



# Effectiveness of an electronic hand hygiene monitoring system on healthcare workers' compliance to guidelines

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**Summary** Hand hygiene is a growing concern among populations and is a crucial element in ensuring patient safety in a healthcare environment. Numerous management efforts have been conducted in that regard, including education, awareness and observations. To better evaluate the possible impact of technology on a healthcare setting, we observed the impact of a particular niche technology developed as an answer to the growing hand hygiene concerns. A study was conducted at Salmaniya Medical Complex (SMC) in Bahrain on a total of 16 Coronary Care Unit (CCU) beds where the system was installed, and the hand hygiene activity of healthcare workers (HCWs) in this area was monitored for a total period of 28 days. Comments, remarks and suggestions were noted, and improvements were made to the technology during the course of the trial. While resistance to change was significant, overall results were satisfactory. Compliance with hand hygiene techniques went from 38–42% to 60% at the beginning of the trial and then increased to an average of 75% at the end of the 28-day trial. In some cases, compliance peaked at 85% or even at 100%. Our case study demonstrates that technology can be used effectively in promoting and improving hand hygiene compliance in hospitals, which is one way to prevent cross-infections, especially in critical care areas.

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## Introduction

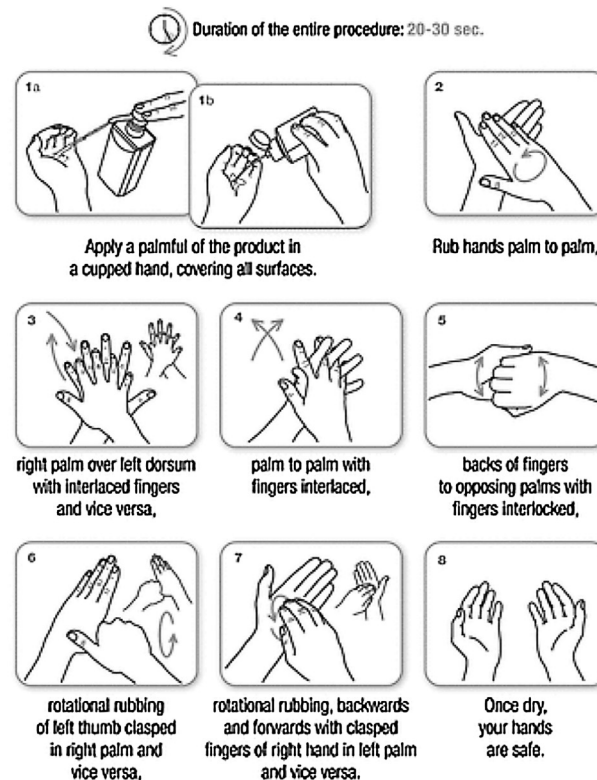
Hand contamination in a healthcare environment has been a subject of meticulous attention, and numerous studies have been performed to control this contamination. Healthcare-associated infections (HCAs) at a healthcare institution jeopardize patient safety [1] and can sometimes lead to significant complications and even death [2]. Pathogens colonizing a patients' skin can easily spread to the surrounding environment and contaminate HCW hands while they perform routine activities [3]. As a result, and given that there is significant contact between HCWs and patients in some hospital areas (i.e., Intensive Care Units), there is a high risk of cross-transmission [4]. Ever since Dr. Semmelweis introduced the concept, hand hygiene has been emphasized as an important way to prevent the spread of infections among patients [5]. However, hand hygiene compliance levels are still considered to be under the acceptable thresholds, and adherence to hand hygiene procedures can sometimes be as low as 38% [6,7] despite the World Health Organization's (WHO) recommendations for proper hand hygiene practices [8].

Many reasons exist for the observed non-compliance to guidelines, some of which have been cited in previous literature, such as (i) skin irritation caused by hand hygiene agents [9], (ii) religious and cultural beliefs [10,11], (iii) high work load and prioritization [7], (iv) lack of administrative sanctions for non-compliers and lack of rewards for compliers [7], (v) lack of awareness [2], etc. Significant initiatives have been implemented to counter hand-hygiene-linked infections. Guidelines for proper hand hygiene have been initiated by international organizations, such as the "Five Moments" introduced by the WHO [12]. Hand hygiene is judged to be crucial in preventing the spread of infections, but it is also important to specify the "when" and "how" of hand sanitation [13] and to educate HCWs about those procedures. Leaflets representing the "Five Moments" of hand hygiene and guidelines for proper hand rubbing techniques have been released by the WHO (Figs. 1 and 2) with a recommendation for medical institutions to use those as a reference for HCW awareness [14].

Despite these efforts, HCW hand hygiene compliance is still insufficient and falls short of the recommended 30 hand rubs per hour [2]. Many different parameters appear to be necessary to increase compliance rates, including HCW education, reminders in the workplace, adoption of an institutional safety climate, monitoring of practices, and performance feedback [3,13].

# How to handrub?

RUB HANDS FOR HAND HYGIENE! WASH HANDS ONLY WHEN VISIBLY SOILED!



**Figure 1** How to hand rub, WHO Guidelines on hand hygiene in health care [8].

Unpublished data collected at the Salmaniya Medical Complex (SMC) in Bahrain showed a low rate of hand hygiene compliance among HCWs, especially in the CCU wing, obviously resulting in the need for improvements. Observation and monitoring of HCWs proved to be an effective tool in increasing hand hygiene compliance. However, its impact was low and is highly dependent on the presence of human observers, which is controversial and non-practical [4,15–17].

Given the importance of observation and monitoring in a healthcare setting [18], and given the effectiveness an electronic monitoring system can have [17] on improving hand hygiene, we will evaluate the impact of such a technology in a study performed on-site in cooperation with the SMC management. As with every new technology introduced in a specific setting, resistance to change might have a significant impact, thus limiting the use of the new system [19]. Technology acceptance is to be considered when planning the execution phase to minimize this resistance, and a specific approach has to be undergone to promote implementation and thus patient safety [20].

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