Gone Viral

Rethinking Infection Vigilance
in a Post-Pandemic World

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The global COVID-19 pandemic, with its still unfolding morbidity and mortality consequences and lethal potential, has raised the bar on already conscientious nurses and other healthcare providers at the patient point of care. The very technology that has vastly improved patient outcomes, facilitated patient tracking and diagnosis, and diminished the risk of medical error presents a source of infection if not considered in the same realm as other contamination risks. This article offers views from an interdisciplinary panel of clinical experts from Vancouver Island Health Authority and the Mayo Clinic as well as industry leaders from HP, Inc. and Clorox Healthcare to help us understand how to rethink clinical and hospital infection prevention vigilance in a post-pandemic world.

Mobile Devices & IoT Devices: HAIs and Viral Pathogens

Studies demonstrate a disconnect between infection control awareness and hygiene. *A French research survey, for example, explored the presence of viral pathogens on healthcare workers' mobile phones. Virus RNA was detected on 38.5% of them. A Canadian study explored the presence of microbial pathogens on wearable and internet of things (IoT) devices. The researchers found that only 45% of clinicians cleaned their smart phones at least weekly and bacterial isolates were detected on 22% these devices. In another study, 100% of participants said they knew their mobile phone could be a host for infectious agents and 64% use their phones during patient care. However, more than 28% never performed hand hygiene before mobile phone use, and 37% admitted they never performed hand hygiene after mobile phone use.*[1]

According to Doe Kley, RN, senior infection preventionist for Clorox and lecturer for the Ohio State University, healthcare-associated infections (HAIs) "are the epitome of patient safety issues and they're a major cause of morbidity and mortality. Poor infection prevention and control practices lead to transmission of pathogens, including drug-resistant ones."

"The CDC's 2019 antimicrobial threat report highlighted the growing problem of antimicrobial resistance with few new drugs to treat them on the horizon," Kley said. "In fact, the CDC predicts that by the year 2050, deaths from antimicrobial-resistant infections will surpass those from all cancers. It's well documented that HAIs increase length of stay in the hospital. Studies indicate this increase is somewhere between three and 23 days depending on the HAI. Additionally, longer hospital stays coupled with invasive procedures and devices only add to the HAI risk."

HAIs can result in human suffering and forever change a patient's life. They can cause long-term health issues and disability, such as the recurrent disease frequently seen with Clostridioides difficile (C. difficile). In addition, HAIs can result in a negative patient healthcare experience.

> *In Canada, HAIs affect 1 in 10 patients and evidence shows that bacterial contaminants can live on objects and*

"Patients entrust healthcare workers with the health issue that brought them in," Kley continued. "That trust can be quickly eroded when we fail to protect them from harm such as HAIs. Trust is an expensive thing; it takes years to earn but can be lost in a single incident."

Infection reduction efforts

In the early 2000s, some states passed laws requiring public reporting of selected HAIs. By 2011, the Centers for Medicare and Medicaid (CMS) implemented national public reporting of HAIs starting with central line–associated

bloodstream infections (CLABSI). And beginning in 2015, hospitals are required to report eight types of HAIs ranging from selected surgical site infections to C. difficile, and individual states may require reporting other HAIs. This data, which can be viewed by anyone at hospitalcompare.gov, are used by many agencies. For example, CMS uses them to determine hospital reimbursement.

The Leapfrog Group, a nonprofit founded by large employers and other health purchasers, uses HAI and other patient safety data to improve healthcare quality and safety. Based on results of an annual survey, Leapfrog assigns a safety letter grade to hospitals. The survey looks at both processes and outcomes, including hand hygiene practices and five selected HAIs. The information provided by Leapfrog allows purchasers, including health insurance plans, to select high-value care. Public reporting of HAIs and other patient safety data can impact a facility's reputation and finances.

The hospital-acquired condition reduction program that started in 2015 is a Medicare pay-for-performance plan that supports CMS's effort to link payments to quality. The total score is based on six quality measures, five of which are HAIs. Hospitals with a score above the 75th percentile (or the worst performing 25%) are subject to a 1% payment reduction that applies to all Medicare discharges for the fiscal year.

Another item under the CMS hospital quality initiative is the Hospital Consumer Assessment of Healthcare Providers and Systems (HCAHPS) survey. The HCAHPS score reflects the patient experience, including hospital cleanliness. The results are publicly available at hospitalcompare.gov.

"The key take-home message here is that CMS rewards and reimburses hospitals based on their performance scores," Kley said. "However, during the COVID-19 pandemic, CMS will not be counting quality data for the first half of the year for performance or payment."

Essential IT wearables and Internet of Things devices are often overlooked as infection vectors in healthcare

Basic errors compound the problem. When a healthcare worker makes a medication error, that healthcare worker knows without a doubt that he or she was the source of the error and will never forget it. However, when that same healthcare worker breaches infection control (for example, missed hand hygiene or failure to disinfect a surface or item), he or she may never realize that those actions or inactions resulted in patient harm. Clear accountability for cleaning and disinfection frequently is missing. The recent introduction of cleaning accountability or responsibility grids is one solution to this issue.

Kley recommends taking healthcare team members (including all disciplines) into a room or area and go item by item, surface by surface (including mobile equipment) and explain who should clean what and when.

"It's eye opening," Kley said, "to learn just how many things are not being routinely cleaned because of a lack of assigned ownership." And mobile staff should be provided guidance for regularly cleaning and disinfecting their mobile equipment.

Studying solutions
Dr. Sean Spina, coordinator of clinical pharmacy services at Island Health in Victoria, British Columbia, Canada, leads a research program evaluating technology in clinical practice and its impact on patient care outcomes.

"We realized over the years that hospital communication is essential and [that it should] occur seamlessly," Spina said. "We know that people use smartphones, smart watches, and wearables to communicate…efficiently… as patients transition through our care team. But as communication needs expanded, we realized that we were bumping up against some of the same infection prevention and control policies [seen on the wards]—clinicians regularly use personal or corporate mobile devices."

Spina's trial (I-SWIPE), which he led with Stephanie Huffman and Carly Webb investigated appropriate methods for cleaning smartphones and wearables in patient care environments.

"We endeavored to perform a real-world clinical trial that looks at real data and how it's being used in clinical practice," Spina explained. "In our publicly funded healthcare system in Canada, our team felt a responsibility to put data to some of the impact that technology has on clinical practice."

The purpose of the I-SWIPE trial, which was a prospective before and after study, was to determine if ultraviolet-C (UV-C) disinfection devices are more effective at eliminating bacteria on smartphones and wearables compared to usual care. The trial was conducted at three hospitals on Vancouver Island: a community hospital (Campbell River General Hospital) and two acute-care hospitals (Victoria General Hospital and the Royal Jubilee Hospital).

When asked about frequency of cleaning mobile devices in a baseline questionnaire, 45% of participants said they cleaned their smartphones weekly, 61% said they cleaned their smart watches weekly, and 29% said they cleaned their badges weekly. Until recently, many technology manufacturers stated that IoT devices cannot withstand disinfection with conventional germicidal wipes.

"We looked at using UV-C in a real-world setting with a product called CleanSlate, which uses ultraviolet germicidal irradiation," Spina said. "This disinfection method uses short wavelengths of ultraviolet light to kill or inactivate microorganisms. It…[destroys] the nucleic acids, disrupting their DNA and leaving them unable to perform vital cellular functions."

Users place a mobile device into CleanSlate (a glass box that's permeated by ultraviolet light). Spina's team tested the devices before the study and found that 22% of them grew bacteria. When participants used CleanSlate twice a day during their shifts, 20% of the devices grew bacteria. The researchers found that CleanSlate reduced the rate of bacteria to 4%.

Performing the study in a real-world environment helps researchers understand how different cases can affect cleaning. For example, mobile phones or cases with crevices or cracks could still grow bacteria. In addition, the researchers inoculated smartphones that were going to be discarded with methicillin-resistant clostridium and vancomycin-resistant enterococci and then placed them in CleanSlate. The result was a 100% kill rate. Of the participants who participated in the study, 90% were satisfied with the UV-C device and 95% said it was very easy to use.

"We found that the IoT and wearable devices grew pathogenic bacteria from 7% to 50% of the devices depending on what they were," Spina explained. "And ultraviolet lights appeared

to be more effective at eliminating bacteria on smartphones and wearable devices when you compare that to usual care. We feel that the results of our study indicate that this technology is beneficial in the hospital setting for IoT and wearable devices." However, Spina recommends further studies to determine the optimal interval at which UV-C should be used. "This is early evidence," he said. "I think that the future is going to go this way."

Sandra Dunford, RN, infection prevention control consultant at Island Health in Victoria, British Columbia, Canada, explained that "Island Health is the authority on Vancouver Island and provides delivery of care across the Island for all residents, and it includes home, community, long-term, and acute care. The infection control team was pleased when we were invited to participate with Dr. Spina because one of the major problems we're having is trying to engage staff to recognize and understand the importance of cleaning and disinfecting medical devices, whether they're personal or professional."

"When we're looking at the Spaulding classification for noncritical medical devices," Dunford continued, "we see that they have to be cleaned and disinfected mostly between use. People are carrying these devices all through their work within a healthcare facility, moving from place to place, patient to patient, room to room. This creates an opportunity for infectious microorganisms to be transmitted within that environment. I believe that current COVID-19 circumstances indicate that we really do need to step up and ask people to take ownership of the ability to contain microorganisms when they're working in a healthcare environment."

HAI risk by the numbers
Healthcare-associated infections (HAIs) are a significant problem that can be costly and deadly for patients, their families, and healthcare providers. According to the CDC, HAIs in the United States

- *infect 1 in 31 patients*
- *account for 1.7 million infections*
- *lead to approximately 99,000 deaths each year*
- *cause more fatalities than car accidents*
- *cost $5.4 billion in hospital costs*

COVID-19 and the impact on infection prevention

Dr. Elie Berbari, chair of infectious diseases at the Mayo Clinic in Rochester, Minnesota, lays out the global impact: "[After] the early report of cases in the Wuhan province in China [and] the first U.S. documented case…on January 20…the WHO…declared the COVID-19 pandemic a global public health emergency. After that, things accelerated and the death toll in China started to increase significantly. Multiple countries have banned travel across the oceans and across countries. [In March], we started seeing… an increasing number of cases throughout the United States, but mostly in California, Seattle, and New York, [and] most of the numbers in the US started to increase significantly."

"As of [this writing on March 24, 2020], the US has more than 830,000 confirmed cases and an excess of 45,000 or 46,000 deaths," Berbari said. "A lot of the cases and deaths have occurred on the East coast, the West coast, and parts of…Florida as well as Louisiana. Predominantly [COVID-19] is transmitted through droplets, but it can be transmitted through direct or indirect contact. Occasionally it can be transmitted through airborne or droplet nuclei. In the Mayo Clinic, multiple teams [including the incident command center, infection control, and occupational health] were activated early in the crisis."

"[We] have almost universal masking of both patients and healthcare providers [at Mayo Clinic]," Berbari continued. "All patients who are suspected of having COVID or who have COVID are placed in modified droplet isolations. Some of the barriers that we've identified to implementing personal protective equipment (PPE) and infection prevention

practices have been around supply chain and mask and eye protection availability. Another barrier was being nimble in transforming infection prevention practices pretty much 180 degrees from what we've known in the past. We've also relied heavily on testing, including polymerase chain reaction (PCR) and serology, over the last month and a half and have implemented programs around utilization of testing to identify, detect, and isolate patients as well as employees. Contact tracing of employees and employee exposure has been significantly minimized as a result of implementation of wide-scale PPE as well as targeted testing and surveillance."

"There are four key elements to creating an effective infection prevention and control protocol."—Dr. Elie Berbari, Chair of Infectious Diseases at the Mayo Clinic, Rochester, Minnesota

Berbari describes four key elements to creating an effective infection prevention and control protocol: "The first is gathering key clinical and other staff to examine interaction points in healthcare workflow to identify gaps. The second is establishing a specific decontamination ownership of potential gaps. The third is establishing and implementing nimble (and I want to underscore the word nimble here), real-time protocols for clinical staff. This was so important in the COVID-19 response. And the fourth is ensuring that technology acquired for in-hospital use is designed to withstand the requisite aseptic rigors of the healthcare environment."

Familiarity breeds adherence
"I'm sure we all are aware of the amount and complexity of technological and mobile devices that are coming into healthcare. [Their use is] exponentially increasing," Dunford added. "Infection control has striven over the last couple of years to keep pace with that. Unfortunately, [there's a lack] of understanding of the ability these devices have to transmit [infection]."

"The I-SWIPE trial allowed us to bring together the collaborators we need to develop the processes [for] cleaning and disinfecting noncritical medical devices," Dunford continued. "[It also allowed us] to engage staff so that they're thinking about it and they can even think about what's going to happen when they go home and how they're going to protect their families."

Dunford continued: "When we're talking about establishing protocols, and new protocols in particular, we have found it's very important to tie them to already familiar policies and procedures. When we were looking at the I-SWIPE trial or bringing in UV-C technology, we tied it very specifically to hand hygiene and the ability to make sure we are handling medical devices with clean hands only. So when [Dr. Spina] set up the procedure it [included wiping] down the device [to remove organic material] before putting it in [the UV-C machine]. And then prior to taking it out of the machine, performing hand hygiene. So the principle is…only handling…medical devices [with] clean hands."

Collaboration for best practices
Another important consideration when adding any new technology, including cleaning and disinfecting technology, is ensuring the product can do what it claims. As technology increases, claims are made about infection control. COVID-19 has shown us that no one fix exists to clean, disinfect, and mitigate HAI risk. All of the processes and technology should be designed to work together to provide the best practice for ensuring devices are not fomites for microorganism transmission.

In an impromptu study, Kley's infection control department received an adenosine triphosphate (ATP monitor) to perform random spot checks around the hospital.

"One of the highest ATP readings I've ever seen of all items tested throughout the hospital was the touch screen control panel for the department printer," Kley said. "The relative light unit (RLU) reading was in the tens of thousands; we considered an RLU reading below 200 to be clean. This single example

highlights the importance of considering the pathogens that could be on the various touchscreens of all kinds of equipment throughout a hospital. To reduce HAIs and staff absenteeism, I recommend frequently cleaning and disinfecting mobile devices, computers, keyboards, and office equipment, including printers."

"In the past, departments [that were] responsible for IT or IoT devices [were] uncertain [about] how they should move forward with sanitizing," said Daniel Colling, RN, Global Head Healthcare Industry Solutions & Practice, HP Inc. "To be able to truly provide recommendations and protocols, HP has provided global thought leadership through working with APIC, the Association for Professionals in Infection Control and Epidemiology, to outline how to sanitize these devices. We have [produced] a webinar and…a whitepaper [to help] IT departments work with epidemiologists…and environmental services."

HP has a partnership with Clorox (which is the leader when it comes to germicidal wipes in healthcare systems and is committed to developing innovative disinfection and sanitization solutions) and has developed fit-for-purpose built technology to withstand caustic germicidal wipes so that users can follow through with infection prevention policies and protocols.

"In the coming years, we're only going to see more and more mobile and other IT devices used in healthcare," Kley said. "In fact, with the COVID-19 pandemic, healthcare experienced huge increases in the use of telemedicine, which relies on such devices. I predict that in the post COVID-19 world, the use of telemedicine is going to remain at very high levels. I, for one, am truly grateful for the partnership between HP and Clorox in which we collaborate to provide the best possible solutions for the cleaning and disinfecting of these critical healthcare tools. The industry definitely needs more collaborations such as this."

As IT and IoT devices become more prevalent to help clinicians improve efficiency, it's critical that vendors and companies producing or developing hardware consider the need for disinfection, keeping clinicians and patients as a priority. In the end, the goal is to provide safer, smarter, and more secure technology that is outcomes based and can be sanitized and disinfected.

References
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