



Assessment Of Hand Hygiene In Nursing At Emergency Department At King Abdulaziz Hospital

Duaa. A. Alharbi^{1*}, Rawan. J. Maghlah², Shekha. A. Alhatemi³, Raniah. H. Alharthi⁴, Aishah. R. Alsolami⁵, Norah. A. Alzahrani⁶, Reham. B. Alshengiti⁷, Maryam. A. Alzahrani⁸, Amira. K. Bakashwin⁹, Taya. M. Abdalsalam¹⁰, Afraa. N. Kutbi¹¹, Hafsah. H. Hawsawi¹².

^{1*,2,3,4,5,6,7,8,9,10,11,12}Ministry of Health- Health cluster in Mecca, Saudi Arabia

***Corresponding Author:** Duaa. A. Alharbi

*Ministry of Health- Health cluster in Mecca, Saudi Arabia

Introduction

A History of Handwashing

For generations, handwashing with soap and water has been considered a measure of personal hygiene. Only in the last two centuries has the link between handwashing and the spread of disease been clearly established¹.

As early as 1822, a French pharmacist demonstrated that solutions containing chloride of lime or soda could eradicate the foul odor associated with human corpses and be used as disinfectants and antiseptics. In a paper published in 1825, the pharmacist said that those who attend patients with contagious diseases would benefit by moistening their hands with a liquid chloride solution².

In 1846, Ignaz Semmelweis observed that women whose babies were delivered by physicians in the first clinic at the General Hospital of Vienna consistently had a higher mortality rate than those delivered by midwives in the second clinic. He noted that physicians who went directly from the autopsy suite to the obstetric ward had a disagreeable odor on their hands, and he postulated that puerperal fever was caused by "cadaverous particles" transmitted from the autopsy suite to the obstetrics ward by way of the hands of physicians. As a result, in May 1847, Semmelweis insisted that physicians cleanse their hands with chlorine solution between patients. Thereafter, the maternal mortality rate in the first clinic dropped dramatically².

In 1961 the U.S. Public Health Service (PHS) recommendations directed personnel to wash their hands with soap and water for 1 to 2 minutes before and after patient contact. Rinsing hands with an antiseptic agent was believed to be less effective than handwashing with plain soap and was recommended only in emergencies or in areas where sinks were not available¹.

In 1975 and 1985 guidelines on handwashing practices in hospitals were published by the Centers for Disease Control (CDC). They recommended handwashing with plain soap between patients and washing with antimicrobial products before and after performing invasive procedures. Waterless antiseptic agents such as alcohol-based solutions were recommended only in situations where sinks were not available².

In 1988 and 1995, guidelines similar to those of the CDC were published by the Association for Professionals in Infection Control³. The 1995 APIC guidelines included discussion of alcohol-based hand rubs and supported their use in more clinical settings than had been recommended earlier¹.

In 1995 and 1996, the Healthcare Infection Control Practices Advisory Committee (HICPAC) recommended that upon leaving the rooms of patients with multi-drug resistant pathogens such as methicillin-resistant *Staphylococcus aureus* (MRSA), caregivers use either antimicrobial soap or a waterless antiseptic agent to cleanse their hands. These guidelines also recommended handwashing and hand antisepsis for routine patient care³.

In 2002, the Guideline for Hand Hygiene in Health-Care Settings (GHHHCS) was published as the recommendations of the Healthcare Infection Control Practices Advisory Committee and the HICPAC/APIC Hand Hygiene task force. In 2010, the 2002 guideline continued to be available on the CDC website².

In 2009, the World Health Organization (WHO) reaffirmed the recommendation to wash hands with soap and water when visibly dirty, soiled with blood or other body fluids, or exposed to potential spore-forming pathogens, such as *Clostridium difficile*. When hands are not visibly soiled, the WHO recommended the use of alcohol-based hand rubs as the preferred means for routine hand antisepsis¹.

In 2011, although the guidelines of all these healthcare organizations have been adopted by the majority of hospitals, adherence by healthcare providers to recommended handwashing protocols remains low. For this reason, various professional groups have undertaken studies to identify factors that improve adherence to hand hygiene protocols. Infection associated with health care affects hundreds of millions of patients worldwide, contributing to death or incapacity as well as generating additional costs to those of the disease which initially required patient care¹.

The most common cause of healthcare-associated infections is person-to-person transmission of nosocomial pathogens via the hands of healthcare personnel⁴. Nursing practices, such as direct touching, contact with bodily fluids, and wound care, can result in high levels of microorganism contamination⁵⁻⁷.

Microorganisms are not only present on the surface of the skin, but also under watches and cuffs. Several studies have indicated that the hands of health care workers may be colonized or contaminated with pathogens such as *Staphylococcal aureus*, *Escherichia coli*, *Pseudomonas aeruginosa*, and *Enterococcus faecalis* after patient contact and physical examination⁸.

Previous studies determined that the number of microorganisms found on the hands of nurses increased significantly after they had performed care procedures⁹⁻¹⁰. The microorganisms that colonize the external layer of the skin temporarily are eradicated when hands are washed with antiseptic and antimicrobial agents¹¹. The number of bacteria was reduced considerably after hands had been washed with soap and alcohol-based agents¹².

The handwashing habits of nurses are thought to be poor for many reasons, which include the complicated structure of emergency department, the characteristics of the patients in emergency department, the heavy workload in such units, and an insufficient number of nurses¹³⁻¹⁵.

The quality of handwashing by nurses was poor, theoretically, choice of hand washing agent depends on the type of clinical procedure performed and the degree of contamination likely to result, but really in most cases there is no alternative to soap. Even when skin disinfectants are available they may be avoided because they are perceived to be damaging to skin when used frequently¹⁶. Studies indicated that large areas of the hand surfaces were missed by nurses asked to wash hands in their usual manner¹⁷.

Hand hygiene (HH) by health care workers reduces health care associated infections. There are only a few studies of HH and other infection control practices among emergency department (ED) staff¹⁸⁻¹⁹ and these have often reported poor hand hygiene. The administration and staff of the study ED perceived a problem with accessibility of HH facilities and therefore requested a wearable dispensing device and improving access to alcohol-based hand sanitizers is recommended to improve to hand hygiene in ED²⁰.

Significance of the study:

For improving hand washing in clinical setting, implementation of an effective hand disinfectant system should be considered. However, factors that contribute to poor compliance in hand washing practices for prevention of nosocomial infections has received little attention²¹. To be able to develop successful interventions for the improvement of hand hygiene, it is essential to identify the factors influencing hand hygiene behaviour, and to investigate which interventions best target these factors²².

Aim of the study

This study is aimed to:

- Assess nurses' knowledge, attitude and behavior about hand washing between patients contact in the emergency department.
- Assess nurses' practice and application of hand hygiene according to the indications in the emergency department.

Hypotheses

The nurses' employees in emergency department as a critically setting should be have the knowledge, behavior, attitudes that enable their hand hygiene performance and practice according to indications of hand hygiene in ED.

Review of literature

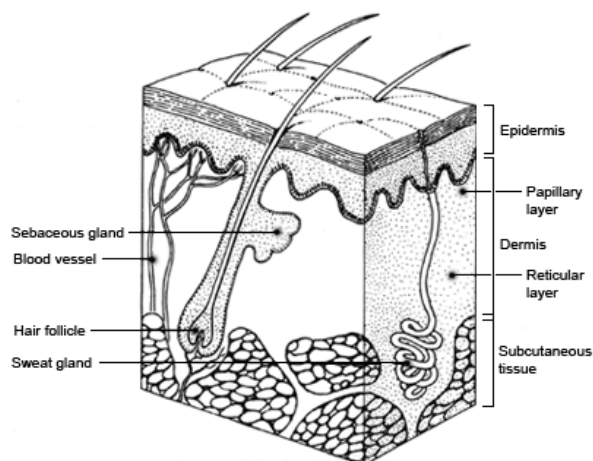
Skin Physiology and Normal Skin Flora

Function and Structure of the Skin

The primary function of the skin is to reduce water loss, provide protection to the body against abrasive action and microorganisms, and act as a permeable barrier to the environment. The skin helps maintain body temperature and transmits awareness of external stimuli. In addition, it serves a barrier function for the body by secreting glycerolipids and sterols to protect and nourish skin cells²³.

Considered a bodily organ, the skin varies in thickness from less than one millimeter in the eyelids to greater than four millimeters on the soles of the feet. It is composed of two layers, the epidermis and dermis, and is underlain by subcutaneous tissue called the hypodermis²⁴.

- The **epidermis** has five layers of cells—the stratum corneum, stratum lucidum, stratum granulosum, stratum spinosum, and stratum basale—though it is relatively thin when compared to the dermis.
- The **dermis** has two layers of cells—the papillary and reticular—and contains hair follicles, sebaceous and sudoriferous glands, blood vessels, and nerve cells.
- The hypodermis lies below the dermis; it cushions and supports the skin with fat cells and connective tissue.



The skin has two layers, the epidermis and the dermis, below which lies subcutaneous tissue.

Flora of the Skin

If we could see bacteria on our skin, we might be surprised to find that it is covered with colonies of microorganisms. Generally speaking, however, there are two categories of flora on the skin: transient and resident²⁵.

- **Transient flora** colonizes the superficial layers of the skin and is more amenable to removal by routine handwashing. They are the organisms most frequently found in healthcare-associated infections.
- **Resident flora** is attached to deeper layers of the skin and is more resistant to removal.

The hands of some caregivers may become persistently colonized with resident pathogenic flora such as *Staphylococcus aureus*, gram-negative bacilli. Investigators have found that although the number of transient and resident flora varies from person to person, the number of resident flora is relatively constant²⁶.

Skin irritation caused by chemicals, removal of tape, and other physical disruptions leads to a decrease in the skin's barrier function provided by glycerolipids and sterols in the skin. Detergents and acetones remove these protective secretions. When they are removed, it takes the skin about 6 hours for just half of the normal barrier function of these protective secretions to return and 5 to 6 days for their barrier function to completely return. Thus, caregivers need to nourish the skin of their own hands with protective creams or lotions²⁷.

Transmission of Pathogens by Way of the Hands

Pathogens are transmitted from patient to patient by way of the hands of caregivers because:

- Pathogenic organisms are present on patients' skin and objects in the environment
- Some of these organisms are transferred to healthcare workers' hands
- Pathogenic organisms may become resident flora on some caregivers' hands
- Inadequate hand cleansing allows organisms to contaminate workers' hands
- Cross-transmission of organisms occurs by contaminated hands²⁸⁻³².

Healthcare-associated pathogens can be spread not only from infected or draining wounds but also from frequently colonized areas of normal intact skin. Commonly, the perineal or inguinal areas of the body are the most heavily colonized, but the axillae, trunk, upper extremities, hands, and fingernails also may be contaminated³³⁻³⁴.

The number of organisms present on intact areas of the skin varies from individuals to individual. For instance, those with chronic dermatitis, diabetes, and chronic renal failure are more likely to have intact skin areas colonized by *Staphylococcus aureus*³⁵.

Environmental Sources of Pathogens

Common contaminants in the healthcare setting are gram-negative bacilli, *Staphylococcus aureus*, *Enterococci*, and *Clostridium difficile*.

Caregivers may contaminate their hands or gloves merely by touching contaminated surfaces. Patient gowns, bed linen, bedside furniture, and other objects in the patient's immediate environment can easily become contaminated with pathogenic organisms. Other objects in patient rooms—such as the side-rails of beds, handles of bedside table drawers, and intact areas of patients' skin—can also be contaminated. Pathogens are often found at handwashing stations, on the handles of faucets, and on other fixtures³⁵.

Of course, **patients** themselves may be a source of infection. Caregivers of infants infected with respiratory syncytial virus (RSV) have been known to acquire the virus simply by touching an infant and then touching their own nose or mouth³⁶.

Healthcare Worker Sources of Pathogens

Studies have documented that the area under the **fungernails** or in chipped nail polish often harbor high concentrations of bacteria, most frequently coagulase-negative *Staphylococci*, gram-negative rods (including *Pseudomonas*), *Corynebacteria*. Whether artificial nails contribute to transmission of pathogens is unknown³⁷.

Recently, an outbreak of *Pseudomonas aeruginosa* in a neonatal intensive care unit was attributed to two nurses, one with long natural nails and one with long artificial nails. They both carried the strains of *Pseudomonas* on their hands and were believed to be the likely source of the pathogens. Personnel wearing artificial nails also have been epidemiologically implicated in several other outbreaks of infection caused by gram-negative bacilli and yeast. Although these studies provide evidence that wearing artificial nails poses an infection hazard, additional studies are needed to confirm the concern³⁸.

While the WHO *Guidelines* urge each healthcare facility to create policies regarding artificial nails and nail polish, the consensus is that “healthcare workers should not wear artificial fingernails or extenders when having direct contact with patients and that natural nails should be kept short (≤ 0.5 cm long)” (WHO, 2009). Many hospitals and hospital systems have adopted policies in line with WHO recommendations³⁹.

Several studies have demonstrated that skin underneath rings is more heavily colonized with pathogens than comparable areas of skin on fingers without rings. One study found that 40% of the caregivers tested harbored gram-negative bacilli on skin under rings and some carried the organism for several months. Other studies showed that bacterial colony counts on hands after handwashing was similar for persons who wore rings and those who did not. Clearly, further study is needed to establish whether wearing rings results in greater transmission of pathogens in healthcare facilities⁴⁰.

While acknowledging the need for more studies, the WHO *Guidelines* state: “The consensus recommendation is to discourage the wearing of rings or other jewelry during healthcare; the use of a wedding ring for routine care may be acceptable, but in high-risk settings, such as the operating theatre, all rings or other jewelry should be removed” (WHO, 2009). Many hospitals and hospital systems have adopted policies in line with the WHO recommendations¹.

WHO Recommendations

In 2009, WHO recommended:

- Before beginning surgical hand preparation, remove jewelry. Artificial nails are prohibited.
- Sinks should be designed to reduce the risk for splashes.
- Visibly soiled hands should be washed with plain soap and water before surgical hand preparation, and a nail cleanser should be used to remove debris from under fingernails, preferably under running water.
- Brushes are not recommended.
- Before donning sterile gloves, surgical hand antisepsis should be performed with suitable antimicrobial soap or alcohol-based hand rub, preferably one that ensures sustained activity. Alcohol-based hand rub should be used when quality of the water is not assured.
- When using an antimicrobial soap, scrub hands and forearms for the length of time recommended by the maker, usually 2 to 5 minutes.
- When using an alcohol-based surgical hand rub, follow the maker’s instructions; apply to dry hands only; do not combine with alcohol-based products sequentially; use enough product to keep hands and forearms wet throughout surgical hand preparations; and allow hands and forearms to dry thoroughly before donning sterile gloves⁴¹.

Glove Use

In addition to their recommendations for surgical scrub, WHO (2009) recommendations for glove use by caregivers state:

- Glove use does not replace the need for hand hygiene.
- Gloves are recommended in situations in which contact with blood or other potentially infectious material is likely.
- Remove gloves after caring for a patient and do not reuse.
- Change or remove gloves if moving from a contaminated body site to either another body site within the same patient or the environment.

The CDC further recommends that healthcare workers wear gloves in order to reduce the risk that:

- Caregivers will acquiring infections from patients
- Pathogens of caregivers will be transmitted to patients
- Caregiver hands will transmit pathogens from one patient to another

When there is a risk that hands may become heavily contaminated, caregivers should wear clean gloves as compared to sterile gloves. This is recommended because hand-cleansing asepsis does not remove all organisms. After removing gloves, caregivers should cleanse their hands with antiseptics or soap and water as a precaution against leakage through damaged gloves. Gloves should be discarded after use and not reused. Fresh gloves should be used for each patient to prevent transmission of organisms from patient to patient⁴².

The integrity of gloves varies according to type and quality of glove material, intensity of use, and the length of time gloves are used. Intact vinyl gloves provide comparable protection to latex gloves, however vinyl gloves have been found to have more defects after prolonged use than latex gloves. Petroleum-based hand creams may weaken the integrity of latex gloves. To accommodate caregiver preferences, institutions usually provide more than one type of glove⁴³.

Adherence to Hand Hygiene Practices

Hand hygiene is the simplest, most effective measure for preventing nosocomial (hospital-associated) infections, yet studies indicate that, on average, healthcare workers follow recommended hand hygiene procedures less than half of the time⁴⁴.

The term *hand hygiene* includes two primary actions: (1) washing the hands with soap and water to decrease colonization of transient flora by removing dirt, soil, and loose flora and (2) rubbing hands with a small amount of highly effective, fast-acting antiseptic agent, termed a *hygienic hand rub*⁴⁵.

Adherence Rates

In the largest hospital-wide survey of hand hygiene practices, predictors of poor adherence to hand hygiene measures were identified according to:

- Professional category (physicians, nurses, pharmacists, technicians, etc.)
- Hospital unit (emergency department, pediatrics, maternity, adult medical, etc.)
- Time of day/week (day, evening, night shifts, and Monday through Sunday)
- Type and intensity of patient care (intensive, moderate, minimal care).

In one study of 2,834 observed opportunities for hand hygiene, researchers found the average adherence rate was a shockingly low 48%. Adherence was highest among nurses during weekends and in pediatric units. Nonadherence was higher in intensive-care units, during procedures that carried a high risk of bacterial contamination, and when the intensity of patient care was high. In other words, the higher the need for hand hygiene, the lower the adherence⁴⁶.

The lowest adherence rate (36%) was found in intensive care units, where indications for hand hygiene were typically more frequent. The highest adherence rate (59%) was observed in pediatrics wards, where the average intensity of patient care was lower than in other hospital areas. This study indicates that much needs to be done to improve adherence to hand hygiene practices⁴⁷.

Overcoming Barriers to Adherence

Why, you may ask, is the rate of adherence to hand hygiene so low, especially among healthcare providers, who should be the most diligent? The reasons these same workers gave to researchers were:

- Inaccessible hand hygiene supplies
- Skin irritation caused by hand hygiene agents
- Priority of care (the patient's need takes priority over hand hygiene)
- Lack of knowledge of the guidelines
- Insufficient time for hand hygiene and forgetfulness
- High workload and understaffing
- Lack of scientific information about healthcare related infection rates

To decrease nosocomial (hospital-associated) infections and increased adherence to hand hygiene protocols, barriers to their implementation must be addressed. Institutions need to:

- Place dispensers of skin cleansing and emollient agents in accessible locations
- Minimize hand hygiene dermatitis by providing emollient agents
- Educate caregivers about infection rates and hand hygiene protocols
- Increase nurse-patient ratios
- Create an institutional culture of care that includes antiseptic hand hygiene

Accessibility of Hand Hygiene Facilities

Studies indicate that the frequency of handwashing or antiseptic hand scrubs by personnel is affected by the accessibility of hand hygiene facilities. In some institutions, only one sink or hand hygiene product dispenser is available in rooms housing several patients. This discourages hand cleansing between patients and adds extra steps and effort for caregivers⁴⁸. Fortunately, dispensers for alcohol-based hand rubs do not require plumbing. They can be located in every patient-care unit, lavatory, near doorways, and in other convenient locations. In addition, staff may use pocket dispensers of alcohol-based hand rub products. To avoid confusion between soap and alcohol hand rubs, both dispensers should be clearly marked. Soap dispensers should be placed beside sinks. Alcohol-based cleanser dispensers should be placed some distance from sinks⁴⁹.

Caregivers need to know that washing their hands with soap and water after use of an alcohol hand rub is neither necessary nor recommended. When personnel feel a "build-up" of emollients on their hands after repeated use of alcohol hand gels, some manufacturers recommend hand washing with soap and water to remove excessive gel⁵⁰.

Minimizing Hand Hygiene Dermatitis

When choosing hand cleansing products, institutions need to select those that are both efficacious and as nonirritating to skin as possible. Because caregivers must cleanse their hands frequently, skin irritation and dryness, or concerns about these conditions, may influence the acceptance and use of hand cleaners¹.

As a consequence, institutions can minimize hand hygiene dermatitis by:

- Selecting less-irritating hand hygiene products
- Encouraging healthcare providers to use moisturizing skin care products after hand cleansing

Educating Healthcare Providers

Education is the cornerstone of improved hand hygiene practices. Healthcare workers need scientific information about hand hygiene, healthcare-associated infections, and resistant organism transmission rates. They need to know how to cleanse their hands and use appropriate and efficacious antiseptic and protective agents (described earlier in this course)⁵¹. Written guidelines should be available to everyone, including visitors. New employees should receive these guidelines during their initial orientation. Then, all caregivers should be observed and given feedback about how consistently they are adhering to established hand hygiene protocols⁵².

Increasing Caregiver-to-Patient Ratios

When patient-care units are understaffed and healthcare providers are overworked, they tend to cut corners. Often, one of those corners is hand hygiene. As a result, infection rates rise; death rates mount; and the health of caregivers, visitors, and patients suffers.

Traditionally, nurse-to-patient ratios have been decided by healthcare agencies, many of which are for-profit institutions seeking to cut costs. In recent years, nursing organizations have been pressing for laws to mandate minimum staffing ratios in patient-care units. In 2004, California became the first state to pass legislation mandating nurse-patient ratios⁵³, as follows:

As of September 2009, fourteen states and the District of Columbia had enacted nurse staffing legislation and/or adopted regulations addressing nurse staffing and another seventeen states had introduced legislation⁵⁴.

In 2010, a study compared nurse-to-patient ratios in surgical units in New Jersey and Pennsylvania hospitals. Using death rates in all three states, researchers found that if the average patient-to-nurse ratios in New Jersey and Pennsylvania hospitals had been what it is in California, New Jersey would have had 14% fewer patient deaths and Pennsylvania would have had 11% fewer deaths. Over a 2-year period, 468 lives might have been saved⁵⁵.

HH was defined as handwashing with soap and water with a minimum of 15 seconds scrubbing before rinsing or use of antiseptic gel applied to and rubbed into all hand surfaces until dry. The definitions of hand hygiene opportunities, invasive procedures, and patient contact used for the study are consistent with the guidelines set by the CDC and prevention and the association of professionals in infection control and epidemiology. Any HH opportunity that did not completely adhere to these definitions was considered a failed attempt¹.

Hospital-acquired infections affect 5% to 10% of all hospitalized patients and are the most common cause of preventable morbidity and mortality facing health care today. It is estimated that 30% of hospital-acquired infections are avoidable with healthcare provider adherence to hand hygiene (HH) guidelines, thus preventing patient-to-patient and healthcare worker-to-patient transmission of microorganisms that cause most nosocomial infections. In a seminal observational study by Semmelweis over 150 years ago, maternal mortality because of puerperal fever was reduced from 22% to 2% as a result of handwashing between performing necropsies and newborn deliveries⁵⁶.

The lack of adequate hand washing by our healthcare providers continues to be the primary cause of infection in our country's healthcare facilities. Nosocomial, or hospital acquired, infections are the most common and pervasive of all preventable adverse events and result in substantial direct and indirect costs to our nation, not to mention the substantial pain and suffering for the unfortunate patients that are affected.⁵⁷

Despite the current clear evidence and widespread acceptance that healthcare provider adherence with handwashing is the cornerstone of effective infection control, rates of adherence observed in numerous studies are disappointing. HH adherence among healthcare providers ranges from 5% to 81%, with an overall average of 40%. Physician adherence is commonly inferior to that of nurses. Previous studies attempting to improve HH behavior of healthcare workers have been unable to sustain success in improving infection control practices. A multidisciplinary, hospital-wide program promoting HH has been the most effective means of improving HH practice.⁵⁸

Factors identified as having positive influences on handwashing adherence are knowledge that handwashing prevents nosocomial infections, personal commitment to handwashing, easy access to hand-rub solution, and knowledge of being part of a study. Behavioral change has undergone extensive investigation, resulting in various ideas of what influences change. Unfortunately, handwashing adherence in daily work routines has not improved with implementation of these theories. The use of role models or mentors to influence behavior has been suggested in the past. Role models in nursing education influence the knowledge, skills, and values that are brought to the bedside, and play a significant influence on the career choices made by graduating nursing students. Few studies have examined the impact of role modeling by senior physicians and nurses on the HH behavior of their junior colleagues. It has been suggested that the effect of the role model is highly significant, but most potent in negatively influencing hand hygiene behavior. In a large cross-sectional survey, the belief of being a role model for other colleagues positively influenced the behavior of the nurses involved⁵⁹.

For almost 150 years, healthcare workers have been taught that cross-infections are transmissible but not contagious and that the most effective way to prevent these cross-infections is to wash their hands before and after every patient contact. As one physician-investigator observed, "but they don't do it. They don't merely not do it every time, they don't do it most of the time and sometimes not even when it might be most expected, as when caring for an intensive care unit (ICU) or emergency room patient"⁶⁰.

In U.S. hospitals today, hand washing is still the exception rather than the rule. Most studies agree that between 40 to 60% of all doctors and nurses fail to wash their hands between patients. Low-level compliance with hand hygiene is particularly poor in ICUs, where studies show that compliance does not exceed 40%.⁶¹

Why do healthcare workers continually fail to adequately wash their hands? The answer, unfortunately, remains elusive. Some of the reasons that have been suggested for such a low level of compliance include the lack of priority over other required procedures, insufficient time, inconvenient placement of hand washing facilities, allergy or intolerance to hand hygiene solutions, and lack of leadership from senior medical staff.⁶²

There is little doubt, however, that economic considerations also play a role. In an infection control journal article entitled *why don't doctors and nurses wash their hands?*, Dr. Peter Heseltine sadly observes, "as healthcare costs more and budgets contract, there has emerged a philosophy of the reversed field of dreams. If we don't build it, they won't come." Additionally, The American Journal of Infection Control (AJIC) has warned that if we only consider the direct economic consequences of preventing infections, an institution's infection control program could conceivably result in an apparent decrease in net revenue, a serious problem indeed for any healthcare administrator today.⁶³

If hospitals were not reimbursed for their patient's hospital acquired infections, facility administrators would surely demand diligent adherence to its hand washing protocol, and would do so very quickly! If physicians were not paid for their treatment of these infections, it would be a safe bet that hand washing rates would soar while the occurrence of healthcare acquired infections would drop precipitously!

Nevertheless, new research suggests that having a busy workload, being in a technical specialty and performing activities with a high risk of cross-transmission are all factors that increase the odds that a physician will not follow hospital handwashing guidelines. Some studies show that the failure to properly wash ones hands is inversely related to status: Doctors are less likely to wash than nurses' aides.⁶⁴

Hand washing with tap water and detergents suspends millions of microorganisms and allows them to be rinsed off; this process is referred as mechanical removal of transient microorganisms. Hand washing with decontaminating agents kills or inhibits the growth of microorganisms, this referred as chemical removal for both transient and some resident microorganisms.⁶⁵⁻⁶⁷

Other studies recommended washing the hands for 1-2 minutes to be effective. However, good hand washing technique is not only the vital, but also we need a hygienic way of drying hands. It is pointless taking time to wash properly if we use the same towel that everyone else has been using. It has been suggested that paper towels operate effectively by two mechanisms. First they rub away transient organisms and old dead skin loosely attached to the surface of the hands. Second, they remove bacteria from deeper layer of skin brought to the surface by friction plus the warmth and moisture generated through washing.⁶⁸

Theoretically, choice of hand washing agent depends on the type of clinical procedure performed and the degree of contamination likely to result, but really in most cases there is no alternative to soap. Even when skin disinfectants are available they may be avoided because they are perceived to be damaging to skin when used frequently.⁶⁹

Studies indicated that large areas of the hand surfaces were missed by nurses asked to wash hands in their usual manner. For improving hand washing in clinical setting, implementation of an effective hand disinfectant system should be considered. However, factors that contribute to poor compliance in hand washing practices for prevention of nosocomial infections has received little attention.⁷⁰

Subjects & Methods

Aims of the study:

The present study is an observational research design aiming to:

- Assess nurses' knowledge, attitude and behavior about hand washing between patients contact in the emergency department.
- Assess nurses' practice and application of hand hygiene according to the indications in the emergency department.

Research design:

A quantitative approach using an observational design is proposed for this study.

Subjects:

The study sample consists of 60 staff nurses (32 female nurses & 28 male nurses) employed in emergency department of King Abdul-Aziz hospital at Makkah Almukaramah being selected as participants in the study.

Setting:

The study was conducted on the emergency department (both male ED and female ED) in King Abdul-Aziz hospital at Makkah Almukaramah. The emergency department had 33 beds, the female section has 10 beds for daily care and 5 beds for observation and 3 beds for splinting fractures, also the male section have 10 beds for daily care and 5 beds for observation and critical patient, and a total of 20 alcohol sanitizer and 2 soap dispensers. All rooms in the emergency department were open and visible from the nurses' station: one in female section and another in male section so that several patients could be observed simultaneously.

Tools of the study:

The data was collected using the following tools:

Tool (1): A proper questionnaire are utilizing for the purpose of the current study was entitled: *“Perception of Hand Hygiene among Nurses in Emergency Department”*. This questionnaire was developed and used by the researchers based on reviewing the related literature and taken from the available evidence, as outlined within the *(WHO guidelines on hand hygiene in health care 2009)*¹ and *(Offra 2009)*⁷¹, to assess nurses’ knowledge, attitude, and behavior about hand washing in ED. The questionnaire consisted of four parts:

- The *first part* is concerned with: The demographic characteristics of nurses' (age, gender, years of experience, qualification degree and nursing shifts).
- The *second part* contains (11 questions) for assessing nurses knowledge (technique and duration) regarding hand-washing.
- The *third part* is concerned with nurses’ attitude (importance, preferred method) regarding hand- washing.
- The *last part* is concerned with nurses’ self-reported behavior regarding hand- washing.

Tool (2): Hand Hygiene Observational Checklist in ED

An observational checklist for Hand hygiene in ED was obtained from *(WHO guidelines on hand hygiene in health care 2009)*¹ and it included: when nurses should wash their hands (before patient care activities, after patient care activities, after touching contaminated surfaces, after gloves removal), and the solution that may be used in hand washing soap or alcohol-chlorhexidine hand rub (ACHR). Observation was done during routine work.

On the basis of the indications for hand hygiene listed in the recommendations of the hand hygiene guideline of the CDC and prevention,⁷² for assessing nurses’ performance and situational analysis of hand-washing and drying practices between patients’ contact in ED. The researcher noted when a hand hygiene episode was indicated and whether the staff member used either soap and handwashing or the alcohol sanitizer.

Methods:

1. An administration permission to conduct the study was obtained from the director of king Abdul-Aziz Hospital and head nurse of emergency department after explanation of the aim of the study.
2. The tools of data collection were development after reviewing of literatures.
3. The developed tools were reviewed by consultant specialist for content validity, clarity, feasibility, and applicability of the tools.
4. An informed consent was obtained from nurses in the emergency department who will be participates in the study after explanation of the aim and nature of the study.
5. A pilot study was conducted on 10% from the study subjects (6 nurses) to test the clarity and applicability of the selected tools, and the necessary modifications were done.

The data was collected in the duration of 3 months (August, September and October of 2012) through the following four steps:

Firstly, the researchers were listed about 213 indications for hand hygiene related only to ED that collected from many resources,⁷² on the basis of these indications that noted when a hand hygiene episode was indicated and whether the staff member used. The number of indications for hand hygiene was estimated according to the following assessment:

1. Directly observe personnel long enough to observe approximately 213 indications (*213 indication of hand hygiene were observed during a period of 8 hours*).
2. Divide the total number of indications by the total time observed to obtain a mean number of indications for hand hygiene per hour ($213/8= 27$ *indication per hour*).
3. Multiply the value obtained in step 2 by 24 to get the mean number of indications per day ($27 \times 24=648$ *indication per day*).
4. Obtain the patient census for the period the observations were made (*Patient census for day of observation was 35*).
5. Calculate mean number of indications for hand hygiene per day per patient by dividing mean number of indications per day by the census value ($648/35=18$ *indications for hand hygiene per day per patient*).

The second step, researchers were distributes the questionnaire about perception of hand hygiene among the study nurses in ED, after illustration of its content and helped them to understand the questions and translation of others to insure that there were no obstacles. Each researcher was responsible for watching two subjects when they fill the questioners’ answers for one hour.

In third step, direct observations for the subjects using hand hygiene observational checklist in ED were conducted by the researchers to determine actual frequency and indications for hand hygiene. An observer recorded the number of patient contacts and activities for each participant during two-hour observation periods in each shift. Activities were categorized as either clean or dirty according to indication. The use of gloves was noted and hand-washing technique and duration were recorded. A hand-washing break in technique was defined as failure to wash hands after a patient contact and before proceeding to another patient or activity. The observers were conduct observations openly, without interfering with the ongoing work, and keep the identity of the health care providers confidential.

Finally, the researchers recorded the hand hygiene behavior of each participant in their hand hygiene observation checklist, and the researchers conducted 60 assessment sheets about hand hygiene for those participants to assess their performance regarding hand hygiene practice.

Statistical analysis:

A compatible personal computer was used to store and analyze the data and to produce graphic presentation of the important results. The statistical analysis was performed using the Statistical Package for Social Science (SPSS) program, version 16.0 for Windows Data Editor. The collected data was organized, categorized, tabulated and statistically analyzed to evaluate the difference between the groups under study as regards the various parameters. The statistical significance and associations were assessed using, the arithmetic mean (\bar{X}), the standard deviation (SD), and the T-test to calculate the difference between two independent variables. A significant P value was considered when $P < 0.05$, and no significant $P > 0.05$.

Ethical consideration:

This study was approved by Um Al Qura University, King Abdul-Aziz hospital, and head nurse of emergency department permission to conduct the research during the shift was obtained.

Limitations of the study:

The sample size in some groups was small as in years of experience.

Results

The results obtained from this study are categorized as the following:

1. Perception of hand hygiene knowledge among nurses in emergency department
2. Attitude toward hand hygiene among nurses in emergency department
3. Behavior toward hand hygiene among nurses in emergency department
4. Observation of nurses' hand hygiene in emergency department

Table (1): Socio-demographic characteristics of nurses in ED at King Abdul-Aziz Hospital

Socio-demographic characteristics	Frequency (60)	% (100)
Gender:		
Females	32	53.3
Males	28	46.7
Years of experience:		
1 year	31	51.7
1-4 years	13	21.7
5-10 years	12	20.0
> 10 years	4	6.7
Profession:		
Nurse	58	96.7
Auxiliary nurse	2	3.3
Nursing shifts:		
Day (7am-3pm)	27	45.0
Evening (3pm-11pm)	18	30.0
Night (11pm-7am)	15	25.0
Training in hand hygiene:		
Yes	52	86.7
No	8	13.3
Use of alcohol-based hand rub:		
Yes	53	88.3
No	7	11.7

Table (1): Shows the characteristics of the study sample, It included 60 nurses, (53.3%) of them were males. Concerning experience, (51.7%) them had one year experience. The majority (96.7%) of them had the profession of nurse and (45.0%) working in morning shift. Most of the sample (86.7%) attended training of hand hygiene and (88.3%) used of alcohol-based hand rub.

1. Perception of Hand Hygiene among Nurses in ED

Table (2): Nurses' knowledge about hand hygiene in ED

Knowledge	Frequency (60)	% (100)	Mean \pm SD
1. Definition of hand hygiene	44	73.3	1.27 \pm 0.44
2. Improving hand hygiene	38	63.3	1.28 \pm 0.45

3.	Antimicrobial activity against bacterial spores	22	36.7	2.25 ± 1.26
4.	No hand rubs for visibly spoiled hands	25	41.7	2.80 ± 1.01
5.	Time required for applying hand rubs.	23	38.3	2.95 ± 0.91
6.	Necessity of hand hygiene when wearing gloves	26	43.3	3.13 ± 0.81
7.	Main route of cross-transmission of germs	30	50.0	1.85 ± 0.73
8.	Main source of infection	30	50.0	2.43 ± 0.78
9.	Prevention of germs transmission to patients			
	a) Touching patients	48	80	1.20 ± 0.40
	b) Risk of body fluid exposure	55	91.7	1.23 ± 0.42
	c) Patient's immediate surroundings	46	76.7	1.17 ± 0.37
	d) Clean/aseptic procedure	50	83.3	1.17 ± 0.37
10.	Prevention of germs transmission to workers			
	a) Touching patients	56	93.3	1.15 ± 0.36
	b) Risk of body fluid exposure	51	85	1.27 ± 0.44
	c) Clean/aseptic procedure	44	73.3	1.27 ± 0.44
	d) Patient's immediate surroundings	47	78.3	1.07 ± 0.25
11.	Alcohol-based rubs versus hand washing with soap and water			
	a) Time for hand cleansing	56	93.3	1.28 ± 0.45
	b) Causing Skin dryness	43	71.7	1.37 ± 0.48
	c) Effectiveness against germs	38	63.3	1.28 ± 0.45
	d) Both are recommended to be performed	43	71.1	1.85 ± 1.02
12.	Time needed to kill germs	32	53.3	1.45 ± 0.53
13.	Methods of hand hygiene in different situations			
	a) Preparation of abdomen	43	71.7	1.75 ± 0.43
	b) Injections	34	56.7	1.68 ± 0.56
	c) Bedpan	45	75	1.25 ± 0.43
	d) Using examination gloves	35	58.3	1.93 ± 0.31
	e) Making beds	28	46.7	1.03 ± 0.18
	f) Blood exposure	54	90	1.18 ± 0.39
14.	Avoiding colonization of hands with germs			
	a) Jewelry	58	96.7	1.17 ± 0.37
	b) Damaged skin	49	81.7	1.18 ± 0.39
	c) Artificial fingernails	50	83.3	1.03 ± 0.18
	d) Hand cream	43	71.7	1.13 ± 0.34
15.	a) How bacteria spread in hospitals	58	96.7	1.03 ± 0.18
	b) Cause of nosocomial infections	52	86.7	1.13 ± 0.34
	c) Effect of hand jewelry	43	71.7	1.28 ± 0.45

Table (2): Show the Nurses' Knowledge and the True Answers about Hand Hygiene in ED as the following:

(73.3%) of the study sample of nurses has positive knowledge about definitions of hand hygiene comes. (63.3%) of nurses in ED has true answer about improving hand hygiene. (36.7%) of nurses has true answer about antimicrobial activity against bacterial spores. No hand rubs for visibly spoiled hands was the answer of (41.7%) among nurses. The true answer about time required for applying hand rubs was (38.3%), necessity of hand hygiene when wearing gloves by (43.3%) of the study sample. (50%) of the study sample gives true answer about main route of cross-transmission of germs.

Also, (50%) of the study sample of nurses has positive knowledge about main source of infection. Prevention of germs transmission to patients, about (91.7%) of nurses answer that immediately after a risk of body fluid exposure and (83.3%) answer that immediately before a clean/aseptic procedure in the second while the before touching a patient was the answer about (76.7%) of nurses. Prevention of germs transmission to workers (93.3%) responded that after touching a patient from following hand hygiene actions prevents transmission of germs to the healthcare worker, and the immediately after a risk of body fluid exposure by (85%), then the after exposure to the immediate surroundings of a patient comes in the third rank by (78.3%).

About alcohol-based rubs versus hand washing with soap and water, the table shows that (55%) of the study sample responded that the hand rubbing is more rapid for hand cleansing than hand washing is true, and hand rubbing causes skin dryness more than hand washing comes by (71.7%), while the hand washing and hand rubbing are recommended to be performed in sequence comes by (71.1%), but the hand rubbing is more effective against germs than hand washing comes

by (63.3%). About time needed to kill germs, the table shows that (53.3%) of the study sample responded that the 20 seconds is the minimal time needed for alcohol-based hand rub to kill most germs on your hands is true.

The table shows that the methods of hand hygiene in different situations was after visible exposure to blood among answer of (90%) of the study sample, while (46.7%) of the study sample responded that after making a patient's bed is the true answer.

Regarding avoiding colonization of hands with germs the table shows that the wearing jewelry is the following should be avoided, as associated with increased likelihood of colonization of hands with harmful germs by (96.7%) of the study sample. Through the previous table shows that, (96.7%) of the study sample responded that the spreading of bacteria in hospitals occurs mainly via the hands of personnel is true.

2. Attitude toward hand hygiene among nurses in emergency department

Table (3): Nurses' attitude toward hand hygiene in ED

Attitude	Frequency (60)	% (100)	Mean ±SD
1. After going to the toilet	41	68.3	1.03 ±0.18
2. Before caring for a wound	32	53.3	1.03 ±0.18
3. After caring for a wound	42	70	1.08 ±0.27
4. After touching potentially contaminated objects	35	58.3	4.60 ±0.74
5. After contact with blood or body fluids	41	68.3	4.15 ±1.05
6. After inserting an invasive device	36	60	4.60 ±0.69
7. Before entering an isolation room	41	63.3	4.43 ±0.75
8. After contact with a patient's sink	34	56.7	4.58 ±0.69
9. After exiting an isolation room	36	60	4.43 ±0.76
10. Before endotracheal suctioning	43	71.7	4.53 ±0.67
11. After contact with a patient's secretions	34	56.7	4.38 ±0.82
12. Before patient contact	32	53.3	4.48 ±0.70
13. After removing gloves	41	63.3	4.52 ±0.83
14. If they look or feel dirty	42	70	4.20 ±1.08

Table (3): Shows that, (86.3%) of the study sample responded that they wash their hands always after going to the toilet, and (53.3%) of the study sample responded that they wash their hands always before caring for a wound and (70%) of the study sample responded that they wash their hands always after caring for a wound, and (58.3%) of the study sample responded that they wash their hands always after touching potentially contaminated objects.

Also, the table shows that, (68.3%) of the study sample responded that they wash their hands always after contact with blood or body fluids, and (60%) of the study sample responded that they wash their hands always after inserting an invasive device, and (63.3%) of the study sample responded that they wash their hands always before entering an isolation room, and (56.7%) of the study sample responded that they wash their hands always after contact with a patient's sink, and (60%) of the study sample responded that they wash their hands always after exiting an isolation room, and (71.7%) of the study sample responded that they wash their hands always before endotracheal suctioning, and (56.7%) of the study sample responded that they wash their hands always after contact with a patient's secretions.

Also, the table shows that, (53.3%) of the study sample responded that they wash their hands always before patient contact, and (63.3%) of the study sample responded that they wash their hands always after removing gloves, and (70%) of the study sample responded that they wash their hands always if they look or feel dirty.

3. Behavior toward hand hygiene among nurses in emergency department

Table (4): Nurses' self-reported behavior toward hand hygiene in ED

Behavior	Frequency (60)	% (100)	Mean ±SD
1. I wash visibly soiled hands with water and soap	58	96.7	1.03 ±0.18
2. I wash or disinfect hands before and after each patient contact	58	96.7	1.03 ±0.18

3. I wash hands or rub with alcohol before performing simple surgery And caring for wounds, in patients with normal immune systems	55	91.7	1.08 ±0.27
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Table (4): Shows that through the previous table shows that, (96.7%) of the study sample responded that the statement "I wash visibly soiled hands with water and soap" form self-reported behavior, also, (96.7%) of the study sample responded that the statement "I wash or disinfect hands before and after each patient contact" form self-reported behavior, and (91.7%) of the study sample responded that the statement "I wash hands or rub with alcohol before performing simple surgery and caring for wounds, in patients with normal immune systems" form self-reported behavior.

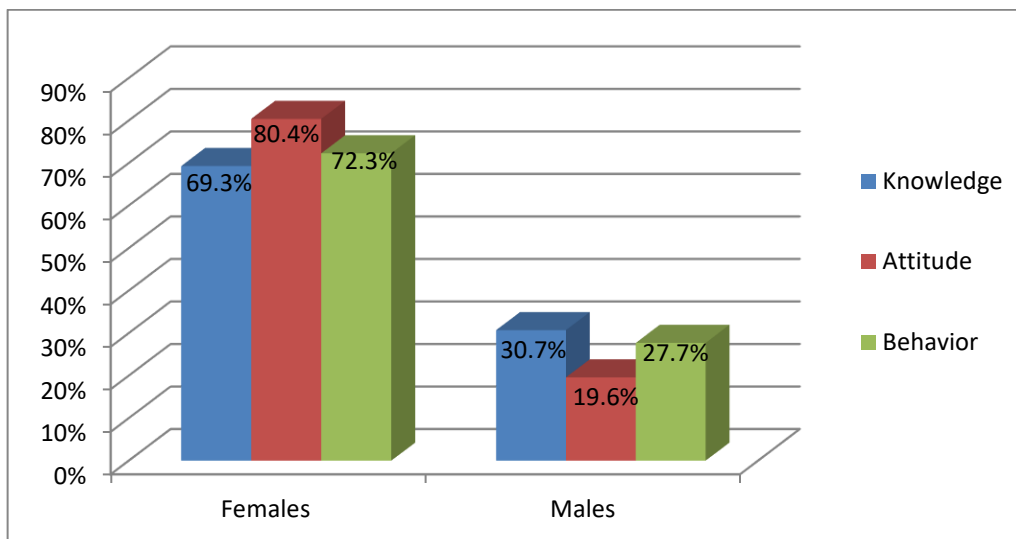


Figure (1): The relation between the nurses' gender and their knowledge, attitude, and behavior

Figure (1): Shows that there is statistically significant relationship between the nurses' gender and their knowledge, attitude and behavior as (T-test =3.197, 2.312, 2.805 and P value < 0.05).

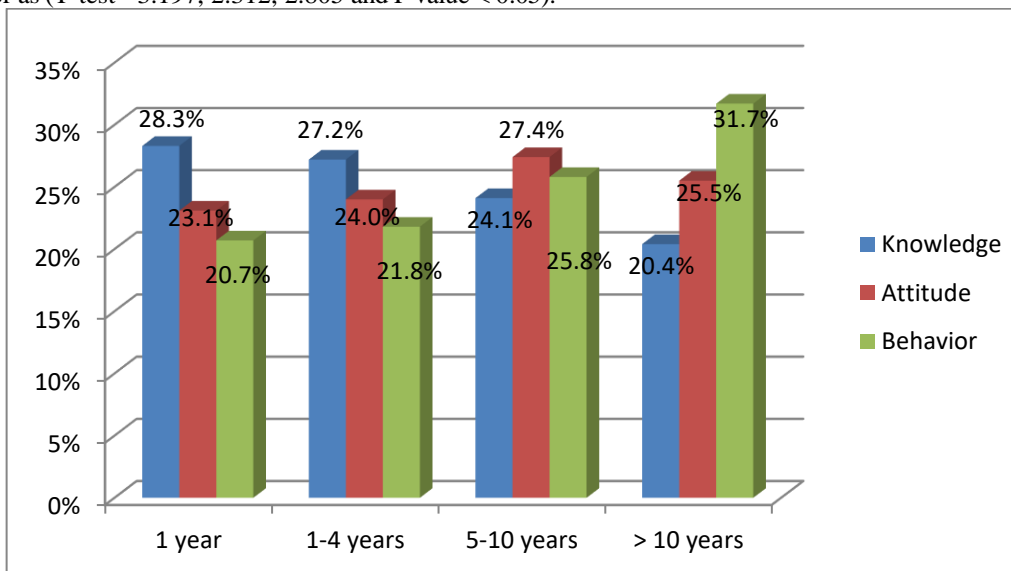


Figure (2): The relation between the nurses' years of experience and their knowledge, attitude, and behavior

Figure (2): Shows that there is no statistically significant relationship between the nurses' years of experience and their knowledge, attitude, and behavior as (T-test = -0.895, 1.559 and 0.323 and P value > 0.05).

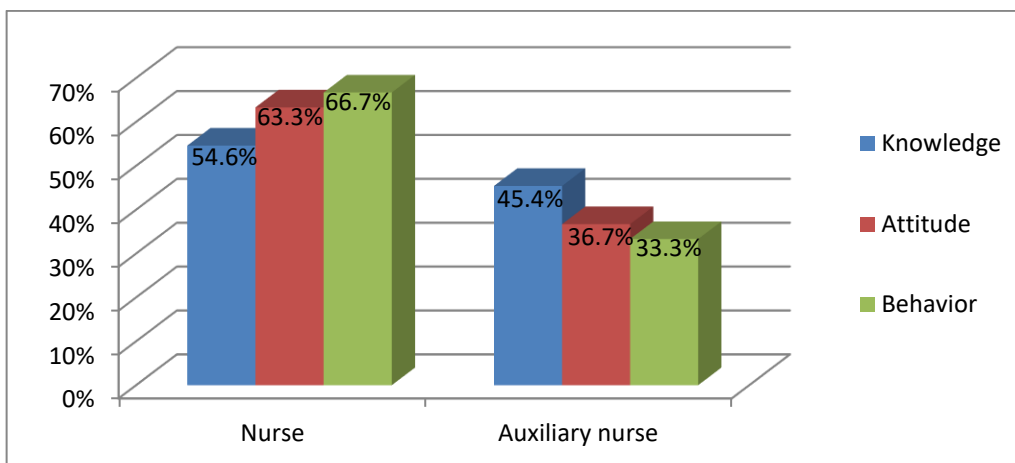


Figure (3): The relation between the profession of nurses and their knowledge, attitude, and behavior

Figure (3): Shows that there is no statistically significant relationship between the profession of nurses and their knowledge, attitude and behavior as (T-test = -1.638, 0.731 and 0.371 and P value > 0.05).

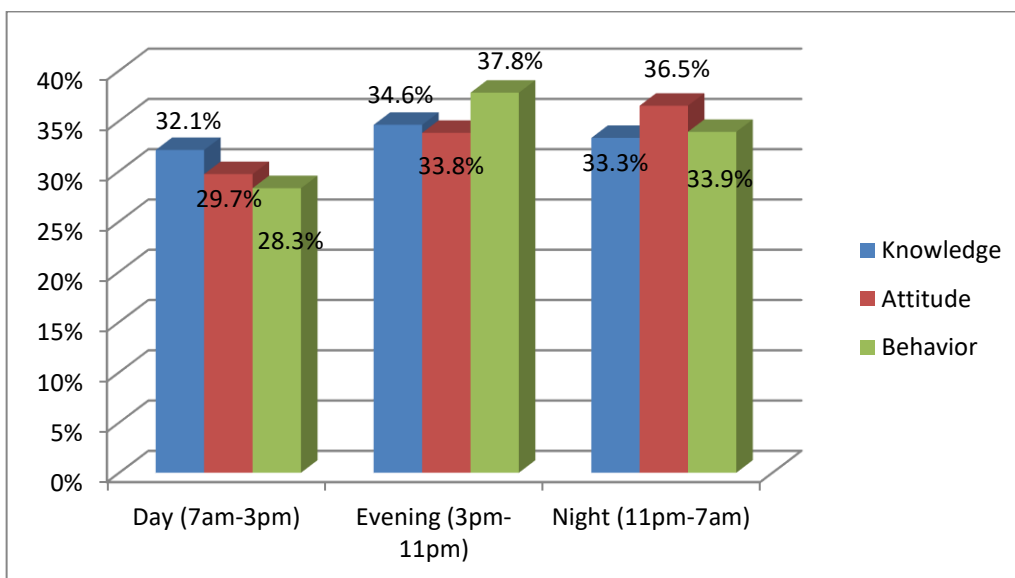


Figure (4): The relation between nursing shifts and their knowledge, attitude, and behavior

Figure (4): Shows that there is no statistically significant relationship between the nursing shifts and their knowledge, attitude, and behavior as (T-test = 0.607, -0.202 and -1.693 and P value > 0.05).

4. Observation of Nurses’ Hand Hygiene in Emergency Department

Table (5): Hand hygiene observation for nurses in ED before and after patient care activities

Floor Assigned Time	Before Patient Care Activities				After Patient Care Activities				T-test	P Value	Sig.
	Yes		No		Yes		No				
	No. (60)	% (100)	No. (60)	% (100)	No. (60)	% (100)	No. (60)	% (100)			
Day (7am-3pm) Nurses' no=27	6	22.2	21	77.8	25	92.6	2	7.4	3.608	< 0.05	(S)
Evening (3pm-11pm) Nurses' no=18	5	27.8	13	72.2	15	83.3	3	16.7	3.418	< 0.05	(S)

Night (11pm-7am) <i>Nurses' no=15</i>	3	20.0	12	80.0	13	86.7	2	13.3	3.573	< 0.05	(S)
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Table (5): through the previous table shows that, the most of the study sample across day, evening and night shifts responded don't perform hand hygiene before patient care activities (77.8%, 72.2% and 80%).

But, during day, evening and night shifts, the majority of the study sample (92.6%, 83.3%, and 86.7% perform hand hygiene after patient care activities.

There is no statistically significant relationship between the nursing shifting and before or/ after patient care activities because the P value > (0.05).

Table (6): Hand hygiene observation for nurses in ED after touching contaminated surfaces and after glove removal

Floor Assigned Time	Touching Contaminated Surfaces				After Glove Removal				T-test	P Value	Sig.
	Yes		No		Yes		No				
	No. (60)	% (100)	No. (60)	% (100)	No. (60)	% (100)	No. (60)	% (100)			
Day (7am-3pm) <i>Nurses' no=27</i>	26	96.3	1	3.7	4	15	23	85.0	4.108	< 0.05	(S)
Evening (3pm-11pm) <i>Nurses' no=18</i>	15	83.3	3	16.7	4	22.2	14	77.8	3.718	< 0.05	(S)
Night (11pm-7am) <i>Nurses' no=15</i>	13	86.7	2	13.3	2	13.3	13	86.7	3.873	< 0.05	(S)

Table (6): Shows that the percentage of respondents who agree with that hand hygiene in emergency department is after touching contaminated surfaces are the major than who did not agreed as is clear from the answers respondents percentages in the three shifts as follows (96.3%, 83.3%, 86.7%)

Also, the table found that the percentage of respondents who did not agree with that hand hygiene in emergency department is after glove removal greater than who agreed, as is clear from the answers respondent's percentages in the three shifts as follows (85%, 77.8%, and 86.7%). And there is statistically significant relationship between the nursing shifting and after touching contaminated surfaces and after glove removal because the P value < (0.05).

Table (7): Hand hygiene observation for nurses in ED about the uses of ACHR and soap

Floor Assigned Time	The Uses of ACHR		The Uses of Soap		Non		T-test	P Value	Sig.
	No. (60)	% (100)	No. (60)	% (100)	No. (60)	% (100)			
Day (7am-3pm) <i>Nurses' no.=27</i>	23	85.2	3	11.1	1	3.7	3.697	< 0.05	(S)
Evening (3pm-11pm) <i>Nurses' no.=18</i>	14	77.8	1	5.5	3	16.7	3.549	< 0.05	(S)
Night (11pm-7am) <i>Nurses' no.=15</i>	11	73.4	2	13.3	2	13.3	3.454	< 0.05	(S)

Table (7): The table shows that, the percentage of nurses who use ACHR as hand hygiene in emergency department more than the percentage of nurses who use soap, and also more than the none of uses, as is clear from the answers respondent's percentages as follows (85.2%, 77.8%, 73.4%).

Also, there is statistically significant relationship between nursing shifting and the uses in the morning, afternoon, and in the night because the P value < (0.05).

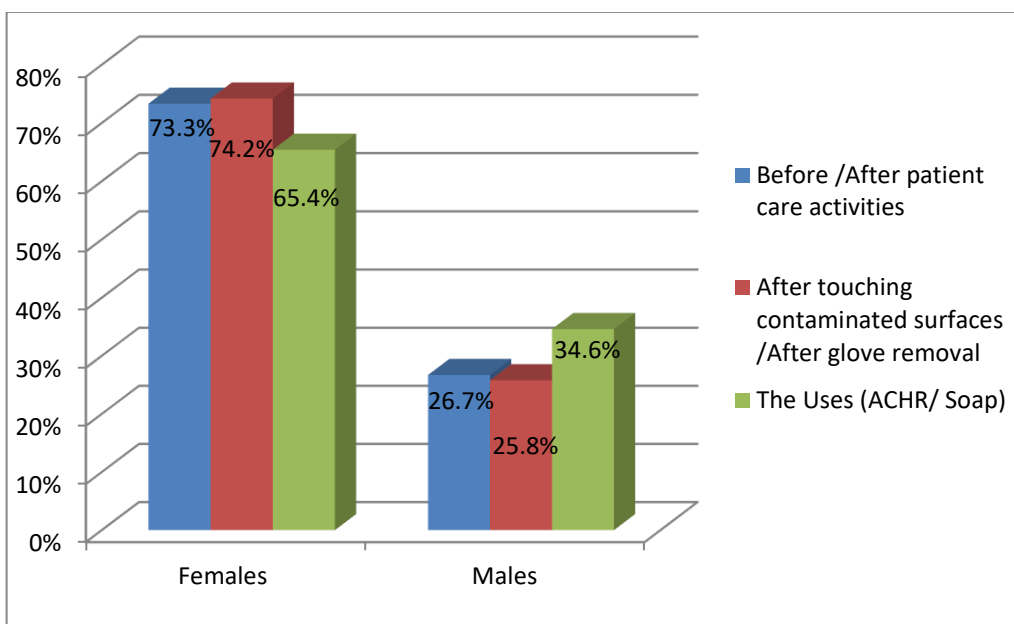


Figure (5): The relationship between the nurses’ gender and the observation of hand hygiene practice among nurses in ED

Figure (5): Shows that there is statistically significant relationship between the nurses’ gender and their hand hygiene practice before/ after patient care activities as (T-test = 4.867 and P value < 0.05).

Also, the figure shows that there is statistically significant relationship between the nurse’s gender and their hand hygiene practice after touching contaminated surfaces/ after glove removal and the uses of ACHR or soap as (T-test = 4.567, and 4.215 and P value < 0.05).

The relationship between the nurses’ years of experience and the observation of hand hygiene practice among nurses in ED

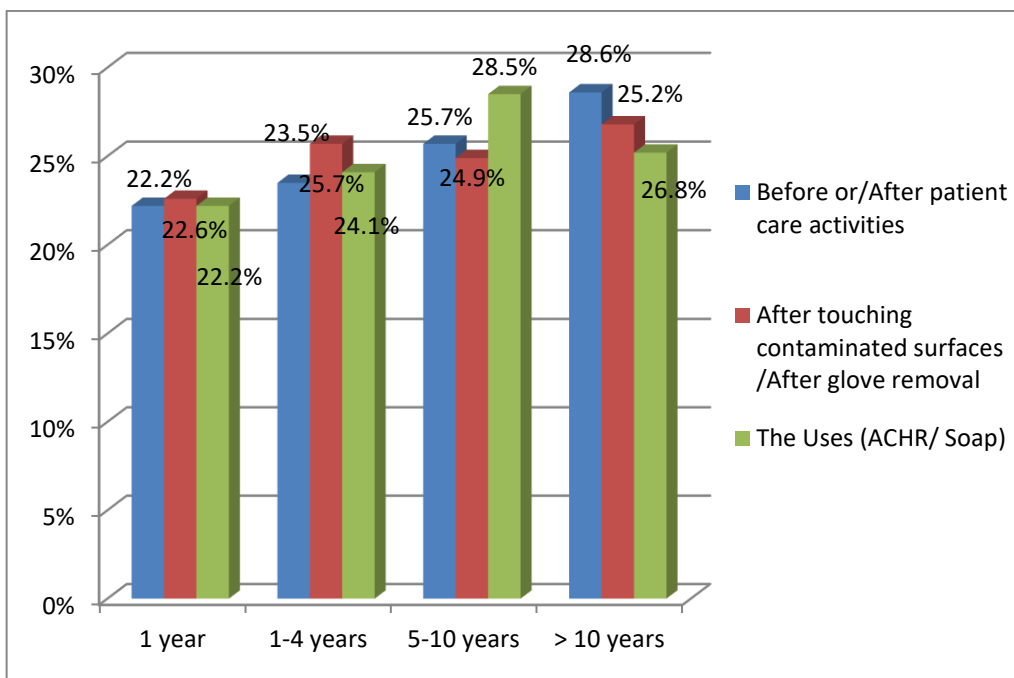


Figure (6): The relationship between the nurses’ years of experience and the observation of hand hygiene practice among nurses in ED

Figure (6): Shows that there is no statistically significant relationship between the nurses' years of experience and their hand hygiene practice before/ after patient care activities, after touching contaminated surfaces/ after glove removal and the uses of ACHR or soap as (T-test = -0.097, -0.668 and -0.102 and P value > 0.05).

1. The relationship between the profession of nurses and the observation of hand hygiene practice among nurses in ED

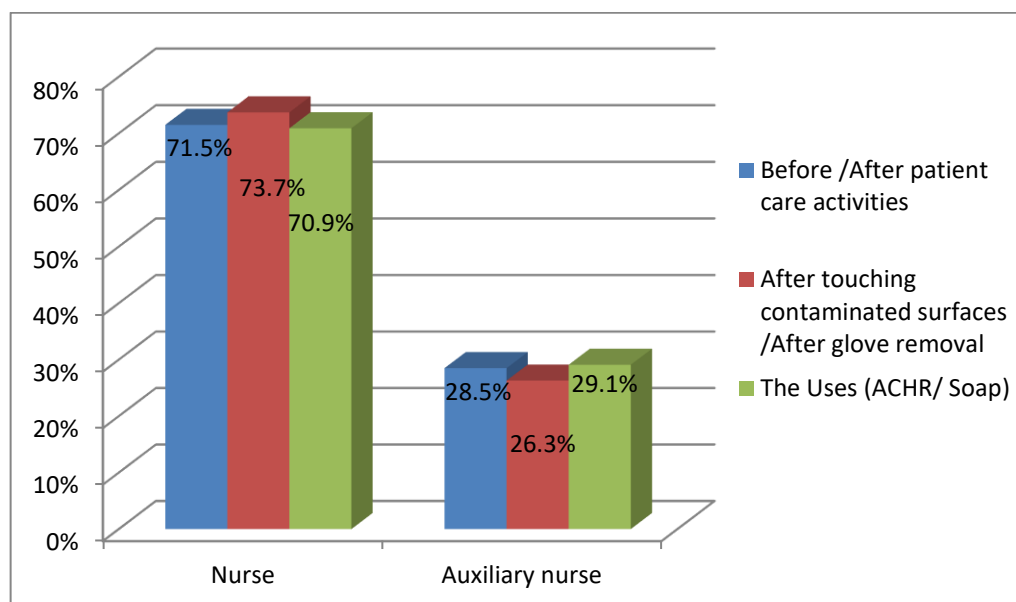


Figure (7): The relationship between the profession of nurses and the observation of hand hygiene practice among nurses in ED

Figure (7): Shows that there is statistically significant relationship between the profession of nurses and their hand hygiene practice before/ after patient care activities as (T-test = 4.867 and P value < 0.05).

Also, the figure shows that there is statistically significant relationship between the profession of nurses and their hand hygiene practice after touching contaminated surfaces/ after glove removal and the uses of ACHR or soap as (T-test = 4.340 and 4.185 and P value < 0.05).

Discussion

The ED is a critical setting for appropriate HH because it is a frequent interface between the public and patients with communicable diseases. The ED is responsible for half of all hospital admissions. Additionally, because ED nurses are subject to a unique set of human factors, such as frequent interruptions and distractions that may be barriers to infection control activities, it is important to study and understand barriers to HH specific to the ED. This study conducted one of the largest observational studies of hand hygiene in the ED setting⁷³⁻⁷⁵.

The results of this study suggest that there was intrinsic difference in handwashing rates between female and male nurses in ED as female represented about more than half of the study sample.

This confirmed with what was reported by the studies of handwashing frequency in selected hospitals and among adults in public toilets, which showed that females handwashed more frequently than males following use of toilet facilities.⁷⁶⁻⁷⁸

In the same line, the results of the other study found that female HCWs reported handwashing more frequently. Also, suggested that intergender differences in handwashing behavior may be the result of intrinsic differences in the emphasis parents place on hand hygiene for girls and boys. It also may be the case that females tend to be more compliant.⁷⁹⁻⁸²

Regarding the relation between the nurses' gender and their knowledge, attitude, and behavior toward hand hygiene, the present study shows that there is statistically significant relationship between the nurses' gender and their knowledge.

The finding of this study was agreed with a study comparison of hand drying methods found that female scored higher on the knowledge question and had more positive scores on the believes, practice and hand hygiene importance scales there was also a non-significant trend toward female reporting a higher percentage compliance with HH guidelines and female were more likely to rate HH as the most importance infection control measure.⁸³⁻⁸⁵

Also, regarding assessment of attitude and behavior, also these study indicated that there is statistically significant relationship between the nurses' gender and their attitude and behavior toward hand hygiene there is considerable evidence to suggest that female generally are more complaint with HH guidelines than males.

This agreed within worldwide reported 75% of females hand washed after using the toilet compared to 58% of males, and in a previous study 47% of females hand washed in this situation compared to 61% of males, and 90% of females hand washed after going to the toilet compared to 72% of males despite these gender difference, when gender was controlled for in this study there was still a significant⁸⁶⁻⁸⁷.

This study found that the percentage of the study sample have 1 year of experience is about half of the study sample, while those who have experience of 5-10 years was less than quarter of the sample, but the study sample who have more experience of 10 years by percentage (6.7%). Which revealed to working of the newly graduated nurses and the awareness about studying of nursing programs may be increased in our countries.

Also, this study revealed that there is no statistically significant relationship between the nurses' years of experience and their assessment of knowledge, attitude, and behavior. And this may be due to the nurses who have more experience of 10 years not perform hand washing because of the decreased number of their contact with patients in ED, and they working as a head nurse in ED.

In addition to the one factor that became apparent when reviewing the literature on handwashing was that HCWs may take their behavioral cues from strong role models within their environment. For example noted that doctors followed the example set by a leading specialist. If the leading specialist washed his or her hands following patient contact on doctor's rounds, all the other doctors followed suit. However, if the leading doctor failed to handwash, none of the other doctors washed their hands either.⁸⁸⁻⁹⁰

The result of this study shows that the majority of the study sample was nurses, but the percentage of the study sample from auxiliary nurses is (3.3%) And there is no statistically significant relationship between the profession of nurses and their assessment of knowledge, attitude and behavior.

The study data clearly show that while there was a marked professional difference in handwashing rates among nurses across professions, these differences were not apparent within professional nurses. The low numbers of observations made on some groups may have influenced the findings. Other factors that may influence professional differences in handwashing rates may include the presence/absence of an orientation program or some level of training that stresses handwashing.

A previous study of the self-reported handwashing practices of a group of North American nurses found similar professional differences in handwashing, the study examined practices in a group of nurses' graduates who had undergone structured teaching on infection control practices during their undergraduate training. This is not the whole story, however, as many studies show little effect of teaching programs on handwashing rates in HCWs.⁹¹⁻⁹²

About nursing shifts in ED, this study reveals that about half of the study sample of nurses working in the day shift and this due to the increased numbers of patients follow to the ED in the day time more than evening and night.

On the same line of this study, there was no statistically significant relationship between the nursing shifts and their knowledge, attitude, and behavior because of overcrowding in ED by the critically ill patients which may be barriers hand hygiene frequency.

This finding coincides with *Gould (2012)*⁹³ who found that the frequency of hand washing is decreased in busy wards and when resources are not readily available. He reported that, the lack of direct benefit associated with hand disinfection in the clinical setting was taken to justify the exclusion of expensive medicated agents from routine use and to establish what is considered acceptable.

In the present study; the proportion of nurses who have received formal training in hand hygiene during the past three years is major, while nurses who did not receive formal training percentage (13.3%).

Furthermore, there is statistically significant correlation between the formal training in hand hygiene in the last three years and their knowledge, attitude, and behavior, and this reflect that the training program about hand hygiene is important to improve knowledge, attitude, and behavior among nurses in ED.

These results were in accordance with, when the influence of training on the hand-washing behavior of nurses was assessed; there was a significant increase in the frequency of hand-washing events in a single shift. Similarly, Huang and Wu found that the total time spent on hand washing by assistant nurses increased significantly after training.⁹⁴⁻⁹⁷

In a further study aimed at changing hand-washing behaviors determined that, following training, nurses washed their hands more frequently before providing care to patients. The results obtained imply that the nurses in our study were affected by the training, that they understood the importance of hand washing after the training, and thus spent more time on it⁹⁸⁻¹⁰⁰.

The study revealed that the proportion of nurses who use an alcohol-based hand rub for hand hygiene is (88.3%), while nurses who did not use an alcohol-based hand rub for hand hygiene percentage reached for (11.7%), And there is statistically significant correlation between the routinely use an alcohol-based hand rub for hand hygiene and their knowledge, attitude, and behavior.

Regarding hand hygiene observation for nurses in ED before and after patient care activities, the most of the nurses don't perform hand hygiene before patient care activities across day, evening and night shifts. But, during day, evening and night shifts the majority of the nurses perform hand hygiene after patient care activities, and there is statistically significant relationship between the nursing shifting and before or/ after patient care activities.

In addition to hand hygiene observation for nurses in ED after touching contaminated surfaces and after glove removal, this study found that the percentage of respondents who agree with that hand hygiene in emergency department is after touching contaminated surfaces are major than who did not agreed. Also, the percentage of respondents who did not agree with that hand hygiene in emergency department is after glove removal more than who agreed. But, there is statistically significant relationship between the nursing shifting and after touching contaminated surfaces and after glove removal.

Furthermore, hand hygiene observation for nurses in ED about the uses of ACHR and soap in this study shows that, the percentage of nurses who use ACHR as hand hygiene in emergency department more than the percentage of nurses who use soap. Also, there is correlation and statistically significant relationship between nursing shifting and the uses in the morning, afternoon, and in the night.

The study revealed that many of the respondents will not wash hands before putting on gloves or before changing gloves in the event of torn gloves. It may be proper to say that the respondents have deficient personal hygiene, as hand washing stands out prominently as a measure of personal hygiene.

Other study stated that “plain soap” should be used for hand washing unless otherwise indicated. Moreover, an important study did not favor alcohol compounds which are not accepted by health care workers. On the other hand, the present study indicated that the efficacy of washing hands with antiseptic bar soap was low even after hand drying. This was explained that bare soap may get contaminated during use and trigger an outbreak. Another clinical study indicates that hand washing with medicated soap was insufficient to completely eradicate methacillin resistant *S. aureus* in hands of nurses¹⁰¹⁻¹⁰².

Regarding the relationships between socio-demographic characteristics of the nurses and observation of their hand hygiene according to indications and uses in ED, this study revealed that there is statistically significant relationship between the nurses’ gender and profession and their hand hygiene practice before/ after patient care activities, hygiene practice after touching contaminated surfaces/ after glove removal and the uses of ACHR or soap.

Furthermore, this study revealed that there is no statistically significant relationship between the nurses’ years of experience of nurses and their hand hygiene practice before/ after patient care activities, hygiene practice after touching contaminated surfaces/ after glove removal and the uses of ACHR or soap.

Although, the knowledge, attitude and behavior toward hand hygiene are present among nurses in ED in this study but, improving hand hygiene perception to the nursing students needs both understanding and motivation about their individual’s behavior. Furthermore, to evaluate specific actions that contributes to the risk factors of the patient’s health.

Conclusion

The nurses employees in emergency department of King Abdul-Aziz hospital at Makkah AlMukaramah have adequate knowledge, behavior, attitudes, and practice toward hand hygiene but, they needs to be improved by the educational and program approach. Emergency department nurses reported that they washed their hands according to indications, should wash their hands more effectively. Institutions should take precautions to ensure that emergency nurses wash their hands effectively. Further observational studies of the hand washing behavior of nurses are required.

Recommendations

Based on the finding of the study, the researchers recommend that:

1. Provide written guidelines for all healthcare providers.
2. Introduce and demonstrate hand hygiene protocols to all caregivers.
3. Encourage leaders to model and support antiseptic hand hygiene practice.
4. Monitor and give feedback to all healthcare providers, including physicians, nursing care providers, food service personnel, laboratory technicians, pharmacists, and therapists.

Summary

Hand washing is an important indicator of safety and quality of care delivered in any health because there is a substantial evidence to demonstrate the correlation between good hand hygiene practices and low health care associated infection rates substantially reduces the number of microbes that may be shared between patients and health care personnel or between health care personnel and contaminated surfaces.

Aims of the study:

The present study is an observational research design aiming to:

- Assess nurses’ knowledge, attitude and behavior about hand washing between patients contact in the emergency department.
- Assess nurses’ practice and application of hand hygiene according to the indications in the emergency department.

Research design:

A quantitative approach using an observational design is proposed for this study.

Subjects:

The study sample consists of 60 staff nurses (32 female nurses & 28 male nurses) employed in emergency department of King Abdul-Aziz hospital at Makkah AlMukaramah being selected as participants in the study.

Setting:

The study was conducted on the emergency department (both male ED and female ED) in King Abdul-Aziz hospital at Makkah AlMukaramah.

Tools of the study:

The data was collected using the following tools:

Tool (1): Perception of hand hygiene among nurses in emergency department A proper questionnaire was obtained from (*WHO guidelines on hand hygiene in health care 2009*) to assess nurses' knowledge, attitude, and behavior about hand washing in ED.

Tool (2): Hand hygiene observational checklist in ED:

An observational checklist for hand hygiene in ED was obtained from (*WHO guidelines on hand hygiene in health care 2009*) to assess nurses' practice of hand hygiene according to the indications in the emergency department.

Methods:

1. An administration permission to conduct the study was obtained from the director of king Abdul-Aziz Hospital and head nurse of emergency department after explanation of the aim of the study.
2. The tools of data collection were development after reviewing of literatures.
3. The developed tools were reviewed by consultant specialist for content validity, clarity, feasibility, and applicability of the tools.
4. An informed consent was obtained from nurses in the emergency department who will be participates in the study after explanation of the aim and nature of the study.
5. A pilot study was conducted on 10% from the study subjects (6 nurses) to test the clarity and applicability of the selected tools, and the necessary modifications were done.

Results:

The characteristics of the study sample, It included 60 nurses, (53.3%) of them were males. Concerning experience, (51.7%) them had one year experience. The majority (96.7%) of them had the profession of nurse and (45.0%) working in morning shift. Most of the sample (86.7%) attended training of hand hygiene and (88.3%) used of alcohol-based hand rube.

There is statistically significant relationship between the nurses' gender and their knowledge, attitude and behavior as (T-test =3.197, 2.312, 2.805 and P value < 0.05).

There is no statistically significant relationship between the nurses' years of experience, profession of nurses, nursing shifts and their knowledge, attitude, and behavior as P value > 0.05.

There is no statistically significant relationship between the nursing shifting and before or/ after patient care activities because the P value > (0.05).

There is statistically significant relationship between the nursing shifting and after touching contaminated surfaces and after glove removal because the P value < (0.05).

There is statistically significant relationship between nursing shifting and the uses of ACHR / soap in the morning, afternoon, and in the night because the P value < (0.05).

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Appendix I

Definition of Terms

Healthcare-associated infection (HAI) is defined as an infection ‘that patients acquire during the course of receiving treatment for other conditions within a healthcare setting’. Other terms used interchangeably with HAI include nosocomial infection (NI), and hospital-acquired infection.

Hand hygiene products:

Alcohol-based (hand) rub. An alcohol-containing preparation (liquid, gel or foam) designed for application to the hands to inactivate microorganisms and/or temporarily suppress their growth. Such preparations may contain one or more types of alcohol, other active ingredients with excipients, and humectants.

Antimicrobial (medicated) soap. Soap (detergent) containing an antiseptic agent at a concentration sufficient to inactivate microorganisms and/or temporarily suppress their growth. The detergent activity of such soaps may also dislodge transient microorganisms or other contaminants from the skin to facilitate their subsequent removal by water.

Antiseptic agent. An antimicrobial substance that inactivates microorganisms or inhibits their growth on living tissues. Examples include alcohols, chlorhexidine gluconate (CHG), chlorine derivatives, iodine, chloroxylenol (PCMX), quaternary ammonium compounds, and triclosan.

Antiseptic hand wipe. A piece of fabric or paper pre-wetted with an antiseptic used for wiping hands to inactivate and/or remove microbial contamination. They may be considered as an alternative to washing hands with non-antimicrobial soap and water but, because they are not as effective at reducing bacterial counts on HCWs’ hands as alcohol-based handrubs or washing hands with an antimicrobial soap and water, they are not a substitute for using an alcohol-based handrub or antimicrobial soap.

Detergent (surfactant). Compounds that possess a cleaning action. They are composed of a hydrophilic and a lipophilic part and can be divided into four groups: anionic, cationic, amphoteric, and non-ionic. Although products used for handwashing or antiseptic handwash in health care represent various types of detergents, the term “soap” will be used to refer to such detergents in these guidelines.

Plain soap. Detergents that contain no added antimicrobial agents, or may contain these solely as preservatives.

Waterless antiseptic agent. An antiseptic agent (liquid, gel or foam) that does not require the use of exogenous water. After application, the individual rubs the hands together until the skin feels dry.

Hand hygiene practices:

Antiseptic handwashing. Washing hands with soap and water, or other detergents containing an antiseptic agent.

Antiseptic handrubbing (or handrubbing). Applying an antiseptic handrub to reduce or inhibit the growth of microorganisms without the need for an exogenous source of water and requiring no rinsing or drying with towels or other devices.

Hand antiseptis/decontamination/degerming. Reducing or inhibiting the growth of microorganisms by the application of an antiseptic handrub or by performing an antiseptic handwash.

Hand care. Actions to reduce the risk of skin damage or irritation.

Handwashing. Washing hands with plain or antimicrobial soap and water.

Hand cleansing. Action of performing hand hygiene for the purpose of physically or mechanically removing dirt, organic material, and/or microorganisms.

Hand disinfection is extensively used as a term in some parts of the world and can refer to antiseptic handwash, antiseptic handrubbing, hand antiseptis/decontamination/degerming, handwashing with an antimicrobial soap and water, hygienic hand antiseptis, or hygienic handrub. Since disinfection refers normally to the decontamination of inanimate surfaces and objects, this term is not used in these *Guidelines*.

Hygienic hand antiseptis. Treatment of hands with either an antiseptic handrub or antiseptic handwash to reduce the transient microbial flora without necessarily affecting the resident skin flora.

Hygienic handrub. Treatment of hands with an antiseptic handrub to reduce the transient flora without necessarily affecting the resident skin flora. These preparations are broad spectrum and fast-acting, and persistent activity is not necessary.

Hygienic handwash. Treatment of hands with an antiseptic handwash and water to reduce the transient flora without necessarily affecting the resident skin flora. It is broad spectrum, but is usually less efficacious and acts more slowly than the hygienic handrub.

Surgical hand antiseptics/surgical hand preparation/presurgical hand preparation. Antiseptic handwash or antiseptic handrub performed preoperatively by the surgical team to eliminate transient flora and reduce resident skin flora. Such antiseptics often have persistent antimicrobial activity.

Surgical handscrub(bing)/presurgical scrub refer to surgical hand preparation with antimicrobial soap and water.

Surgicalhandrub(bing) refers to surgical hand preparation with a waterless, alcohol-based handrub.

Appendix II

Umm Al-Qura University
 Faculty of Nursing
 Research
 Internship Nursing Students



Perception of Hand Hygiene among Nurses in Emergency Department

I. Demographic Data:

1. Hospital: _____
2. Gender: Female Male
3. Years of experience: < 1year 1-4 years 5-10 years > 10 years
4. Profession: Nurse Auxiliary nurse
5. Nursing shifts: Morning Afternoon Night

II. Assessment of Knowledge:

6. Did you receive formal training in hand hygiene in the last three years? Yes No
7. Do you routinely use an alcohol-based hand rub for hand hygiene? Yes No
8. Hand hygiene refers to....
 - a. Hand washing using plain soap and water.
 - b. Using an antiseptic hand rub (e.g. alcohol, chlorhexidine, iodine).
 - c. Hand washing using antimicrobial soap and water.
 - d. All of the above.
9. Hand hygiene adherence in health-care facilities might be improved by....
 - a. Providing personnel with individual containers of alcohol-based hand rubs.
 - b. Providing personnel with hand lotions or creams.
 - c. Providing personnel with feedback regarding hand hygiene adherence/performance.
 - d. All of the above.
10. Alcohol-based hand rubs have good or excellent antimicrobial activity against all of the following except....
 - a. Viruses.
 - b. Fungi.
 - c. Mycobacteria.
 - d. Bacterial spores.

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11. Alcohol-based hand rubs are indicated for all of the following clinical situations except....
 - a. When hands are visibly soiled.
 - b. Preoperative cleaning of hands by surgical personnel.
 - c. Before inserting urinary catheters, intravascular catheters, or other invasive devices.
 - d. After removing gloves.
12. Each of the following statements regarding alcohol-based hand rubs is true except....
 - a. Alcohol-based hand rubs reduce bacterial counts on the hands of health-care personnel more effectively than plain soaps.
 - b. Alcohol-based hand rubs can be made more accessible than sinks or other handwashing facilities.
 - c. Alcohol-based hand rubs have been demonstrated to cause less skin irritation and dryness than handwashing using soap and water.
 - d. Alcohol-based hand rubs are only effective if applied for more than 60 seconds.
13. The following statements regarding hand hygiene in health-care settings are true except....
 - a. Overall adherence among health-care personnel is approximately 40%.
 - b. Poor adherence to hand-hygiene practice is a primary contributor to health-care associated infection and transmission of antimicrobial-resistant pathogens.
 - c. Personnel wearing artificial nails or extenders have been linked to nosocomial outbreaks.
 - d. Hand hygiene is not necessary if gloves are worn.
14. Which of the following is the main route of cross-transmission of potentially harmful germs between patients in a health-care facility? (*tick one answer only*)
 - a. Health-care workers' hands when not clean
 - b. Air circulating in the hospital
 - c. Patients' exposure to colonised surfaces (i.e., beds, chairs, tables, floors)
 - d. Sharing non-invasive objects (i.e., stethoscopes, pressure cuffs, etc.) between patients
15. What is the most frequent source of germs responsible for health care-associated infections? (*tick one answer only*)
 - a. The hospital's water system
 - b. The hospital air
 - c. Germs already present on or within the patient
 - d. The hospital environment (surfaces)

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16. **Which of the following hand hygiene actions prevents transmission of germs to the patient?**
- a. Before touching a patient Yes No
 - b. Immediately after a risk of body fluid exposure Yes No
 - c. After exposure to the immediate surroundings of a patient Yes No
 - d. Immediately before a clean/aseptic procedure Yes No
17. **Which of the following hand hygiene actions prevents transmission of germs to the health-care worker?**
- a. After touching a patient Yes No
 - b. Immediately after a risk of body fluid exposure Yes No
 - c. Immediately before a clean/aseptic procedure Yes No
 - d. After exposure to the immediate surroundings of a patient Yes No
18. **Which of the following statements on alcohol-based hand rub and hand washing with soap and water are true?**
- a. Hand rubbing is more rapid for hand cleansing than hand washing True False
 - b. Hand rubbing causes skin dryness more than hand washing True False
 - c. Hand rubbing is more effective against germs than hand washing True False
 - d. Hand washing and hand rubbing are recommended to be performed in sequence True False
19. **What is the minimal time needed for alcohol-based hand rub to kill most germs on your hands? (tick one answer only)**
- a. 20 seconds
 - b. 3 seconds
 - c. 1 minute
 - d. 10 seconds
20. **Which type of hand hygiene method is required in the following situations?**
- a. Before palpation of the abdomen Rubbing Washing None
 - b. Before giving an injection Rubbing Washing None
 - c. After emptying a bedpan Rubbing Washing None
 - d. After removing examination gloves Rubbing Washing None
 - e. After making a patient's bed Rubbing Washing None
 - f. After visible exposure to blood Rubbing Washing None

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21. **Which of the following should be avoided, as associated with increased likelihood of colonisation of hands with harmful germs?**
- a. Wearing jewellery Yes No
 - b. Damaged skin Yes No
 - c. Artificial fingernails Yes No
 - d. Regular use of a hand cream Yes No
22. **Please state if the following statements are true or false:**
- a. Spreading of bacteria in hospitals occurs mainly via the hands of personnel. True False
 - b. Nosocomial infections are mainly caused by bacteria brought into the hospital by hospital workers. True False
 - c. Hand jewellery make a good hand hygiene impossible. True False

III. Assessment of Attitude:

23. **Please state if the following statements are true or false:**
- a. Before contact with immune compromised patients, hands must always be washed with soap and water or rubbed with alcohol. True False
 - b. Washing hands or rubbing them with alcohol is, for patients with a normal immune system, only necessary before simple surgery and caring for wounds. True False
 - c. Hands should be washed before starting work on the ward. True False
 - d. Visibly soiled hands must be washed with water and soap. True False
 - e. It is the duty of every hospital employee to keep their hands as free of bacteria as possible. True False
 - f. After handling of soiled linen, hands must be washed or rubbed with alcohol. True False
 - g. Nails should be cut short, clean and well-cared for. True False
 - h. On wards nurses should use disposable tissues for blowing their nose. True False
 - i. On wards nurses should wash their hands after blowing their nose. True False

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IV. Assessment of Behavior:

24. Self-reported behaviour:

- a. I wash visibly soiled hands with water and soap. Yes No
- b. I wash or disinfect hands before and after each patient contact. Yes No
- c. I wash hands or rub with alcohol before performing simple surgery
And caring for wounds, in patients with normal immune systems. Yes No

Thank you very much for your time!

Hand Hygiene Observation Tool in Emergency Department

Name of Facility: _____	Form No.: [][][][]
Observer-ID: [][][][][][][][]	Number of Observations: [][][]
Date: [][][][][][][][]	Day of Week: _____
Assigned Time: <input type="checkbox"/> Day (7a-3p) <input type="checkbox"/> Evening (3p-11p) <input type="checkbox"/> Night (11p-7a)	

Floor/ Time	Before Patient Care Activities		After Patient Care Activities		After Touching Contaminated Surfaces		After Glove Removal		The Uses		Comments
	Yes	No	Yes	No	Yes	No	Yes	No	ACHR	Soap	

* ACHR: Alcohol-Chlorhexidine Hand Rub