

Hand hygiene: A simple strategy for health care-associated infection prevention and control with implications for control of the current COVID-19 outbreak

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Abstract:

The World Health Organization (WHO) defines Health Care-Associated Infection (HCAI) as an infection a patient acquired in health care settings. In Canada, more than 220,000 patients are infected by HCAs annually, with 8,500 to 12,000 of these patients resulting in death, thus becoming the fourth leading cause of death for Canadians. Hand hygiene practice is the most critical measure to prevent HCAs, however, research indicates that in hospitals worldwide, just 40% of health care workers abide by the advised hand hygiene guidelines. A new effective HCAI control and prevention program is needed to sustain benefits, building on prior interventions such as including hand hygiene education that stresses the necessity of this practice in the protocol, providing factual proof of the effectiveness of hand hygiene, the acknowledgment by senior staff of their responsibility as role models for all staff, innovative technological methods, and regular auditing/feedback. With the current outbreak of coronavirus disease (COVID-19) that has infected millions around the world, a new HCAI control and prevention program can increase the compliance rate of handwashing with alcohol-based hand rub/sanitizer amongst healthcare professionals thus aiding in prevention and control of spread within the community.

The WHO defines HCAI as an infection acquired by a patient during the process of health care in various settings, including and not limited to hospitals, long-term care, family medicine clinics, home care, and ambulatory care and are not present or incubating at admission. The WHO identifies HCAs as the most harmful and recurrent event in healthcare delivery worldwide [1]. HCAs appear within 2 to 30 days following health care [6]. This infection can then spread from the health care environment to society upon contact outside these settings, being detrimental to human health. HCAs also include occupational infections among healthcare staff, such as doctors, nurses, and administration. Factors including advanced age, underlying illness, the prevalence of antibiotic-resistant organisms, and international travel lead to an increase in the risk of developing HCAs [6].

Moreover, HCAs alone constitute a significant burden, causing significant morbidity and mortality in hospitalized patients. HCAs are now the fourth leading cause of death for Canadians, whereas two decades ago, it was the eleventh leading [7]. Although preventable, in Canada, HCAs remain persistent with more than 220 000 patients infected

annually, and an estimated 8,500 to 12,000 deceased while receiving healthcare [2]. HCAI's also constitute a significant financial burden on society, with Canada's annual direct costs estimated to be one billion dollars [2].

However, this significant mortality, morbidity, and financial burden caused by HCAs can be reduced and are often preventable. About 80% of common infections are spread by health care workers, patients, and visitors [7]. Through infection prevention and control strategies, researchers estimate that 70% of HCAI's can be prevented [7]. Employing the best strategies for preventing HCAs can reduce HCAI risk significantly. Antibiotics are the most common treatment for HCAs, but this increases antibiotic-resistant organisms and requires extended health care stays, resulting in a lack of efficient hospital systems, possible disability, and mortality in some cases. The often neglected and poorly performed hand washing practice is the most critical measure to prevent HCAs [8].

Nonetheless, research indicates that in hospitals worldwide, just 40% of health care workers abide by the advised hand hygiene guidelines [3]. Depending on the type, mi-

croorganisms can survive on hands from 2 to 60 minutes after contact with patients and contaminated environments such as patient gowns, bed linen, and bedside furniture [9]. Poor hand hygiene can be the result of using an inadequate amount of product or limited duration of hand washing, which increases the likelihood of microbial transfer. Health care workers' contaminated hands due to poor hand hygiene have been linked to endemic HCAs and numerous HCAI outbreaks [9]. Hand hygiene is the primary proven measure effective in HCAI prevention and antimicrobial resistance spreading, and effective interventions exist to improve compliance [9]. However, low compliance rates among health care workers have been reported from both developed and developing countries, with an overall average of just 38.7% [9].

In the past, there have been HCAI epidemics called nosocomial outbreak (NO), but most occur sporadically. In some cases, during an outbreak investigation, once the NO has been identified, the source may be traced to a single health care worker. Danzmann et al. (2013) conducted a systematic review evaluating outbreaks caused by healthcare workers [10]. A total of 152 NOs in 26 countries from 1958 through 2006 were included in the review, finding pathogens Hepatitis B virus, *S. aureus* bacteria, and *S. pyogenes* bacteria to be predominant [10]. Transmission of pathogens mainly occurred via direct contact with patients, with 41.5% of outbreaks deriving from physicians and 39.4% outbreaks deriving from nurses [10].

Currently, Coronavirus Disease 2019 (COVID-19), a new viral illness that is part of the same family as the severe acute respiratory syndrome (SARS) coronavirus, has globally infected millions of people. The severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), which is the strain of coronavirus that causes COVID-19, can survive up to 72 hours on plastics, 48 hours on stainless steel, 24 hours on cardboard, and 4 hours on copper [11]. These are all surfaces found in hospitals that can contaminate hands due to poor hand washing practice if the coronavirus virions are not thoroughly removed from the hospital setting [11]. Enveloped viruses, such as coronaviruses, are generally more susceptible to handwashing detergents and the use of alcohol-based sanitizers due to lysis or the solubilization of the lipids and proteins of their cell membrane [12,13]. For this novel coronavirus, the WHO advises that standard practices still hold for this outbreak: regular and thorough hand washing with alcohol-based hand rub/sanitizer will aid in killing any possible viruses on the hand [5]. With the current outbreak of COVID-19 that has infected millions around the world, a new HCAI control and prevention program can increase the compliance rate of handwashing with alcohol-based hand rub/sanitizer amongst healthcare professionals thus aiding in prevention and control of spread within the community.

At present, hand hygiene interventions include health care staff education, handwashing performance feedback and audits, verbal reminders and signs, improvement of water and soap availability, automated handwashing machines, and introduction of hand sanitizer. The WHO Multimodal Hand

Hygiene Improvement Strategy and guidelines were developed by informed literature on spread methodology, implementation science, behavioral change, diffusion of innovation, and impact evaluation [9]. Wearable hand hygiene products such as hook-on alcohol-based hand rub dispensers that allow staff to disinfect while mobile are now available and research has shown an increase in the rate of handwashing from 37% to 49% [8]. This wearable dispenser would be convenient and easily accessible and thus can help form a habit of washing.

Nevertheless, further measures for the prevention of HCAI during the current COVID-19 pandemic are essential. Research indicates that multi-modal education and behavior interventions increase hand hygiene compliance, and if not implemented, benefits cannot be maintained, and prior interventions cannot be built on [14]. Trajtmann et al. (2013) found ultraviolet, visible markers to be useful as an audit tool in evaluating surface cleaning compliance, which could prevent contamination on hand [15]. Storey et al. (2014) found increased hand hygiene compliance by providing electronic badges for hospital staff that displays immediate hand hygiene status to colleagues and patients [16]. Dalziel et al. (2017) found that continuous monitoring of the volume of alcohol-based hand rub used is a valid indicator of compliance [17]. Thus, technology-enabled observation of actual practice can help to sustain hand hygiene compliance [14].

Although these current interventions enable hand hygiene, there seem to be barriers to handwashing for healthcare workers. First, when recognizing Hawthorne effects where a performance improvement occurs due to the awareness of being observed, these interventions would likely result in positive changes in compliance and perhaps are not sustained [14]. Further, researchers investigated the reason behind low rates of hand hygiene compliance among healthcare workers. Hand hygiene knowledge varied among staff, junior staff followed poor hygiene examples from senior staff, there was a belief of lacking effectiveness in good hygiene, and hand hygiene were not found to be integral. For the stated interventions to be successful and sustained, these further measures need to be coupled with existing methods. Improved awareness of the evidence across good hand hygiene is required to improve ownership of those behaviors. There is also a need for senior staff to acknowledge their responsibility as role models in developing the culture of hand hygiene practices within the workplace [4].

Also, as of May 5, 2020, Public Health Ontario reported 292 outbreaks, with 16.1% of health care workers infected with COVID-19 since April 21st, 2020, in public hospitals and long-term care [18,19]. A NO of COVID-19 is unnerving as the Centers for Disease Control and Prevention reports that infection with SARS-CoV-2 is associated with a mortality rate currently estimated to be 0.2% [20]. In health and congregate care settings, the Ontario Coalition reported 4951 patients/residents infected with COVID-19, an increase of 155.7%, and 1878 patients and residents deceased in outbreaks, an increase of 333.7% [21]. Older patients/residents and those with chronic conditions would be at higher risk of

infection, along with those who work in these settings. Health care workers can be infected since they are in close contact with those infected with COVID-19 and the community, thus transmitting to hospitalized patients if infected.

Currently, in Wuhan, SARS-CoV-2 was found to be extensively distributed on object surfaces in a hospital, indicating a possible high infection risk for health care workers and patients [22]. Respiratory droplets and close contact are found to be the primary transmission routes for this virus [23]. Handwashing with alcohol-based hand rub/sanitizer by healthcare workers will be essential to protect against coronavirus infections in healthcare settings due to the high possibility of infection from object surfaces and close contact with patients. An increased handwashing compliance rate among hospital staff is essential in achieving control during this pandemic. It prevents contraction from infected patients and, thus, transmission to the community and uninfected patients.

To conclude, the acknowledgment of the factual proof surrounding COVID-19 is vital for controlling infection and prevention during this pandemic due to the dangerously low hand hygiene compliance rate among health care workers [9]. Future studies that analyze the impact of an increase in hand hygiene compliance during the current COVID-19 outbreak will help improve patient care and safety. A new and effective HCAI infection control and prevention program is needed to sustain benefits. Hand hygiene education included in existing interventions will stress the importance of this practice in the protocol. Factual proof of the effectiveness of hand hygiene, senior staff acknowledging their responsibility as role models for all staff, innovative technological methods, and regular auditing/feedback are required [4]. It is likely that including these measures into the program will increase and, most importantly, sustain hand hygiene compliance of healthcare workers, and thus control the spread of the COVID-19. It is unfair for uninfected patients hospitalized for other conditions as well as health care professionals to be more likely to contract this disease due to poor hand hygiene. With this current COVID-19 outbreak that has infected millions worldwide, an increase in healthcare worker compliance of a common and simple practice such as handwashing with alcohol-based hand rub/sanitizer can make a difference [5]. The difference is as follows: a reduction in the likelihood of nosocomial infection in hospitals, thus helping in decreasing the probability of patients and healthcare workers becoming infected by this viral infection, which in turn will control and prevent spread to the community.

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