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Hospital Cleaning in the 21st Century

DR. STEPHANIE J. DANCER, MEDICAL MICROBIOLOGY, HAIRMYRES HOSPITAL, UK



There is general consensus that environmental cleanliness is important for controlling infection, and there is increasing evidence to support basic cleaning in hospitals when considering hospital-acquired infections (HAIs). Finding the evidence to support cleaning as a significant factor in preventing infection has been seriously disadvantaged because there are no accepted risk-based standards to verify whether a hospital is truly clean and safe. Visual inspection of the hospital environment does not provide a reliable qualitative nor quantitative assessment of the infection risk for patients - microbes are invisible and they are not necessarily associated with visual dirt. Indeed, there has been a recent surge of articles supporting the importance of cleaning, including in the paper from which this article is derived (Euro J Clin Microbiol Infect Dis. 2011 Dec;30(12):1473-81).

Pathogens survive in the hospital environment

The microbes linked with HAI have two special properties. Not only do they cause disease, but they survive in the hospital environment for weeks. Examples include methicillin-resistant *Staphylococcus aureus* (MRSA), *Clostridium difficile*, Acinetobacter, and vancomycin-resistant enterococci

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No financial support has been provided by Virox Technologies Inc. to authors of articles included in this newsletter.

Virox Tradeshow Schedule

February

February 15 - 3rd Annual CHICA-TPIC-RICN Infection Prevention and Control Education Day

February 23 - Ryerson University Symposium - Progress in Hygiene Science and Public Health - Sponsored by: Virox Technologies Inc. and Stanier Institute, Ottawa

April

April 19-20 - PICNet 2012 Educational Conference

May

May 14 -16 - AIPI - Association of Nurses in Infection Prevention

June

June 4-6 - APIC Infection Prevention: Improving Outcomes, Saving Lives 2012

June 7 - CHICA-HANDIC Education Day

June 16-21 - CHICA Canada - National Education Conference "Growing for the Future"

GREEN TEAM UPDATES

Winter is here and it is the first Green Team Update of 2012. We are extremely proud of our accomplishments in 2011. Through our new "Label Recycling Program" (the label backings and corrugate cores are recycled into plastic decking), we were able to divert over 26,455lbs from landfills! Our corrugate recycling program (includes the recycling and reusing of our cardboard boxes) diverted an additional 53,000lbs also from landfill and reduced our carbon footprint.

As part of our LEED Certification, Virox has also completed several projects in 2011, and we are excited to see the impact that it will have on our energy consumption, water consumption, and indoor air quality in 2012. (1) We have undergone a full lighting retrofit within our production and warehouse areas, replacing all the old fixtures with energy efficient fluorescent lights that will also improve the lighting levels dramatically while reducing our energy consumption. (2) We have also undergone a plumbing refit to ensure all of our toilets and faucets are low-flow options that will reduce our water consumption. (3) The Virox HVAC system has been refitted which will not only improve performance, reduce energy consumption for heating and cooling, but will also improve the comfort of our employees.

Winter 2012 Virox Update



2012 CHICA SCHOLARSHIP

The Virox Scholarship fund celebrates its 10th year in 2012. The Virox team and our partners have contributed over \$120,000 to the fund since its inception, which has allowed 120 Infection Control Practitioners to attend the annual CHICA-Canada Conference. This year Virox Technologies will be the sole contributor to the fund and will be allocating \$20,000 to be awarded to this year's winners. The deadline close was January 31st, 2012. Good Luck to those who applied!

2012 CHICA CLEANING, DISINFECTION AND STERILIZATION SYMPOSIUM

In 2012 we will continue to support educational opportunities for the infection control community. We have again partnered with CHICA-Canada to sponsor a "Cleaning, Disinfection and Sterilization" pre-conference day on Monday June 18th at the Saskatoon 2012

CHICA National conference. The day promises to provide the most current information on trends in environmental surface disinfection and medical device reprocessing. The breadth of subject matter is sure to lead to useful discussion on best practices and common misconceptions, and lead us to search for responses and suggestions to the challenges we face in our daily practice and research. For more information on the day please check out the CHICA-Canada website at www.chica.org

PTS TALK CLEAN TO ME BLOG

Thank you to everyone for your ongoing support of the Talk Clean to Me Blog. The Professional and Technical Services Division of Virox has taken the war against microbes to cyber space by educating the world on chemical disinfectants for infection prevention through weekly blogs. Thanks to those guest bloggers - Dr. Michael Gardam, Dr. Syed Sattar, Mark Heller, Darrel Hicks - who provided exceptional insight into the challenges that we all face when addressing cleaning and disinfection of surfaces, hands, and devices. We are proud to have over 1500 active monthly users who are concerned with clearing the haze of smoke and mirrors marketing surrounding chemical disinfectants. In 2012, we look forward to continuing our educational efforts to ensure decision makers can select the right product for the right application with the right protocol. We hope you will join us on our mission to fight the spread of pathogens and save lives! Some of upcoming blog topics for 2012 include:

Disinfectant Chemistry Report Cards – Each month a disinfectant chemistry will be reviewed and graded based on the key decision making criteria. Does your chemistry make the grade?

Unintentional Consequences of Infection Prevention – How does compatibility differ in a health-care facility verses your home?

Norovirus – Don't make it your winter weight loss program! – What is it? Who gets it? How to prevent spreading it?

Come join our conversation! www.talkcleantome.blogspot.com

The Potential Role of Classroom Hygiene in the Spread of Infectious Diseases

PROF. CHARLES GERBA, UNIVERSITY OF ARIZONA

There are approximately 164 million lost school days each year in the United States among students in kindergarten through 12th grade, with a yearly average of 4.5 days absent per student due to bacterial or viral infection. In a recent study (*The Journal of School Nursing*, Nov.10, 2009) we explored the survival of bacteria and viruses on environmental surfaces (fomites) in a classroom setting. We also sought to discover how proper classroom environmental hygiene such as the use of disinfectant wipes on desks and other surfaces may reduce the transfer of pathogens between fomites and the hands of children and thereby reduce the spread of diseases.

The transfer of bacteria and viruses from fomites to hands and from hands to fomites has been demonstrated in numerous studies. Nevertheless, the contribution of such microbial transfer to the spread of diseases is unclear. In one study, 46% of day care center surfaces tested positive for human biochemical markers (hemoglobin, urea, amylase) and 65% tested positive for protein levels greater than 200 mg/ml, suggesting contamination by blood, mucus, sweat, saliva, or urine. Rotavirus has been found on 16% to 30% of surfaces in day care centers. In a study by Gwaltney and Hendley, over 50% of individuals became ill after handling coffee cup handles and other objects that had been contaminated with rhinovirus, strongly suggesting transmission via fomites.

The Study

This study was not meant to be an epidemiological study. Heterotrophic bacterial plate counts were included as a general indicator of microbiological quality of an environmental surface to identify the areas in the classroom most likely to become contaminated by microorganisms. Norovirus and influenza A virus were included as indicators of the potential for spread of gastrointestinal and respiratory viruses via classroom fomites.

In a period between January 26 and March 15, six elementary school classrooms (with a total of 148 students) from one school in the Seattle area were included in the study. Disinfectant wipes were used daily to clean surfaces in a set of intervention classrooms. In addition, student illness and absenteeism records were kept to determine the impact of the use of the wipes. The teachers were given a list of symptoms (e.g., coughing, sneezing, fever, headache, sinus problems, sore throat, vomiting, abdominal pain, diarrhea) to ask about to guide the interviews of



students when they returned to the classroom following an absence due to illness.

There were three control classrooms including Grades 5, 1, and 4, respectively. The children's age range was 6–11 years old across the grades. The control classrooms did not receive any disinfectant wipe intervention. Three classrooms including Grades 5, 1, and a mixture of 3 and 4, respectively, were included as intervention classrooms. Adult parent volunteers wiped all of the test surfaces with disinfectant wipes in the morning each weekday prior to the arrival of the students. Although the teachers were aware of the intervention or the lack thereof, the students in the intervention classrooms were unaware of the disinfectant wipes being used in their classroom.

Results

The water fountain toggle and the manual pencil sharpener handle are used by numerous students throughout the day and were found to be the two most bacterially contaminated

classroom surfaces in this study. The sink faucet handle and the paper towel dispenser lever are likewise used by multiple students and were also among the most contaminated classroom surfaces.

Sink faucet handles, paper towel dispenser levers, and student desktops were the surfaces most often contaminated by influenza A virus; however, most desks are used by only an individual student. Norovirus was detected on these fomites as well.

Classrooms undergoing daily intervention with disinfectant wipes were found to have a statistically significant reduction in student absenteeism due to illness.

The results of this study suggest that proper classroom environmental hygiene such as the use of disinfectant wipes may also reduce the transfer of pathogenic bacteria and viruses between fomites and the hands of children and thereby reduce the spread of diseases. This preliminary work emphasizes the need for further epidemiological studies using more classrooms and greater numbers of students to determine the potentially important role of microbial contamination, particularly that by viruses, of classroom fomites in the transfer and spread of infectious diseases and how this relates to student absenteeism rates.

The Virox team has been pleased to support Teleclass Education since its launch in 2001. This educational initiative reaches healthcare professionals in at least 180 countries around the globe, making it the single most widely accessed infection prevention and control education program worldwide. The fact that it is run entirely by volunteers makes it doubly impressive. Sharing infection control information is at the core of what we do here at Virox Technologies, and we encourage everyone to take advantage of this remarkable opportunity.

2012 Teleclass Education Lecture Series

Syed A. Sattar, PhD^a, and Paul Webber^b; University of Ottawa Faculty of Medicine^a; Webber Training Inc.^b

Teleclass Education is a telephone-based, internet-supported lecture series, run entirely by volunteers around the world. Registration fee is \$40 per teleclass per site - many teleclasses are free-registration. Participants from developing nations are entitled to full access without charge. For more information on registrations, refer to www.webbertraining.com or info@webbertraining.com.

January

- 19 - *Optimizing Environmental Hygiene: The Key to C. difficile Control*, Phillip Carling
- 26 - *Infection Control Strategy for Multidrug-Resistant Gram Negative Bacilli*, Satoshi Hori

February

- 2 - *The Role of Fomites in Disease Transmission in Public Environments*, Charles Gerba
- 7 - *Surgical Site Infections – Advancing the Prevention Agenda*, Judith Tanner
- 8 - *Behavioural Change in Infection Prevention and Control*, Andreas Voss
- 14 - *Outbreaks of Vaccine Preventable Diseases - Communicating the Science and Closing the Gaps*, Nikki Turner
- 23 - *The Biofilm Hypothesis of Chronic Infection*, Phillip Stewart

March

- 1 - *Developing a Sustainable and Effective Approach to Hygiene and Infection Prevention in Home and Everyday Life Settings*, Sally Bloomfield
- 7 - *Achievements in Improving Injection Safety Worldwide*, Selma Khamassi
- 22 - *Hand Hygiene: New Frontiers in Messaging and Measurement*, Katherine Ellingson
- 29 - *Water and Infection Control in Healthcare*, Andy Streifel

April

- 5 - *Standardizing Training for Environmental Cleaning in Healthcare*, Grace Volkening, Brenda Smith, Nora Boyd
- 12 - *Innate Resistance to Sporicides and Potential Failure to Decontaminate*, Jean-Yves Maillard
- 17 - *Implementing Change: The Technical & Socio-Adaptive Aspects of Preventing Catheter-Associated Urinary Tract Infection*, Sanjay Saint
- 18 - *Central Line Associated Infection in ICU: Prevention*, M.L. McLaws
- 24 - *Managing Urinary Catheters and CAUTIs*, Sharon Eustice
- 26 - *Clostridium difficile Infection: Lessons from the Quebec Experience*, Yves Longtin

May

- 3 - *Meet The Press - Tips and Techniques for Dealing with the Media*, Jim Armour
- 7 - *Keeping the Hand Hygiene Agenda Alive: Acting on Data and the Influence of Global Surveys*, Didier Pittet
- 10 - *Emerging Carbapenem Resistance: What Do We Do Now?*, Andrew Simor
- 17 - *Bug Basics - Essential Microbiology for Everyone*, Jim Gauthier
- 24 - *Healthcare Workplaces - Moving from Discord to Patient-Centered*, Irwin Rubin
- 31 - *Infection Prevention for Outpatient Settings: Minimum Expectations for Safe Care*, Melissa Schaefer

June

- 6 - *Economic Impact of Healthcare-Associated Infections in Low and Middle Income Countries*, A. Nevzat Yalcin
- 13 - *Hand Hygiene Initiatives in Australia*, Philip Russo

July

- 11 - *Patient Empowerment in Infection Control*, Claire Kilpatrick
- 19 - *Top 10 Must-Do's for the Elimination of Hospital-Associated Infections*, William Jarvis

August

- 8 - *Processing Medical Devices in Settings with Limited Resources: A Neglected Priority for Infection Prevention*, Nizam Damani

September

- 5 - *Successes and Challenges in Developing and Implementing Bundles in Infection Prevention*, Don Goldmann
- 13 - *The Hand is Quicker Than a Sneeze in the Spread of Disease*, Charles Gerba
- 20 - *Inspiring Mature Minds - Adult Education in Infection Prevention and Control*, Barbara Catt

October

- 2 - *The Role of Education in Low and Middle Income Countries*, Shaheen Mehtar
- 18 - *Meningococcal Disease and the New Zealand Experience - Where to From Here*, Tony Walls
- 25 - *Sharpening Skills of the Infection Preventionist in the Critique and Use of the Scientific Evidence*, Russell Olmstead
- 30 - *Reduce, Reuse, Recycle – Implications for Infection Prevention and Control*, Andrew Nichols

November

- 1 - *Current Trends and Infection Prevention Issues in Healthcare Laundry*, Lynne Schulster
- 7 - *Measuring Impact: Key to Infection Control Scaling Up and Sustainability*, Jacquie Reilly
- 8 - *Surface Disinfection and Microbial Resistance*, Markus Dettenkofer
- 15 - *Human Waste Disposal - Assessing the Risks of Differing Management Solutions and Why There is No Internationally-Accepted Standard*, Carol Pellowe

December

- 5 - *New Developments in Infection Control for Renal Dialysis - An Update*, WH Seto
- 13 - *Microfibre Cleaning in Healthcare: Is it Really All it's Cracked Up to Be?*, Michelle Alfa



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The Role of Toilet Lids in Reducing *C. diff* Environmental Contamination Risk

NICOLE KENNY, VIROX TECHNOLOGIES INC.

The January 2012 issue of the Journal of Hospital Infection led off with an article that I found interesting. It sought to quantify the level of contamination of environmental surfaces, particularly with *Clostridium difficile* spores, caused by the flushing of a lidless toilet. The full title of the article is "Potential for aerosolization of *Clostridium difficile* after flushing toilets: the role of toilet lids in reducing environmental contamination risk".

Toilet facilities in healthcare settings vary widely, but patient/resident toilets are commonly shared and typically do not have lids. When a toilet is flushed without the lid closed, aerosol production may lead to surface contamination within the toilet environment. This article, by Best, Sandhoe, and Wilcox (Prof. Mark Wilcox that is, global *C diff* expert), sought to substantiate the risks of airborne dissemination of *C difficile* following toilet flushing, particularly when there is no lid. The authors claim it to be the first study to investigate this effect.

The authors simulated an episode of *Clostridium difficile* diarrhea when there is likely to be heavy contamination of both the internal toilet bowl and water. They used an inoculum of *C. difficile* spores representative of the average bacterial load present in *Clostridium difficile* infection (CDI). The highest levels of *C. difficile* were recovered immediately following flushing, and then declined 8-fold after 60 minutes and a further 3-fold after 90 minutes. The highest bacterial counts were detected at the level of the toilet seat. However it was still possible to recover the organism at heights up to 25cm above the toilet seat, and from the floor and other surfaces surrounding the toilet, demonstrating that water turbulence during flushing can force droplets out of the toilet bowl and into the air.

The authors used just one toilet in their study and I would suggest that there is room for more research of this sort. They used a standard flush tank toilet, whereas a flush valve toilet creates far greater force and thus presumably greater turbulence and greater risk of aerosolization.

The scope for environmental seeding associated with toilet flushing highlights the imperative for hand washing after toilet use, and frequent cleaning to remove contamination. Toilets with improved design that do not create aerosols are desirable. The study results demonstrate that if lids are fitted to current models they will very likely become contaminated up on flushing. It is already known that *C. difficile* may spread markedly in hos-



pitals. Lidless conventional toilets increase the risk of *C. difficile* environmental contamination, and thus the authors suggest that their use is discouraged, particularly in settings where CDI is common.

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(VRE). Viruses such as norovirus and influenza, and fungi such as *Candida albicans*, may also persist in hospitals for long periods of time. Gram-negative coliforms, e.g. *Escherichia coli* and *Klebsiella* spp., are less robust but survive on dry, as well as wet, surfaces, although this tends to be for shorter periods of time. A hospital pathogen will persist in an appropriate environmental niche unless removed through some cleaning process. If abandoned, it may contaminate hands or be lifted by air currents and deposited onto a patient or surfaces beside the patient.

Location of pathogen reservoirs

Environmental screening can identify pathogens on a variety of hospital surfaces. Organisms attached to droplets, skin scales or dust particles may intermittently disperse through the atmosphere, ultimately settling on floors, but any surface can host a range of microbes for varying lengths of time. Items or surfaces that are frequently touched present the largest risk of contamination by pathogens spread on hands. These sites then act as reservoirs for subsequent dispersal. Seeding pieces of cauliflower mosaic virus onto a telephone in a paediatric unit allowed researchers to track the movement and spread of the virus marker around the unit, from hand-touch site to hand-touch site, over the course of hours and days. Furthermore, a community-based study that placed virus marker onto a door handle in a students' flat revealed how direct hand-to-hand contact, as which occurs during hand-shaking, was able to spread viral pieces to a succession of people following initial contamination from the door handle. Past and recent studies have shown how pathogens can be retained on hands or gloves following contact with the hospital environment.



Cleaning reduces infection risk for patients

Insufficient cleaning, or the mistiming of a cleaning intervention, encourages the re-emergence of cases. This is further exacerbated by a higher throughput of more vulnerable patients, due to shorter lengths of stay. The persistence of viral and bacterial pathogens also exposes new patients to enhanced infection risk, as aptly demonstrated by studies examining the residual contamination of rooms previously occupied by infected patients. The clinical management of hospital-acquired infection involves extended length of stay as well as expensive, powerful drugs. Such avoidable costs are well worth considering when planning basic cleaning schedules.

Sites for targeted cleaning

Since contaminated near-patient hand-touch sites are thought to constitute the highest risk for patients, cleaning schedules should emphasize these sites. There is little scientific support for this at present and virtually no evidence to convey cleaning methods or frequency.

Some environmental sites are forgotten or ignored for various reasons. The underside of the overbed table, for example, is touched everyday by the patient and staff, but it is usually only the upper surface that receives a wipe down before and after mealtimes. An organism intent on accessing the gastrointestinal tract, e.g. *C. difficile*, would do well by contaminating this particular site. A recent audit on a surgical ward found high levels of organic soil on clinical items that did not appear to have anyone responsible for their cleaning. The use of ATP monitoring clearly showed the effect on domestic staff when they received educational guidance.

Cleaning staff

The trouble with motivating staff is that both short and longer term stimuli aimed at improving cleaning standards wear off over time. If cleaning fails, it is more likely to be a failure of personnel, rather than of product or procedure. Domestic personnel have a tiring and repetitive physical job to do. Maintaining high levels of compliance deserves appropriate recognition, but since it is difficult to measure, extra effort usually goes unrewarded. As with all professional activities, cleaning requires teaching and training, and never more so than in a hospital.

Cleaning methods and materials

Detergent-based cleaning might remove microbes, but will not necessarily kill them. There are numerous examples of contaminated cleaning cloths and equipment actually spreading microbes across surfaces rather than removing them. Numerous guidelines emphasize the importance of cleaning but offer little practical advice on how to achieve this, or how often sites should receive cleaning attention.

Despite the promising results from new decontamination methods and from antimicrobial surface coatings, traditional cleaning methods should not be relaxed or abandoned. No one single process will remove all relevant microbial soil from the hospital. There has already been concern raised over the efficacy of some methods such as microfibre, steam cleaning, ozone, and high-intensity light irradiation, and doubts remain over disinfectant activity in the field, since laboratory testing does not necessarily predict what actually happens on hospital surfaces.

Conclusion

Targeted and comprehensive cleaning regimens reduce the risk of acquiring a hospital pathogen. Comprehensive cleaning is also easier to implement than persuading busy staff to wash their hands or by reducing empirical antimicrobial use. A culture of hygiene pervading all healthcare facilities would influence and encourage the importance of cleaning and cleanliness for everyone. Global business and industry already play a central role in bringing novel methods onto the market; working together with doctors and scientists, government and cleaners themselves should continue to establish the importance of cleaning for everyone in the 21st century.