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## Risk of Organism Acquisition From Prior Room Occupants: A Systematic Review and Meta-Analysis

PROF. BRETT MITCHELL, AVONDALE COLLEGE OF HIGHER EDUCATION, WAHROONGA, NSW, AUSTRALIA



It is now acknowledged that the healthcare environment may play a key role in facilitating the transmission of important pathogens associated with healthcare infections. Such organisms are able to survive in the environment for long periods of time, up to several weeks, thus posing an ongoing risk of transmission and acquisition to hospital patients. In recent years, there has been more interest from infection control staff, clinicians, health planners and government on maintaining a clean environment.

# Virox Update

## Accelerated Hydrogen Peroxide® (AHP®): A DfE Approved Cleaner-Disinfectant that Provides a Sustainable and Safer Choice for Infection Prevention

We are excited to announce that we have been awarded the Safer Choice (DfE) 2016 Partner of the Year Award due to our achievements as an outstanding Safer Choice Innovator. This award program is run by the Design for the Environment (DfE) group of the EPA (Environmental Protection Agency) and is aimed to bring recognition to companies that have advanced the goal of chemical safety through exemplary participation in the Safer Choice/DfE Program. Virox was recognized as the “Innovators”, given our extensive efforts to innovate and formulate in compliance with the DfE criteria.

A core value of Virox is to create safer and greener hydrogen peroxide-based formulations without compromising germicidal efficacy. Environmental responsibility has also been a core focus in every activity that we as a company are involved in. Not only do we have multiple formulations that are certified by reputable third party green certification programs (EcoLogo, Green Seal, Green Guard and now DfE), but our entire facility, including manufacturing, is LEED Silver Certified (the only Canadian chemical company to have LEED certification for the manufacturing area).

This is another “First” for Virox, as we are now the first peroxide-based technology to win the Safer Choice (DfE) Partner of the Year Award!

## New PREempt™ Surface and Instrument Cleaning and Disinfection Products



We are pleased to announce the launch of our new PREempt™ family product line which includes both surface and instrument cleaners and disinfectants. This brand will replace the Accel brand in markets such as respiratory therapy, labs, tattoo parlours, spas and salons, footcare, and other markets that have unique processing requirements. This brand will include specific label language and industry specific efficacy claims to help user compliance with cleaning and disinfection protocols. To learn more about PREempt™ please visit <http://info.virox.com/preemptproductscan>



THE VIROX TEAM  
CELEBRATING EARTH DAY BY  
KEEPING COVENTRY ROAD CLEAN.

## 2016 IPAC-Canada Cleaning, Disinfection and Sterilization Symposium

The Virox team is excited to continue our sponsorship of the IPAC-Canada bi-annual “Cleaning, Disinfection and Sterilization Symposium” at the Niagara 2016 IPAC Canada National conference. In line with our mandate to provide educational opportunities to the infection control community, the 2016 symposium will focus on Implementation Science. It will include a workshop designed to help put theory into practice and equip infection control professionals across Canada with the knowledge and tools they need to prevail in the battle against germs.

## Virox Future Forum 2016

We were excited to once again facilitate the Virox Future Forum in March with Sheridan College in Mississauga. The Virox Future Forum is an opportunity for the Sheridan Pilon School of Business student leaders and successful business leaders to discuss the future needs of industry, and to help Sheridan graduates launch a successful career in business.

## Virox Partners With Dr. Marty Becker's Fear Free™ Program

Fear Free™ is an initiative that promotes a considerate approach and gentle control techniques used in calming environments during a veterinary visit. Developed by Dr. Marty Becker, the American Animal Hospital Association and Vet Folio, utilization of Fear Free™ methods and protocols leads to reduction or removal of fear, anxiety and stress triggers, which creates an experience that is rewarding and safer for all involved, including pets, their owners, and veterinary health care teams. Since Accelerated Hydrogen Peroxide® (AHP®) has no artificial fragrances and no harsh chemical odours as well as being a very effective disinfectant and cleaning technology, it is the perfect complement to Dr. Becker's Fear Free™ environment.



## It's what's inside that counts.

When we think of **disinfectants** and the **environment**, we often only consider one aspect... is the bottle recyclable? However, it's what's inside the bottle that counts. Until recently, most disinfectants were considered to be environmentally unfriendly due to their toxic nature.

The introduction of the EPA's Design for the Environment (DfE) Antimicrobial Pesticide Pilot Project allows users to select more sustainable disinfection options proudly certified under DfE.

Virox Technologies Inc.® specializes in providing disinfection solutions for infection prevention through our patented Accelerated Hydrogen Peroxide® (AHP®) technology. At Virox, we don't believe in having to compromise between efficacy and safety to users and the environment which is why we have succeeded in developing **the first Hydrogen Peroxide based hospital grade disinfectant certified under DfE.**



**“ Our focus on environmental responsibility and sustainability is a legacy we will be proud to pass on to future generations. ”**

Randy Pilon, President and CEO of Virox Technologies Inc.\*

Virox has long prided itself on developing and manufacturing cleaners and disinfectants that provide a safer and greener alternative for end users. A few of the accreditations we've received include:







## Put the Patient in the Room ... Always

SIR LIAM J DONALDSON, CHAIR,  
WHO WORLD ALLIANCE FOR PATIENT SAFETY

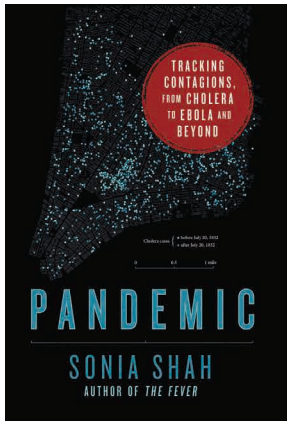


Patients can have a meaningful role in improving safety. Patients and their families often have a unique perspective on their experience of healthcare and can provide information and insights that healthcare workers may not otherwise have known.

There used to be a time when, in a meeting to discuss the safety of healthcare, someone would stand up and say indignantly, “We have been discussing safety all day and no one has used the word ‘patient’, not even once.” Everyone would smile ruefully and acknowledge the oversight. But everyone stayed within their comfort zone - no threat, no challenge to attitudes, beliefs or practice. Then came a time when, in such a gathering, a doctor, nurse or chief executive officer would relate the experience of a patient that they knew or had heard of. It would always enrich a discussion and provide insights. But everyone was still in a comfort zone. There was no challenge and little emotion. It was all too tidy. The true, authentic patient experience was the elephant in the room. No one wanted to face the painful reality that medical errors caused tragedies that robbed families of their future.

Today we are in an era when in some gatherings (and especially the most enlightened ones) the patient or their family members are in the room. They tell their own stories, relate their own experiences, recount their own emotions. This moves outside the comfort zone. There

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## Pandemic - The Book

OLIVIA LATTIMORE, VIROX TECHNOLOGIES INC.

I am one of more than a million people who anguished over Sonia Shah's 2013 Ted Talk - “3 reasons we still haven't gotten rid of malaria”. She wove anecdotes, insights, perspective-shifting concepts, and practical, forward-thinking ideas throughout that 15-minute talk. In the same way she envelops the reader of her new book, “Pandemic .. Tracking Contagions, from Cholera to Ebola” (ISBN: 9780374122881). It's a great read ... have a look.

# Hygienic Conditions In Child-Care Facilities: An Integrated Microbial and Observational Study

NICOLE KENNY, VIROX TECHNOLOGIES INC.



Over the last three decades, the need for child-care has grown steadily in North America, to the point that, according to Statistics Canada, more than half of all parents report paying for child-care services. While child-care can be a marvelous experience for social engagement skills, children in child-care are reported to be up to 3.5 times more likely to get diarrhea, than those cared for in their own homes. And how does one decide between a commercial child-care centre and someone's home-based child-care. A very nice study by Prof. Angela Fraser and colleagues of Clemson University had a look at this issue (from the standpoint of hygiene at least) using data from both microbial contamination as well as observational feedback.

Episodes of acute gastrointestinal illness (AGI) associated with child-care are estimated to cost \$2.3 billion (USD) each year. Many outbreaks in child-care settings are related to child-to-child or child-to-care provider transmission; however transmission related to the contamination of environmental surfaces also plays an important role. The aim of Prof. Fraser's study was to determine

if there were significant relationships between concentrations of key microbiological indicators (eg, total aerobic bacteria and coliform counts) and hygienic conditions in child-care facilities.

Previous studies that have sought to evaluate the importance of environmental contamination as a risk factor for AGI have used two approaches. The first approach sought to determine the presence and amount of microbial contamination on common, high touch nonporous surfaces such as diaper-changing tables and toys, and/or on hands. Most of these studies used classic microbiological indicators (eg, fecal coliforms) as proxies for general cleanliness or adequate hygienic conditions.

The second major approach used to study risk factors for AGI in child-care environments is survey studies. These studies are usually designed to evaluate the degree of compliance with pertinent regulatory provisions or compliance with key hygiene interventions (eg, hand washing, diaper changing, and food

preparation). In those studies, data were collected by direct observation, questionnaires, interviews with staff, or by focus groups.

Both of these study designs have their own advantages and disadvantages. It is generally recognized that when used alone, neither is very effective in establishing causal relationships for AGI transmission. Microbiological and survey study designs are rarely done in conjunction with one another, nor are the data analyzed to determine if microbiological data are associated with disease risk, human behavior, and/or adherence to recommended practices or procedures. Prof. Fraser's study integrated both approaches to maximize the utility of the findings, enabling better understanding of potential risk factors for microbial contamination in child-care settings.

In the study, a total of 508 child-care facilities in North and South Carolina were contacted to participate in the study. Eighteen North Carolina and 22 South Carolina child-care facilities agreed to participate and were visited by a team of trained data collectors. More than three quarters of the facilities were classified as "centres" and the balance as homes. Environmental samples were collected from common high-touch surfaces (eg, faucet and refrigerator handles, toys, diaper changing areas, and eating tables) as well as the hands of care providers and food workers. A total of 652 samples were collected for microbial analysis.

Also, at the beginning of the site visit, directors of participating facilities were given a brief questionnaire to complete while the trained data collectors conducted an audit of facility activities. The questionnaire included the following sections: training, facility policies, facility characteristics, and employee and child health.

When comparing homes to centres, there was no statistically significant difference between aerobic plate counts on hands or surfaces. However, samples collected from home day-care facilities had significantly higher coliform counts across all surfaces compared with centres. One possible explanation is that the homes had less physical space than did the centres (square footage was not assessed during the site visit), inherently placing children in closer proximity to one another. Another possible explanation is that the homes the researchers visited had higher proportions of younger children (aged < 36 months), who are more likely to be in diapers, compared with the centres.

Next, and I think crucially, the researchers explored effect of written food handling and sanitation policies being in place, because it relates to degree of environmental contamination. Not surprisingly, facilities without a written food preparation or surface cleaning policy had significantly higher aerobic plate counts on all surfaces. The authors could not find any published study that compared the presence and use of such written policies to enteric disease risk or microbiologic indicator levels. It is reasonable to believe though that having a written policy in place would be more likely to translate into practice, because this provides workers with a clear guideline regarding how to execute recommended practices. On the other hand, written surface cleaning policies were reported in 80% of all participating facilities, demonstrating that even if written policies are in place, they are not always followed. To increase adoption of procedures, training must be ongoing and workers must be monitored to ensure they are following the practices.

So what can we take from this study? Certainly the study tells us that cleaning, disinfection, and general good hygiene practices are as essential in child-care facilities as in healthcare. I believe though that the more important points are that the presence of written procedures for food handling and surface cleaning practices appear to have a positive influence on overall microbial loads in child-care facilities. Furthermore, the existence of procedures without training on those procedures is inadequate.

The full text of Prof. Fraser's publication can be found in the American Journal of Infection Control - Am J Infect Control. 2014 Jul;42(7):781-6.

## How Cockroaches Could Save Lives

EXCERPTS FROM BBC NEWS MAGAZINE



Cockroaches are often associated with dirty kitchens and grimy bathrooms - scuttling away as soon as you enter the room and turn on the light. But pest controllers aren't the only people interested in them - these insects are inspiring research into antibiotics, robots and mechanical limbs, writes Mary Colwell.

Wise and beautiful are words not often associated with these creatures but their bad reputation is not always justified. Out of the 4,500 known species, only four are considered pests. Most don't live near human homes and they perform a vital ecological role, eating dead and decaying matter.

But rather than finding them repulsive, scientists see them as a source of inspiration. Scientists had long wondered how roaches could spend their lives in dirty environments with no ill effects and it turns out they produce their own powerful antibiotics.

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# *Clostridium difficile* Infection Incidence: Impact of Audit and Feedback Program to Improve Room Cleaning

MATTHEW P. MULLER, ST. MICHAEL'S HOSPITAL, UNIVERSITY OF TORONTO

Contamination of the hospital environment with *C. difficile* appears to play an important role in the transmission of *Clostridium difficile* Infection (CDI). In a recent study (*Journal of Hospital Infection* 92 (2016)), we conducted an interrupted time-series analysis to determine whether our audit and feedback program was successful in reducing the incidence of hospital-acquired CDI. This is the first study to attempt to link audit and feedback, using fluorescent marking, with a reduction of hospital-acquired CDI.

*C. difficile* spores can persist on inanimate surfaces for months; nearly all CDI patient rooms are contaminated with *C. difficile*; and patients subsequently admitted to these rooms are at increased risk of acquiring CDI themselves. In addition to the intrinsic hardiness of the spores, one potential explanation for the persistent contamination of surfaces in CDI rooms, is that critical high-touch surfaces are not routinely or thoroughly cleaned.

The study was conducted at St Michael's Hospital, a 475-bed tertiary care teaching hospital in Toronto, Canada. Fifteen inpatient units in which one or more CDI cases occurred per year were included. A transparent gel that fluoresces under UV light was used to mark 8 to 12 high-touch surfaces in the patient room and bathroom (where applicable) after patient discharge. The surfaces marked were selected based on a literature review, and included surfaces in the patient's room (e.g. call button, tray table, intravenous pole), and the patient's bathroom (e.g. toilet flush, sink, light switch). Some additional surfaces were marked in the ICU setting (e.g. side rail monitor, suction canister).

Following routine cleaning and disinfection, the surfaces were inspected by an Environmental Services supervisor. Audits were conducted for a median of 5 discharges per unit per quarter. Cleaning staff were asked to watch an online educational module about the importance of environmental cleaning and the need to thoroughly clean high-touch surfaces. They received weekly feedback based on the audit results.

At the roll-out of the program, all audits were performed by a single quality improvement specialist during weekday daytime hours only. Following this roll-out, two 'program evaluations' were conducted. After the initial evaluation, the auditing schedule was expanded to include evening shifts and weekends, and staff with consistently high scores received a congratulatory letter and small incentive (i.e. gift card, value less than C\$5). After the second evaluation, responsibility for conducting the audits was shifted from the quality improvement specialist to the Environmental Services supervisors and the incentive program stopped.

The primary study outcome was hospital-acquired CDI incidence. Other outcomes measured included the thoroughness of room cleaning (i.e. proportion of surfaces with fluorescent marker removed post cleaning out of all surfaces marked), and staff hand hygiene compliance according to the 'four moments of hand hygiene'.



A total of 1002 room cleaning audits were performed as part of our audit and feedback program. During the initial rollout of the intervention, 49% of high-touch surfaces were cleaned. However, cleaning thoroughness increased rapidly after feedback was provided to cleaning staff, reaching 76%, and then continuing to rise throughout the post-intervention period.

Over the entire study period, 903 CDI cases were diagnosed on the 15 study units, of which 452 (50%) were hospital-acquired. Of the hospital-acquired cases, 262 occurred pre-intervention and 165 occurred post-intervention; 25 cases were excluded from the analysis as they occurred during the intervention roll out period or in low-incidence units. Overall hospital-acquired CDI incidence was substantially lower than these numbers indicate, as the units with the fewest CDI cases were not included in this analysis. Hospital-acquired CDI incidence fell from 54 to 42 cases per 100,000 patient-days following the intervention, despite an increase in non-hospital acquired CDI over the same time period. Although CDI rates were already in decline prior to the intervention, the intervention appeared to accelerate the rate of decline, and time series analysis demonstrated that the intervention led to an additional ongoing reduction of CDI of 1.35 cases per 100,000 patient-days per quarter.

Our results were obtained through an interrupted time-series analysis and are more robust and less prone to bias than those produced by other quasi-experimental study designs. Additionally, because our intervention was implemented at a time when hospital-acquired CDI incidence was already declining, our results are less impacted by the inherent biases that are present when facilities implement novel infection control methods in response to outbreaks or other increases in disease incidence. Our results demonstrate a small but significant reduction in CDI associated with the introduction of a fluorescent marking audit and feedback program. We believe our results provide evidence in support of the use of fluorescent marking as a tool to both improve room cleaning thoroughness and reduce CDI incidence.

Webber Training Teleclass Broadcast ....

**FREE-REGISTRATION**

## Physicians, Farmers, and the Politics of Antibiotic Resistance: A One Health Analysis

LIVE BROADCAST .. MONDAY, MAY 16 11AM-12 NOON EASTERN TIME



**Laura Kahn, MD, MPH, MPP, FACP**

Co-Founder, One Health Initiative  
Research Scholar, Program on Science and Global Security at Princeton University

Vice President, Princeton Board of Health  
International Consultant, One Health Initiative in South Asia, Kathmandu, Nepal

**Virox Technologies** is pleased to sponsor the teleclass broadcast of this live IPAC Canada conference lecture.

The rise of antibiotic resistant bacteria has created a crisis in medicine and veterinary medicine. The use of antibiotics as growth promoting agents in livestock has been a highly political issue. Using a One Health approach by integrating the perspectives of medicine/public health and veterinary medicine/agriculture, this presentation will discuss the history of antibiotic use in livestock. The experiences in the UK and Sweden will be examined. The presentation will also compare and contrast the EU versus the US experience regarding antibiotic use, antibiotic resistance, and livestock production. When genomic analysis was applied to VRE, a surprising discovery emerged.

If you miss the live broadcast, your registration for this lecture allows you access to the slides, handouts, and the on-line recording.

## How Cockroaches Could Save Lives

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Dr. Simon Lee of the University of Nottingham School of Veterinary Medicine and Science explains, "Insects often live in unsanitary and unhygienic environments where they encounter many different types of bacteria. It is therefore logical that they have developed ways of protecting themselves against micro-organisms."

They might hold the key when it comes to developing drugs to knock out the most virulent bacteria that make humans ill, such as *E. coli*, MRSA and other superbugs resistant to many existing treatments.

Cockroach cures are nothing new, though. In the 19th Century Lafcadio Hearn, a journalist and writer who travelled through the southern states of the US, noted, "For tetanus, cockroach tea is given. I do not know how many cockroaches go to make up the cup; but I find faith in this remedy is strong among many of the American population of New Orleans."

Today, hospitals in parts of China use a cream made from powdered cockroaches to treat burns and a cockroach syrup is sometimes given to patients to alleviate the symptoms of gastroenteritis.

As the human population and its need for mass produced protein grows, perhaps the reviled cockroach will one day feed and heal the world. If only people could be a little less squeamish.

“ Scientists had long wondered how roaches could spend their lives in dirty environments with no ill effects and it turns out they produce their own powerful antibiotics. ”

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Despite advances in technology, increased attention towards cleanliness and new cleaning practices, studies have shown that if a patient is admitted to a room where the prior occupant was colonized or infected with a hospital pathogen, there is an increased risk of the next patient acquiring the same organism. Although not definitive, such studies are pivotal for supporting the notion that the environment plays an important role in infection transmission. They provide evidence that, despite our best efforts to date, the risk of acquiring a multidrug-resistant organism or *C. difficile* increases as a direct result of patient placement, regardless of any other infection prevention strategies including hand hygiene. Further, these studies justify a move to impose scientific standards for measuring microbial soil and environmental cleanliness in order to gauge the cleaning effect and infection risk to patients.

Our recent systematic review and meta-analysis of published literature (*Journal of Hospital Infection* 91 (2015) 211-217) investigates the acquisition risk associated with prior room occupancy. Specifically applicable to hospitalized patients, the review determines whether being admitted to a room where the prior occupant was colonized or infected with an organism increases the risk of acquiring that organism. Differences in the risk of acquisition between Gram-positive and Gram-negative organisms are also explored.

The findings of our systematic review support the notion that admission to a room previously occupied by a patient infected and/or colonized with a specific pathogen is a risk factor for acquisition. Our study identified seven articles, which explored the relationship between acquisition and prior room occupancy. We undertook a meta-analysis of six of these articles. The analysis of the combined data from these studies overwhelmingly indicated an increased risk of acquisition. The sub-analysis suggested that regardless of the organism - VRE, MRSA, ESBL-producing Gram negative bacilli, *A. baumannii* or *P. aeruginosa* - the risk of acquisition increases. A comparison of risk between Gram-negative and Gram-positive organisms indicated a greater pooled acquisition rate for Gram-negative organisms. This difference remained even after excluding *C. difficile* from the Gram-positive group and *A. baumannii* from the Gram-negative group. A meta-regression of the studies was not possible as the key data on age, sex and colonization pressure were either incomplete or absent for the majority of patients.

Our systematic review and meta-analysis have important implications for infection control professionals, environmental cleaning services, administrators, and the wider public. The findings will assist infection control staff and hospital managers in understanding and managing the risks associated with the determination of room placement. Knowing the status of the prior room occupant may serve as important information in decision-making. For environmental cleaning services and administrators, this review suggests that current cleaning practices fail to reduce the risk of acquisition. There is a need for renewed interest and emphasis on hospital cleaning, and particularly discharge or terminal cleaning – and appropriate methods to objectively evaluate cleanliness. As such, this requires all responsible parties to work together to find methods that reduce this risk to an acceptable level.

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is challenge. It can be uncomfortable. It can be raw. It can be emotional, sometimes confrontational. Those who create opportunities for this direct dialogue with patients and their families do not always have the gratitude of their colleagues. They are often resented. They are seen as bringing problems, causing difficulties, making life untidy. Their role is often a lonely one.

On the international stage, the World Health Organization World Alliance for Patient Safety has established as one of its core activities a Patients for Patient Safety program. Led by patients, this initiative aims to ensure that patients and families who have been the victims of medical error are empowered to lead, challenge and inspire as active partners in the international patient safety movement. A global network of patient champions is growing. These champions, drawn from more than 50 different countries, are advocating for improvements in patient safety through open dialogue and partnership with patients and their families.

We need to go further. We need to think of those who are not able to step into such leadership positions. What of the families that are left behind - the mothers, the fathers, the sons, the daughters? What should we do for them?

There are some things we should never do. We should not turn our backs on them. We should not reject them. We should not deny them explanations and we should never, ever be afraid to tell them the truth. Beyond this, we should ask them to be involved: to bring the wisdom of their experience to help design safer healthcare institutions and to bring about that culture change that is so badly needed. At the global level in major strategic programs, at the national level in the determination of health policy priorities, at the hospital level in the running of the institution, at the clinical level in the design of the patient pathways, the patient should be in the room. Not just sometimes, but always.

Adapted from *Quality and Safety in Health Care* · <http://qualitysafety.bmj.com>

Virox Technologies is pleased to sponsor an important  
**Webber Training Teleclass**

## INFECTION CONTROL AND PET THERAPY

PROF. SCOTT WEESE, UNIVERSITY OF GUELPH, CANADA

**September 15, 2016 • 1:30-2:30pm Eastern Daylight Time**



### Objectives:

- Identify infectious disease concerns associated with animals in healthcare facilities
- Understand the issues associated with different types of animals that may enter healthcare facilities
- Identify practices to reduce the risk of zoonotic pathogen transmission in healthcare facilities
- Learn to adapt and apply current guidelines for animals in healthcare facilities to different situations.



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