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Research Article

Knowledge, attitudes and practices of hand hygiene among final year medical and nursing students at the University of Sri Jayewardenepura

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Abstract

Effective hand hygiene is essential for reducing healthcare associated infections. However, compliance of healthcare workers to hand hygiene guidelines are reportedly poor. It is important therefore to instill adequate knowledge and good attitudes and practices at the time of primary training of the healthcare workers. This study was done to identify gaps in knowledge, attitudes and practices to improve existing training programs and enhance good practices and working ethics in the future. A self-administered questionnaire based cross sectional study was done to compare the knowledge, attitudes, practices and satisfaction (KAPS) of facilities between final year medical and nursing students of the Faculty of Medical Sciences, University of Sri Jayewardenepura. Participants had moderate knowledge (77%) but attitudes, practices and satisfaction of facilities of all the participants was overall poor (<50%). However the nursing students had better knowledge ($p=0.023$), attitudes ($p<0.001$), practices ($p<0.001$) and satisfaction of facilities ($p<0.001$) compared with the medical students**.** The knowledge, attitudes, practices and satisfaction of facilities of medical and nursing students are unsatisfactory. The study shows the need for further improvement of the existing hand hygiene training programs to address the gaps in knowledge, attitudes and practices. Further, there is a need to improve the facilities available for hand hygiene and make them readily accessible for students at their training centers to enable them to engage in good practices which will be beneficial for them as doctors and nurses in the future.

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Introduction

Effective hand hygiene can lower the prevalence of healthcare associated infections. Unfortunately, the prevalence of these infections continues to rise and poses a challenge to healthcare providers. Healthcare associated infections due to poor hand hygiene has been linked to an unacceptably high level of morbidity, mortality and healthcare costs.[1] In developing countries it's prevalence is found to be as high as 19%.[2]

Previous studies have shown that hand hygiene compliance among healthcare workers is generally low.[3] Further increase in compliance is difficult to sustain, although the World Health Organization (WHO) has compiled guidelines in this regard in order to reduce the prevalence of health care associated infections.[3] Furthermore, many studies done to assess the knowledge, attitudes, compliance and reasons for non-adherence to hand hygiene guidelines have found that compliance with hand hygiene protocols by health care workers (HCW) is poor[4,5,6] due to several constraints, including heavy work load, high number of clinical procedures and skin conditions of the HCW.[7,8] An alarming revelation was that compliance was found to be worst before high-risk procedures.[5,9]

In Asia there is a paucity of studies[10,11,12] exploring this subject, although the prevalence of health care associated infections is high in this region. In Sri Lanka, a study[13] conducted at the National Hospital of Sri Lanka (NHSL), showed that more than 60% of the nursing staff had substandard practices when it came to aseptic techniques including hand washing. It was also shown that nursing students, less experienced nurses and those who had recently got their knowledge updated were more likely to have better compliance with aseptic techniques. Work overload at NHSL and shortage of equipment were the main problems which were identified. In Anuradhapura Teaching Hospital,[14] although ICU staff had adequate knowledge, the majority of them had poor attitudes and practices regarding hand hygiene. In this study, the majority were dissatisfied with the facilities available for hand hygiene.

Most of these studies have explored the knowledge, attitudes and practices of doctors and nurses with only a few including nursing students. The primary training of these groups is the responsibility of the faculty and the hospital where they receive their initial training. We believe a much needed study would be to explore the effectiveness of undergraduate training programs. This would be useful in identifying gaps in knowledge, poor attitudes and substandard practices to improve existing training programs and enhance good practices and work ethics in the future.

Method

Setting and Study Population

Medical and nursing students from the Faculty of Medical Sciences, University of Sri Jayewardenepura who had started clinical training at the Colombo South Teaching Hospital and Sri Jayewardenepura General Hospital were enrolled in this study. The investigator visited groups of students and explained the nature of the study. Verbal consent was obtained from those who volunteered to participate.

Study Design

This was a questionnaire based cross sectional study. Ethical clearance for the study was obtained from the Ethical Review Committee of the University of Sri Jayewardenepura. A self administered questionnaire was used which consisted of 5 parts; demographic information, assessment of knowledge, attitudes, practices and availability of facilities. Knowledge was assessed using 25 questions which included multiple choice and "yes" or "no" questions. Attitudes were measured using 10 questions where the respondents were given the option to select on a 1 to 7 point scale between strongly agree and strongly disagree. Practices and facilities were assessed in a similar way using 6 and 8 questions respectively.

A scoring system was used where 1 point was given for each correct response to knowledge, positive attitudes, good practices and satisfaction with facilities. 0 was given for incorrect knowledge, negative attitudes, poor practices and dissatisfaction with facilities. A score of more than 75% was considered good, 50-74% moderate and less than 50% poor. Different Knowledge Attitudes and Practices (KAPs) studies have used different analytic methods. In our study we used descriptive statistics by use of percentages for each of the responses given. The cut off values to determine good, moderate and poor levels were taken from previously published studies with some modification to suit our purpose.[14,15] Data was analyzed using Microsoft EXEL 2010 software. The two sample equal variance T-test was used to check for statistically significant differences between the two study populations, namely medical and nursing students, assuming that both groups had equal variance. A p value less than 0.05 was considered significant.

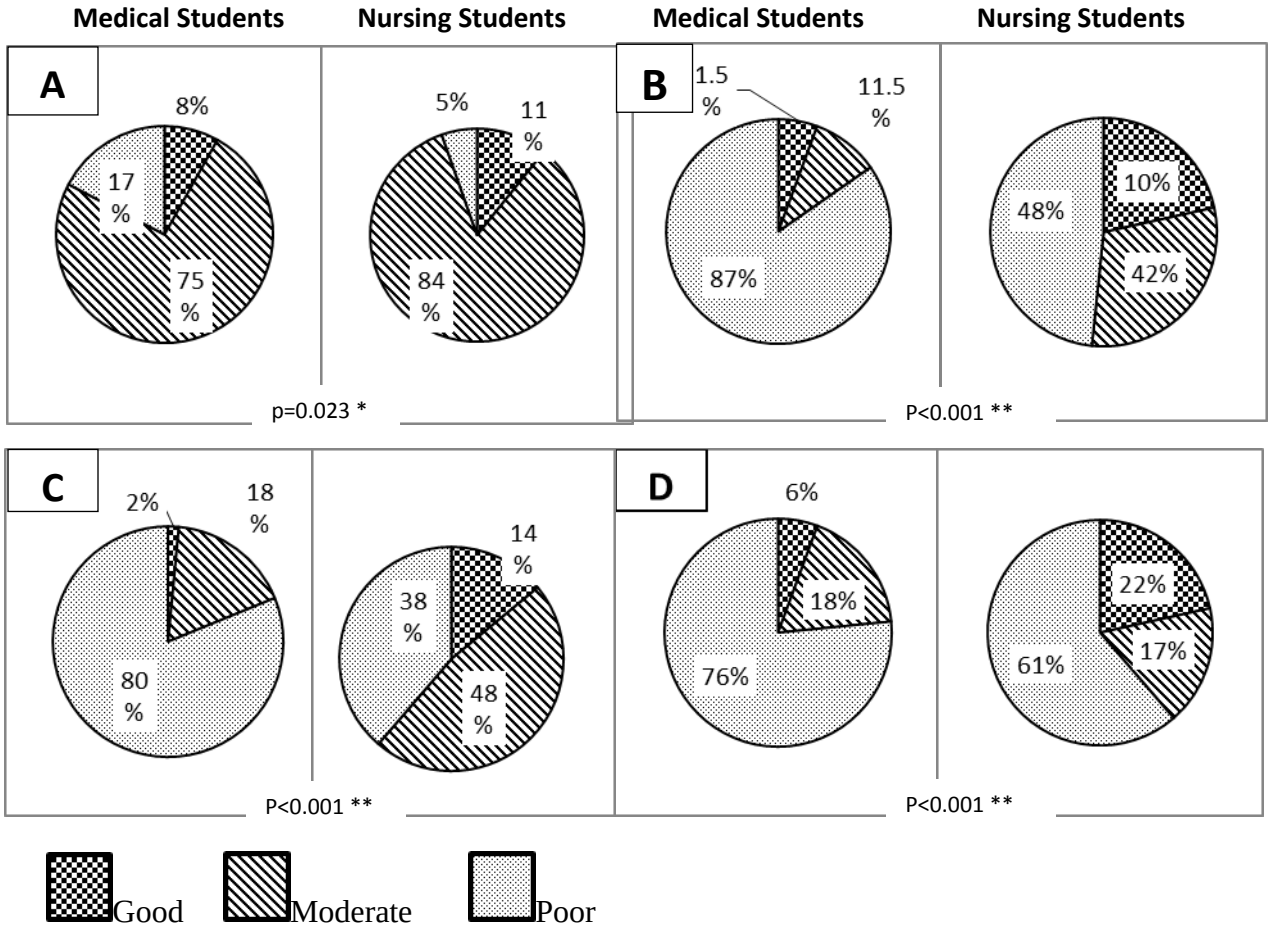
Results

There were a total of 289 study participants (196 medical students and 93 nursing students). When considering the total study group, a majority (81%, 232 out of 289) had claimed to have received formal training in hand washing. A significant difference ($p<0.001$) was observed between medical (142 of 196, 72.4%) and nursing (90 of 93, 96.7%) students who had received formal training in hand hygiene. However, when asked about the correct technique of hand washing, 187 of 196 medical students (95.5%) and 92 of 93 nursing students (98.9%) said they knew the correct technique of hand washing.

Knowledge on hand hygiene

The knowledge on hand hygiene was moderate (224 of 289, 77%) among the total study population. Only 9% of participants (26 of 289) had good knowledge regarding hand hygiene. Nursing students had significantly better knowledge than medical students. ($p= 0.023$) [Figure 1 A] The percentages of correct responses of the two groups of students to the individual questions on hand hygiene knowledge are given in Table 1.

Figure 1: Comparison of knowledge, attitudes, practices and satisfaction with facilities between medical and nursing students



A-Knowledge (p=0.023) *, B- Attitudes (p=7.47 x 10^{-8})**, C- Practices (P=4.6 x 10^{-20})**, D- Satisfaction with facilities (P=0.0002)**. Significance (p value) calculated using students t Test. Significant difference between medical and nursing students (P<0.05) is indicated by *, or highly significant difference (P<0.001) is indicated by **.

Attitudes on hand hygiene

When assessed for attitudes, overall the results were disappointing as the majority of students had poor attitudes. However nursing students had significantly (p<0.05) better attitudes (52%) compared to medical students (16%) as shown in Figure 1 B. The percentages of correct responses of the two groups of students to the individual questions on hand hygiene attitudes are given in Table 2.

Table 1: Comparison of knowledge in medical and nursing students on each question

		Medical students n=196		Nursing students n=93		P value
K1	Which of the following is the main route of transmission of potentially harmful germs between patients (Health care workers hands when not clean)	142	72.4%	68	73.1%	NS
K2	What is the most frequent source of germs responsible for health care associated infections? (Germs already present on or within the patient)	89	45.4%	25	26.9%	** 0.0025
Hand hygiene actions that prevent transmission of germs to the patient?						
K3	Before touching a patient(yes)	183	93.3%	92	98.9%	NS
K4	Immediately after risk of body fluid exposure(yes)	158	80.6%	78	83.8%	NS
K5	After exposure to immediate surroundings of a patient(no)	57	29.1%	28	30.1%	NS
K6	Immediately before a clean/aseptic procedure(yes)	166	84.7%	84	90.3%	NS
Which of the following hand hygiene actions prevents transmission of germs to the health care worker?						
K7	After touching a patient(yes)	185	94.4%	93	100%	*0.02
K8	Immediately after a risk of body fluid exposure(yes)	176	89.7%	85	91.4%	NS
K9	Immediately before a clean/aseptic procedure(no)	96	48.9%	57	61.3%	*0.05
K10	After exposure to the immediate surroundings of a patient(yes)	151	77.0%	76	81.7%	NS
Which of the following statements on alcohol-based hand rub and hand washing with soap and water are true ?						
K11	Hand rubbing is more rapid for hand cleansing than handwashing (true)	143	72.9%	76	81.7%	NS
K12	Handrubbing causes skin dryness more than handwashing (false)	62	31.6%	19	20.4%	NS
K13	Handrubbing is more effective against germs than handwashing (false)	90	45.9%	32	34.4%	*0.01
K14	Handwashing and handrubbing are recommended to be performed in sequence (false)	71	36.2%	13	14.0%	NS
K15	What is the minimal time needed for alcohol based hand rub to kill most germs on your hands ?(20 seconds)	68	34.6%	23	24.7%	NS
Which type of hand hygiene method is required in the following situations ?						
K16	Before palpation of the abdomen rubbing	53	27.0%	36	38.7%	*0.02
K17	Before giving an injection rubbing	47	23.9%	28	30.1%	NS
K18	After emptying a bed pan washing	134	68.4%	74	79.5%	*0.02
K19	After removing examination gloves rubbing/washing	136	69.4%	77	82.7%	NS
K20	After making a patients bed rubbing	60	30.6%	12	12.9%	**0.0005
K21	After visible exposure to blood washing	92	46.9%	54	58.0%	*0.03
Which of the following should be avoided, as associated with increased likelihood of colonization of hands with harmful germs ?						
K22	Wearing jewellery (yes)	153	78.0%	90	96.8%	**0.0001
K23	Damaged skin (yes)	184	93.8%	86	92.4%	NS
K24	Artificial fingernails (yes)	158	80.6%	84	90.3%	*0.04
K25	Regular use of a hand cream (no)	116	59.1%	67	72%	NS

Correct answer to each response is given within brackets. Significance calculated using student T-test
*p<0.05 (Significant), **p<0.001 (highly significant), NS (Not significant)

Table 2: Comparison of attitudes among medical and nursing students on each question.

		Medical students n=196		Nursing students n=93		P value
A1	I adhere to correct hand hygiene practices at all times	41	20.9%	58	62.4%	**<0.001
A2	I have sufficient knowledge about hand hygiene	70	35.7%	69	74.1%	**<0.001
A3	Sometime I have more important things to do than hand hygiene	41	20.9%	33	35.5%	*0.004
A4	Emergencies and other priorities make hygiene more difficult at times	16	8.1%	5	5.4%	NS
A5	Wearing gloves reduce the need for hand hygiene	50	25.5%	36	38.7%	*0.01
A6	I feel frustrated when others omit hand hygiene	54	27.5%	51	54.8%	**<0.001
A7	I am reluctant to ask others to engage in hand hygiene	39	19.8%	14	15. 0%	NS
A8	Newly qualified staff has not been properly instructed in hand hygiene in their training	52	26.5%	46	49.5%	**<0.001
A9	I feel guilty if I omit hand hygiene	77	39.3%	64	68.8%	**<0.001
A10	Adhering to hand hygiene practices is easy in the current setup	53	27%	43	46.2%	*0.008

Significance calculated using student T-test
*p<0.05 (Significant), **p<0.001 (highly significant), NS (Not significant)

Practices of hand hygiene

When assessed for hand hygiene practices, we found that only 5.53% had good practices, while 26.9% had moderate practices and the majority (67%) had poor hand hygiene practices. Nursing students had better practices than medical students and the difference was statistically significant ($p<0.05$).[Figure 1, C] The percentages of correct responses of the two groups of students to the individual questions on hand hygiene practices are given in Table 3.

Satisfaction regarding facilities available for hand hygiene.

The satisfaction of medical students and nursing students regarding the overall facilities available for hand hygiene was reported as poor by 76% medical students and 61% nursing students. However the nursing students had more significant satisfaction with the facilities than the medical students.($P=0.0002$). [Figure 1, D] The percentages of responses of the two groups of students to the questions regarding satisfaction with facilities are given in Table 4.

Table 3: Comparison of the correct responses to hand hygiene practices of medical and nursing students.

Significance calculated using student T-test

		Medical students (n=196)		Nursing students (n=93)		P value
P1	Sometime I miss out hand hygiene simply because I forget it	32	16.3%	43	46.2%	**<0.001
P2	Hand hygiene is an essential part of my role	92	46.9%	78	83.8%	**<0.001
P3	The frequency of hand hygiene required makes it difficult for me to carry it out as often as necessary	12	6.1%	26	27.9%	**<0.001
P4	Infection prevention team have a positive influence on my hand hygiene	41	20.9%	51	54.8%	**<0.001
P5	Infection prevention notice boards remind me to do hand hygiene	52	26.5%	49	52.7%	**<0.001
P6	It is difficult for me to attend hand hygiene courses due to time pressure	22	11.2%	28	30.1%	**<0.001

*p<0.05 (Significant), **p<0.001 (highly significant), NS (Not significant)

Table 4: Comparison of satisfaction of facilities between medical and nursing students.

		Medical students n=196		Nursing students n=93		P value
F1	Are you satisfied with the facilities available for hand hygiene *yes	113	57.6%	57	61.3%	NS
Satisfaction with the availability of						
F2	Infection prevention notices	40	20.4%	43	46.2%	**<0.001
F3	Soap/antiseptic and water for hand washing	48	24.5%	44	47.3%	**<0.001
F4	Alcohol rub	29	14.8%	24	25.8%	*0.01
F5	Paper/clothes for drying hands	23	11.7%	23	24.7%	*0.002
F6	Availability of gloves	64	32.6%	27	29%	NS
F7	Number of sinks with running water	64	32.6%	38	40.8%	NS
F8	Training programmes on hand Hygiene conducted by the hospital	19	9.7%	29	31.2%	* <0.001

Significance calculated using student T-test

*p<0.05 (Significant), **p<0.001 (highly significant), *p<0.05, NS (Not significant)

Discussion

Compliance of health care workers to adhere to correct hand hygiene are reported to be poor in Sri Lanka as well as other countries.[1,13,14] However hand hygiene is a single most effective preventive measure against hospital acquired infections, and can contribute to shorter hospital stay, reduction in patient morbidity and health care costs.[1] It is important to carry out training programmes on hand hygiene regularly for health care workers as it has been associated with increased compliance to hand hygiene practices and reduction of infection.[16,17] Our study group consisted of final year medical and nursing students undergoing primary training. It is important

to instill correct hand hygiene practices, good attitudes and correct knowledge regarding hand hygiene during the primary training..

In our study, both study groups had moderate knowledge on hand hygiene, which was a positive finding. However it is important to address the gaps of knowledge with regard to sources and transmission of germs and appropriate methods of hand hygiene during their training. Seventy two percent of all participants knew that unhygienic hands of HCWs were the main route of transmission in a health care facility (HCF). However, only 45% of medical students and 27% of nursing students were aware that the main source of germs in a HCF was from patients, with medical students having significantly better knowledge in this aspect.

Use of alcoholic hand rub solutions or gels has been shown to be effective for hand antisepsis.[19] However the availability of hand rub solutions in hospitals are still unsatisfactory. In our study, 75% were aware that hand rubbing is more rapid for hand cleansing. Knowledge about hand washing as a more effective method was found to be significantly better among medical students when compared to the nursing students. An unexpected finding was that only few medical and nursing students (35% and 25% respectively) knew that 20 seconds is the minimum time required for effective hand hygiene as documented in the WHO guideline.[3] Both groups had poor knowledge regarding the correct method of use prior to palpation of abdomen (31%), giving an injection (26%) and after making a patient's bed (25%). It is important to address this during future clinical training sessions. Both medical and nursing students had a good knowledge (69%, 83% respectively) of the proper method of hygiene following removal of examination gloves. However the overall correct responses regarding appropriate use of hand rub and hand washing was unsatisfactory and there were several gaps in their knowledge with regard to the accurate procedure. One of the reasons may be due to unavailability of hand rub solution in the hospital for medical and nursing students as shown in Table 4. It has been shown that increased compliance to hand hygiene can be achieved by making the hand rub solutions available at the bedside of patient.[16]

In our study, nursing students showed better attitudes towards hand hygiene than medical students. A majority (74%) of nursing students thought they had sufficient knowledge about hand hygiene compared to just 35% of medical students. This shows the need to conduct hand hygiene sessions for medical students regularly. Further, a significantly higher percentage of nurses (62.4%) reported adhering to correct hand hygiene methods compared to just 20% of medical students. In our study, 26% medical students and 39% nursing students thought that wearing gloves could replace hand hygiene. More nursing students (69%) claimed that they felt guilty about omitting hand hygiene as compared with medical students (39%) as shown in [Table 2. Although these nursing students had a better overall attitudes regarding hand hygiene, they did not recognize important practical aspects such as the importance of hand hygiene after preparing a patient's beds. The nursing students also were more satisfied with the facilities available. It may be hypothesized that nursing students have better access to facilities than medical students.

Dissatisfaction with facilities available for hand hygiene was high among the study group. Only a few of the respondents (27% medical students and 46% nursing students) felt that adhering to hand hygiene practices in current practice was easy. In order for the students to develop good

practices regarding hand hygiene, it is important to make proper hand hygiene facilities available. When these students are facing situations requiring urgent patient care, they are more likely to omit hand hygiene practices when facilities are not easily accessible to them. Increasing the supplies necessary for hand washing and institutional support is essential in combating substandard practices in hand hygiene. We propose that a quantitative measure of hand hygiene facilities be done to better assess the available resources. An ideal follow-up of this study would be to implement certain interventions and reassess the same groups to look for an improvement.

On the other hand, it is also important to improve the current training programmes targeting hand hygiene practices in medical and nursing students. Previous studies have shown that self reported compliance of hand hygiene is higher than the actual compliance during the working shift. However, having regular hand hygiene campaigns, displaying posters and encouraging peers to remind colleagues of hand hygiene has been shown to improve the compliance of HCWs significantly.[16] Our findings are in agreement with previous observational studies which found that nurses had better hand hygiene practices than doctors.[7,17] Being a doctor rather than a nurse is an observed risk in non-adherence to hand hygiene.[3] For nursing students, infection control is taught in the first year of their nursing curriculum at Sri Jayewardenepura University. Furthermore these students' start their ward training in the first year and they may be getting better exposure to correct hand hygiene techniques regularly from a very early stage. This may be the reason that nursing students fared better than medical students in most areas, including better attitudes and practices which is a positive finding towards proper nursing practices in the future.

Our study highlights that it is important to improve the current training programs targeting hand hygiene practices among medical and nursing students. Hand hygiene training sessions may need to be conducted more frequently for medical students with continuous monitoring and performance feedback to encourage them to follow correct hand hygiene practices. As doctors and nurses are the two key players in the health care team, it is important to provide the best appropriate knowledge and proper training regarding preventive practices of infectious diseases. It has been shown that physician compliance with proper hand hygiene practices can be improved by personal encounters, direct meetings with the infectious disease physician and videotaped presentations.[18] We recommend that the infection prevention team of the hospitals get more involved with student training and the updating of infection prevention notices.

Conclusion

The students had moderate knowledge on hand hygiene. However, attitudes, practices and satisfaction of facilities of medical and nursing students were unsatisfactory. The study shows the need for further improvement of the existing hand hygiene training programs to address the gaps in knowledge, attitudes and practices. Further display of infection prevention notices, easy access to hand hygiene facilities at the training centers and active involvement of staff to emphasize the importance of correct hand hygiene as well as encouraging students to follow good hand hygiene practices will be useful in increasing hand hygiene compliance among these students. This will improve hand hygiene practices of fully qualified doctors and nurses in the future.

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References

1. Trampuz A., Widmer A.F. Hand Hygiene: A frequently missed life saving opportunity during patient care. *Mayo Clin Proc*. 2004; **79**:109-116 *http://dx.doi.org/10.4065/79.1.109*
2. WHO: The Burden of health care-associated infection worldwide. A Summary. *http://www.who.int/gpsc/country_work/summary_20100430_en.pdf*
3. WHO Guidelines on Hand Hygiene in Health Care First Global Patient Safety Challenge Clean Care is Safer Care. 2009. *http://whqlibdoc.who.int/publications/2009/9789241597906_eng.pdf*
4. Kennedy A.M., Elward A.M, Fraser V.J. Survey of knowledge, beliefs and practices of neonatal Intensive Care Unit healthcare workers regarding nosocomial infections, central venous catheter care and hand hygiene. *Infection Control and Hospital Epidemiology*, 2004; **25** (9):747-752 *http://dx.doi.org/10.1086/502471*
5. Rumbaua R.O., Yu C.T., Pena A.C. A point-in-time observational study of hand washing practices of healthcare workers in the Intensive Care Unit of St. Luke's Medical Center. *Phil J Microbiol Infect Dis* 2001; **30** (1):3-7 *No doi*
6. Kennedy M., Burnett E. Hand hygiene, knowledge and attitudes : Comparison between student nurses. *Journal of Infection Prevention.* 2011; **12**:246-250 *http://dx.doi.org/10.1177/1757177411411124*
7. Abd Elaziz K.M., Bakr I.M. Assessment of knowledge, attitude and practice of hand washing among health care workers in Shams University Hospitals in Cairo. *J Prev Med Hyg.* 2009; **50**(1):19-25. *No doi*
8. Jang J.H., Wu S., Kirzner D., Moore C., Youssef G., Tong A., Lourenco J., Stewart R.B., McCreight L.J., Green K., McGeer A. Focus group study of hand hygiene practice among healthcare workers in a teaching hospital in Toronto, Canada. *Infect Control Hosp Epidemiol*. 2010: **31**(2):144-50. *http://dx.doi.org/10.1086/649792*
9. Creedon S.A. Hand Hygiene Compliance: Exploring variations in practice between hospitals. *Nurs Times*. 2008; **10**4(49):32–35 *No doi*
10. Yuan C.T., Dembry L.M., Higa B., Fu M., Wang H., Bradley E.H. Perceptions of hand hygiene practices in China. *J Hosp Infect*. Feb 2009; **71**(2):157-62. *http://dx.doi.org/10.1016/j.jhin.2008.09.017*
11. Anwar M.A., Rabbi S., Masroor M., Majeed F., Andrades M., Baqi S. Self reported practices of hand hygiene among the trainees of a Teaching Hospital in a resource limited country. *Journal of Pakistan Medical Association* . 2009; **59** (9):631-634 *No doi*
12. Patarakul K., Tan-Khum A., Kanha S., Padungpean D., Jaichaiyapum O.O. Cross-sectional survey of hand-hygiene compliance and attitudes of health care workers and visitors in the intensive care units at King Chulalongkorn Memorial Hospital. *J Med Assoc Thai*. 2005; **88** Suppl 4: S287-93. *No doi*

13. Batuduwaarachchi V.R., Balasubramanium M., Balasooriya D., Senerath L.D.J.U. Compliance with aseptic procedures during intravenous access among the nursing staff at the National Hospital of Sri Lanka. *International Journal of Infection Control*. 2011; **7** (13):1-6 *No doi*

14. Kudavidanage B.P., Gunasekara T.D.C.P.,Hapuarachchi S. Knowledge, attitudes and practices on hand hygiene among ICU staff in Anuradhapura Teaching Hospital. *Anuradhapura Medical Journal*.2011: 1: 29-40 *No doi*

15. Suchitra JB, Lakshmi Devi N. Impact of education on knowledge, attitudes and practices among various categories of health care workers on nosocomial infections. *Indian Journal of Medical Microbiology* 2007; **25**:181-7 *http://dx.doi.org/10.4103/0255-0857.34757*

16. Randle J., Clark M., Storr J., Hand hygiene compliance in health care workers. *Journal of Hospital Infection* 2006; **64**: 205-209 *http://dx.doi.org/10.1016/j.jhin.2006.06.008*

17. Salemi C., Canola M.T., Eck E.K., Hand washing and physicians: How to get them together. *Infection Control and Hospital Epidemiology*, 2002; **23**(1):32-35 *http://dx.doi.org/10.1086/501965*

18. Larson E. Skin hygiene and infection prevention: More of the same or different approaches? *Clinical Infectious Diseases.* 1999: 29: 1287–94 *http://dx.doi.org/10.1086/313468*

19. Abd Elaziz, K. M., Bakr I. M,. Assessment of knowledge, attitude and practice of hand washing among health care workers in Ain Shams University hospitals in Cairo. *The Egyptian Journal of Community Medicine* 2008; **26**(2):1-12 *No doi*