



Nursing Management Information System for Monitoring Hand Hygiene Compliance of Health Care Workers

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Abstract

Introduction: Healthcare Associated Infections (HAIs) are one of the health problems in developed and developing countries, the incidence of nosocomial infections occurs almost all over the world and greatly affects developing and poor countries. One way or effort that can be done to prevent nosocomial infections is by hand decontamination where disease transmission through hands can be minimized by maintaining hand hygiene by means of hand hygiene.

Results: The advancement of information system technology is growing rapidly along with the needs of humans as its users. The benefits of information system technology can also be enjoyed and applied in the health sector. Management information systems can also be utilized in health promotion efforts, namely in efforts to monitor hand hygiene compliance. Efforts to monitor hand hygiene compliance consist of hardware as a recording tool, and software as a processor to present the required data. Efforts to apply observation technology using the latest tools integrated with the management information system are expected to be a solution to the shortcomings of direct observation carried out by officers including human error susceptibility, data presented, and solutions to the time taken from the documentation collection process.

Conclusion: The author uses literature studies as a writing method. This article presents recommendations for the health care sector to use integrated management information system technology as an effort to improve the quality of health care, especially in the field of nursing based on evidence-based practice.

Keywords: hand hygiene compliance, hand hygiene compliance monitoring technology, management information system

Received May 12, 2025; Received in revised form July 2, 2025; Accepted August 18, 2025; Available online October 25, 2025

INTRODUCTION

Healthcare Associated Infections (HAIS) or better known as nosocomial infections are defined as infections that develop after 48 hours of hospitalization or treatment at a health facility starting from the time of registration (Bradley, jhon 2015). Healthcare Associated Infections (HAIs) are one of the health problems in developed and developing countries, the incidence of nosocomial infections occurs almost throughout the world and greatly affects developing and poor countries, the results of a prevalence survey conducted by WHO in 55 hospitals from 14 countries representing 4 WHO Regions (Europe, Middle East, Southeast Asia and Western Pacific) showed an average of 8.7% of hospital patients experience nosocomial infections. At any time, more than 1.4 million people worldwide suffer from complications from hospital-acquired infections. The highest frequency of nosocomial infections was reported from hospitals in the Middle East and Southeast Asia Region (11.8% and 10.0% respectively), with a prevalence of 7.7% and 9.0% respectively in the European and Western Pacific Regions (WHO, 2009).

Prevention and control of infection must absolutely be carried out by nurses, doctors/dentists including prospective dentists and all people involved in patient care. One way or effort that can be done to prevent nosocomial infections is by hand decontamination where disease transmission through hands can be minimized by maintaining hand hygiene by means of hand hygiene (Depkes.RI., 2007). Hand hygiene is one of the effective steps to break the chain of infection transmission, so that nosocomial incidence can be reduced.

Hand hygiene behavior using soap is the cheapest and most effective health intervention compared to the results of health interventions in other ways in reducing the risk of transmission of various diseases (Fewtrell et al., 2005). Therefore, hand hygiene by cleaning hands needs to be given high priority, because hand hygiene

with soap as a cleaner, scrubbing, and rinsing with running water will wash away dirt particles that contain many microorganisms (Fatonah, 2005).

Another study that observed the level of hand hygiene compliance of health workers in the intensive care unit of Pantai Indah Kapuk Hospital, North Jakarta, showed that the highest level of hand hygiene compliance was nurses 43%, doctors 19% and other health workers 28% (Jamaluddin et al., 2012), while the results of the study on differences in hand hygiene compliance rates for health workers at Kariadi General Hospital, Semarang, showed that the hand hygiene compliance rate for nurses was 31.31%, residents 21.22% and Co Ass 21.69% (Suryoputri, 2011).

Efforts made to improve hand hygiene compliance have so far been carried out by direct observation carried out by infection control officers (Jamaludin et al, 2012). This method is considered quite effective in stimulating health workers to carry out hand hygiene correctly and properly. Along with the development of technology, efforts to monitor hand hygiene compliance can be carried out by machines integrated with existing information systems. For this reason, a literature review is needed to find innovations related to technology that can be used in developing efforts to monitor hand hygiene compliance of officers.

METHOD

1. Management Information System

An information system is a system that integrates data collection, processing, reporting and use of information needed to improve service effectiveness through better management at every level of health services (WHO, 2004). Furthermore, Milliarou & Zyga in their research explained that an information system is a computerized system that is useful for facilitating the process of collecting, storing, processing, retrieving, displaying, and communicating information needed in practice, education, administration and research. This system provides various advantages such as reducing errors, speed and accuracy in providing services (Milliarou & Zyga, 2009).

One of the information systems in the field of nursing that can be used to facilitate supervision, data collection and data processing is automatic hand hygiene compliance monitoring. With this tool, hand hygiene compliance monitoring which was originally carried out by officers (observers) is directly replaced by an automatic monitoring tool.

2. Hand Hygiene

Hand hygiene is an effort or action to clean hands, up by using antiseptic soap under running water (hand washing) or by using alcohol-based handrub (hand rubbing) with systematic steps in sequence, so as to reduce the number of bacteria on the hands (WHO, 2009). One of the important procedures to prevent and reduce the incidence of nosocomial infections is to use hand hygiene guidelines correctly and implement them correctly and effectively (WHO, 2002).

According to the results of the Formative Study of Hygiene Behavior by the Water and Sanitation Program, it was found that Hand Hygiene with Soap (CTPS) behavior has not become a common habit or a social norm in everyday life (USAID, 2006) and the national prevalence rate of correct behavior in hand hygiene is 47% (Rikerdas, 2013).

Several studies have also found that the level of hand hygiene compliance by nurses is still below standard. One study that observed the level of hand hygiene compliance of health workers in the intensive care unit of Pantai Indah Kapuk Hospital, North Jakarta, showed that the level of hand hygiene compliance of nurses was 43% (Jamaluddin et al., 2012). In addition, according to Suryoputri's research, 2011, the hand hygiene compliance rate of nurses at Kariadi General Hospital, Semarang was 31.31%.

In 2009, WHO formulated an innovative strategy for implementing hand hygiene for health workers entitled My five moments for hand hygiene. My Five Moments for hand hygiene is a benchmark for when a health worker should perform hand hygiene, namely:

a. Before contact with the patient

Before touching the patient, it is required to perform hand hygiene first, which aims to protect the patient from pathogenic bacteria on the health worker's hands.

- b. Before performing aseptic actions
Before performing aseptic actions, it is required to perform hand hygiene first, which aims to protect the patient from pathogenic bacteria, including those originating from the patient's own body surface.
- c. After contact with patient body fluids
After contact with patient body fluids, hand hygiene is required to protect health workers from pathogenic bacteria originating from the patient.
- d. After contact with patients
After contact with patients, hand hygiene is required first, which aims to protect health workers from pathogenic bacteria originating from the patient.
- e. After contact with the patient's environment/surrounding area
After contact with the patient's environment/surrounding area, hand hygiene is required even if it does not touch the patient, which aims to protect health workers and the surrounding area from pathogenic bacteria originating from the patient.

According to Kampf (2009), there are several steps that can be taken to improve hand hygiene compliance, namely:

- a. Staff training related to clinical indications for hand hygiene.
- b. Hand hygiene disinfection must be sufficiently available and located in strategic areas.
- c. Senior staff members must set an example or role model and act according to the correct hand hygiene guidelines

3. System of Implementation of Information System Technology in Hand Hygiene Compliance Monitoring.

Research conducted by Hong, et. al. (2015), states that this system has the following objectives:

- a. Integrate soap dispenser sensors and door sensors into a dual-sensing system with a warning alarm using a continuous device.
- b. Accurately track hand hygiene compliance levels with a dual-sensing system.
- c. Store hand hygiene compliance levels centrally in a database.

Hong, et. al. (2015) also assumes that supervision in this system is based on the following work system:

- a. Only one person enters at a time and all entries are human.
- b. Everyone must perform hand hygiene before entering the treatment room. There are some instances where a person is not required to perform hand hygiene, for example if a health worker has just finished hand hygiene.
- c. The patient is already in the room.
- d. Hand sanitizer wipes are full and users know how to use them correctly.
- e. Hand hygiene occurs at the right time. After observing the patient room, we have set this time to 2 seconds.
- f. The system will reset after 2 seconds. Specifically, this means that the next action cannot take place until 2 seconds after the first.

Hong, et. al. (2015) described a prototype of an automated hand hygiene monitoring system, consisting of a door sensor, two sanitizer dispenser sensors, a microprocessor and an alarm. The door sensor used to track the entrance is an ultrasonic sensor (Maxbotix LV-EZ1 Ultrasonic Sensor, Max Range 6.45 m, Digital Output) attached to the outside of the door frame. It works by creating a constant distance reading in an empty door, by emitting a correlated pulse width (Figure 1c). As the beam moves (Figure 1d), the change in distance is detected, indicating the activation of the entrance door. The device is equipped with a BFlatback U-Ring (Figure 1a), a device designed to accommodate a small IR beam detector (SHARP Infrared Sensor (GP2D120XJ00F), Range: 4-30 cm, Analog Output). This is used to determine whether hand sanitizer has been used because it moves the beam below the nozzle (Figure 1b)

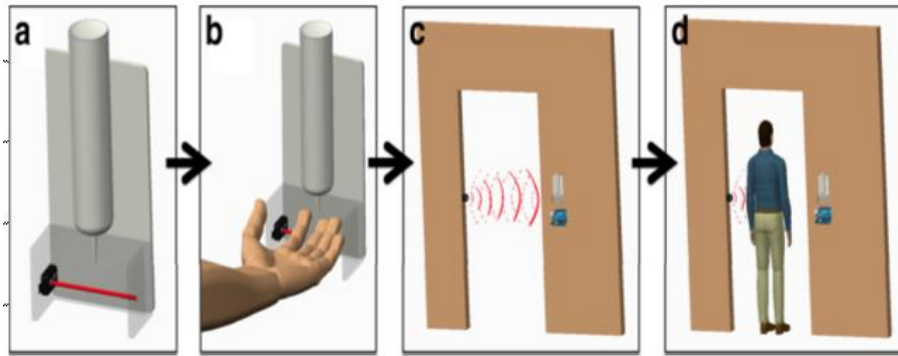


Figure 1. Hand sanitizer unit equipped with BFlatback U-Ring (A); IR detecting during hand hygiene (B); Door with attached US beam (c); US beam on the door moves by human entry into the room (d) The sensors are connected to an Arduino microprocessor (Arduino Uno Micro-processing Board), which is placed on the wall where the sensed information is processed. Using its built-in Wi-Fi capability, the Arduino can send data to the hospital's wireless network, allowing the data to be captured in a centralized location for analysis. The Arduino sends the number of hand hygiene compliant and non-compliant patients. These numbers can be recorded to create compliance levels by department. In addition to sending data, when a hand hygiene non-compliance event occurs, the Arduino uses its built-in speaker to sound a short, audible alarm, reminding the person entering the room to sanitize (Hong, 2015).

Advantages of Implementing Management Information Systems in Hand Hygiene Compliance Monitoring

Hand hygiene compliance monitoring by health workers is carried out by observing other workers. This monitoring method is carried out by direct observation using the best standards. Officers on duty in shifts are recorded regarding hand hygiene behavior based on hand hygiene provisions or standards. So it is expected that officers can periodically carry out hand hygiene correctly and appropriately. (Boyce JM, et al in Deepti Sharma, BS et al, 2012)

Although the direct observation method carried out by officers uses the best standards, there are things that cause the results of direct observation to be less than optimal. Direct observation techniques are prone to bias in the results obtained. Data reliability is not obtained properly because it is caused by inconsistent sampling. So the observation method shifts by using the help of information system technology (Boyce JM, et al in Deepti Sharma, BS et al, 2012).

The information system technology used to assist in efforts to monitor hand hygiene compliance has several advantages. This computerized method applies a recording system through radio signal transmission. Data of officers who perform hand hygiene are recorded using the code a) not performing hand hygiene before the action; b) not performing hand hygiene after the action; c) performing hand hygiene before the action; d) performing hand hygiene after the action; e) performing hand hygiene when entering the room. (Deepti Sharma, BS et al, 2012). All data are quickly recorded and stored in a computerized information system management database. As a result, observations can be carried out automatically and data can be collected more quickly and presented as a systematic report.

RESULT

HAI's have been associated with increased healthcare and medical costs, increased length of stay, increased complications, and worsening health outcomes and mortality. Many countries and hospitals have adopted policies and regulations in recent years to attempt to reduce the impact of these health-related infections. These include skin and surgical room infections, urinary tract infections, pneumonia, bacterial infections, and diarrhea. While many infections can be prevented by practicing good hand hygiene using alcohol-based hand rubs or using soap and water to kill microorganisms on the hands, non-compliance with health care workers in practicing hand hygiene can increase the risk of nosocomial infections. The World Health Organization (WHO) supports good hand hygiene programs to reduce nosocomial infections, a WHO release stated that health care workers' compliance with hand hygiene is believed to be very low globally (McCalla et al 2017). Various countries in the world are trying to improve health workers' compliance in hand hygiene by developing hand

hygiene monitoring technology, in 2013 the Shannon Medical Center USA implemented automatic hand hygiene monitoring system technology by placing automatic hand hygiene monitoring devices in the post-surgical room as many as 5 units in October 2011 and in the South 5 medical-surgical units in May 2013, the technology is used as an automatic hand hygiene monitor in 147 hand hygiene places, involving 294 health workers, the results of monitoring for one year showed a significant increase of 74% of health workers having compliant hand hygiene behavior (Peggy 2014). In 2014 - 2015 the United States implemented hand hygiene monitoring technology with the majority of patients treated in the infectious disease unit, Cardiology, and Pulmonology Department, the electronic system technology compared to human observation, obtained results that substantially captured more hand hygiene compliance data than compliance observers involving human observers. In 2014, by comparison, this technology captured 632,404 hand hygiene events, more than human observers (Mc Calla et al 2017).

Electronic hand hygiene monitoring systems have another huge potential for maintaining hand hygiene compliance, they can be a major plus in promoting and maintaining compliant hand hygiene behaviors, and electronic systems can also play a role in monitoring and improving hand hygiene quality (Pires and Pittet 2017). In the United States in 2015, the hand hygiene compliance monitoring system (HHCS) conducted continuous data collection and observation from mid-February 2015, the results of monitoring carried out by HHCS obtained the results of hand hygiene compliance rates reaching 95%, the results of the implementation of HHCS obtained the results of a substantial decrease in the incidence of HAIs during the HHCS implementation period, although there was no statistically significant reduction, there was a decrease in multidrug-resistant organisms (MDROs) (2.0 per 1,000 patients per day) and no catheter-associated urinary tract infections (CLABSI) in the intensive care unit (ICU) after the implementation of HHCS. (S. McCalla et al 2017). The implementation of the hand hygiene compliance monitoring system significantly increased the compliance of health workers in carrying out hand hygiene, this had an effect on reducing the incidence of HAIs in hospitals, thus minimizing patient care days and reducing patient care costs (Marra Edmond 2013., Peggy 2014., WHO, 2002., Pires and Pittet 2017., S. McCalla et al 2017.) Although there are many advantages to be gained from this technology, this technology is also not yet able to differentiate the implementation of the five steps in performing hand hygiene, the high cost of maintenance is also an obstacle in the application of this technology, the need for the selection of appropriate and efficient technology or combination of technologies to measure health worker compliance in hand hygiene (Marra, Edmond 2013). Furthermore, this hand hygiene compliance monitoring system has not been able to identify the criteria of respondents who are the objects of the application of this technology.

In 2012, Jamaludin et al conducted a study of 40 hospitals in Indonesia with the results of hand hygiene compliance before and after contact with patients varying between 24 - 89%, this study was conducted after WHO campaigned for hand hygiene through hand hygiene. The results of the 2013 Basic Health Research showed that correct hand hygiene behavior was only 47.2% (RISKESDAS 2013). From the results of the study, it can be concluded that the compliance of health workers in carrying out hand hygiene is still low, this will have an effect on the occurrence of HAIs in hospitals, therefore it is necessary to monitor compliant behavior in hand hygiene. Until now, there has been no research on the application of hand hygiene compliance monitoring technology in Indonesia, but this needs to be tested for the use of this technology, in the application of this technology in Indonesia there are several things that must be considered such as the hospital's financing capacity related to the procurement and maintenance of equipment based on the classification of hospitals in Indonesia.

CONCLUSION

Hand hygiene is a basic promotive effort for health professionals as a step in preventing the spread of massive infections in health care settings. Based on data on compliance rates, it was found that hand hygiene compliance by health professionals is still below standard so that it is still not as expected. For this reason, a method of monitoring hand hygiene compliance is needed, namely by using a direct observation method carried out by supervisory officers. Supervision by direct observation has disadvantages, namely inefficient time, the results obtained are less effective because of the vulnerability to biased results, and inconsistent data, so it is necessary to use a more effective and efficient method. The advancement of technology that is integrated with information system management provides a choice of solutions, namely by using hardware for data collection and software for recording, documenting, and presenting data desired by the user, but monitoring and evaluation are needed to perfect the tools and systems used so that they can be developed optimally and minimize unexpected results

By using this technology, several advantages will be obtained, namely as follows:

- a. For hospitals, it is one way to improve the quality of health service standards, monitor health professional compliance in hand hygiene so that prevention of infections caused by humans or HAIs can be optimized and minimize hospital losses if an outbreak occurs caused by nosocomial infections;
- b. For patients, it is to increase satisfaction with the nursing care provided, because the treatment period for the disease can be minimized, avoiding disability and the care received is complete.
- c. For health institutions, it can be a trigger in developing findings on technology to improve health services more effectively and efficiently.

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