



Assessment of Hand Hygiene Knowledge, Practice and Attitude among Healthcare workers in Dermatology department, Benghazi Medical Center

*Rima.H. Ali**, *Omar N. El Gadari***, *Fatma F. Al-borki***, *Ebtehal S. Alshakmak***,
and *Sara Rabea Abdulmohsen***

Department of Environmental Health, Faculty of Public Health, University of
*Benghazi

**BSc of public Health, Department of Environmental Health, Faculty of Public Health,
University of Benghazi.

Email address:

Rima.ali@uob.edu.ly (R.ALI)

*Corresponding author

Abstract

In every healthcare facility, staff practice, which is driven by their knowledge and attitudes, plays an important role in the achievement of infection control programs. **Objective:** To assess the knowledge, practice and attitude regarding hand hygiene among healthcare workers in dermatology department –Benghazi Medical Center and to find out if there is bacterial contamination in the hands of healthcare workers. **Method:** A cross-sectional study was conducted from January to August 2020 in dermatology department. A total sample of 78 HCWs were included. A self – administrated, pretested questionnaire in Arabic were used which were developed from the WHO hand hygiene questionnaire. The hands of 20 HCWs were swabbed and cultured. **Results:** All of the HCWs responded to the questionnaire, giving a response rate of 100%. Most of the respondents ages were ranging between 25-34, and the majority of the them were females (74.4%). 83.4% of the respondents were doctors, 12.8% of them were nurses and 3.8% were pharmacists. The level of knowledge regarding hand hygiene was moderate among 61.5%, while 17.9% have a good level of knowledge, and 20.5% have a poor level of knowledge. The knowledge level was not associated with age and gender but type of profession was significantly different in level of knowledge. Bacteria isolated showed *Acinetobacter spp.* was the predominant organism (45%), *Escherichia coli* (10%), *Pseudomonas aeruginosa* (5%), *Klebsiella spp.* (5%) *lactobacillus* (20%) and *staphylococcus aureus* (15%). **Conclusion:** Majority of the participants have moderate level of knowledge regarding hand hygiene. The most defect in the knowledge was regarding the minimum time necessary for hand rubbing with an alcoholic product to kill the microbes on the hands and also regarding the main source of microbes causing hospital infection.

Key words: hand hygiene, nosocomial infections, knowledge, attitude, and practice.

Introduction:

Nosocomial infections are diseases obtained within the hospital or other health care facilities that weren't present or incubating at the time of the patient's admission. It is also known as hospital-acquired infections. It comprises those infections that become symptomatic after the patient is discharged; it also includes infections among medical workers. Most Nosocomial infections are transmitted by health care workers (HCWs) who fail to practice proper hand washing procedures or change gloves between patient's contacts ⁽¹⁾.

Standard precautions are required on the principle that contagious infectious agents may be included in each one blood, body fluids, excretions, secretions, (except sweat), non-intact skin, and mucous membranes. Standard precautions involve hand hygiene, use of proper personal protective equipment (PPE), apply of aseptic technique to lower patient exposure to microorganisms, they also include management of sharp objects, blood spills, and waste to maintain a safe environment ⁽²⁾.

Frequently colonized areas of normal, intact patient skin may contain health care-associated pathogens ⁽³⁾. Intact areas of the skin of some patients contain number of microorganisms such as *Acinetobacter spp*, *Proteus mirabilis*, *S. aureus*, and *Klebsiella spp.* ranging from 100 to 10⁶ CFU/cm² ⁽⁴⁾. Many objects in the immediate environment of the patient such as patient cloths, bedside furniture and bed linen, become contaminated with patient flora ⁽⁵⁾. Such contamination is most likely due to *staphylococci*, *enterococci* or *Clostridium difficile* which are more resistant to desiccation. Contamination of the non-living environment has also been detected on the hand wash station surfaces and many of the organisms isolated were *staphylococci* ⁽⁶⁾.

Gram-negative *bacilli*, *S. aureus*, *enterococci* or *C. difficile* can contaminate the HCWs hands or gloves by carrying out "clean procedures" or touching intact areas of skin of hospitalized patients ⁽⁷⁾.

Compliance with hand washing, however, is frequently sub optimal. This is due to many reasons, including: poor knowledge of staff about risks and procedures, absence of suitable available equipment, high staff-to-patient ratios, allergies to hand washing products, too long a duration approved for washing, and the time needed ⁽⁸⁾.

Healthcare workers and any person involved in patient care, should be prepared to correctly perform hand hygiene and at the adequate time. Certain guidelines on how to perform hand hygiene was determined by World Health Organization (WHO)⁽⁹⁾.

There are differences in the practice of hand washing among various HCWs while on duty even with guidelines by the WHO⁽¹⁰⁾. The WHO recommends regular use of alcohol-based hand rubs before or after contact with patients, after contact with body fluids, and before performing invasive procedure on patients⁽¹¹⁾.

It also recommends the use of soap and water when hands are obviously dirty or soiled or when alcohol-based hand rubs are not available.

Correct use of hand hygiene techniques can go a long way in reducing Nosocomial infections, and the risk of occupational exposure to infectious diseases⁽¹²⁾.

The hands of doctors in dermatology ward are usually colonized with microbial pathogens, but compliance with hand hygiene practice recommendations is low, in spite of a reasonably high awareness of the importance⁽¹³⁾.

Hands can be cleaned by two methods, that is, hand washing and hand rubbing. Hand washing is carried out with soap and water (Figure 1) whereas hand rubbing is completed with an alcohol-based hand rub (Figure 2). Hands should be washed for a minimum of 15 seconds so as to kill the microbes while ensuring that each one areas of the hands are cleaned properly. Hand rubbing is the preferred method for cleaning hands in a healthcare setting, it takes less time, it kills the potentially lethal germs better than a soap does, it doesn't dry or irritate the skin unlike soap and is more accessible than a hand washing sink⁽¹⁴⁾.

In view of the fact that the first and the most important part of controlling Nosocomial infections acquired through poor hand hygiene is increasing the level of HCWs' knowledge and also because of limited awareness to this problem in our region, identifying the knowledge about hand hygiene practices among HCWs can be helpful⁽¹⁵⁾.

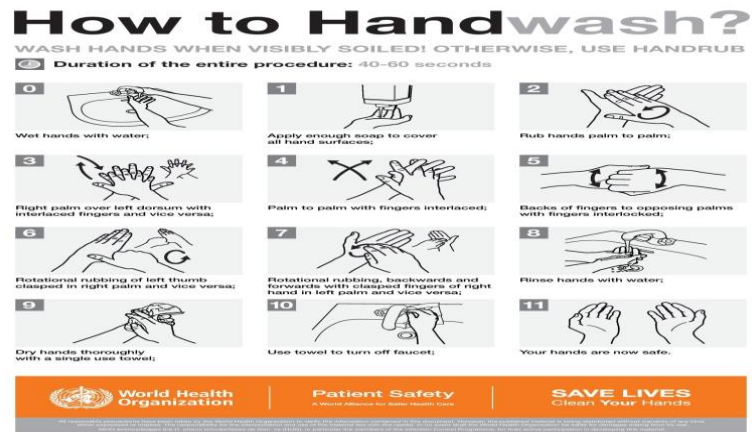


Figure (1): Hand washing technique by World Health Organization



Figure (2): Hand rubbing technique by World Health Organization

Literature Review

In Palestine, Mu'taz, *et al.* performed a cross-sectional study to evaluate the knowledge, practice, and attitude of 200 nurses and doctors who worked in the main governmental and private hospitals. Hand Hygiene Questionnaire was used for data collection. The results reveal that the participants had a moderate knowledge regarding the hand hygiene. The attitude score of the respondents was better than the practice score. In practice score there was a significant difference between gender only. Older respondents had better attitudes, and governmental hospitals had significantly lower scores for compliance of hand hygiene and practice than private hospitals⁽¹⁶⁾.

Another study by Amissah, *et al* to evaluate hand hygiene knowledge and practices amongst health-care workers in a teaching hospital in Ghana in 2016. Knowledge in hand hygiene practices was good. The main contributing factors preventing proper hand hygiene practices were heavy patient load, forgetfulness, and deficiency of water and detergent. Also, alcohol-based hand rubs support was low and only 5.3% had access to warm running water⁽¹⁷⁾.

Furthermore, a convenience sample including 209 physicians was used in a cross-sectional design by Alamer *et al* in 2015. WHO questionnaire was used to assess the knowledge level, they found that 68% of the physicians have fair knowledge and 15% have good knowledge regarding hand hygiene. The lack in the knowledge of the respondents was on the minimum time required for alcohol-based hand rubbing to kill the majority of the hand microbes. Nonhuman resources for hand hygiene were accessible but there was lack in the lotions or creams that are used for moisturizing the hands to prevent hand dryness after hand hygiene⁽¹⁸⁾.

A study in 2014 in New Delhi conducted by Post Graduate Institute of Medical Education and Research (PGIMER), showed that the overall healthcare-associated infections (HAI) prevalence was 8.78%. The prevalence was high in

intensive care unit (33.3%) followed by pediatric wards (12.5%) and surgical wards (10.3%)⁽¹⁹⁾.

In 2014 a cross-sectional study by Maheshwar *et al*, in a tertiary health care setting of Bhopal City, the knowledge and attitude regarding hand hygiene practices among 160 participants were studied. Significant difference among resident and nurses was seen regarding most common source of microbes responsible for HAI. A significant difference was observed in colonization due to jewelry and artificial nail between the participants. The attitude of the nurses about accurate hand hygiene practices to be followed at all times was better (62.5%) as compared to residents (21.3%)⁽²⁰⁾.

In South-West Nigeria, a cross-sectional study was conducted in Lagos University Teaching Hospital (LUTH), Lagos, in August 2011 by Timothy and Okafor. Five hundred HCWs (250 doctors and 250 nurses) was selected by simple random sampling. Data collection was done with a self-administered structured questionnaire. A total of 430 HCWs participated in the study with a response rate of 86%.

83 percent of the respondents had good knowledge; 69.9% had good hand washing practices and 97.6% had good attitude. Hand washing practices were better among nurses than doctors and nurses were more likely to wash their hands before patient contact than doctors. Training on infection control had a significant positive effect on the knowledge and hand washing practices among HCWs in LUTH and they have good hand washing knowledge but suboptimal practices especially with hand-drying⁽²¹⁾.

In addition, a cross-sectional study by Ghadmgahi, *et al* was done in 2010 on 135 nurses in selected hospitals of Mashhad. The data was collected by a questionnaire made by the researcher assessing the participants knowledge, attitude and Self-Efficacy in hospital infections control. The results showed that

67.9% of the participants had average knowledge and 29.9% had good knowledge regarding infection control. They also found that 90.4% had positive attitude towards the expected threats of nosocomial infections, 36.2% were agreed with the perceived benefits of infection control, 17.2% were agreed with the perceived barriers of infections' prevention and control, 74.8% had good Self-Efficacy, and 25.2% had average Self-Efficacy. There wasn't significant relationship between knowledge and Self-Efficacy. In addition, there was no association between attitude and efficacy but there was a significant relationship between knowledge and gender⁽²²⁾.

In Pakistan, a study conducted in 2009 by Anwar *et al* revealed that only 4.7% of the doctors washing their hands before direct contact with the patients. Only 17% claimed to be known of the WHO guidelines about hand hygiene. The lack of sinks, soap, water and disposable towel were considered as a main barrier towards hand hygiene adherence by majority of the participants. In general compliance of hand hygiene was 38.8% but it widely varied as a function of patient care activity⁽²³⁾.

A study was conducted in 2009, by Rudrajit *et al* to find out the prevalence of bacterial contamination in the hands of doctors in the Medicine and Dermatology wards of a tertiary care hospital in India, The hands of 44 doctors were swabbed and cultured at entry to ward and at exit. Contamination of the doctors' hands at entry was 59.1% and at exit it was 90.9%. Overall, the predominant organism was Staphylococcus, it was 59% at entry to the ward and 85% at exit; while coagulase-negative Staphylococcus were more prevalent at entry (32%) and coagulase-positive ones were more prevalent at exit (54%). The contamination rates within the Medicine and Dermatology wards were similar. The most Gram-negative organisms isolated were *Enterococci* (13.6%), *Escherichia coli* (4.5%), *Pseudomonas* (4.5%), and *Klebsiella* (9%). The

prevalence of these organisms was more significant at exit compared with their numbers at entry ⁽²⁴⁾.

Moreover, in a study by Pessoa-silva *et al* ,in May 2001 ,in the neonatal unit of the University of Geneva Hospitals, Switzerland , an anonymous, self-administered questionnaire based on the theory of planned behavior was distributed to 80 neonatal HCWs to evaluate intention to comply, attitude regarding hand hygiene, behavioral and subjective norm perceptions, and perception of difficulty to comply. The response rate was 76%. Of the 49 nurses and 12 physicians responding, 75% believed that they may improve their compliance with hand hygiene. Intention to comply was associated with perceived control over the difficulty to perform hand hygiene and a positive perception of how superiors valued hand hygiene ⁽²⁵⁾.

Methodology:

A cross-sectional study was conducted from January to August 2020 in Dermatology department – Benghazi medical center. There is a total of 96 health care workers working in the dermatology department (77 doctors, 16 nurses, and 3 pharmacists) who provide care and have direct involvement in patient care. All health care workers Libyan and non-Libyan both sexes were included in this study.

A total sample of 78 HCWs who were available during data collection and interested in participating in the study were included, all of them responded to the questionnaire.

A self – administrated, pretested questionnaire in Arabic were used which were developed from the WHO hand hygiene questionnaire for health care workers. The data was collected by a four-part questionnaire, the first part included the demographic features of healthcare workers. The second part consists of 21 questions concerning knowledge about hand hygiene (fourteen questions "yes " or " No" and seven multiple choice questions) The third part consisted of five questions regarding hand hygiene practices (one " yes " and " No" and four multiple choice questions). The fourth part consisted of three questions regarding attitude of health care workers towards hand hygiene (three multiple choice questions). The questions in the third and fourth parts were developed by the researchers themselves. The questionnaire was given

personally to participants and then collected when the participants have completed. Verbal consent was obtained from all participants.

The hands of 20 HCWs (11 doctors, 6 nurses, and 3 pharmacists) were swabbed and cultured. The collection of the samples was done randomly. The samples were collected by cotton swabs, moistened with sterile normal saline, from both hands all the fingers and tip of nails, including finger-rings). The swabs were immediately (less than 2 hours) inoculated on Nutrient broth. The pairs of inoculated Nutrient broth were incubated aerobically at 35-37°C for 24 hours before culture for Blood agar, chocolate agar, MacConkey agar, Mueller-Hinton agar, and then examined for bacterial growth according to standard protocol.

The bacteria then isolated by assessing colony characteristics and Gram reaction, and by conducting various biochemical tests. Gram positive and -negative ones were identified by standard methods. The cultures were Incubated up to 72 hours before declaring negative for growth. The disc-diffusion method was used for sensitivity analysis.

The isolates were tested for sensitivity to eleven antibiotics applied at discs these antibiotics are (ceftazidime, ciprofloxacin, gentamicin, imipenem, Augmentin, aztreonam, clindamycin, erythromycin, cefoxitin, oxacillin, vancomycin).

Statistical analysis: -

Assessments scores of knowledge level: A total score for knowledge level was calculated by one score was given for each correct answer while a zero score was given for an incorrect answer. A score of 0-50% (0-10 of 20) was considered poor knowledge, more than 50-70% (11-14 of 20) was moderate knowledge and more than 70% (15-20) was good knowledge.

Data analysis:

The IBM SPSS version 22 was used to analyze the collected data that obtained from the questionnaires.

Frequency distribution table, cross tabulation, column charts, and multiple column charts were used to describe and compare variables. A significance testing such as Chi-square test was used to examine relationships of variables; the level of significance was set at 5% ($p < 0.05$). Spearman correlation was used to measure the effect of knowledge on practice. Data analysis was performed using the Statistics Package Social Science (SPSS) program version 18.

Results

A total sample of 78 HCWs who were available during data collection and interested in participating in the study were included, all of them responded to the questionnaire , giving a response rate of 100%.

Socio-demographic characteristics details of the respondents were presented in Figure (3). Most of the respondents were between the ages of 25-34 (42.3%), followed by 29.5% of the respondents were between the ages of 45-54, and 21.8% of the respondents were between the ages of 35-44. The majority of the respondents were females (74.4%) and males were (25.6%). 83.4% of the respondents were doctors, 12.8% of them were nurses and 3.8% of the respondents were pharmacists.

Percent of respondent's profession according to gender is shown in Figure (3). 23.1% of males and 60.2% of females were doctors; 1.3% of males and 2.6% of females were pharmacists; while 1.3 of males and 11.5% of females were nurses.

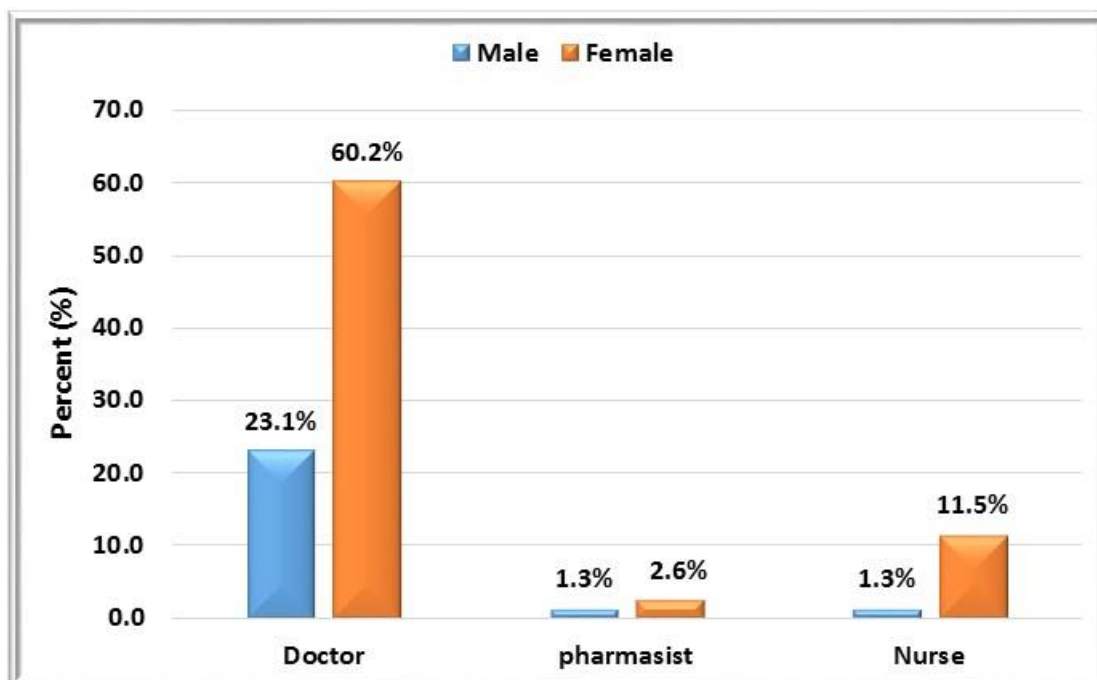


Figure (3): Percent of respondent's profession according to gender

Percent of respondents who had attended hand hygiene training according to the profession is shown in Figure (4). Twenty (25.6%) of the respondents had attended hand hygiene training, 11 (14.1%) of the respondents were doctors, and 9 (11.5%) of the respondents were nurses; while no one of pharmacists had attended hand hygiene training.

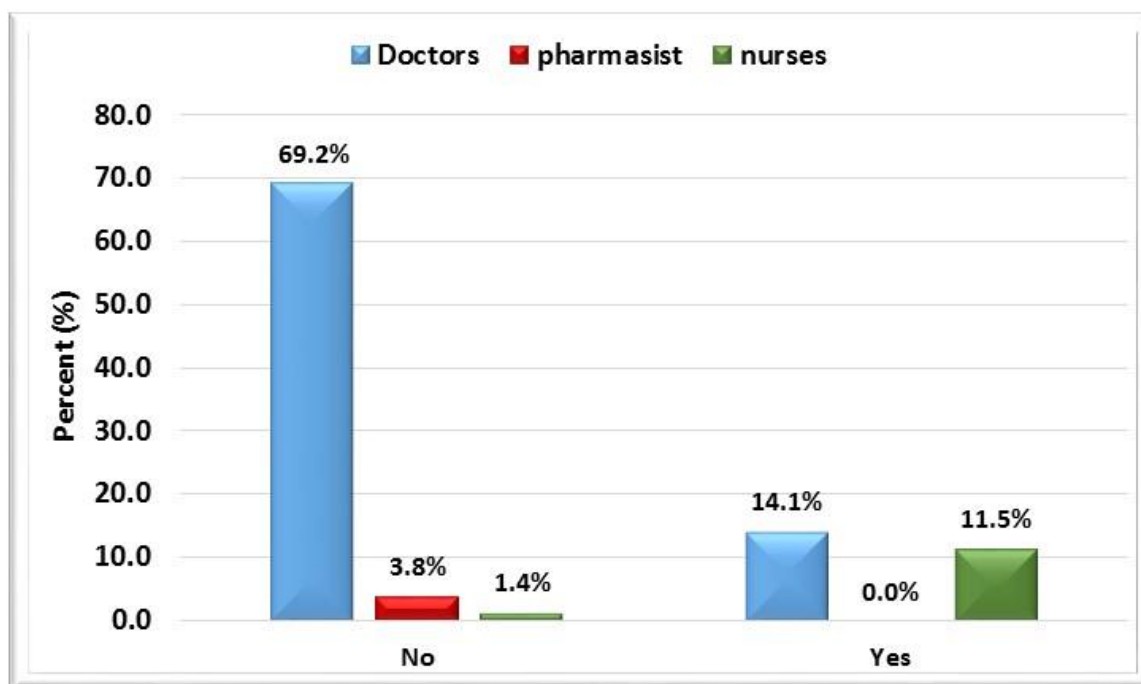


Figure (4): Percent of respondents who had attended hand hygiene training according to the profession

Assessment of the knowledge level about hand hygiene among the respondents is shown in Figure (5). The level of knowledge was poor among 20.5% of the respondents, while 61.5% of them have a moderate level of knowledge, and 17.9% of the respondents have a good level of knowledge regarding hand hygiene.

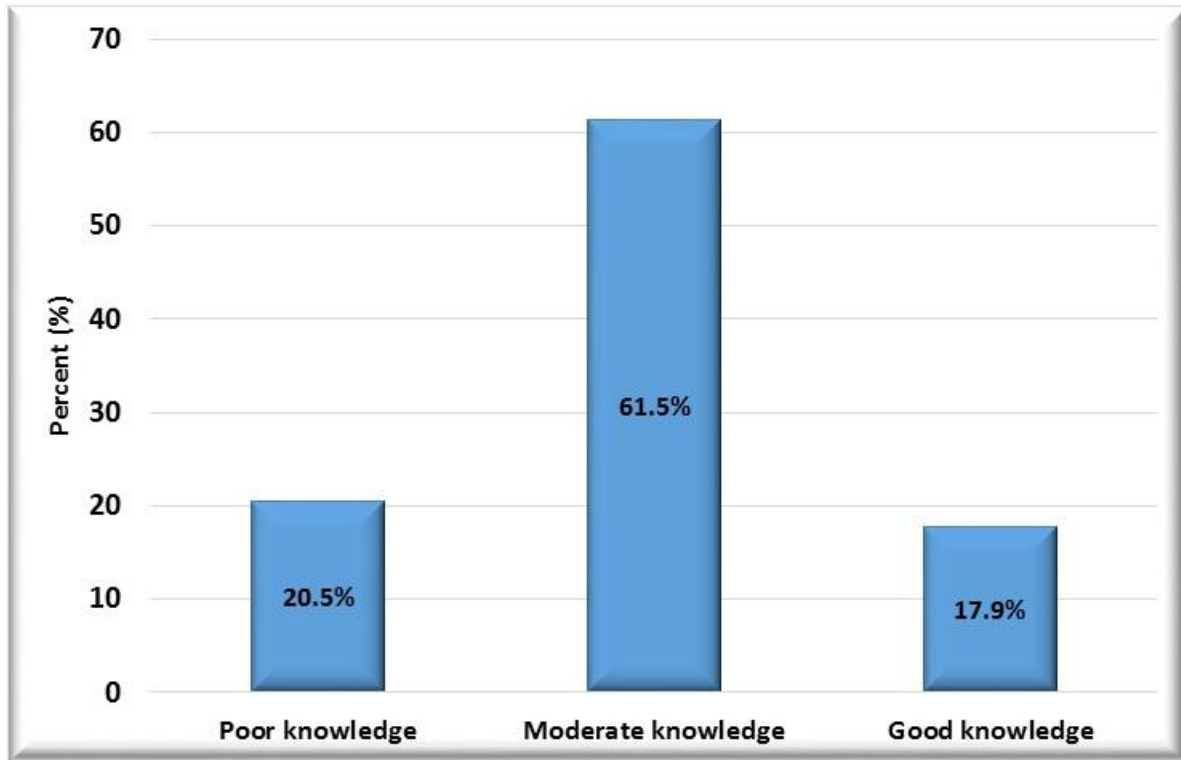


Figure (5): Assessment of the knowledge level about hand hygiene

© GSJ

Table (1): The comparison of knowledge level according to the respondents' age, gender, profession, and training on hand hygiene

Socio- demographic characteristic	Knowledge Level		
	Poor No. (%)	Moderate No. (%)	Good No. (%)
Age group in years			
25-34	6 (7.7%)	20 (25.6%)	7 (9.0%)
35-44	3 (3.8%)	11 (14.1%)	3 (3.8%)
45-54	7 (9.0%)	12 (15.4%)	4 (5.1%)
More than 54	0 (0%)	5 (6.4%)	0 (0%)
Chi-square= 6.5 df= 6 P= 0.3			
Gender			
Male	6 (7.7%)	13 (16.7%)	1 (1.3%)
Female	10 (12.8%)	35 (44.9%)	13 (16.7%)
Chi-square= 4.35 df= 2 P= 0.1			
Profession			
Doctor	14 (17.9%)	42 (53.8%)	9 (11.5%)
Pharmacist	2 (2.6%)	0 (0%)	1 (1.3%)
Nurse	0 (0%)	6 (7.7%)	4 (5.1%)
Chi-square= 12.8 df= 4 P= 0.01*			
training on Hand hygiene			
Yes	3 (3.8%)	10 (12.8%)	7 (9.0%)

No	13 (16.7%)	38 (48.7%)	7 (9.0%)
Chi-square= 5.3df= 2 P= 0.07			

* **P<0.05 is statistically significant**

The knowledge level was not associated with age (P=0.3), the majority of respondents have a moderate knowledge level of hand hygiene in different age groups. Also, there was no significant difference in the knowledge level between males and females (P=0.1); 44.9% of females and 16.7% of males have a moderate knowledge level of hand hygiene. According to the analysis, type of profession was significantly different in level of knowledge (p=0.01). All nurses have a moderate or good knowledge level of hand hygiene; while 2 of 3 pharmacists have poor knowledge; the majority of doctors have a moderate or good knowledge level of hand hygiene. There was no significant difference in the knowledge level between the respondents who had received formal training in hand hygiene and those who had not (P=0.07). As shown in Table (1).

Table (2): Practice hand hygiene

Questions	No.	%
How many times do you wash your hands at work per day?		
Only once	20	25.6
Two times or more	58	74.4
At any one time for how long do you wash your hands?		
Less than one minute	47	60.3
About one minute or more	31	39.7
Why do you wash your hands?		

To prevent myself from getting an infection	14	17.9
To prevent myself and my patients from getting an infection	64	82.1
Do you apply antiseptic hand rub to clean hands?		
Yes	64	82.1
No	14	17.9
How often do you use gloves?		
Always	28	35.6
Sometimes	45	57.7
Never	5	6.4

Hand hygiene practice among the respondents summarized in Table (2). 74.4% of the respondents washed their hands twice or more at work per day. 60.3% of them spent less than one minute when washing their hands. 82.1% of the respondents believed that they washed their hands to prevent themselves and their patients from getting an infection. 82.1% of them used antiseptic hand rub to clean their hands. 57.7% of the respondents sometimes use gloves in works. Moreover; there was a weak positive correlation between knowledge of hand hygiene and practice (coefficient correlation; $r = 0.1$).

Table (3): respondents 'attitude about hand hygiene

	Strongly agree	Agree	Disagree	Strongly disagree
Hand washing should be done when in contact with all patients and patient's fluids?	63 (80.8%)	15 (19.2%)	-	-

Hand washing is often not adhered to because of busy work	11 (14.1%)	16 (20.5%)	34(43.6%)	17 (21.8%)
Hand washing can be improved by administrative order and continuous health education	54 (69.2%)	22(28.2%)	1(1.3%)	1(1.3%)

80.8% of the respondents believed 'strongly agree' about the statement "Hand-washing should be done when in contact with all patients and patient's fluids". 43.6% of them believed 'disagree' about the statement "Hand washing is often not adhered to because of busy work". 69.2% of the respondents' attitude as 'agree' about the statement "Hand washing can be improved by administrative order and continuous health education". As shown in Table (3).

Results of hand swabs

The hands of 20 HCWs (11 doctors, 6 nurses, and 3 pharmacists) were swabbed and cultured, and all the specimens were culture positive. Both Gram negative and Gram-positive bacteria was isolated. Gram negative organisms (65%) were significantly more prevalent than Gram positive organisms (35%). Cultural and biochemical characterization of bacteria isolated showed the presence of six species of bacteria. Among the Gram-negative organisms, *Acinetobacter spp.* was the predominant organism (45%), then *Escherichia coli* (10%), *Pseudomonas aeruginosa* (5%) and *Klebsiella spp.* (5%) were the main ones isolated. Among the Gram-positive organisms *lactobacillus* (20%) then *staphylococcus aureus* (15%). The antibiotic-sensitivity pattern shows that *all S. aureus* isolates were resistant to oxacillin and cefoxitin (MRSA).

One of the *Acinetobacter spp.* isolates were multidrug resistant (to Ciprofloxacin, Gentamicin, Ceftazidime, Augmentin, Imipenem, Aztronam)

Discussion

The included participants in the current study were assessed the knowledge, attitude and practice of hand hygiene. Remarkably, the recent study discovered that the knowledge and appropriate practice of hand hygiene was not satisfactory in the evaluation.

The comparison of knowledge among the healthcare workers in the dermatology department displayed that the level of knowledge regarding hand hygiene was moderate among 61.5% of the respondents, while 17.9% of them have a good level of knowledge, and approximately 20.5% of the respondents have a poor level of knowledge. Parallel results have been reported in study of Alamer N *et al* (2015)⁽¹⁸⁾.

In the finding of the present study the knowledge level was not associated with age, also, there was no significant difference in the knowledge level between males and females. This indicates that, the demographic factors such as age and sex did not contribute to acquisition of knowledge about hand hygiene. As showed by Zakeri H *et al* (2017), in two teaching hospitals in Mashhad and in agreement with the contemporary study, about 68% of the participants had a moderate level of knowledge regarding hand hygiene. The score of 21% was poor and only 10.6% of the participants had a good knowledge score., the mean knowledge score was not associated with age, gender or profession⁽¹⁵⁾. Meanwhile, in a study done by Fashafsheh *et al* (2015) in Palestinian hospitals no significant statistical differences were found between mean knowledge scores towards age, but important statistical differences were found between mean knowledge scores towards gender⁽²⁷⁾.

The type of profession was significantly different in level of knowledge. Wherever, the results of our study showed that the people with higher education, such as pharmacist have relatively less knowledge about hand hygiene. On the other hand, all nurses have a moderate or good knowledge level of hand hygiene. In addition, the majority of doctors have a moderate or good knowledge level of hand. It seems that hand hygiene knowledge is considered more thoughtful in nursing curriculums compared to medical students. In contrast to the present findings eighty three percent of HCWs at the Lagos University Teaching Hospital (LUTH) have good knowledge of hand washing. Doctors had a non-significant better knowledge of hand washing than nurses. None of the doctors had poor knowledge unlike 5% of the nurses⁽²¹⁾.

Education is an important part in the training of all HCWs, especially in countries where there is a lack of proper and well-organized infection control programs. In our study twenty (25.6%) of the respondents had attended hand hygiene training, this is lower than other study by Zakeri H *et al* (2017) where 53.4% of the participants had received the formal training in hand washing⁽¹⁵⁾. The results of another study showed that about two thirds of participants hadn't had prior courses on infection control⁽²⁷⁾

We found that there was no significant difference in the knowledge level between the respondents who had received formal training in hand hygiene and those who had not, this is similar to what is found by Fashafsheh *et al.*⁽²⁷⁾ and Zakeri H *et al.* ⁽¹⁵⁾ .While in the previous study done in LUTH there was a statistically significant association between attending a training or seminar on infection control and knowledge of hand washing⁽²¹⁾.

Furthermore we found that 75.6% of the respondents knew that "Hand hygiene is necessary even if gloves are worn ". This is in contrast to a study by Jemal S in Ethiopia (2018) where 74.7% of the respondents didn't know that hand washing was obligatory even if gloves were worn correctly⁽²⁸⁾. In previous study, when asked if wearing gloves substitutes a hand rub, 68% answered correctly with "never". 52% of the nurses knew they always have to use hand rub after using gloves ⁽²⁹⁾.

The results we obtained 73.1% of the respondents knew that "Hand rubbing with alcohol is more quickly in cleaning hands than washing with soap and water", and only 14.1% of them knew that "Hand rubbing with alcohol does not cause skin dryness more than hand washing". while in other study in India 61.4% agreed that hand rubbing is more rapid for hand cleansing than hand washing and nearly 57.7% agreed that hand rubbing does not cause skin dryness more than hand washing ⁽¹⁴⁾. A more detailed view showed that our participants have an exaggerated belief about side effect of hand rubbing (skin dryness). This point should be intended by the HCWs administrators. In

the current study only 33.3% of respondents knew that the minimum time required by alcohol-based hand rub to kill germs on hands is 20 second, this is nearly similar to study done in India by Modi, *et al* in 2017 ⁽¹⁴⁾.

The findings of the present study showed that only 28.2% of the respondents knew that the germs that are present on or within the patient is the most frequent source of germs responsible

for health care-associated infections this is similar to study done in India ⁽¹⁴⁾. Additionally, 88.5% of the respondents knew that "Hand washing immediately before a clean procedure of patients prevents the transmission of the microbe to the patient", this is higher than in findings of study done by Geberemariam *et al* in Ethiopia in 2018 (46.3%) ⁽³⁰⁾.

Regarding hand hygiene practice among the participants in our study, 82.1% of them used antiseptic hand rub to clean their hands, while it was approximately 62.2% in previous study done by Geberemariam *et al* in Ethiopia in 2018 ⁽³⁰⁾. Hand rubbing is an important method for cleaning hands and care should be taken that areas between fingers, thumb, and fingertips are not missed. In addition, it should be noted that hand hygiene is mandatory even after removing gloves. The efficiency of a hand rub depends on the quantity of the alcohol-based antiseptic used for hand hygiene. The more the quantity, the better the hand hygiene. Because *Clostridium difficile* is a very common infection in a healthcare surroundings and its spores cannot be killed by an alcohol-based antiseptic so this infection can only be prevented by wearing gloves before examining a patient who are infected by this organism and washing hands with soap and water after examination of this patient. ⁽³¹⁾

In our study 57.7% of the respondents sometimes use gloves in work. In contrast to previous study carried out by Geberemariam *et al*, where 52.3% always use gloves in work ⁽³⁰⁾. Furthermore, our results illustrated that 80.8% of the respondents 'strongly agree' that "Hand-washing should be done when in contact with all patients and patient's fluids", 43.6% of them 'disagree' that "Hand washing is often not adhered to because of busy work" and 69.2% of the respondents 'strongly agree' that "Hand washing can be improved by administrative order and continuous health education", while in study of LUTH, 62.8% of HCWs agree' that "Hand-washing should be done when in contact with all patients and patient's fluids", and 37.9% agree that "Hand washing is often not adhered to because of busy work", almost all HCWs (97.5%) in LUTH believed that administrative order and continuous health education can improve hand washing among them ⁽²¹⁾.

According to the results of swabs that were taken from the HCWs in the dermatology department in BMC, We found that among the Gram negative organisms, *Acinetobacter spp.* was the predominant organism about (45%), then *Escherichia coli* (10%), *Pseudomonas aeruginosa* near (5%) and *Klebsiella spp.* (5%) were the main ones isolated, while in other study done by Rudrajit *et al.*(2011) reveals that *Enterococci* (13.6%), *Escherichia coli* (4.5%), *Pseudomonas* (4.5%), and *Klebsiella* (9%) were the most Gram-negative organisms isolated. ⁽²⁴⁾

ESKAPE pathogen which composed of (*Enterococcus faecium*, *Staphylococcus aureus*, *Klebsiella pneumoniae*, *Acinetobacter baumannii*, *Pseudomonas aeruginosa*, and *Enterobacter species*), is a group of pathogens with a high rate of antibiotic resistance that are responsible for the majority of nosocomial infections⁽³²⁾. Most species of the genus *Acinetobacter* are often found in soil samples, but it is almost exclusively isolated from hospital environments.⁽³³⁾

Staphylococcus aureus is one of the five most common causes of hospital-acquired infections and is often the cause of wound infections following surgery. Each year, around 500,000 patients in hospitals of the United States contract a staphylococcal infection, chiefly by *S. aureus*.⁽³⁴⁾

The recorded values of *staphylococcus aureus* compose in the present study were (15%) of the isolated organisms, this be different from a study in Geneva, Switzerland, (2004) where they found *Staphylococcus aureus* (n = 10, 2.5%)⁽³⁵⁾. Pittet D *et al.* (1999) found that there were isolates of *Staphylococcus aureus* (n=39, 10.5%)⁽³⁶⁾.

During the 1960s, one group of investigators was among the first to demonstrate that although *Staphylococcus aureus* is normal flora generally residing in the anterior nares, it is rarely airborne, it is almost always transmitted by direct touch, and hand washing reduces its transmission several fold⁽³¹⁾. Similarly, significant transmission of nurses' antibiotic-resistant coagulase-negative staphylococcal flora to critically ill patients has been shown to occur after relatively short times⁽³⁷⁾.

The antibiotic-sensitivity pattern in our study shows that all *S. aureus* isolates were oxacillin resistant, while in Trick *et al.* (2003) study only 3 of the 63 *S. aureus* isolates were methicillin resistant,⁽³⁸⁾ and in other study in Campania, southern Italy in 2006, found that out of the nine *S. aureus* isolated, three were methicillin-resistant.⁽³⁹⁾

Conclusion:

The current study considered the first study to assess the hand hygiene knowledge in dermatology department - Benghazi Medical Center. Though the HCWs have a general awareness about the importance of hand hygiene, they lack specific information about the appropriate hand hygiene appliance. The majority of the participants in the study have a moderate knowledge level of hand hygiene practice. There was no relationship between the level of knowledge and the age and sex of participants, but there was a significant different in

knowledge among the various type of professions. Most of the respondents never received any formal training about hand hygiene practices. There was a weak positive correlation between knowledge of hand hygiene and practice. According to results of swabs which were taken from hands of HCWs, the *Gram-negative* organisms were significantly more prevalent than *Gram positive* organisms. Cultural and biochemical characterization of bacteria isolated showed the presence of six species of bacteria (*Acinetobacter spp.*, *Escherichia coli*, *Pseudomonas aeruginosa*, *Klebsiella spp.*, *Lactobacillus*, and *Staphylococcus aureus*). *Acinetobacter spp.* was the predominant organism. The antibiotic-sensitivity pattern shows that all *S. aureus* isolates were oxacillin resistant.



References:

1. Delaune SC, Ladner PK Fundamental of nursing Standards and Practice. (4th edn) Delmar Cengage Learning. 2010
2. Abou El-Enein NY, El-Mahdy HM Standard precautions: a KAP study among nurses in the dialysis unit in a University Hospital in Alexandria, Egypt. J Egypt Public Health Assoc .2011; 86:3-10
3. Bhalla A, Aron DC, Donskey CJ. *Staphylococcus aureus* intestinal colonization is associated with increased frequency of *S. aureus* on skin of hospitalized patients. BMC Infectious Diseases. 2007;7:105.
4. Larson EL, et al. Differences in skin flora between inpatients and chronically ill patients. Heart & Lung. 2000; 29:298–305.
5. Hayden MK, et al. Risk of hand or glove contamination after contact with patients colonized with vancomycin-resistant enterococcus or the colonized patients' environment. Infection Control and Hospital Epidemiology. 2008; 29:149–154.
6. Griffith CJ, et al. Environmental surface cleanliness and the potential for contamination during hand washing. American Journal of Infection Control. 2003; 31:93–96.
7. Riggs MM, et al. Asymptomatic carriers are a potential source for transmission of epidemic and nonepidemic *Clostridium difficile* strains among long-term care facility residents. Clinical Infectious Diseases. 2007; 45:992–998.
8. World Health Organisation. Prevention of Hospital-Acquired Infections. A Practical Guide 2nd Edition
<http://apps.who.int/medicinedocs/documents/s16355e/s16355e.pdf> (Malta, 2002).

9. Hand Hygiene: Why, How & When?

http://who.int/gpsc/5may/Hand_Hygiene_Why_How_and_When_Brochure.pdf 2009

10. Scheithauer, S., et al. Workload even affects hand hygiene in a highly trained and well-staffed setting: a prospective 365/7/24 observational study. *Journal of Hospital Infection*, 2017; 97.1: 11-16.

11. World Health Organization. Guideline: WHO Guidelines on Hand Hygiene in Health Care. First Global Patient Safety Challenge Clean Care is Safer Care. Geneva: WHO; 2009. p. 30-156.

12. Infection prevention in hospitals: The importance of hand hygiene. <https://www.healio.com/infectious-disease/nosocomial-infections/news/print/infectious-disease-news/%7Bdd1e115b-8a00-4889-9e85-8566391f2541%7D/infection-prevention-in-hospitals-the-importance-of-hand-hygiene> 2014

13. Cohen, H. A., et al. Hand washing patterns in two dermatology clinics. *Dermatology*, 2002; 205.4: 358-361.

14. Modi, Pranav D., et al. Hand Hygiene Practices Among Indian Medical Undergraduates: A Questionnaire-Based Survey. *Cureus*. 2017;9(7):e1463. Published 2017 Jul 12. doi:10.7759/cureus.1463

15. Zakeri, Hosein, et al. The knowledge of hand hygiene among the healthcare workers of two teaching hospitals in Mashhad. *Electronic physician*, 2017; 9.8: 5159.

16. Mu'taz, M. Dreidi, et al. Hand hygiene knowledge, practices and attitudes among nurses and physicians. *Health*, 2016; 8(5): 456-462.
17. Amissah, I.; Salia, S.; Craymah, J. P. A Study to assess hand hygiene knowledge and practices among health care workers in a teaching hospital in Ghana. *IJSR*, 2016; 5: 301-307.
18. Alamer, Naheel, et al. Physicians knowledge about hand hygiene at King Fahad Hospital of University, Dammam, KSA. *Int J Med Sci Pub Health*, 2015; 4: 1242-1246.
19. Malhotra S, Sharma S, Hans Hans. Prevalence of hospital-acquired infections in a tertiary care hospital in India. Available online, last accessed (3/8/2020)
http://internationalinventjournals.org/journals/IJMMS/Archive/2014/July_vol-1-issue-7/fulltext/Malhotra%20et%20al.pdf *IJMMS*. 2014;1:91–94.
20. MaheshwarI, Veena, et al. A study to assess knowledge and attitude regarding hand hygiene amongst residents and nursing staff in a tertiary health care setting of Bhopal City. *Journal of clinical and diagnostic research: JCDR*, 2014; 8.8: DC04.
21. Okafor, E.; Ekwere, T. A.; OkafoR, I. P. Hand hygiene knowledge and practices among healthcare providers in a tertiary hospital, south west, Nigeria. *Int J Infect Control*, 2013; 9.9: 4-4.
22. Ghadmngahi, F., et al. Knowledge, attitude and self-efficacy of nursing staffs in hospital infections control. *Journal Mil Med*, 2011; 13.3: 167-172.

23. Anwar MA, Rabbi S, Masroor M, et al. Self-reported practices of hand hygiene among the trainees of a teaching hospital in a resource limited country. <https://www.ncbi.nlm.nih.gov/pubmed/19750862>. J Pak Med Assoc. 2009; 59:631–634.

24. Paul, Rudrajit, et al. Bacterial contamination of the hands of doctors: a study in the medicine and dermatology wards. Indian Journal of Dermatology, Venereology, and Leprology, 2011; 77.3: 307.

25. Pessoa-silva, Carmem Lucia, et al. Attitudes and perceptions toward hand hygiene among healthcare workers caring for critically ill neonates. Infection Control & Hospital Epidemiology, 2005; 26.3: 305-311

26. Krejcie, Robert V.; Morgan, Daryle W. Determining sample size for research activities. Educational and psychological measurement, 1970; 30.3: 607-610.

27. Fashafsheh, Imad, et al. Knowledge and Practice of Nursing Staff towards Infection Control Measures in the Palestinian Hospitals. Journal of Education and Practice, 2015; 6.4: 79-90.

28. Jemal S. Knowledge and Practices of Hand Washing among Health Professionals in Dubti Referral Hospital, Dubti, Afar, Northeast Ethiopia. Advances in Preventive Medicine, 2018;2018.

29. Hammerschmidt, Judith; Manser, Tanja. Nurses' knowledge, behaviour and compliance concerning hand hygiene in nursing homes: a cross-sectional mixed-methods study. BMC health services research, 2019; 19.1: 547.

30. Geberemariam et al. Assessment of knowledge and practices of

healthcare workers towards infection prevention and associated factors in healthcare facilities of West Arsi District, Southeast Ethiopia: a facility-based cross-sectional study. *Archives of Public Health*, 2018; 76:69.

31. Mortimer EA, Wolinsky E, Rammelkamp CH. et al. The transmission of staphylococci by the hands of personnel, Skin bacteria and their role in infection, 1965 New York McGraw-Hill (pg. 187- 99)

32. Rice, LB. "Federal funding for the study of antimicrobial resistance in nosocomial pathogens: no ESKAPE". *The Journal of Infectious Diseases*. 2008; 197 (8): 1079–81.

33. Antunes, Luísa C.S.; Visca, Paolo; Towner, Kevin J. "Acinetobacter baumannii: evolution of a global pathogen". *Pathogens and Disease*. 2014; 71 (3): 292–301.

34. Bowersox, John. "Experimental Staph Vaccine Broadly Protective in Animal Studies". NIH. Archived from the original on 5 May 2007. Retrieved 28 July 2007.

35. Pessoa-silva, Carmem Lucia, et al. Dynamics of bacterial hand contamination during routine neonatal care. *Infection Control & Hospital Epidemiology*, 2004; 25.3: 192-197.

36. Pittet, Didier, et al. Bacterial contamination of the hands of hospital staff during routine patient care. *Archives of internal medicine*, 1999; 159.8: 821-826.

37. Vishniavsky N, Archer G. The epidemiology of antibiotic-resistant coagulase-negative staphylococci in a cardiac surgery unit [abstract 465], Program and abstracts of the 34th Interscience Conference on Antimicrobial

Agents and Chemotherapy (Orlando, FL), 1984 Washington DC American Society for Microbiology pg. 175

38. Trick, William E., et al. Impact of ring wearing on hand contamination and comparison of hand hygiene agents in a hospital. *Clinical infectious diseases*, 2003; 36.11: 1383-1390.

39. Brunetti, L., et al. Surveillance of nosocomial infections: a preliminary study on hand hygiene compliance of healthcare workers. *J Prev Med Hyg*, 2006; 47.2: 64-68.

