The Effectiveness of Hand Hygiene Education Intervention for Medical Students in Primary Care Settings, Ismailia City, Egypt

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Abstract

Background: All medical students must be aware and practice hand hygiene procedures as one of the infection control measures that could lower health care acquired infections.

Aims: to improve practice of hand hygiene among medical students in health care settings and to evaluate the effectiveness of educational training on hand hygiene among the medical students.

Methods: The study is a prospective before-and-after trial of an educational intervention with longitudinal follow up. Pre-post intervention was between April and May 2014 with one month interval and the follow up was 6 months later. The pre post intervention included all the first year medical students with affiliation to Faculty of medicine, Suez Canal University in Ismailia city. The follow up included all the participants who continued their second educational year in the same faculty. The researchers used a validated questionnaire and observation checklist to collect data in all periods of the study. Educational training program was designed and conducted by the researchers on hand hygiene importance, measures, technique, time and compliance.

Results: The educational intervention had a significant improvement in KAP, one and six months after the intervention (P <0.001). Non significant decrease in median scores of knowledge with no change in median scores of attitude but significant improvement of median scores of practice and overall KAP scores of hand hygiene in the follow up (P <0.001) was observed.

Conclusion: The educational intervention was effective in improvement in KAP of hand hygiene in pre-post intervention with one month interval and in the follow up after six months after the intervention.

Key words: Hand hygiene, intervention, medical students

Introduction

Hand hygiene is a general term referring to any action of hand cleansing. The World Health Organization (WHO) guidelines on hand hygiene in health care provide a comprehensive review of scientific data on hand hygiene rationale and practices in health care. The strategy of "My five moments for hand hygiene" by WHO, can be used to ensure proper education of the trainee health work force. These five moments that call for the use of hand hygiene include the moment before touching a patient, before performing aseptic and clean procedures, after being at risk of exposure to body fluids, after touching a patient, and after touching patient surroundings.[1]

Hand hygiene awareness and compliance among undergraduate medical students of the Qassim College of Medicine, Saudi Arabia, was very low.[2] There was a previous study in Ain Shams University hospitals in Cairo that recommended the implementation of hand washing training programs for undergraduate doctors, house officers and nurses to improve Hand wash practice. [3] Also in a study comparing hand hygiene knowledge, beliefs and practices of Italian nursing and medical students, mean scores on the knowledge questions were low for both groups and in another Italian study knowledge of the medical students was lower than that of nursing students; also they had lower values in adherence to practice.[4,5]

Students are bound to develop faulty hand hygiene practice if the curriculum is not enforced with hand hygiene concepts and skills.[2] Behavioral change is part of hand hygiene intervention and the dynamic of behavioral change is complex and multifaceted. It involves a combination of education, motivation, and system change.[1] Education is pivotal to the outcome of effective healthcare-associated training programmes and nowhere is this more apparent than in infection prevention and control (IPC). Hand hygiene is one of the basic principles of ICP and requires all healthcare practitioners (and others) to consider IPC as an integral part of their lives and working practice.[6] Previous studies have revealed educational deficits among medical students regarding patient safety. It has been previously recommended that the importance of hand hygiene must be taught to medical students from the first year and integrated into their clinical curriculum.[7, 8]

The medical students in Faculty of medicine-Suez Canal University are in direct contact with patients from their first year of education in primary care clinical training. This item is not included in their family medicine theoretical curriculum and is supposed to be learned during their clinical training which could differ from one to another primary care centers or trainers. All primary care centers have policies and procedures of infection control measures including hand hygiene. All the medical students must be aware and practice hand hygiene procedures as one of the infection control measures that could lower health care acquired infections.

Aims

To improve practices of hand hygiene among medical students in health care settings and to evaluate the effectiveness of educational training on hand hygiene among the medical students.

Materials and methods

Design:
The study is a prospective before-and-after trial of an educational intervention with longitudinal follow up. Pre-post intervention was carried out in 6 training primary care units (4 urban and 2 rural settings) in Ismailia city between April and May 2014. The pre intervention assessment and the educational intervention were conducted in April while the post intervention was carried out one month later. Follow up was carried out in the same primary care units, 6 months later between November and December in the first term of the second educational year (2014-2015).

Participants:
The pre-post intervention included all the first year medical students with affiliation to Faculty of medicine, Suez Canal University in Ismailia city; 145 completed the intervention out of a total 153 with a response rate of 94.8%. The follow up was carried out among all the participants who continued their education in the same faculty,132 out of total 137, with a response rate of 96.4% as 16 participants moved from the faculty of medicine in Ismailia city to Port Said city, 4 students were recurrently absent at the time of follow up and one student recently joined the second year and was excluded.

Questionnaire:
A validated modified questionnaire was self-administered by the medical students before and after their clinical training on hand hygiene and in the follow up.

The questionnaire included 4 sections:

1. Characteristics of the medical students; training, if they had been previously educated about hand hygiene within the primary care unit; whether they previously learned about hand hygiene from the posters or lectures.
2. Knowledge of hand hygiene included: source and main route of transmission of harmful germs, 5 moments of hand hygiene; the precautions with hand hygiene; the difference between routine hand wash with soap and water and alcohol based hand rub in indications, time and their efficiency. Knowledge test was previously used among medical and nursing students in other studies.[9-11] The selected items were adapted from WHO's hand hygiene questionnaire for health care workers.[12] It included multiple choice and "false" or "true" questions. Maximum score was 25.
3. Attitude was assessed by 4 questions that were developed by the researchers including the support with sufficient knowledge; importance of hand hygiene; their readiness to practice and the presence of facilitation to

use it within primary care units. They were given a score three for agree, two for not sure and one for don't agree with a maximum score of 12.
4. Practice included 3 parts: compliance (self report), technique of hand wash including hand rubbing steps and its duration (observation). Compliance was self-reported in the questionnaire as correct practice of hand hygiene on physical examination of their last 3 patients; if they practiced hand hygiene before, after or both. It scores one to yes and zero to no or sometimes. Maximum score was 2 for before and after. The students who reported the correct practice before and after were considered compliant. The questionnaire was translated into Arabic, then it was back translated into English by a bilingual consultant; both translators met for necessary modifications, restatement and rewording. A Pilot study was carried out before the study on a sample of students to assess the feasibility and reliability of the questionnaire.

Observation checklist:
An observation checklist was used to assess the whole technique of hand washing in eleven steps (e.g. run water, use soap, rubbing the palm of the hand, rubbing the dorsum of the hand, rubbing between fingers, rubbing the back of fingers, rubbing the thumbs, rubbing the finger tops within the palms, rinse the hands, drying their hands and closing tap with single use towel). Time of hand washing was also assessed. WHO recommends 40-60 seconds for hand washing with 20-30 seconds of hand rubbing.[1, 12] Maximum score of practice was 14: 2 for compliance which was added to 11 of hand wash technique and 1 for the appropriate time. Observations were recorded by the first author to avoid bias. Maximum score of Knowledge, attitude and practice (KAP) was 51.

Training program:
It was conducted for all the first year medical students. It has a theoretical and practical orientation. Both were adapted from WHO guidelines and the monograph by the Joint Commission 2009.[1,12]

The program lasted 90 minutes. It was structured as follows:

1. Brief overview of the background of infection prevention and WHO concept of five moments for hand hygiene. [1]
2. All students were made aware of their non-adherence to hand hygiene, a strategy aimed to enhance responsibility awareness and behavioral change.
3. Instructions for optimal hand hygiene procedures. These mainly focused on the timing and the whole technique of hand washing.
4. Instructions about the similarities between the Alcohol based hand rubbing and the hand wash with water and soap in involvement of 6 areas for rubbing with the difference in indications, time, drying and efficiency.
5. Performance feedback on personal hand hygiene practices and peer auditing.
6. Tutors and health care workers within primary care units and centers were encouraged to improve social norms regarding hand hygiene by serving as role models, encouraging medical students to comply with hand hygiene protocol and building a culture shift to better hand hygiene.

Methods of training: A lecture in 30 minutes represented the theoretical part; videos regarding the WHO concept of technique and five moments for hand hygiene were presented to them; along with cluster-field training; small group discussion; simulations followed by one-to-one teaching method of hand washing. Tutors were encouraged to remind the student to comply with hand hygiene measures. At every primary care unit: each training clinic had a washing sink, liquid soap dispensers and drying tissues. Reminders in primary care units: illustrative posters of the steps of hand wash were above each sink. Reminders on hand: printed figures of hand hygiene and the educational videos were sent to the students through their email.

Outcome measures:
Knowledge, attitude, practice of hand hygiene were assessed in pre-post intervention and in the follow up.

Ethical clearance:
The study was approved by the ethics committee of Faculty of Medicine, Suez Canal University (no.2086) and was performed in accordance with the ethical standards laid down in the Declaration of Helsinki (1964). Informed consents were obtained from medical students who participated in the study. Questionnaire did not contain any critical questions and confidentiality of data was maintained.

Statistical analysis:
The collected data were analyzed using SPSS 20.0 for Windows. Categorical data are presented as numbers and percentages. Continuous data as the knowledge, attitude and practice scores and total scores before and after the educational intervention were tested for normality of distribution using one sample Kolmogorov-Smirnov test. The samples were found not to follow a normal distribution and median was calculated as a measure of central tendency, interquartile range as measure of variance. Non-parametric tests were used for comparison across the different periods of intervention. Friedman two-way test for repeated measures was used to compare median values in the three evaluations and Wilcoxon signed - rank test with post-hoc correction in paired measures for continuous variables. Cochran Q test was used for repeated measures to assess changes over time and McNemar test for pairwise measures when comparisons were in categorical variables.

Median of knowledge, attitude, practice and total scores were compared among different subgroups of participants with regard to characteristics of the students: gender, site of PHC, learning and training of infection control measures before and after the intervention using the Mann-Whitney test for dichotomous variables. A p value less than 0.05 was taken as statistically significant, with post hoc Bonferroni correction p value less than 0.016 considered statistically

significant. Spearman correlation test was used to test significant relationship between knowledge attitude and practices scores in the different study periods.

Results

	Pre		Post		Follow up		Friedman test	Post Hoc Wilcoxon Sign Rank Test		
	Median	IQR	Median	IQR	Median	IQR		Pre-post	Post-follow up	Pre-follow up
Knowledge	14	(12-18)	23	(22-24)	22	(21-23)	260.24**	-9.97*	-2.33 NS	-9.90*
Attitude	8	(7-10)	11	(10-12)	11	(10-12)	210.96**	-9.32*	-0.635 NS	-9.28*
Practice	6	(4-8)	11	(10-12)	13	(12-13)	215.64**	-9.45*	-8.02*	-9.91*
KAP	28	(25-31)	44	(42-47)	46	(44-48)	227.64**	-9.93*	-6.26*	-9.97*

**Repeated measure analysis using the Friedman test P<0.05
*Post-hoc analysis with Wilcoxon signed rank test was conducted with a Bonferroni correction applied P <0.016
NS: non significant

Table 1: Comparison of pre, post intervention and follow up of students' knowledge, attitude, practice and total KAP of hand hygiene (n=132)

The pre-post intervention sample was all the first year medical students. The follow up were in the second medical year. The mean age of students at the start of the study was 18.5±0.65. More than half of the study sample were female (57.9%). More than two thirds of the study sample (71.7%) were trained in rural PHC units. All the trainers were family physicians. No previous formal training in the PHC units was experienced by most of the students. Previous learning was mentioned by only (13.8%) of the sample.

Repeated measures of knowledge, attitude and practice of hand hygiene:

The intervention leads to statistically significant change between the pre, post intervention and follow up in the median scores of knowledge (14, 23, 22), attitude (8,11,11), practice (6, 11,13) of hand wash and the overall KAP scores (28, 44, 46) (P<0.001). The changes in median scores of knowledge, attitude, practice and the overall KAP were statistically significant in the Pre-post intervention and pre-follow up of the intervention. In post-follow up of intervention, statistically significant change was observed in the median scores of practice and the overall KAP with no statistically significant change in median scores of knowledge or attitude. (Table 1)

Pre-post intervention changes in practice of hand hygiene

Technique: The present study revealed a highly statistically significant increase in practice of all steps of hand wash among the study sample in pre-post intervention with maintenance/improvement in the follow up after 6 months. The palms and backs of the hands were more frequently observed than other areas of hand rubbing among pre-post intervention and in the follow up (P < 0.001). [Table 2]

Table 2: Comparison of pre, post and follow up of students' practice sub-items

	Technique	Pre		Post.		Follow up		Cochran's Q	Pre-post	Post-follow up	Pre-follow up
			%		%		%				
	Run water	132	100	132	100	132	100	-	-	-	-
	Liquid	132	100	132	100	132	100	-	-	-	-
	PP	79	59.8	132	100	132	100	106.00**	51.02*	-	51.02*
	PB	66	50	132	100	132	100	132.00**	64.01*	-	64.01*
	INT	37	28	108	81.8	116	87.9	133.39**	63.63*	1.88 NS	69.93*
	BF	22	16.7	83	62.9	119	90.2	131.14**	48.00*	47.02*	93.09*
	Thumb	30	22.7	107	81.1	127	96.2	144.38**	63.47*	12.89*	93.09*
	Top	22	16.7	83	62.9	115	87.1	137.79**	46.08*	36.21*	95.09*
	Rinse water	132	100	132	100	132	100	-	-	-	-
	Dry hand	57	43.2	101	67.5	107	81.1	83.02**	34.24*	0.893 NS	44.46*
	Close tap	27	20.5	54	40.9	82	62.1	70.90**	16.48*	24.30*	51.15*
	Appropriate Time:	7	5.3	67	50.8	92	69.7	109.04**	49.73*	11.75*	77.54*
	Self reported compliance	7	5.3	61	46.2	94	71.2	130.04**	52.02*	27.67*	85.01*

** Cochran's Q test P Value < 0.05

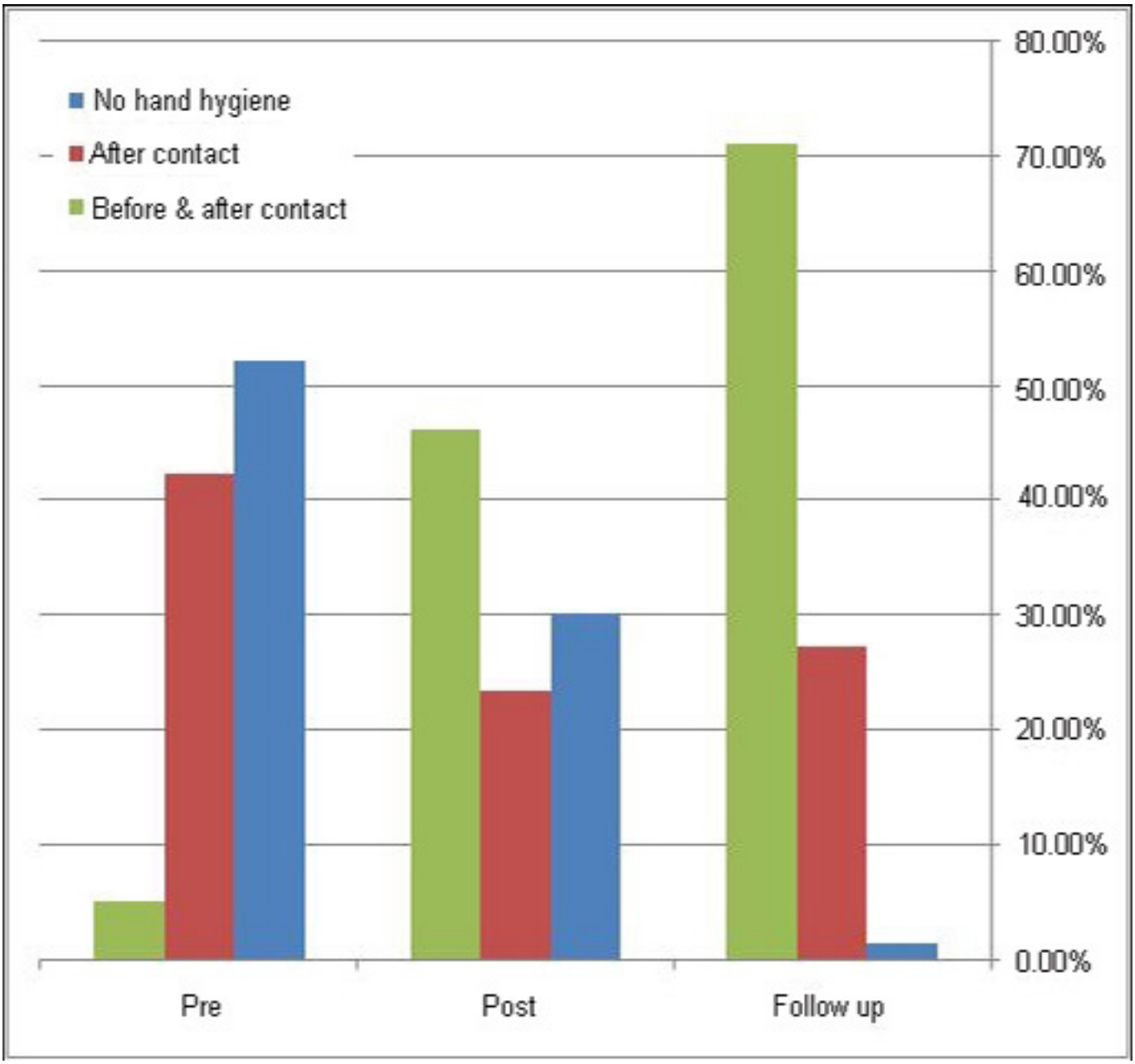
* McNemar test was conducted with a Bonferroni correction applied P <0.016

NS: non significant

Time:
The frequency of students who practiced hand rubbing in appropriate time increased significantly in pre-post intervention from (5.3-50.8%) and increased in the follow up among (69.7%) of the students (P < 0.001). [Table 2]

Compliance:
The appropriate practice of hand hygiene before and after patient contact was reported by only (5.3%) of the students which significantly increased to (46.2%) while it increased among (71.2%) of the students in the follow up (P<0.001). [Table 2] No hand wash was decreased among the students from (52.3 to 30.3) in pre-post intervention with further decrease to (1.5%) in the follow up. [Figure 1]

Figure 1: Comparison of pre-post intervention and follow up of self reported compliance of hand hygiene



Pre-post changes in knowledge, attitude, and practice changes and personal characteristics of the study sample:
There was a high statistically significant relationship between the changes in knowledge, attitude and practice with previous training and the greater differences were observed among those who didn't receive training.

Correlations between Knowledge, attitude and practice across the study periods
Statistically significant correlations were found between knowledge, attitude and practice scores in each period of the study. [Table 3]

Table 3: Correlation between Knowledge, attitude, practice scores among the study sample

	Median (IQR)		Median (IQR)		Spearman's rho	P value
Correlation between Knowledge and Attitude scores						
Before	14	(12-18)	8	(7-10)	0.244	0.005*
After	23	(22- 24)	11	(10-12)	0.428	<0.001*
Follow up	22	(21-23)	11	(10-12)	0.371	<0.001*
Correlation between Knowledge and Practice scores						
Before	14	(12-18)	6	(4-8)	0.453	<0.001*
After	23	(22- 24)	11	(10-12)	0.308	<0.001*
Follow up	22	(21-23)	13	(12-13)	0.250	0.004*
Correlation between Attitude and Practice scores						
Before	8	(7-10)	6	(4-8)	0.360	<0.001*
After	11	(10-12)	11	(10-12)	0.218	0.012*
Follow up	11	(10-12)	13	(12-13)	0.232	0.007*

* Bivariate analysis using Spearman's correlation P Value < 0.05

Discussion

The intervention was effective in changing the knowledge, attitude, practice and overall KAP scores among the students in all periods of the study with a high statistically significant difference between the pre intervention and the follow up. The non significant decrease of median scores of knowledge and maintenance in median scores of attitude in the follow up; with the improvement in the practice and overall scores of practice and KAP could be due to the maintenance of the same situations in practice settings and the reminders that were on hand of the students. These results were nearly similar to the results in a quasi-experimental study among 100 randomly assigned nurses to receive an educational intervention prior to and 4 months after the training. The educational training significantly improved Chinese nurses' knowledge, practice, and behavior related to universal precautions by Huang et al., [13] and the Iranian study by Rezaee et al., [14] on 4th year medical students as a significant difference were found between the pre and the late post-test scores in knowledge and performance but not the attitude. Also they found a significant difference only in the performance pre-test and immediate post-test scores, category. While another intervention by Gould and Chamberlain[15] determined the effect of a hand hygiene education program after 3 months and found no effect of the program. The difference could be related to the difference in the used tools of assessment.

There was significant increase of the students (40.2%) that correctly rub of palm to palm from (59.8 to 100%) with maintenance of 100% in follow up. Also there was an increase in palm to back from (50 to 100%) without change in the follow up. Students who rub between fingers were increased significantly from (28 to 81.8%) with increase to 87.9% in the follow up. Students with rubbing of the back of fingers were increased significantly from (16.7 to 62.9%) with increase to 90.2% among the students in the follow up. Thumb rubbing was increased among the students from (22.7 to 81.1%) with increase to 96.2% of the students. Rubbing of the top of fingers increased from (16.7 to 62.9%) in pre-post intervention with increase to

96.2% of the students. Rubbing of the top of fingers increased from (16.7 to 62.9%) in pre-post intervention with increase to 87.1% in the follow up. These results were similar to those of Helder et al.,[16] who found that along all observation periods the palms and backs of the hands were significant better disinfected than wrists, between fingers, finger tops and thumbs.

Regarding the reported compliance of hand hygiene in contact with patients; the appropriate practice of hand hygiene before and after patient contact was increased significantly by 65.9% from (5.3% to 46.2%) pre-post intervention while it increased significantly to 71.2% of the students after 6 months. These results were higher than other hand hygiene interventions based on observations where difference from pre to post evaluations in overall hand hygiene ranged from 14% -27 % by other studies.[16-18] The higher compliance in the present study could be due to the self reported which is expected to be much higher than with direct observation. In another study by KuKanich et al., Gel sanitizer and informational posters were introduced together as an intervention and they found that hand hygiene improved from baseline to the intervention period for precontact and postcontact observations, and this improvement was sustained with no significant decreases in hygiene during the follow-up period. [19]

Although Self-reported data were not considered a valid measure of compliance Gould et al., 2010, [20] In a previous study, self reported adherence was higher 61% than observed practice 44%.[21] The current study revealed that 52.3% didn't practice hand hygiene with no one practiced it before contact wit patient while only 1.5% before and after in the pre intervention. These results were in congruent with that found by Anwar et al., [22] where only 4.7% of the physicians reported to decontaminate their hands before direct contact with patients and 20.9% after contact.. The current reported compliance at the start of the study could be related to the lack of formal training of most of the students.

Appropriate time of hand rubbing as recommended by WHO, was observed among 5.3% of the student in the pre intervention that significantly was increased to 50.8% in the post intervention observations but it was further increased among 69.7% of the students after 6 months-follow up. The higher compliance in the follow up could explain the improvement in the technique of hand hygiene among the students in their second educational year. The most inappropriate hand washing at the pre intervention were appropriate time 5.3%; the top and back of fingers 16.7% and closing the tap 20.5%. Also in a descriptive study by Abd Elaziz and Bakr[3] 2009, the most common form of inappropriate hand washing was in the improper drying and having short contact time 23.2%.

The current study revealed high statistically significant pre-post changes in knowledge, attitude and practice with previous training and the greater differences were observed among those who didn't receive training. Fear or a wish to protect oneself is also a motivational factor in taking measures to prevent and control of health acquired infections. Many medical students and others learn by example and in particular through the influence of mentors or those senior personnel whom the student admires. [8]

Statistically significant correlations were found between knowledge, attitude and practice median scores in all periods of the study. With high intensity between knowledge and attitude relatively high intensity of correlation between knowledge and practice mainly pre and due to the intervention.

Limitations of the study

The study was not controlled trial. The researchers aimed to provide structured educational training to all first year medical students, to be continued rather than only to involve the students in a research. Compliance was assessed based on self-report for time constrains. Most of the published researches that studied hand hygiene among medical students were descriptive that calls for comparison with other intervention studies that included other health care personnel.

Conclusion

The intervention on hand hygiene to the first year medical students was effective in improvement of knowledge, attitude, practice and overall KAP of the students after education with further improvement after 6 month in the follow up in their second educational year. Inclusion and implementation of the educational training on hand hygiene is recommended to the medical students in health care settings.

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