-C (254 nm range) to decontaminate surfaces while measuring UV reflection from flat surfaces to calculate the time to deliver the programmed dose. A trained person operates the device via a remote control from outside a sealed patient's room.

To our knowledge, only 4 studies have compared the effectiveness of standard terminal disinfection alone with that when combined with UV-C disinfection in real hospital settings.[17-20] Two other studies evaluated the effectiveness of UV-C in a clinical setting

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Previous presentation: Presented as a poster at ID Week, New Orleans, LA; October 27, 2016.
Conflicts of interest: None to report.

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Raggi UV

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American Journal of Infection Control 46 (2018) 1003-8

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American Journal of Infection Control

Major Article

Environmental effectiveness of pulsed-xenon light in the operating room

Sarah Simmo
Deborah G. Pa

Efficacia ambientale di PX-UV in sala operatoria

that number decreased to 38% of all sampled surfaces—a 44% reduction. When comparing manual cleaning to PX-UV, the reduction in CFU count was statistically significant.

Conclusion: When used after the manual cleaning process, the PX-UV device significantly reduced contamination on high-touch surfaces in the OR.

BACKGROUND

Current literature demonstrates that manual cleaning and disinfection of the operating room (OR) environment may be inadequate.[1] Human error inherent in the manual cleaning process results in only half of the surfaces in the OR environment being disinfected throughout the day, with the remaining surfaces having persistent contamination with pathogenic organisms. In the inpatient environment, these residual pathogens have the potential to increase the risk of infection transmission from contaminated surfaces to patients who inhabit the room during their hospital stay.[2,3] In fact, the direct relationship between surfaces contaminated with pathogens and increased risk for infection acquisition has been repeatedly demonstrated in the inpatient environment.[4-6] Similar evidence of this relationship is emerging for ORs.

A review of literature demonstrates that possible residual contamination in ORs may contribute to surgical site infections (SSIs), which are one of the most prevalent hospital-acquired infections (HAIs), representing 22% of all HAIs.[7,8] There is evidence that the environment plays a role in the transmission of SSIs.[9] Figure 1 shows a proposed mechanism for how pathogens move from contaminated surfaces to the patient or the sterile field, leading to the development of an infection. In essence, residual contamination left on surfaces across the OR after manual cleaning can be disturbed and aerosolized by movements of staff members or equipment prior to or during the surgical procedure.[11] These aerosolized particles can then settle onto sterile instruments or the sterile field, onto high-touch surfaces leading to hand contamination, or into the surgical wound itself. Even small movements, such as the surgeon bending at the waist, have been shown to significantly increase the level of aerosolized particles contaminating the sterile surgical field.[12] The recommended number of air exchanges per hour (>15) in the OR may be inadequate to capture all aerosolized organisms efficiently. A recent study of SSI risk factors found that settle plates placed in an undisturbed OR overnight produced 15 CFU/ft^2 per hour, but the CFU levels drastically increased to 300-400 CFU/ft^2 per hour when OR personnel were present.[13] Edmiston et al. found that air samples

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Raggi UV

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American Journal of Infection Control

Major Article

Clinical, operational, and financial impact of an ultraviolet-C terminal disinfection intervention at a community hospital

Robert R
Weimi

Impatto clinico, operativo ed economico di disinfezione terminale con UV-C

Conclusions: The UV-C disinfection intervention was associated with a statistically significant facility-wide reduction of multidrug-resistant HAIs and generated substantial direct cost savings without adversely impacting hospital operations.

Hospital-acquired infections (HAIs) are highly associated with increased mortality, morbidity, length of inpatient stay, and associated cost.[1-3] HAIs may be caught during routine inpatient acute care, and many are preventable. An estimated 722,000 infections are caught by hospital inpatients each year in the United States, of which approximately 75,000 die during hospitalization.[4] In addition, hospitals' inpatient cost of care attributable to HAIs is often not reimbursed, which significantly increases the financial burden to hospitals.[4,5] New methods to reduce HAIs are needed.[6]

A previous study estimated that approximately 20%-40% of HAIs come from exogenous sources (eg, patient environment, hands of health care workers),[7] and subsequent research shows the hospital environment plays a role in the intrahospital transmission of numerous HAI-causing multidrug-resistant organisms (MDROs).[8] MDROs can survive on inanimate surfaces for days to months, are incompletely removed during terminal disinfection, and contaminate mobile clinical equipment and the hands of health care providers.[8-10] Direct evidence of horizontal MDRO transmission is summarized in a meta-analysis wherein 6 multidrug-resistant bacterial species, including *Acinetobacter baumannii*, *Klebsiella pneumoniae*, methicillin-resistant *Staphylococcus aureus* (MRSA),

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Conflicts of interest: R.R. reports to being an officer and employee of PHCMC. K.A. reports to being an employee of PHCMC. C.W.H. is an employee and stakeholder of CSGI. W.T. received funding from Clean Sweep Group Inc. W.T.'s sole responsibility is statistical analysis of epidemiology data from the PHCMC pilot study. He is not a shareholder, officer, or full-time employee of Clean Sweep Group Inc or PHCMC.

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Raggi UV

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American Journal of Infection Control

Letters to the Editor

Shining a light on ultraviolet-C disinfection: No golden promises for infection prevention

AJIC 2018

ted time series. This study
year before and 1 year after
the main results are based
before and after the inter-
plication is profoundly dis-
tement.[2] Application of a
e taken into account trends
n and established whether
ct.[3] The rates in months 6
are worthy of comment.
m, including rates on HAIs
gens that are mostly endog-
omparisons.[3] Not all patho-
hospital environment.[4,5]
nsively assess a UV-C disin-
ld have reported key pro-
tcome measures. However,
fection prevention and con-
nt-nurse ratios. It is also
infected over time. Clinical
l, and it would have been
e patient population with
ven though the laboratory
tile,"[1] it would have been
tially the number of cases
re-and-after study periods.
ighly effective against *C dif-*
authors could supply their
data on C difficile ribotype comparison. In the text, the authors also stated that inpatient device usage ratios were lower in the intervention period, but the rates throughout the study were not supplied, and the analysis was not adjusted for this major confounder. Overall, this makes it difficult to disentangle the effect of confounders and the true effect of the intervention.

The article focused on the effect on the overall incidence of HAI caused by 5 prespecified MDR organisms at 6 body sites. Their Tables 3 and 4 show that most of the reduction was actually owing to a decrease in the number of positive nares after the start of the intervention. Their Table 4 shows that the most relevant HAI, based on positive blood cultures, actually increased by 72% in the postintervention period. Although this finding was not statistically significant owing to small numbers, the authors did not discuss this important finding.

Although the authors mentioned several important limitations in their discussion section, most of these could have easily been prevented in this purposely designed study. This raises the question of whether this could be considered a marketing trial[7]; the conflicts of interest statement indicates that one author is an employee of, and another author received funding from, Clean Sweep Group Inc, the company selling UVC equipment. The community hospital was reported as providing study funding. The main outcome was cost

blood, body fluid, nares, sputum, urine, and wounds. It is unclear how it was determined whether HAI increased the length of stay. Single patients could have had multiple HAIs if multiple body sites were positive. How did the authors know which positive sample was responsible for an increased length of stay? Moreover, how did colonized nares increase the length of stay? Although positive blood cultures are most likely to indicate infection, culture-positive body fluids, sputum, or urine are less so, and positive nares almost never represent an infection. How can simple carriage events contribute to the incidence of HAI? This study did not evaluate HAI but rather colonization, which is an important difference and does not have the same implications.

Furthermore, no information was provided on the MDR screening policy and its implementation, such as the proportion of patients who were screened before and after intervention, who was responsible for the screening, or whether the personnel involved were blinded for the intervention. Indeed, the nares infection rates showed the largest reduction, which could be attributed to a change in screening protocol or frequency.

The gold standard for evaluating an intervention in a clinical setting is a (cluster) randomized clinical trial; however, this is often complicated or unethical in a real-life setting. A more feasible design

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Journal of Hospital Infection

journal homepage: www.elsevier.com/locate/jhin

Short report

Ultraviolet-C decontamination of hand-held tablet devices in the healthcare environment using the Codonics D6000™ disinfection system☆

M. Muzslay [a,*],

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[b] Clinical Microbiology

Sanificazione con UV-C di tablet sanitari

JHI 2018

Introduction

The use of mobile phones and tablet computers has become widespread both in public places and in the clinical environment. Tablets are increasingly used for electronic patient and observation records, often without hand hygiene between patient and device. These hand-held devices may be contaminated with micro-organisms and be a potential source for transmission of pathogens between healthcare workers (HCWs) and patients.

Bacteria may survive for months on inanimate surfaces [1]. The majority of HCWs' mobile phones are never cleaned. Ulger *et al.* demonstrated low rate of compliance (10.5%) with cleaning mobile phones in a healthcare setting [2].

There is no generally accepted guidance on how to reduce contamination on mobile devices in hospitals. Manufacturers (e.g. Apple, Inc.) recommend cleaning of their tablet devices and phone displays with only a soft, lint-free cloth, avoiding aerosol sprays, solvents, or abrasives [3]. In a study by Albrecht *et al.*, 47.9% of the initial bacterial contamination remained on a tablet personal computer (iPad®) after following the manufacturer's instructions to clean tablet devices [4].

☆ The project was presented as a poster at the Federation of Infection Societies Annual Conference and the 10th Healthcare Infection Society International Conference, Edinburgh, UK, November 2016.

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Raggi UV

Moro

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Major Article

A trial of pulsed xenon ultraviolet disinfection to reduce *Clostridioides difficile* infection

Priya Sampathkumar MD [a,*], Carla Folkert MBA [b], Jean E. Barth MPH, RN, CIC [b], Larry Nation MA [b], Michel Benz MSN, RN [c], Allison Hesse MS, RN, Catherine L. Mielke MS, APRN, Kathryn W. Zavaleta MHSA

Disinfezione con PX-V riduce le infezioni da *C. diff.*

AJIC 2019

The Mayo Clinic is a large tertiary care hospital in the upper Midwest with 2,059 licensed beds, an average of 50,000 admissions, and 330,000 patient days annually. The hospital-wide health care–associated *Clostridium difficile* infection (CDI) rate in 2014 was 9.23 per 10,000 patient days. The rate was up to 5 times higher in some units, including the hematology and bone marrow transplant (BMT) units. *C difficile* spores are resistant to routine cleaning agents,[1] and additional cleaning methods may help reduce environmental contamination and transmission of CDI in hospitals. Bleach cleaning had been implemented as a CDI reduction measure, but CDI rates remained high.

METHODS

As part of a quality improvement project aimed at reducing CDI rates, an intervention was designed to test whether the addition of an ultraviolet (UV) disinfection step after terminal cleaning would be helpful in reducing CDI rates in a real-world situation. Three units (2 hematology and BMT units and a medical-surgical unit) were designated as pilot units for the intervention, and 3 units with similar patient populations served as control units. Because of the high rates of CDI, all patient rooms on the hematology and BMT units were being cleaned with bleach daily and at terminal cleaning. PDI Sani-Cloth bleach wipes (PDI Healthcare, Orangeburg, NY) were used to wipe surfaces. After the wet contact time of 4 minutes, surfaces were rewiped with plain water. In the medical-surgical units, only the rooms of patients with known CDI were cleaned with bleach. The medical-surgical unit in the intervention arm had a few double rooms; all other units had only private rooms with private toilets. In the 3 units selected for the intervention, a UV disinfection step was added after patient discharge and terminal cleaning. Patient rooms received pulsed xenon UV (PX-UV) disinfection (Xenex Disinfection Services, San Antonio, TX) for a 6-month period between October 2014 and March 2015. The PX-UV device emits high-intensity broad-spectrum germicidal light of wavelength 200-300 nm at a pulsed frequency greater than 60 Hz. This UV disinfection was performed in 3 positions in 5-minute cycles after terminal cleaning and before the bed was made. Drawers and doors inside the room were left open, telephone and blood pressure cuffs were hung, television remotes were placed on the tray table, pillows were positioned on window

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American Journal of Infection Control 000 (2018) 1–7

Contents lists available at ScienceDirect

American Journal of Infection Control

journal homepage: www.ajicjournal.org

Major Article

Influence of a visible-light continuous environmental disinfection system on microbial contamination and surgical site infections in an orthopedic operating room

Influenza di un sistema di sanificazione continua con luce visibile su contaminaz. microbica e ISC in S.O. di Ortopedia

AJIC 2019

Surgical site infections (SSI) continue to place a substantial burden on the US health care system.[1] They are among the most common health care–associated infections, accounting for a major source of perioperative morbidity, prolonged hospitalizations, and health care expenditures.[1-3] This is particularly true for SSIs involving an implant, such as periprosthetic joint infections (PJI), which have been associated with a cost of $389,307-$474,004 per infection, a mortality rate of 2%-7%, and a 5-year survival rate— that is worse than many cancers.[4-6]

Traditional stratification of SSI risk begins with the patient's own microbiome, followed by perioperative practice variables including surgical technique, attire and instrument sterility, and operating room (OR) environment.[7] The latter, however, is increasingly recognized as a potentially significant reservoir for pathogens. Multiple studies have demonstrated the presence of organisms commonly associated with SSIs in the air and on surfaces within the OR, despite regular manual cleaning,[8-11] underscoring the idea that many traditional manual disinfection and decontamination protocols are suboptimal in achieving a truly "clean" OR environment.[11-15] Residual contamination can pose an infection risk via the complex interplay of surface and air dynamics in an occupied OR. Staff and equipment movement can disturb residual organisms and particulates on surfaces leading to their aerosolization and potential settling onto high-touch surfaces, sterile equipment, and into the surgical wound.[15-19]

The present study was a 2-pronged investigation to assess the efficacy of a visible-light continuous environmental disinfection (CED) system in (1) reducing bacterial contamination on surfaces within an orthopedic OR, and (2) impacting SSI rates for procedures performed

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Conflicts of interest: None to report.

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Raggi UV

oro

1. Introduzione
2. Raccomandazioni
3. Dalla letteratura

Take Home Messages

I raggi UV:

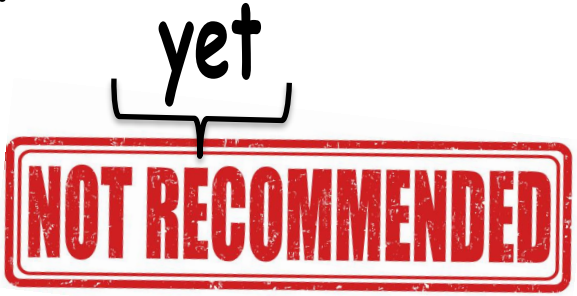
1. riducono la contaminaz. ambientale di patogeni ?

ma …

2. riducono le ICA ?

3. *cost-effectiveness* ?

4. quindi "s'hanno da fare" ?



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Practice Forum

A model for choosing an automated ultraviolet-C disinfection system and building a case for the C-suite: Two case reports

Maureen Spencer RN, MEd, CIC [a], Michelle Vignari RN, CIC [b], Elizabeth Bryce MD [c], Helen Boehm Johnson MD [d,*], Loretta Fauerbach MS, CIC [e], Denise Graham BS [f]

Practice Forum

A model for choosing an automated ultraviolet-C disinfection system and building a case for the C-suite: Two case reports

Maureen Spencer RN, MEd, CIC [a], Michelle Vignari RN, CIC [b], Elizabeth Bryce MD [c], Helen Boehm Johnson MD [d,*], Loretta Fauerbach MS, CIC [e], Denise Graham BS [f]

Environmental disinfection has become the new frontier in the ongoing battle to reduce the risk of health care–associated infections (HAIs). Evidence demonstrating the persistent contamination of environmental surfaces despite traditional cleaning and disinfection methods has led to the widespread acceptance that there is both a need for reassessing traditional cleaning protocols and for using secondary disinfection technologies.[1-10] Research has shown that as many as 50% of surfaces remain contaminated with pathogens, including multidrug-resistant organisms such as methicillin-resistant *Staphylococcus aureus* (MRSA), despite regular manual cleaning efforts.[2] Additionally, it has become clear that there are multiple reservoirs for these pathogens within the health care setting, from portable blood pressure monitors to intravenous stopcocks, that are not adequately disinfected even with enhanced manual cleaning protocols.[3,4,11] Ultraviolet-C (UV-C) disinfection is one type of no-touch technology shown to be a successful adjunct to manual cleaning in reducing environmental bioburden.[12-18] The dilemma for the infection preventionist, however, is how to choose the system best suited for their facility among the many UV-C surface disinfection delivery systems available and how to build a case for acquisition to present to the hospital administration/C-suite.[19,20] This article proposes an approach to these dilemmas based in part on the experience of 2 health care networks.

BACKGROUND

The literature is replete with evidence documenting the persistence of pathogens on environmental surfaces, manual cleaning efforts notwithstanding.[1-10,21-23] The ability of many pathogens to survive for extended periods of time on inanimate surfaces contributes to this problem,[23] but the inadequacy of cleaning protocols and lack of consistency with protocol implementation are clearly important factors.[1,2] The challenge is that the environmental service (EVS) worker must cover all surfaces and allow sufficient contact time of the cleaner or disinfectant per the manufacturer's recommendations. Concerns about poor staff compliance with cleaning protocols and the recognition that pathogens can be spread by means other than direct contact, including through aerial dissemination, have further highlighted the need to supplement manual cleaning

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Review

Four steps to clean hospitals: LOOK, PLAN, CLEAN and DRY

S.J. Dancer [a, b, *], A. Kramer [c]

Received 20 November 2018

4 passi per pulire gli ospedali: osserva – pianifica – pulisci –lascia asciugare e riordina

JHI 2019

outbreaks, in addition to heightened confidence in overall quality of care.

Introduction

Hospital cleaning has assumed more importance with the realization that pathogens survive in the healthcare environment, and contribute towards the risk of healthcare-associated infection (HCAI) [1,2] The environment enables transmission of the most important healthcare-associated pathogens [3]. These pathogens can persist on surfaces for weeks, and represent a transmission risk for both patients and staff [2]. Environmental screening confirms repeated contamination of items, equipment and general sites in bedspaces and rooms of colonized or infected patients and throughout multiple clinical areas in a healthcare institution [1,3,4]. The

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