S O L U T I O N S

VIROX® TECHNOLOGIES INC.

Also In This Issue:

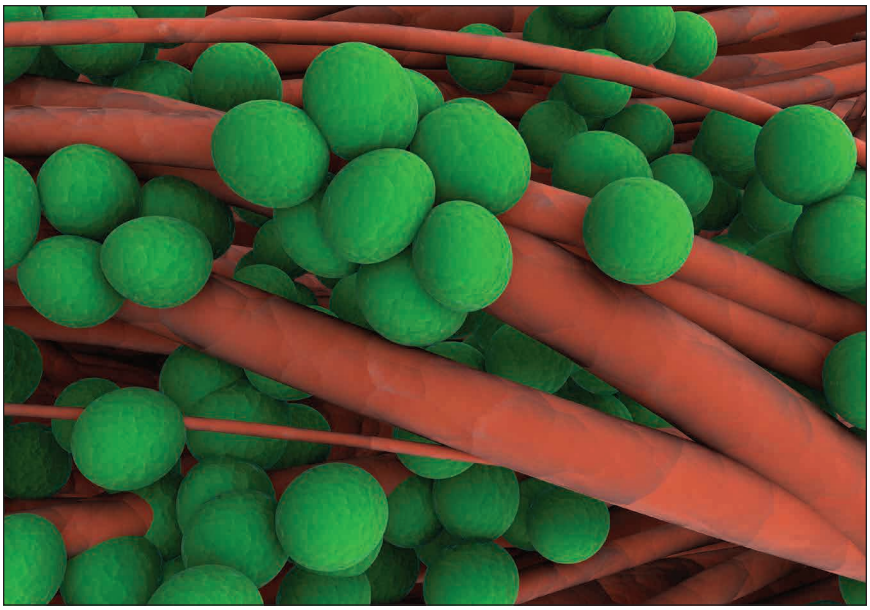
No financial support has been provided by Virox Technologies Inc. to authors of articles included in this newsletter.

VOLUME 31

Persistence of Mixed Staphylococci Assemblages Following Disinfection of Hospital Room Surfaces

PROF. VON SIGLER
DEPARTMENT OF ENVIRONMENTAL SCIENCES, UNIVERSITY OF TOLEDO

Since healthcare-associated infections (HCAIs) are the fourth largest killer in America, characterizing the persistence of pathogens in the hospital environment would facilitate the development of policies to limit HCAIs. Of the 30 or so known *Staphylococcus* species, approximately half are associated with important human infections and HCAIs, often resulting in significant morbidity, special control measures, extensive surveillance, and longer hospital stays. Since staphylococci



can survive for several months on items touched by the patient and healthcare personnel, understanding the distribution of staphylococci on frequently touched surfaces can be a valuable step in developing appropriate infection control strategies.

Although it is widely known that staphylococci are ubiquitous on hospital surfaces, no study has utilized genetic fingerprinting to simultaneously characterize the persistence of multiple species

CONTINUED ON PAGE 8

2013 Conference Update

April

April 11 to 12 - BC PICNet Conference
April 11 - Community Infection Prevention & Control (IPAC) Education Day
April 24 - Regional Infection Control Networks Education Day (North Simcoe Muskoka)
April 24 to 26 - CleanMed 2013 Conference- Boston
April 27 - Theta Chapter 4th Annual Education Day
April 30 to May 1 - CanClean 2013 Conference

May

May 1 - Regional Infection Control Networks Education Day (North Simcoe Muskoka)
May 1 to 4 - SHEA 203 Conference- Atlanta
May 16 - 17th Annual HANDIC Education Day
May 26 to 28 - AIPI 2013 Conference
May 26 - AIPI Pre-Conference Day sponsored by Virox Technologies Inc.
May 28 to 30 - OHHA 2013 Conference

June

June 2 to 5 - CHICA Canada Conference
June 7 to 10 - APIC 2013 Conference- Ft. Lauderdale
June 13 - 9th Annual Paediatric Patient Safety Symposium
June 14 - CHICA Manitoba Chapter Conference
June 23 to 26 - 79th CIPHI Annual National Educational Conference

Virox is very excited about participating in each of these conferences & education days. We wish the best to all of the various organizers and would like to thank them for their dedication and effort in organizing these very important educational opportunities. We look forward to attending and talking to all of the participants.

Congratulations 2013 Virox Scholarship Winners !

Virox would like to congratulate the 2013 CHICA Scholarship winners. Thirteen Infection Prevention & Control Practitioners from across Canada were chosen by the CHICA-Canada Board of Directors. The monies awarded will help them to attend the CHICA-Canada 2013 National Education Conference in Ottawa. This year's winners are: Lisa Mackey, Danielle Richards, Kathryn Linton, Tina Halloran, Patricia Bedard, Paula Stagg, Sharon Carella, Beverley Sutherland, Faith Stoll, Donna Baker, Sharon Connell, May Griffiths-Turner and Darlene Meeds Montero.

Summer 2013 Virox Update

AIPI 2013 Pre-Conference Day sponsored by Virox Technologies

AIPI is the association of nurses in infection control in Quebec. This year marks 35 years of dedication to the prevention and control of nosocomial infections thorough education, research and collaboration.

This year Virox Technologies has partnered with the AIPI to sponsor a Pre-Conference day on May 26th dedicated to discussion and education around the use of disinfectants for infection prevention. The breadth of subject matter is sure to lead to debate of best practices, reflection on misconceptions and lead us to search for responses in face of the challenges we face in our daily practice and research.

Virox continued support of the SickKids Paediatric Patient Safety Symposium

9th Annual Paediatric Patient Safety Symposium is a one-day conference that brings together national and international experts to share leading practices and applied science in paediatric healthcare.

Virox Technologies is once again the corporate sponsor for the SickKids Foundation Paediatric Patient Safety Symposium that will be taking place on June 13th at SickKids Hospital. The symposium will focus on indentifying the multiple components of a safety culture, define each component and outline influences and impacts to patient safety. It will also recognize how leadership, partnership and infrastructure can successfully transform an organizations' culture to improve safety and the quality of healthcare more broadly. For more information on this event please contact the Patient Safety Symposium organizers at li.conferences@sickkids.ca.

Fifth Annual Virox Future Forum – Sheridan School of Business

The annual Virox Future Forum is an opportunity for Sheridan School of Business graduating students to look into emerging trends in the work world and to get the advice on pitching business ideas. Sponsored by Virox Technologies Inc., the Feb. 14th event featured keynote speakers, demographer Dr. David K. Foot (Boom, Bust and Echo), and venture capitalist (and Dragons' Den consultant), Dr. Sean Wise.

GREEN TEAM UPDATES

We achieved LEED® Silver Certification! In the February Newsletter, we announced that we had achieved LEED Certification. We were 1 point shy of attaining the LEED Silver designation and being so close we did not want to miss the chance to push for LEED Silver certification. On April 1st, 2013 we received the official word from the U.S. Green Building Council (USGBC) that we had achieved LEED® Silver certification for our 46, 000 square foot headquarters which includes the company's corporate offices, Research & Development laboratory and manufacturing and warehousing facility. Virox is the first chemical manufacturer in Canada capable of not just developing EcoLogo and Green Seal Certified products, but manufacturing them in a LEED-certified facility!

Developed by USGBC, LEED® (Leadership in Energy and Environmental Design) is an internationally recognized green building certification system that provides third party verification that a building was designed and built using strategies aimed at improving performance in key environmental areas; energy savings, water efficiency, CO2 emissions reduction, improved indoor environmental quality and stewardship of resources and consideration of their impacts. The LEED program provides building owners a concise framework with which to identify and implement practical and measurable green building design, construction, operations and maintenance solutions. Some of the key projects that made achieving LEED Silver certification included:

CONTINUED ON PAGE 4

Microbial Contamination - Keypad Phones vs. Touch Screen Phones

NICOLE KENNY, VIROX TECHNOLOGIES INC

The fact that cellular phones and other mobile communication devices can become contaminated with potentially pathogenic organisms is not new. To my knowledge, the Brady article, "Is Your Phone Bugged", from the American Journal of Infection Control (2006) was first to identify this potential vector. Even when cellular phones were banished from hospitals, Brady discovered that up to 25% of healthcare workers' personal phones were contaminated with healthcare-associated microbes, including MRSA and VRE strains. As concern about disturbance of electromagnetic fields diminishes, mobile phones, tablets, and other such high-touch communication devices are making strong inroads to acute care settings. Their presence is generating new studies on the infection transmission risk associated with their use.

A group from University College London published an article comparing keypad phones to touch screen phones, particularly in an acute care hospital setting ("Keypad mobile phones are associated with a significant increased risk of microbial contamination compared to touch screen phones", Journal of Infection Prevention, March 2013). The authors observe that the majority of healthcare professionals use the same mobile phone inside and outside the workplace, and this risks contamination to other departments, hospitals, and the community. Many of the phones in use today have touch screens with a solitary smooth surface, as opposed to a keypad with separate buttons and numerous crevices. The authors postulated that, of the two styles of devices, bacterial contamination would be lower on touch screen phones.

For 6 months the authors approached healthcare professionals in their hospital to recruit them (or more precisely, recruit their phones) into the study. Eventually they accumulated samples from 67 mobile telephones from the departments of medicine, surgery, and anesthetics. Ten of the samples were from "on-call" hospital phones that are passed from physician to physician. The study particularly looked for evidence of contamination of Methicillin-Resistant *Staphylococcus aureus* (MRSA), and Vancomycin Resistant Enterococci (VRE).

Even in this rather small sampling, the results were telling. Nine of the 67 samples grew either MRSA or VRE, all but one of those being from keypad phones. All of the "on-call" phones were keypad models, which might have skewed the results, since 40% of these phones showed MRSA or VRE contamination. Of the touchscreen phones, 17 were iPhones, none of which were contaminated with potential pathogens, and none showed microbial growth of greater than 1 cfu/cm2.

To confirm their results the authors repeated the study in another hospital, and with a larger sampling of 126 touchscreen phones, and 47 keypad phones. This second facility had a lower baseline MRSA rate than in the first hospital. In this second attempt, 5 of the touchscreen phones (4%) were contaminated with MRSA. None of the keypad phones were contaminated with MRSA or VRE, but overall the bacterial colony counts were higher with keypad phones.

The authors conclude that touchscreen phones have lower bacterial colonization when compared to keypad phones. Keypad mobile phones were more likely to be contaminated with higher colony counts of bacteria, and the majority of drug-resistant bacteria were isolated from keypad phones. The keypad is the area in contact with the fingertips, and intermittent handling of mobile phones during and between patient consultations is a means for transmission and conceivably reduces the effectiveness of hand hygiene.

Although the increased use of mobile phones in the clinical setting looks to be inevitable, a mechanism for cleaning and decontaminating the devices must be established. Sumritivanicha et al in 2011 established that cleaning mobile phones with a disinfectant wipe can reduce contamination rates. Presumably it would be easier to decontaminate a 2-dimensional flat surface of a touch screen rather than the 3-dimensional crevices of a keypad phone. Care must be taken to use a disinfectant wipe that does not damage or degrade the oleophobic touchscreens, and more research in this area is warranted.

The article, while highly suggestive, is not definitive - larger sample sizes, from more healthcare facilities, and more specificity of the contaminating microbes would be useful. However, I believe it to be a worthwhile effort and might perhaps indicate that: (a) the use of keypad phones should be discouraged in at least acute care settings, (b) that protocol for cleaning and disinfection of all mobile phones is necessary, and finally, (c) that I haven't cleaned by iPhone in quite some time!!

GREEN TEAM UPDATES

Continued from page 2

- Mechanical system upgrades, to enhance occupant thermal comfort and energy efficiency
- Lighting upgrades to provide more efficient, more uniform lighting levels and better quality of light to all areas - manufacturing, warehousing and office
- Plumbing upgrades, to increase water efficiency and user-friendliness throughout the facility
- Installation of a BT Radioshuttle System to allow for high-density racking of manufactured goods
- Installation of a "Get Green System" which lowers fuel costs and reduces CO emissions
- Implementation of a robust sustainable purchasing program
- Implementation of a single-stream recycling program that includes corrugate, plastic (bottles and shrink wrap) and paper across the company which has diverted over 425 cubic yards of recyclable waste from landfill
- Implementation of a recycling program which converts the self-adhesive label backings and corrugate cores to material used for outdoor decking and diverted over 12, 000 kgs of waste from landfill
- Implementation of a Daylight Cleaning Program which of course utilizes the AHP-based EcoLogo certified products

When asked why a chemical manufacture would want to undertake such a challenge, Randy Pilon, President and CEO of Virox stated, "It's the right thing to do. I challenged the team to achieve LEED certification and through the process we created a company that has completely changed its culture and embraced the challenge of being the greenest of the green with such passion that we achieved LEED Silver status."

Bacterial Spore Structures and Their Protective Role in Biocide Resistance

DR. JEAN-YVES MAILLARD, CARDIFF UNIVERSITY, WALES
WITH CO-AUTHORS: DR MARK LEGGETT, PROF S. DENYER, PROF. P SETLOW, AND DR G MCDONNELL.

Spores are a unique dormant form of many types of bacteria, which develop through a remarkable series of stages to render the bacteria naturally resistant to harsh environmental conditions. Spores are also known to demonstrate the greatest resistance to various disinfection and sterilization methods compared with other micro-organisms (but excluding prions) and are widely used to develop, study and test sterilization methods in particular. It is this highly resistant characteristic that makes them such a problem in healthcare settings where the spore-forming *Clostridium difficile* is a major cause of hospital-acquired infection. The following text is abbreviated from a recent article of the same title, published in the Journal of Applied Microbiology (Journal of Applied Microbiology 113, 485–498 2012 The Society for Applied Microbiology).

When cells of certain Gram-positive bacteria, for example *Bacillus* and *Clostridium* spp., encounter environmental stresses such as nutrient starvation, they form a dormant structure termed an endospore (simply referred to as a spore in this review). Bacterial spores can survive in this dormant state for many years, with some studies suggesting that they may even persist for millions of years. It is therefore of interest to investigate how bacterial spores withstand environmental stress, including their ability to resist disinfectants and sterilants.

Spore-former life cycle

The process of sporulation is classically divided into seven stages, being similar for Bacilli and Clostridia. Stage 0 refers to the normal vegetative cell growth. During stage I and II the vegetative cell undergoes asymmetric cell division resulting in two compartments separated by a septum; one is referred to as the prespore being a smaller compartment. At stage III, the prespore is engulfed by the mother cell to form a distinct cell termed the forespore bound by the inner and outer forespore membranes. The spore cortex, composed of peptidoglycan is formed between the inner and outer forespore membranes during stage IV. The spore coat is synthesised during stage V and 'mature' by becoming denser in appearance during stage VI. Stage VII corresponds to lysis of the mother cell and the release of the mature spore.

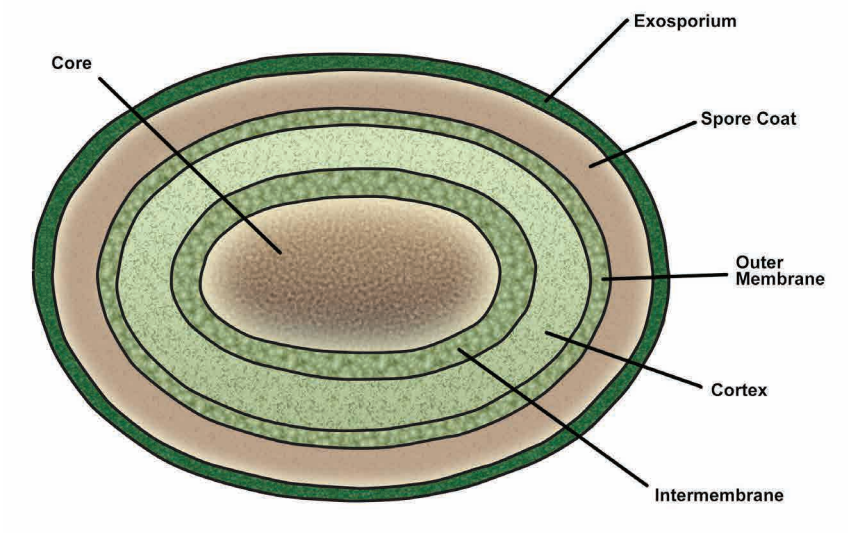
The mature spore structure protects the dormant micro-organism from external influences until the conditions once more become favorable for vegetative cell growth. The dormant spore is then re-activated and undergoes germination and outgrowth. The transition from dormant spore to vegetative cell involves three separate phases: activation, germination and outgrowth. Activation can be triggered by appropriate conditions of heat, pH or chemical exposure and renders the dormant spore poised to enter germination, thus breaking its dormant state.

Spore structure

The exosporium is the outermost structure of many bacterial spores, in particular those of the *B. cereus* group, but is also found in some other Bacilli and Clostridia, including *C. difficile*. The presence of an exosporium is by no means universal, and this structure may be either absent or greatly reduced in many species. The exosporium contains a protein component, a lipid component and a polysaccharide component. Whilst the exosporia of clostridial spores have been described, there is no detailed breakdown of the chemical composition of these structures. Although a number of major proteins have been identified as components of the *B. cereus* and *B. anthracis* spores' exosporia,

their exact function in the spore is unknown. To the best of our knowledge, the exosporium has not in itself been shown to provide the spore with any significant protection from biocide attack.

The spore coat sits within the exosporium (if present) and generally comprises a series of thin, concentric layers, the numbers of which differ depending on the organism under investigation. Indeed, the structure and biochemical composition of the spore coat vary between species and even within different strains of the same species. The coat is made up predominantly of protein, but also contains minor (6%) carbohydrate components, most likely owing to the glycosylation of two low-molecular weight coat polypeptides. Approximately 30% of isolated coat proteins resisted solubilization and define the coat insoluble fraction. The presence of heavily cross-linked material in the spore coat is likely responsible for some of the spore's chemical and mechanical resistance.



Under the spore coat lays the outer spore membrane. Whilst this structure is essential for spore formation, its precise function remains unclear, reportedly having no great effect on resistance to radiation, heat, or some chemicals.

Next is the spore cortex, composed of peptidoglycan, being similar but distinct in structure to peptidoglycan found in the mother cell wall. Bacterial spores contain another peptidoglycan structure, the germ cell wall, which becomes the vegetative cell wall as the spore undergoes germination and outgrowth. There is currently no indication that the germ cell wall plays any great part in spore resistance properties. Cortex-less mutants of spore-forming bacteria have been produced, which apparently lack any / most of the cortex. However, the resistance properties of these mutant spores have not been studied.

Several studies have demonstrated that the dormant spore is remarkably impermeable, as small molecules such as the uncharged lipophilic molecule methylamine and even water permeate into the spore core only slowly. This characteristic has led to the suggestion that the spore inner membrane must differ significantly from the vegetative cell plasma membrane, and this may be responsible for the low spore inner-membrane permeability. However, the precise composition of the spore inner membrane does not provide any obvious reason for this membrane's low permeability.

At the centre of the spore lies the core, which contains the spore's DNA, RNA, ribosomes and most of its enzymes. The core is relatively dehydrated, water making up only 28–57% of spores' wet weight, a factor that is thought to contribute to both spores' enzymatic dormancy and their characteristic resistance to heat and some chemicals. The conditions within the core are strongly linked to the resistance properties of the spore, many of which are in some way involved in protecting spore DNA from damage.

Within the spore's core, small acid soluble proteins (SASPs) bind directly to and saturate spore DNA, providing an important component of spore resistance against chemical and other treatments that target spore DNA. These are abundant proteins in Bacillus and Clostridium species and three main types have been described to date. SASPs are synthesized late in sporulation only in the developing spore and are degraded early during germination, providing a vital source of free amino acids for the outgrowing spore.

Core water content is the major determining factor of a spore's wet heat resistance. Generally, the lower the core water content, the higher the wet heat resistance. Killing of spores by liquid hydrogen peroxide is also affected by core water content, with higher core water levels being associated with greater sensitivity to peroxide, although the reason for such a relationship is unclear. The relationship between high spore water content and decreased resistance to wet heat and some chemical treatments (nitrous acid, but apparently not hydrogen peroxide) has also been demonstrated for spores of *Clostridium perfringens*.

Conclusions and future perspectives

The resistance of spores is clearly due to the cumulative effects of structural, chemical and biochemical features. Even those structures such as the spore cortex that at first glance may appear unimportant to spore resistance can play a functional role. For example, the cortex exerts its influence on the inner layers of the spore, apparently affecting spore resistance indirectly, for example by assisting in the establishment and maintenance of core dehydration and possibly also by influencing the permeability of the inner membrane.

Although there has been considerable work investigating the mechanisms of action of many sporicidal biocides on *B. subtilis* spores, there is far less information available for other species and particularly for various Clostridia. This paucity of information represents a major gap in our knowledge given the importance of the Clostridia as human pathogens. A greater understanding of the structure and resistance factors in various spore-forming bacteria is thus necessary for the development of optimized methods (chemical and/or physical) to inactivate these unique structures.

Distribution of Outbreak Reporting in Health Care Institutions by Day of the Week

CHINGIZ AMIROV MPH, CIC - BAYCREST HEALTH SCIENCES, TORONTO

The anecdotal notion that outbreaks are more likely to be reported on Friday is fairly prevalent in health care institutions, and merited further examination. We undertook a study to determine if a relationship exists between outbreak reporting and the day of week (Am J Infect Control. 2012 Dec;40(10):979-82).

Although various associations between day of the week and different health care outcomes have been described in the literature, there is a dearth of solid data to support or rule out the particular notion of a Friday outbreak. We analyzed data from 901 institutional outbreaks reported to the public health authority in Toronto, Canada. This total represented a combination of enteric and respiratory outbreaks from acute, chronic, and long-term care settings reported over a 4-year period (March 2006 to February 2010).

In our analysis, specific reporting patterns emerged. A clear pattern of underreporting was noted on Saturday and Sunday, which was well below average. Such a pattern is recognized in infectious disease surveillance and has been described elsewhere as a "weekend effect." This effect has been attributed to the structural differences in staffing over the weekends (eg, lower general staffing, fewer or absent infection control staff).

Generally, Monday was the most likely day of the week for outbreak reporting. This finding might be attributed to a "catch-up effect," that is, a delay in detection and reporting of weekend outbreaks until Monday. Friday showed another peak in overall outbreak reporting, in this case likely due to a "deadline effect," that is, a delay in declaration and reporting of midweek outbreaks, eventually urged by the impending onset of the weekend.

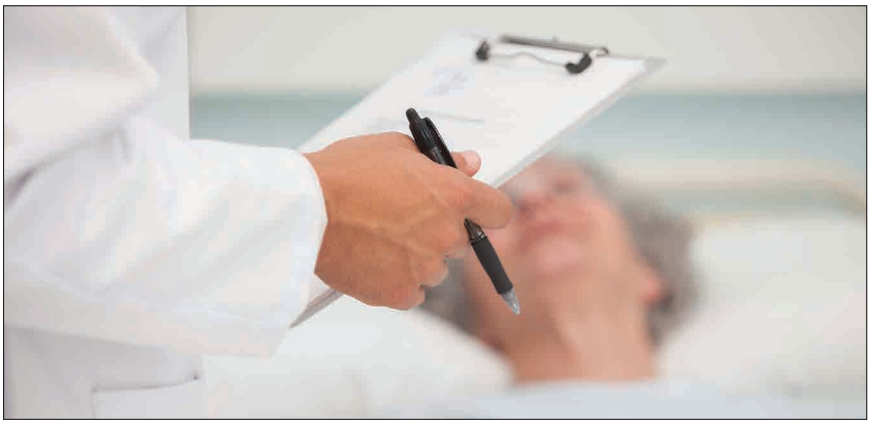
In long-term care institutions, respiratory outbreaks were more often reported on Mondays, but this was not the case for enteric outbreaks. In acute and chronic care facilities, no differences in reporting were detected, likely due to insufficient sample size and limited power.

Theoretically, there is no scientific basis for why the occurrence of outbreaks in health care institutions should be more likely on some days of the week than others. Yet, as our analysis demonstrates, the reporting of outbreaks does follow certain patterns. This suggests a prevalent discrepancy between the true onset date of an outbreak and the date of detection and reporting.

Rapid detection of outbreaks helps achieve earlier containment, shorter duration, and lower attack rates. Weekend outbreaks that go undetected, unreported, and unchecked likely contribute to higher attack rates, resulting in higher morbidity and mortality. Although there are some intrinsic delays in outbreak detection, owing largely to sensitivity of surveillance, delays due simply to calendar cycle are noteworthy and should prompt reexamination of surveillance processes. Designing surveillance systems that enable timely outbreak detection independent of calendar cycle could help improve outcomes.

Correlations Between Bed Occupancy Rates and *Clostridium difficile* Infections

LEE NESBITT, VIROX TECHNOLOGIES INC.



Clostridium difficile infections (CDI) are one of the most common healthcare-associated enteric infections and a frequent cause of morbidity and mortality in hospital settings. The question whether periods of high bed occupancy rates increase the risk for acquiring CDI remains unresolved and is the subject of a study that was published in the scientific journal Epidemiology and Infection (Epidemiol. Infect. (2011), 139, 482–485).

A multivariate time-series analysis was applied to examine the influence of bed occupancy rates and length of hospital stay on the incidence of CDI in a tertiary care university hospital. The monthly number of patients infected with *C. difficile* at University Medical Center Freiburg was recorded using isolation protocols to generate the incidence of CDI over a study period of 67 months. Bed occupancy data were used to calculate series of hospital-wide monthly bed occupancy rates, average turnover intervals and the average length of stay. The number of available bed days is equal to the number of available beds multiplied by the number of days.

Unfortunately, study authors Kaier, Luft, Dettenkofer, Kist and Frank were not able to separate the monthly discharge levels of ICUs from those of general wards. Therefore, they determined the series of turnover intervals only once for the whole hospital.

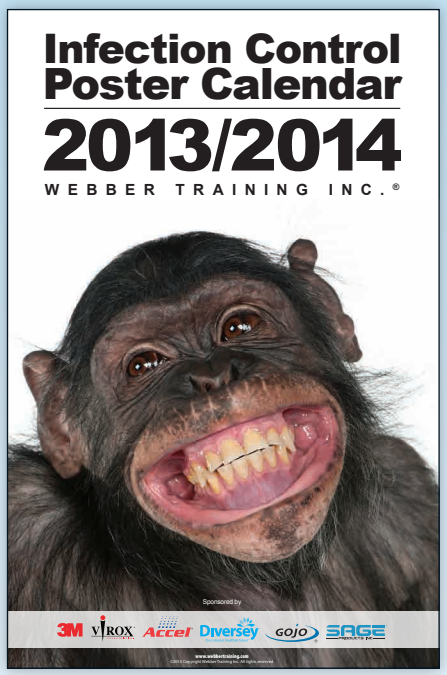
The authors found that bed occupancy rates on general wards and the average duration of patients' stay in the ICU significantly influences the incidence of CDI in hospital settings. It might appear contradictory that the length of ICU stay was associated with the incidence of CDI, although the length of ICU stay fell over the study period, while the incidence of CDI rose. However, the study objective was not to correlate long-run trends, rather to analyse whether short-run temporal variations in the incidence of CDI were associated with short-run temporal variations in the average length of stay in ICU settings.

This study demonstrated that the incidence of CDI correlates with high bed occupancy rates on general wards and lengthier periods of ICU occupancy. We obviously need to search for an alternative explanation for the recent increase in the incidence of CDI. Unfortunately, this study could not distinguish between nosocomial cases of CDI and patients admitted with CDI. Hence, the authors were unable to analyse the influence of colonization pressure from outside the hospital by including the incidence of patients admitted with CDI as an independent variable.

Infection Control Poster Calendar

We are really pleased to once again sponsor the Infection Control Poster Calendar, produced by Webber Training Inc. Within each packet there are 12 professionally designed infection control posters, and a June 2013 - May 2014 calendar. This is the 5th time that Webber Training has produced sets of posters such as these, and they are always extremely popular. You may even find that they disappear from the walls of your facility because people want them for their school, club, or church. Many people use the electronic version of the posters in their PowerPoint slides.

Aside from providing a really great infection control marketing tool, this project is a fund raiser for the Teleclass Education lecture series. Printed packets of this year's Poster Calendar will be distributed by Webber Training at the 2013 CHICA conference in Ottawa, and by Virox at the 2013 APIC conference in Fort Lauderdale. Copies are also available after the conferences upon request from Virox and the other sponsors, and the posters can be downloaded for electronic or print applications from the Free Poster Downloads section of www.webbertraining.com.



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following room cleaning. Methodology to clearly identify and differentiate between mixed *Staphylococcus* spp. is limited. Kassem et al. have developed a denaturing gradient gel electrophoresis (DGGE) assay that effectively characterized DNA assemblages by specifically differentiating 19 *Staphylococcus* spp. in a single fingerprint. We used DGGE analysis to address the impact of a daily, conventional, disinfection protocol on the persistence of staphylococci assemblages on surfaces in rooms housing infected inpatients.

Sampling

Samples were collected from each of ten, single-patient isolation rooms in a 250-bed university hospital. Rooms were selected in collaboration with the infection control practitioner if: the room was occupied by an inpatient infected with *Staphylococcus* spp. (MRSA); and the room had not already been subjected to daily cleaning on the day of sampling. Previous room monitoring in this hospital indicated that MRSA consistently contaminated nine surfaces including the sink area, bed rails, floor, overbed table, television button panel, call light, telephone, dry-erase erasers, and patient information binder. Therefore, these surfaces were sampled before, and within 15 minutes after, the established hospital disinfection protocol by swabbing three areas of each surface. Laboratory analyses were performed within three hours of sampling.

Surface cleaning

Sampled surfaces were cleaned by trained staff following guidelines outlined by the US Centers for Disease Control and Prevention, and according to established hospital protocol using automatically dispensed, hospital-approved, quaternary ammonia product. Microfibre cloths or mops were frequently changed and cloths were not returned to the cleaning solution. Discrete, visual monitoring of the cleaning staff was performed and ensured that all surfaces were cleaned according to the protocol during each sampling event.

Results

A total of 24 of 81 samples (30%) were PCR positive for *Staphylococcus* spp. before disinfection and were analysed by DGGE (along with the post-disinfection sample to give a total of 48 fingerprints) to determine the impact of disinfection on the staphylococcal community. At least one *Staphylococcus* spp. marker was detected in each surface sample after cleaning. In approximately a quarter of the samples, a *Staphylococcus* spp. that was detected before cleaning was not detected afterward. Interestingly, in almost as many cases, a *Staphylococcus* spp. was detected after cleaning that was not noticed on that site before it was cleaned.

The removal of pathogens using routine disinfection is poorly studied but represents an important factor in limiting HCAIs. Except for the telephone, each sampled surface type harboured multiple *Staphylococcus* spp. markers before cleaning (including species known to colonize and infect humans). Many of the same markers were also detected on most sampled surfaces after cleaning. The most frequently detected marker was that of *S. epidermidis/kloosii*, which was detected on all nine surfaces assayed before and after cleaning, and in all but two of the 48 samples (96%). Of particular note is the frequent detection of *S. epidermidis*, which was detected on each surface type assayed - *S. epidermidis* is the *Staphylococcus* spp. most frequently isolated in the clinical environment and is responsible for a large number of infections among inpatients. Additionally, a marker indicating the presence of *S. lugdunensis* was detected on five surfaces (10% of samples) after cleaning. Although *S. lugdunensis* is a skin commensal, its persistence may be regarded as an emerging threat, as it is responsible for a variety of HCAIs and community-associated infections similar to those caused by *S. aureus*.

Our results suggest that increased attention be directed to daily disinfection of frequently touched surfaces, especially since these surface types have been shown to host pathogens more frequently than other surfaces, and the occurrence of contamination on these surfaces positively correlates with colonization of nearby patients. The persistence of potentially pathogenic staphylococci on hospital surfaces, including those found in close proximity to patients, represents an infection threat and should be addressed in future research efforts that examine the efficacy of cleaning materials, protocols, and processes.

The full text of this study is available in the Journal of Hospital Infection, 2013 Mar;83(3):253-6

In Brief ....

An Environmental Disinfection Odyssey

In the journal Infection Control and Hospital Epidemiology we find an interesting article titled “An Environmental Disinfection Odyssey: Evaluation of Sequential Interventions to Improve Disinfection of *Clostridium difficile* Isolation Rooms” (2013 May;34(5):459-65). The authors evaluated the impact of sequential cleaning and disinfection interventions by culturing high-touch surfaces in *Clostridium difficile* isolation (CDI) rooms after cleaning over a 21-month period. Three sequential tiered interventions were implemented: (1) fluorescent markers to provide monitoring and feedback on thoroughness of cleaning facility-wide, (2) addition of an automated ultraviolet radiation device for adjunctive disinfection of CDI rooms, and (3) enhanced standard disinfection of CDI rooms, including a dedicated daily disinfection team and implementation of a process requiring supervisory assessment and clearance of terminally cleaned CDI rooms. To determine the impact of the interventions, cultures were obtained from CDI rooms before and after each cleaning and disinfection intervention. During the baseline period, 67% of CDI rooms had positive cultures after disinfection, whereas during interventions periods 1, 2, and 3 the percentages of CDI rooms with positive cultures after disinfection were reduced to 57%, 35%, and 7%, respectively. The authors conclude that an intervention that included formation of a dedicated daily disinfection team and implementation of a standardized process for clearing CDI rooms achieved consistently high CDI room disinfection.

2770 Coventry Road, Oakville, ON L6H 6R1
Tel:(905) 813-0110 • Toll Free:1-800-387-7578 • Fax:(905) 813-0220
E-mail:info@virox.com• Website:www.virox.com

VIROX® TECHNOLOGIES INC.