

Effect of Educational Activity in Improving Knowledge Related to Infection Control among Recently Graduated Medical Students

Shaima N Elgenaid^{1*}, Mohammed Nimir¹, Sara Shamat¹, Yusra A Mohamed Zein²,
Doaa Eltayeb Soliman Fadlalla¹, Mohamed Nasr Elsheikh³, Waleed Khalid Khalafallah Khalid¹,
Abduraheem Farah Abduraheem Farah¹, Ihab B Abdalrahman⁴

¹Department of Internal Medicine, Faculty of Medicine, University of Khartoum, Khartoum, Sudan

²Department of Pharmacology, Faculty of Medicine, University of Khartoum, Khartoum, Sudan

³Department of Community Medicine, Faculty of Medicine, University of Khartoum, Khartoum, Sudan

⁴Faculty of Medicine, University of Khartoum, Consultant of Acute Care Medicine, Soba University hospital

*Corresponding author: shema2690@gmail.com

Abstract A significant number of patients acquired health care associated infections worldwide, and this has devastating effect on both the patient and the health system. Although they disseminated easily between patients through health-care workers contaminated hands, they are preventable infections. Hand hygiene including hand washing and alcohol based hand rub is the most effective method of prevention. We aimed, in this study, to evaluate the effect of educational activity in improving participants' knowledge about infection control. Ninety seven recent medical graduates with a mean age of 23.8 years attended workshop that included both lectures and practical sessions regarding various aspects of infection control. Hand hygiene was practiced in one station according to WHO guidelines, and was emphasized in all stations as a fundamental pre-requisite. WHO's "Hand Hygiene Knowledge Questionnaire" was used to assess the knowledge both before and after the educational session. Data was analyzed using SPSS statistics version 22, and McNemar test was used to compare participant's knowledge pre and post session. The majority (61.9%) of them did not receive formal training in hand hygiene. The knowledge about hand hygiene improved considerably after the workshop, this is reflected by a significant p value (< 0.05) in 12 out of 24 knowledge related items tested (50%). Adding more clinical scenarios to stress on the practice of infection control measures contributed well to the effectiveness of the workshop in improving the knowledge. In conclusion, conduction of educational sessions that include simulated activity can be very useful to bridge the knowledge gap, as well as carrying out continuous feedback and analysis of outcome to improve the quality of educational activity.

Keywords: educational activity, hand hygiene, infection control, knowledge, medical graduate.

Cite This Article: Shaima N Elgenaid, Mohammed Nimir, Sara Shamat, Yusra A Mohamed Zein, Doaa Eltayeb Soliman Fadlalla, Mohamed Nasr Elsheikh, Waleed Khalid Khalafallah Khalid, Abduraheem Farah Abduraheem Farah, and Ihab B Abdalrahman, "Effect of Educational Activity in Improving Knowledge Related to Infection Control among Recently Graduated Medical Students." *American Journal of Educational Research*, vol. 6, no. 4 (2018): 344-348. doi: 10.12691/education-6-4-7.

1. Introduction

About 15 % of hospitalized patients suffer from healthcare associated infection (HCAI) [1] furthermore, 26,250 deaths can be directly related to this type of infection [2]. In 2002 there was roughly 1.7 million of hospital acquired infections according to national nosocomial infections surveillance [3]. Blood stream associated infection increased the length of stay in surgical intensive care unit from 30 to 54 days and average of \$ 40 000 extra cost per survivor [4]. Hand hygiene is the most effective measure in prevention of dissemination of infectious diseases [5] and reduction of nosocomial

infection [6]. Regarding financial benefit of hand hygiene, every 1 USD paid out for hand hygiene promotion might result in US\$ 23.7 benefit [7], on another hand 1% rise in hand hygiene compliance would save US\$ 39,650 annually [8].

Hand hygiene includes hand washing with medicated soap and alcohol based hand rub, both contains antiseptic ingredients that are able to kill microorganisms. Hand washing is usually used when hands are visibly dirty. Alcohol based hand rub is considered to be highly effective, fast and cause less dryness in compare to washing, using only 2 to 3 ml of solution that contains 75%- 85% alcohol for 20 to 30 second is enough to kill the transient flora and prevent its transmission. Health care providers should perform hand hygiene at the five moments as

recommended by WHO and also whenever they move between health care zone and patient zone [9,10,11].

Application of infection control measures lead to a significant reduction in MRSA bacteremia in acute hospitals [12]. Moreover, an increase in hand hygiene per patients using both soap and alcoholic hand rub had major effect in reduction of both MRSA and *Colistridium difficile* infection in some hospitals by nearly 50% [13]. One of the factors that reduce hand hygiene is lack of knowledge of hand hygiene guidelines, unawareness about risk of transmission of infection between patients and inability to detect moments of hand hygiene during patients care [14]. Health care associated infections have bad consequences such as prolongation of hospital stay; prolong disability, financial burden on both the health system and the patient and increase resistance to drugs. Furthermore, it can result in emotional stress to the patients and their families [15].

Transmission of health care associated infection (HCAI) can occur through various methods but the spread through healthcare workers' contaminated hands is by far the most common way. Those organisms can survive for several minutes, so omission, inadequate hand hygiene or use of wrong agents can result in transmission of organisms between healthcare workers and patients. Regarding hand hygiene improvement, WHO designed tools and strategies including regular educational sessions on the importance of hand hygiene and the correct technique based on the five moments of hygiene [15]. The best way is through active education with demonstration of the right techniques and observation of the practice [16]. Moreover, continuous monitoring of hand hygiene knowledge and practice is needed [15]. Many studies found that hand hygiene knowledge among medical students is inadequate and a structured educational program is required [17,18]. More researches are needed to determine the specific effect of each component of those strategies in reduction of HCAI, so that the most effective one can be used in low resource area [19].

1.1. Aim of the study

The aim of this study was to evaluate the effect of the educational session in improvement of knowledge about hand hygiene among recent medical graduates.

2. Methods

2.1. Intervention

An infection control workshop including hand hygiene section was conducted once in October 2017. The workshop program included didactic lectures describing the burden of HCAI; standard precautions; concepts of basic disinfection and sterilization and post exposure prophylaxis for healthcare providers. These were followed by practical stations demonstrating and discussing: 1) hand hygiene technique and application in the right context; 2) implementation of urinary catheter bundles; 3) implementation of central venous catheter bundles and 4) prevention of surgical site infection.

2.2. Subject

Ninety-seven recent medical graduates participated in this workshop. Hand hygiene was practiced in one station according to WHO guidelines, and was emphasized in all station as a fundamental pre-requisite.

2.3. Tools of Data Collection

The knowledge about hand hygiene for each participant was assessed using WHO's "Hand Hygiene Knowledge Questionnaire", both before and after the educational session.

2.4. Data Analysis

Data was analyzed using SPSS statistics version 22 and McNemar test was used to compare students' knowledge about hand hygiene before and after the educational intervention.

2.5. Ethical Consideration

The proposal of this study was approved by Soba Center for Audit and Research (SCAR).

3. Results

The participants were 97 recent medical graduates, with mean age of 23.8 years old. 87 (89.7%) were female and only 10 (10.3%) were male. Of them 61.9% did not received formal training in hand hygiene in the last three years while only 43.3% claimed that they use alcohol based hand rub routinely. Table 1 and Table 2 show the percentage of the participates choosing a particular answer for each item of the questionnaire which were filled before or after undertaking the educational session, in addition to the *p* values for each item.

Several areas of knowledge probed for by the questionnaire were found to be significantly affected by the session. Out of a total of 24 knowledge related items tested for using the questionnaire, 12 (50%) were significantly affected by the educational session ($p < 0.05$). The significant effects of the workshop were found to be in the knowledge about the main route of transmission of germ between patients, prevention of germ transmission to the patient by hand disinfection after exposure to the immediate patient's surrounding and immediately before a clean aseptic procedure, prevention of germ transmission to the health-care workers by hand disinfection immediately after a risk of body fluid exposure and before a clean aseptic procedure, hand rubbing is more rapid for hand cleaning than hand washing, hand washing and hand rubbing are not recommended to be performed in sequence, minimal time required to kill most germs on hands, type of hand hygiene method required before giving an injection and after making a patient bed and most common healthcare associated infection. All data listed in (Table 1 and Table 2).

Table 1. Results of HAI questionnaire: Hand disinfection.

Question topic	Participants answers	Before	After	P value
Routinely use of alcohol hand rub	yes	43.3%	56.7%	0.007
	No	56.7%	43.3%	
Main route of germ transmission between patients	healthcare workers' hands when not clean	43.7%	56.3%	0.005
	air circulating in the hospital	77.8%	22.2%	
	patients' exposure to colonized surfaces	68.6%	31.4%	
	sharing non-invasive objects between patients	42.9%	57.1%	
source of germs	the hospital's water system	100.0%	0.0%	1
	the hospital air	69.2%	30.8%	
	germs already present on or within the patient	50.9%	49.1%	
	the hospital environment (surface)	46.7%	53.3%	
Prevention of germ transmission to the patient by hand disinfection before touching a patient	yes	49.2%	50.8%	0.581
	No	0.0%	0.0%	
Prevention of germ transmission to the patient by hand disinfection immediately after a risk of body fluid exposure	yes	47.0%	53.0%	0.108
	No	45.8%	54.2%	
Prevention of germ transmission to the patient by hand disinfection after exposure to the immediate surroundings of a patient	Yes	41.9%	58.1%	0.043
	no	65.7%	34.3%	
Prevention of germ transmission to the patient by hand disinfection immediately before a clean aseptic procedure	yes	45.6%	54.4%	0.009
	No	69.2%	30.8%	
Prevention of germ transmission to the health-care worker by hand disinfection after touching a patient	yes	48.3%	51.7%	0.238
	No	75.0%	25.0%	
Prevention of germ transmission to the health-care worker by hand disinfection immediately after a risk of body fluid exposure	yes	46.5%	53.5%	0.008
	No	80.0%	20.0%	
Prevention of germ transmission to the health-care worker by hand disinfection immediately before a clean aseptic procedure	Yes	43.0%	57.0%	0.041
	no	62.7%	37.3%	
Prevention of germ transmission to the health-care worker by hand disinfection after exposure to the immediate surroundings of a patient	yes	47.6%	52.4%	0.134
	No	71.4%	28.6%	
Hand rubbing is more rapid for hand cleaning than hand washing	true	44.6%	55.4%	0.0001
	False	82.4%	17.6%	
Hand rubbing causes skin dryness more than hand washing	True	41.3%	58.7%	0.073
	false	59.1%	40.9%	
Hand rubbing is more effective against germs than hand washing	True	41.4%	58.6%	0.627
	false	51.7%	48.3%	
Hand washing and hand rubbing are recommended to be performed in sequence	True	57.6%	42.4%	0.001
	false	37.2%	62.8%	
Minimal time required to kill most germs on hands	20 seconds	41.0%	59.0%	0.001
	3 seconds	50.0%	50.0%	
	1minute	68.4%	31.6%	
	10 seconds	70.6%	29.4%	

Correct answers as mentioned by WHO are written in **bold font**.

Table 2. Results of HAI questionnaire: Hand rubbing and hand washing.

Question topic	Participants answers	Before	After	P value
Type of hand hygiene method required before palpation of the abdomen	rubbing	46.5%	53.5%	0.076
	Washing	70.7%	29.3%	
	None	12.5%	87.5%	
Type of hand hygiene method required before giving an injection	rubbing	38.7%	61.3%	0.001
	Washing	62.1%	37.9%	
	None	100.0%	0.0%	
Type of hand hygiene method required after emptying a bedpan	rubbing	44.2%	55.8%	1
	Washing	51.4%	48.6%	
	None	100.0%	0.0%	
Type of hand hygiene method required after removing examination gloves	Rubbing	47.4%	52.6%	0.766
	washing	51.4%	48.6%	
	None	87.5%	12.5%	
Type of hand hygiene method required after making a patient bed	rubbing	39.5%	60.5%	0.016
	Washing	61.0%	39.0%	
	None	40.0%	60.0%	
Type of hand hygiene method required after visible exposure to blood	Rubbing	58.8%	41.2%	0.557
	washing	48.7%	51.3%	
	None	75.0%	25.0%	
Most common healthcare associated infection	catheter associated UTI	41.6%	58.4%	0.0001
	surgical site infection	71.0%	29.0%	
	MARSA	75.0%	25.0%	
	clostridium difficile	66.7%	33.3%	
Gloves are not necessary in the following conditions	pillars are being dispensed	46.2%	53.8%	0.180
	A catheter bag is being emptied	72.7%	27.3%	
	an incontinent patient is being repositioned	70.6%	29.4%	
	a wound dressing is being changed	50.0%	50.0%	
Handling collecting bags for patients with urinary catheter	touched only with gloved hands at all times	54.3%	45.7%	0.024
	emptied when it is one forth full	80.0%	20.0%	
	kept off the floor	38.8%	61.2%	
	sprayed with disinfectant daily	75.0%	25.0%	

Correct answers as mentioned by WHO are written in **bold font**.

4. Discussion

Several studies were conducted to illustrate the effect of education workshop on improvement of the knowledge level. *Bush-Knapp ME* et al, reported a significant effect of workshop on knowledge about health care associate infection and antimicrobial resistance among members who attend the session [20], similar results were found in double-blind randomized control trial done by *Cheng GY* et al, they found that training education including supervised practice is more effective than no training in raising the awareness and performance of evidence based searching among clinicians [21]. We aimed in this study to assess the effect of simulation education session on improvement of knowledge about hand hygiene among recent medical graduates.

The majority of participants (61.9%) did not receive proper training and only 43.3% used alcohol based hand rub in routine manner, unlike study conducted by *Modi PD* et al, among medical students in India which showed that although 57% of them did not get any formal training, a significant portion of 71.9% responded that they use alcohol based hand rub routinely [22]. We wonder if the higher use of alcohol rub is related to cultural factors. We noticed that some healthcare providers use alcohol rub after they finish their medical task only. This may represent self-centered practice to protect themselves. The percentage of participants who knew that unclean health care workers hands is a main route of transmission of germ between patients increased from 43.3% to 56.7% after the session, with significant improvement of their knowledge ($P= 0.005$). While only 27% of medical students in study done in India knew that fact [22].

We found a significant impact of workshop on enhancement of medical graduate's knowledge about prevention of germ transmission to the patient by hand disinfection after exposure to immediate patient's surroundings ($P =0.043$), before a clean aseptic procedure ($P= 0.009$), prevention of germ transmission to the health-care worker by hand disinfection immediately after a risk of body fluid exposure ($P =0.008$) and also before a clean aseptic procedure ($P =0.041$). All these components were demonstrated in the educational program by scenarios and asking participant to tackle specific tasks.

Strong association between conduction of education session and improvement of knowledge was also found in related to the awareness about advantage of hand rubbing as faster method of disinfection in compare to hand washing ($P= 0.0001$) as only 20 seconds needed to kill most of germs on hands ($P= 0.001$). And the fact that they are not necessary to be done in sequence ($P= 0.001$). In study done by *Modi PD* et al, among medical students only 36.1 % were aware of the time required to kill the germs [22]. Furthermore ,before the workshop 62.1% of participants responded that hand washing is required before giving an injection but this corrected after the session with 61.3% reported that hand rubbing is the preferred method ($P= 0.001$). Similarly a significant impact was obvious in knowledge about using of rubbing after making patient's bed ($P=0.016$). Many studies illustrated that education sessions are recommended to

improve the practice of health care workers and students; including clear instruction that hand hygiene is easiest and most effective method to decrease HCAI, [23,24,25].

It worth noting that the proportion of medical graduate who knew that catheter associated UTI is most common health-care associate infection considerably increased from 41.6% before to 58.4% after the session with p value of 0.0001. Moreover, a significant impact was seen on participant's knowledge level about handling of collecting bags for patients with urinary catheter ($P= 0.024$). A study done in Cambodia among health-care workers by Conducting lectures and practice on hand hygiene, resulted in significant reduction of HCAI after one year or more of hand hygiene compliance, mainly among health workers of general, surgical and infection department [26].

On another hand although there was increase in number of medical graduate who became aware about use of hand disinfection immediately after exposure to body fluid to prevent cross transmission between the patients and after touching patients and their surroundings to prevent transmission to health-care workers, there was no significant effect on the knowledge ($P> 0.05$) while there was declining in number of participants after the session who reported about most common source of germs responsible for HCAI, advantages of hand rubbing as more effective and causes less dryness than hand washing and using of hand washing as method of disinfection after removing of examination gloves. The effect of educational intervention on knowledge about previous items was also found to be insignificant ($P> 0.05$). A randomized control trial done by *Jansson et al*, among critical care nurse with repeated assessment of knowledge and adherence to hand hygiene guidelines after single simulation education session showed that it had no effect on their knowledge about hand hygiene [27].

We conducted a similar workshop in September 2017 among health care workers, using same content of the lectures. In the practical sessions we demonstrated the technical components of hand hygiene. Assessing the outcome reflected insignificant effect of the educational session on the participant's knowledge level in almost all tested items. In this session we revised the practical stations by adding more scenarios reflecting the context of clinical practice. It is interesting to see that knowledge about hand hygiene among recent medical graduate improved considerably. This is reflected by a significant p value in 12 out of 24 items tested (50%). Feedback and analysis of outcome of educational activity is a very helpful tool in improving educational activity.

5. Conclusion

Hand hygiene is most effective method to decrease the number of patients who develop nosocomial infections, and bridging knowledge gap related to hand hygiene is essential to achieve adequate practice. Conduction of educational sessions that include simulated activity can be very useful in improving the knowledge level and continuous assessment and analysis of the outcome is needed to improve the quality of the sessions itself.

References

- [1] Khan HA, Baig FK, Mehboob R. Nosocomial infections: Epidemiology, prevention, control and surveillance. *Asian Pacific Journal of Tropical Biomedicine*. 2017; 7(5): 478-82.
- [2] Wenzel RP, Edmond MB. The impact of hospital-acquired bloodstream infections. *Emerging infectious diseases*. 2001; 7(2): 174.
- [3] Klevens RM, Edwards JR, Richards Jr CL, Horan TC, Gaynes RP, Pollock DA, et al. Estimating health care-associated infections and deaths in US hospitals, 2002. *Public health reports*. 2007; 122(2): 160-6.
- [4] Pittet D, Tarara D, Wenzel RP. Nosocomial bloodstream infection in critically ill patients: Excess length of stay, extra costs, and attributable mortality. *Jama*. 1994; 271(20): 1598-601.
- [5] Chaithra S, George A, Dan AA, Eapen BA, Hemalatha S, Sivakumar T. *International Journal of Innovative Pharmaceutical Sciences and Research*.
- [6] Pittet D, Hugonnet S, Harbarth S, Mourouga P, Sauvan V, Touveneau S, et al. Effectiveness of a hospital-wide programme to improve compliance with hand hygiene. *The Lancet*. 2000; 356(9238): 1307-12.
- [7] Chen Y-C, Sheng W-H, Wang J-T, Chang S-C, Lin H-C, Tien K-L, et al. Effectiveness and limitations of hand hygiene promotion on decreasing healthcare-associated infections. *PloS one*. 2011; 6(11): e27163.
- [8] Cummings KL, Anderson DJ, Kaye KS. Hand hygiene noncompliance and the cost of hospital-acquired methicillin-resistant *Staphylococcus aureus* infection. *Infection Control & Hospital Epidemiology*. 2010; 31(4): 357-64.
- [9] Longtin Y, Sax H, Allegranzi B, Schneider F, Pittet D. Hand hygiene. *The New England journal of medicine*. 2011; 364(13): e24.
- [10] Sax H, Allegranzi B, Uckay I, Larson E, Boyce J, Pittet D. 'My five moments for hand hygiene': a user-centred design approach to understand, train, monitor and report hand hygiene. *Journal of Hospital Infection*. 2007; 67(1): 9-21.
- [11] Pittet D. Improving adherence to hand hygiene practice: a multidisciplinary approach. *Emerging infectious diseases*. 2001; 7(2): 234.
- [12] Newitt S, Myles PR, Birkin J, Maskell V, Slack R, Nguyen-Van-Tam J, et al. Impact of infection control interventions on rates of *Staphylococcus aureus* bacteraemia in National Health Service acute hospitals, East Midlands, UK, using interrupted time-series analysis. *Journal of Hospital Infection*. 2015; 90(1): 28-37.
- [13] Stone SP, Fuller C, Savage J, Cookson B, Hayward A, Cooper B, et al. Evaluation of the national Cleanyourhands campaign to reduce *Staphylococcus aureus* bacteraemia and *Clostridium difficile* infection in hospitals in England and Wales by improved hand hygiene: four year, prospective, ecological, interrupted time series study. *Bmj*. 2012; 344: e3005.
- [14] Hugonnet S, Pittet D. Hand hygiene—beliefs or science? *Clinical microbiology and infection*. 2000; 6(7): 348-54.
- [15] Safety WP, Organization WH. WHO guidelines on hand hygiene in health care: a summary. 2009.
- [16] Kapil R, Bhavsar H, Madan M. Hand hygiene in reducing transient flora on the hands of healthcare workers: an educational intervention. *Indian journal of medical microbiology*. 2015; 33(1): 125.
- [17] Thakker VS, Jadhav PR. Knowledge of hand hygiene in undergraduate medical, dental, and nursing students: A cross-sectional survey. *Journal of family medicine and primary care*. 2015; 4(4): 582.
- [18] Hamadah R, Kharraz R, Alshanjity A, AlFawaz D, Eshaq AM, Abu-Zaid A. Hand Hygiene: Knowledge and Attitudes of Fourth-Year Clerkship Medical Students at Alfaisal University, College of Medicine, Riyadh, Saudi Arabia. *Cureus*. 2015; 7(8): e310-e.
- [19] Allegranzi B, Pittet D. Role of hand hygiene in healthcare-associated infection prevention. *Journal of Hospital Infection*. 2009; 73(4): 305-15.
- [20] Bush-Knapp ME, Budnitz T, Lawton-Ciccarone RM, Sinkowitz-Cochran RL, Brinsley-Rainisch KJ, Dressler DD, et al. Impact of Society of Hospital Medicine workshops on hospitalists' knowledge and perceptions of health care-associated infections and antimicrobial resistance. *Journal of hospital medicine*. 2007; 2(4): 268-73.
- [21] Cheng GY. Educational workshop improved information-seeking skills, knowledge, attitudes and the search outcome of hospital clinicians: a randomised controlled trial. *Health Information & Libraries Journal*. 2003; 20(s1): 22-33.
- [22] Modi PD, Kumar P, Solanki R, Modi J, Chandramani S, Gill N. Hand Hygiene Practices Among Indian Medical Undergraduates: A Questionnaire-Based Survey. *Cureus*. 2017; 9(7).
- [23] Mathur P. Hand hygiene: back to the basics of infection control. *The Indian journal of medical research*. 2011; 134(5): 611.
- [24] Sharif A, Arbabisarjou A, Balouchi A, Ahmadidarhsima S, Kashani HH. Knowledge, Attitude, and Performance of Nurses toward Hand Hygiene in Hospitals. *Global journal of health science*. 2016; 8(8): 57.
- [25] Boyce JM, Pittet D. Guideline for hand hygiene in health-care settings: recommendations of the Healthcare Infection Control Practices Advisory Committee and the HICPAC/SHEA/APIC/IDSA Hand Hygiene Task Force. *American journal of infection control*. 2002; 30(8): S1-S46.
- [26] Sansam S, Yamamoto E, Srun S, Sinath Y, Moniborin M, Sim KB, et al. Assessment of hand hygiene compliance after hand hygiene education among health care workers in Cambodia. *Nagoya journal of medical science*. 2016; 78(2): 151.
- [27] Jansson MM, Syrjälä HP, Ohtonen PP, Meriläinen MH, Kyngäs HA, Ala-Kokko TI. Simulation education as a single intervention does not improve hand hygiene practices: A randomized controlled follow-up study. *American journal of infection control*. 2016; 44(6): 625-30.