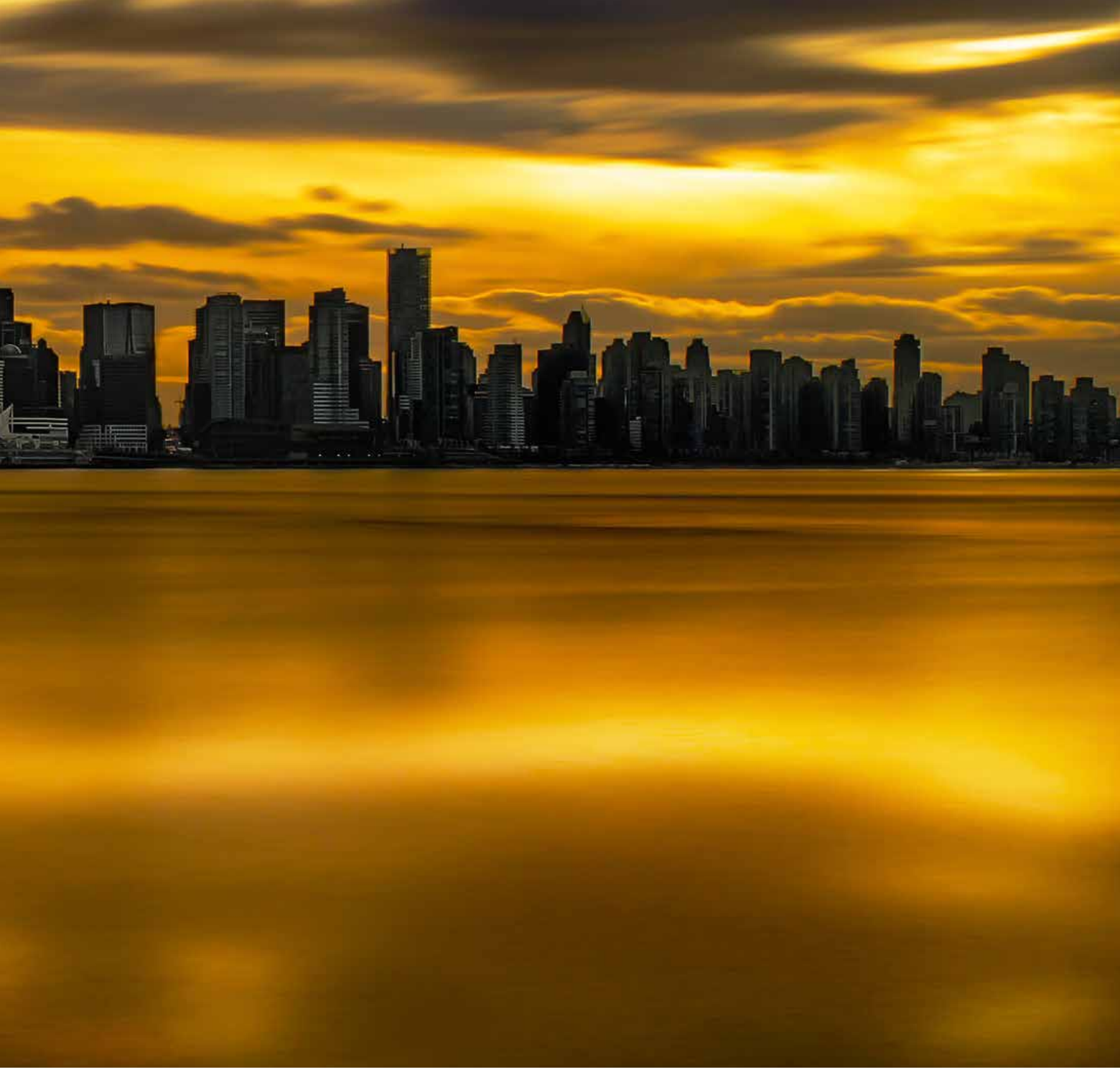
AN ENGINEERED INTERVENTION

VGH undertakes clinical investigation of bone marrow transplant unit in hopes of reducing HAIs

By Richard Dixon

Vancouver Coastal Health (VCH) has earned a nation-wide reputation as a leader in the prevention and control of healthcare acquired infections (HAIs), so it is no wonder the health authority has taken innovative steps in the battle against bacteria and viruses.

In partnership with Genome British Columbia, the B.C. Centre for Disease Control and the Coalition for Healthcare Acquired Infection Reduction (CHAIR) Canada, VCH embarked on a clinical study of the bone marrow transplant (BMT) unit at Vancouver General Hospital in 2014. One of the highest risk groups for infection in a hospital setting is BMT patients. Therapy removes their innate, humoral and cellular immunity, leaving them highly vulnerable to infections until the immune system recovers. For this reason, monitoring the bacterial communities of BMT patients, their primary caregivers and immediate environment can inform and improve infection control practice, ultimately reducing HAIs. In addition, because the patients are in a highly controlled environment, it is an ideal opportunity to re-engineer the setting and then assess the results of this intervention against microbial populations in regular patient rooms.



THE GOODS

CHAIR Canada facilitated management of the project, called GEnBMT (genomics and engineering for bone marrow transplant), in collaboration with the grant team, BMT unit staff and VCH facility maintenance. Its member organizations donated engineered materials and labour for installation in three BMT unit rooms. The logistics of re-engineering the rooms were considerable. All parties worked around patient admissions and discharges to avoid affecting patient care.

Copper-nickel coating was added to high-touch surfaces, such as bathroom sinks, toilet seats, and bathroom and main bedroom electrical switch plates. Solid copper-nickel fixtures and surfaces were also installed in place of 'traditional' bathroom grab bars, bathroom and main door hardware, wardrobe handles, toilet flush levers, door handles, and over bed and bedside table surfaces. A unique clamp-on copper-nickel surface was added to all bed rails and various chair arm rails. It can be easily removed for furniture replacement and maintenance.

Copper alloy has been approved for use by Health Canada as an antimicrobial product that kills 99.9 per cent of bacteria within two hours. In addition to

its self-sanitizing qualities, copper alloy does not scratch or tarnish easily and it's less susceptible to theft than pure copper because of its stainless steel appearance.

A wall-mounted ultraviolet C (UVC) light system was installed in each patient room bathroom, cycling on for five minutes when unoccupied. Specific security features include a door contact system and motion sensors that trigger the UVC system to turn on/off when required. Multiple studies have shown that UVC systems kill bacteria on surfaces and viruses in the air within minutes of use, including C. difficile.

Titanium dioxide was painted on bathroom and patient room walls, and headwalls. The chemical has antimicrobial features as well as a unique ability to reflect UV light, which helps the light rebound around the room into shadow areas.

No-touch sink faucets, paper towel dispensers and gel/soap dispensers were also installed in the three re-engineered rooms. All sinks and faucets conform to CSA standards, and faucets do not have aerators. High-quality water filters were supplied for bathroom sink faucets and showerheads.

Air is routinely supplied to the unit via a HEPA (high-efficiency particulate air) system. However, as part of the pilot project, it was verified to be operating properly and that the pressurization of the air was positive (BMT to adjacent corridors).

Although the three control rooms had unique features and appearance, the same cleaning protocols were followed as the non-control rooms.

RANDOM SAMPLE

During the pilot project, the goal is to have a minimum of six randomly selected patients stay in the control or one of the re-engineered rooms. To date, nine patients have been enrolled in the project. The patients, along with their caregivers and the environment, are followed throughout the duration of their stay.

High-touch surfaces, water and air are sampled weekly. Patient and healthcare worker samples that represent gut, respiratory and skin microflora are also collected. The microbiota from all these samples will be assessed using both traditional microbiological cultures and state-of-the-art DNA sequencing technology. In addition, ATP (adenosine triphosphate) sampling and colony counts of bacteria are performed. Key bacteria of interest in the study include Staphylococcus aureus (methicillin sensitive and resistant), enterococcus (vancomycin sensitive and resistant), Pseudomonas aeruginosa, E. coli, Aspergillus species and C. difficile.

IT IS HOPED THE RESULTS OF THE PILOT PROJECT WILL LEAD TO A BETTER UNDERSTANDING OF THE INTERACTIONS OF MICROBES, ENVIRONMENT AND PEOPLE OVER A PATIENT ADMISSION, AND PROVIDE INSIGHT INTO HOW RE-ENGINEERED SURFACES AFFECT THE MICROBIOTA.

ASSIGNMENT DISCOVERY

The pilot project is designed to assess the feasibility of collecting and analyzing a complex set of samples for traditional bacterial and molecular analysis. To date, with the assistance of BMT unit staff, this has proved to be a realistic task. Even within the small sample range, the group should be able to assess whether there is a difference between re-engineered and control rooms in terms of ATP and bacterial colony counts. Durability and sustainability of products, such as the titanium dioxide and copper-nickel alloys over the course of the pilot project to date, has not proven to be a serious issue.

There was great interest in seeing whether copper-nickel coated surfaces and solid alloys would tarnish under real-life clinical conditions. Early indications from the study show the copper-nickel alloys had mild tarnishing, potentially caused by uric acid splashing on the toilet seat or food spilling on the over bed table. Environmental services staff had difficulty removing most of the tarnish with regular hospital disinfectant chemicals. However, through investigation, the team found a product that quickly removed virtually all the tarnish with minimal impact to cleaning time and costs. CHAIR Canada in cooperation with VCH is now collaborating with the product manufacturer to determine the exact chemical reaction that causes mild tarnish and how the product removes it.

THE VERDICT

The GEnBMT pilot project will formally end with the completion of the molecular analysis and presentation of results in approximately six months' time. While it is hoped the results will lead to a better understanding of the interactions of microbes, environment and people over a patient admission, and provide insight into how re-engineered surfaces affect the microbiota, it is not yet possible to provide any detailed assessment on the economic impact or the affect on HAIs. The pilot will inform researchers as to the practicality and feasibility of conducting a multi-centre randomized control trial in the BMT population.

One result GEnBMT leadership was not expecting was the reaction of patients to the re-engineered rooms. Staff explained the various materials and processes in the room but upon seeing the self-sanitizing copper-nickel surfaces and the bathroom wall-mounted UVC light system that kills bacteria and viruses, it conjured a very positive emotional response from patients. ■

Richard Dixon is deputy chair of the Coalition for Healthcare Acquired Infection Reduction (CHAIR) Canada.