Effectiveness of educational interventions in improving knowledge and practice regarding infection prevention and control among healthcare workers.

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Abstract

Introduction: Rise of major Healthcare associated infections (HAIs) can be mitigated by inculcating good infection control practices which can only be possible by proper and timely educational training of healthcare workers.

Aim: To reinforce infection prevention and control knowledge and practices of nursing staff through proper training program- To conduct the training in multiple sessions, to assess the immediate outcome of training program by conducting Pre and Post test (in written format only)

Materials and Methods: This study was done in a tertiary care hospital in Davangere, Karnataka over a period of 2 years. Healthcare workers including 144 nurses and 12 doctors underwent training in four sessions where knowledge on how to identify, audit and conduct surveillance of major healthcare associated infections, management of needlestick injuries were imparted through interactive lectures and video demonstrations followed by hands on hand hygiene, proper use and disposal of personal protective equipments. Pre and Post test were given to know their basal knowledge and effect of our training intervention. Data was collected, analyzed and tabulated.

Results: Out of four sessions covering a total of 144 nurses, 84 were trained before the onset of COVID-19 and remaining 60 were trained in the latter half of 2021, when the lockdown was relaxed in our region. The mean total Knowledge score in pre test and post test was 5.93 ± 1.336 and 7.95 ± 1.040. The mean difference was -2.021 and it was statistically significant by paired test. (p - 0.001). The mean total practice pretest and post test score was 3.57 ± 1.48 and 4.56 ± 1.114. Paired t test showed significant mean difference between the pretest and post test score. (p - 0.001).

Conclusion: Our training intervention was effective in increasing their awareness on proper infection prevention and control practices. Repeated training and retraining of healthcare care workers have to be carried out to prevent and control healthcare associated infections.

Key words: Infection Control, nurses training, Healthcare associated infections, Assessment, universal precautions, hand hygiene

Introduction

Healthcare facilities are always at high-risk environments for the development and spread of Health care associated infections. Addressing the challenges involved to mitigate these outbreaks, needs to consider the interplay of host, pathogen and environment including the healthcare personnel from all aspects[1]. Good Infection prevention and control measures and practices reduce the opportunities for resistant pathogens to spread in healthcare facilities[2]. However, a lack of adequate system in place and infrastructure for infection prevention and control in many healthcare facilities contributes to the development of healthcare associated infections and the spread of resistant pathogens[3,4]. Thus it is vital to adapt a holistic approach training program to address the challenges posed in containing the healthcare associated infections in a healthcare facility. In this regard, the way a modern healthcare organization/ facility operates is very critical. Societal and cultural

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demands, priorities and values, Policy and financial uncertainty should be kept in mind before planning for strategies to strengthen the existing practices for better healthcare services[5]. Organization or an establishment can improve its healthcare plans by continual education and training of staff as it is a known fact that education on infection control improves health professionals adherence to standard precautions and thereby prevents and control the spread of diseases/ infections in the hospital[6]. Whenever we talk on education or training programs, it is for instance, teaching infection control in nursing education is valuable for preventing nosocomial infection and reducing the infection rate because, worldwide nurses are on the front lines in caring for infected patients[7]. These frequent interactions, while providing daily care, puts the nurses in highest risk zone of transmission of infection[8-11]. In this regard, educating the healthcare personnel from doctors to housekeeping staff is a very essential step towards mitigating the transmission of healthcare associated infections. Thus, Centres for diseases (CDC) emphasizes that education on the principles and practices for preventing the transmission of infections should be given to all HCWs. These education and training programmes should be conducted regularly[12]. But not all hospitals, especially in developing countries are able to carry out proper infection control practices and regular training programs because of several influences such as knowledge deficient, government readiness, and absence of modern equipment necessary for infection control[13,14]**.** Conducting continuous training programs to adopt the good infection control practices seems to be the only solution in controlling healthcare associated infections. But compliance by nursing students, nurses, doctors, and other members of infection control team is a major challenge[15]. In our tertiary care hospital, infection prevention and control is at a budding stage. If this has to stand strong and become a robust system, we need to have the best of nursing staff. And this can happen only when they are well trained. With the vision of strengthening their knowledge and practices, we observed the need for such a program and thus initiated it and planned it's execution in multiple phases so as to cover all the nurses, housekeeping staff and eventually doctors too.

Materials and Method:

Present study was carried out (in 4 sessions) at a tertiary care centre, for over a period of two years. Members of Hospital Infection Control Committee (HICC) and department of Microbiology, planned to conduct training program for nurses as there were some deficiencies observed during the HICC rounds in the hospital. This called for a need to start training and reinforcement of knowledge and practices among nurses. Thus, a preliminary meeting was held with the Medical Director, Nursing Superintendent to conduct the training sessions. As there were more than 300 nurses, multiple training sessions were planned. Nurses from sister concern College also requested to participate and thus 17 of them who were interested were included in the first two sessions. Next two sessions were done only for nurses from our institution. A total of 144 nurses from various departments including critical areas (Intensive Care Units-ICUs) were included in this educational training program. We intended to create awareness on identifying, auditing and surveillance of major healthcare associated infections (HAIs) Healthcare associated infections like catheter associated urinary tract infections (CAUTI) Ventilator associated Pneumonia (VAP), Surgical site infections(SSI), Cather related blood stream infections (CRBSI) and practices on management of needle stick injury, Hand hygiene and biomedical waste management. Educational program was carried out in two sessions before the onset of ongoing pandemic COVID -19. A total of 82 nurses were covered in the program. In the first session, 40 (30 from SSIMS&RC, 10 from JJMMC) nurses and in the second session 44 (37 from SSIMS & RC, 7 from JJMMC) were trained. But with the onset of COVID -19 pandemic and lock down, further sessions could not be carried out. In the latter half of 2021, when the lockdown and other rules were relaxed in our region, we resumed the training program but including nurses from SS institute of medical sciences only. Two more sessions covering 30 nurses per batch were conducted. Thus, by the end of October 2021, a total of 144 nurses (40+44+30+30) were trained. Eminent faculty from the department of Microbiology and Hospital infection control team who have been trained at JIPMER were the resource persons. Interactive lectures followed by video demonstrations and hands on training regarding hand hygiene were carried out. Participants were divided into group of 6-8 during hands on session. Before the sessions started, a Pre-test was given to all the participants to assess their basal knowledge on good infection control practices. At the end of all the sessions, a Post-test was given to find out the effectiveness of our training. Questionnaire was developed and validated by the subject experts. There were 9 questions covering the knowledge part (Hand hygiene, PPE, Needlestick injury, Bio medical waste management and components of Healthcare

associated infections) and 6 questions covering the practice aspect (Management of MRSA, disinfection procedures, waste disposal practices, donning and doffing procedure and spill management). The rationale of conducting pre and post test was a part of preliminary assessment to check the immediate effect of our training program which covered both knowledge and practice aspects of infection prevention and control in day to day practice. Though our staff nurses do follow good practices, there are some areas in which they lack knowledge and do not follow the practices in an orderly manner. Thus, the questionnaire was kept simple and would take around 10 min to answer. (Please find the questionnaire below). Responses were collected, results analysed and tabulated. Oral Feedback from the nurses was also obtained regarding the training program. In order to continue this training program, every second Thursday of the month has been designated for Infection control and prevention classes. Only 12 doctors participated in the training program and 7 of them were from various intensive care units (ICUs), they were already following best practices. Thus, their data is not included in the present study. But the same may not hold good for doctors working in other areas. Hence, we found that even doctors including interns, post graduates and consultants have to be included in the future training programs. We also realised that such sessions have to be conducted for house-keeping staff with much emphasis on needle stick injuries and biomedical waste disposal.

Aim:

1. To reinforce infection prevention and control knowledge and practices of nursing staff through educational intervention.
2. To assess the immediate outcome of educational intervention by conducting Pre and post test (in written format only)

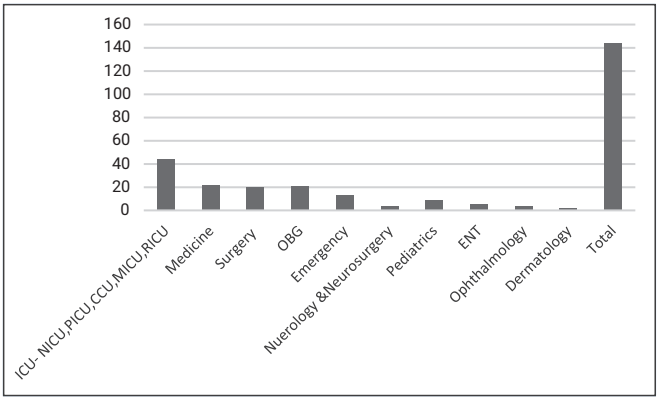
Ethical clearance Permission from Institution ethics board (IERB) has been obtained to publish the data collected during the educational training program.

SPSS (Statistical Package for Social Sciences)

Version 20. [IBM SPSS statistics (IBM corp. Armonk, NY, USA released 2011)] was used to perform the statistical analysis. Descriptive statistics of the explanatory and outcome variables were calculated by mean, standard deviation for quantitative variables. Paired t test was used to test the mean difference for two variables of the same subject. The level of significance was set at 5%.

Results: A total of 144 nurses were trained in multiple sessions.

Total participants - 144, out of which,46 (32%) were male nurses and 98 (68%) female nurses (Graph 1).



Graph-1 shows the number of participants from various departments.

TABLE-1 : Scores of - Knowledge based questions (K-1-K-9) in Pre-test and Post test.

Questions		N	Mean	Std. Dev	Mean Difference	p value
K - 1	Pre test	144	.94	.243	-.035	.166
	Post test	144	.97	.165		
K - 2	Pre test	144	.59	.493	-.375	.000
	Post test	144	.97	.184		
K - 3	Pre test	144	.78	.417	-.146	.001
	Post test	144	.92	.267		
K - 4	Pre test	144	.38	.486	-.563	.000
	Post test	144	.94	.243		
K - 5	Pre test	144	.88	.324	-.083	.010
	Post test	144	.97	.184		
K - 6	Pre test	144	.80	.402	.201	.000
	Post test	144	.60	.492		

K - 7	Pre test	144	.25	.435	-.604	.000
	Post test	144	.85	.354		
K - 8	Pre test	144	.47	.501	-.333	.000
	Post test	144	.80	.402		
K - 9	Pre test	144	.85	.354	-.083	.018
	Post test	144	.94	.243		

Knowledge score in pre- test and post- test was 5.93 ± 1.336 and 7.95 ± 1.040.

TABLE-2: Scores of Practice based questions (P-1-P-6) in Pre-test &Post test.

Questions		N	Mean	Std. Dev	Mean Difference	p value
P - 1	Pre test	144	.69	.462	.208	.001
	Post test	144	.49	.502		
P - 2	Pre test	144	.26	.442	-.590	.000
	Post test	144	.85	.354		
P - 3	Pre test	144	.42	.495	-.014	.800
	Post test	144	.43	.497		
P - 4	Pre test	144	.81	.961	-.104	.201
	Post test	144	.92	.277		
P - 5	Pre test	144	.47	.501	-.424	.000
	Post test	144	.90	.307		
P - 6	Pre test	144	.91	.288	-.063	.029
	Post test	144	.97	.165		

Mean difference of 0.986 and standard deviation was 1.480 and 1.114 in pre and post test scores.

TABLE-3: Mean Standard Deviation (SD) and p value of pre & post test scores.

Total score		Mean	N	Std. Dev	Mean Difference	p value
Knowledge	Pre test	5.93	144	1.336	-2.021	0.001
	Post test	7.95	144	1.040		
Practice	Pre test	3.57	144	1.480	-0.986	0.001
	Post test	4.56	144	1.114		
Total	Pre test	9.41	144	1.980	-3.118	0.001
	Post test	12.53	144	1.896		

Mean difference of 2.021 and standard deviation was 5.93 ± 1.336 and 7.95 ± 1.040 in Knowledge based pre-test and post- test scores. Mean difference of 0.986 and standard deviation was 1.480 and 1.114 in practice based pre and post test scores.

Discussion:

Present study was aimed to educate and train the nurses regarding infection control practices to prevent and put a check on Hospital acquired infections. Nurses who are the torch bearers of any healthcare facility, need to be empowered with good knowledge and practices. Usefulness of educational training in mitigating the spread of infections across any healthcare facility is a well-known factor. It influences the better healthcare practices among working staff. To impart better knowledge on identifying major Healthcare Associated Infections (HAIs) we, conducted interactive lectures on Catheter related blood stream infections (CRBSI), Ventilator associated Pneumonia (VAP), Catheter associated urinary tract infections (CAUTI) and Surgical site infections (SSI) identification. An overview of bundle care approach and surveillance & auditing was also given in the mode of interactive lecture. To estimate the baseline knowledge of participants, we gave a pre- test and to know the effectiveness of our training, a post test was given at the end of all sessions. We noticed that the mean total Knowledge score in pre-test and post-test was 5.93 ± 1.336 and 7.95 ± 1.040. The mean difference was -2.021 and Standard deviation of 1.336, 1.040 and it was statistically significant by paired t test (p-0.001). Our results are similar to study done by Kim[16]. Significant p value implies that interactive

lectures (knowledge part) have been useful for the stake holders. The fact that knowledge is essential for practice is in alignment with a study that shows that the level of knowledge about infection control can be used to predict the practice of infection control[17]. This is also validated by another who found that there is a significant relationship between the extent to which the nurses practice is evidence-based practice and nurses knowledge of the practice[18]. It was observed that Question addressing the knowledge component of probability of transmission of viral infections following needle stick injury (K6), the score is reduced from 0.8 to 0.6. Possible explanation could be that the respondents have mistakenly marked it wrong or our lecture might have not been clear on this point so that they might have got confused.

We also noted that question on disposal practice of is biomedical waste (P3), there was marginal improvement of post test score compared to pre-test score the possible reason for marginal post test score compared to pre-test score could be that the information given to them by us might not have been sufficient or might not have been imparted properly. This issue could be overcome by giving more learner centred activities instead of just lectures.

Mean total of Practice based pre and post test scores in our study was 3.57 ±1.48 and 4.56±1.114. Paired t test showed significant difference between the two scores (p-0.001). Our study showed Mean difference of 0.986 and standard deviation was 1.480 and 1.114 in pre and post test scores respectively regarding practice-based questions. We had covered topics like use of PPEs, hand hygiene and management of needle stick injury in the practice -based section. It has been reported that injection-related accidents occur due to insufficient knowledge regarding blood-mediated infections and non-compliance with worker safety guidelines in standard precautions[19]. Many studies have shown that there is low awareness and performance in wearing protective equipment in relation to compliance with standard precautions[20-22]. Thus, we wanted to ensure that our nurses were aware of and inculcated safe infection control practices by conducting above educational training program.

Limitations:

Our study has some limitations like in the first two sessions, nurses from two different colleges were included. Thus, the results cannot be generalised and may not reflect the true knowledge and practice of our Institution. But the subsequent sessions included nurses from our institution. Secondly, we could not conduct similar educational training program for Interns, post graduates, consultants and housekeeping staff. This needs to be carried out in near future to ensure the best infection prevention and control practices across the hospital.

Thirdly, more activity -based approach could have been planned to impart the information in a better way. This could not be done due to the pandemic situation and time constraints. But will be implemented in our future training programs.

Conclusion:

Our study is a small attempt towards inculcating good infection control practices among the nurses working in out tertiary care centre. Participants in all four sessions have showed positive responses. Repeated sessions are needed to cover the entire task force of nurses, doctors and housekeeping staff. Regular auditing of practices in place after these sessions have been planned and will be conducted periodically. Other Hospitals must be encouraged to put more efforts into their infection control training programmes and increase nurses' knowledge on infection control measures. This could be done by conducting periodic educational training programs followed by assessment of infection control knowledge and practices.

References

1. *Castro-Sánchez E, Holmes AH. Impact of organizations on healthcare-associated infections. J Hosp Infect. 2015;4:346-50.*
2. *Joy IE, Eghiaghe FA, Nwobu RA, Paul ON. Prevalence and multidrug antimicrobial susceptibility of bacteria isolates obtained from surgical site in Nigeria. Int J Curr Microbiol App Sci 2016;5:708 15.*
3. *Zaidi AK, Huskins WC, Thaver D, Bhutta ZA, Abbas Z, Goldmann DA. Hospital-acquired neonatal infections in developing countries. Lancet 2005;365:1175-88.*
4. *Charani E, Castro-Sanchez E, Sevdalis N, et al. Understanding the determinants of antimicrobial prescribing within hospitals: the role of "prescribing etiquette". Clin Infect Dis 2013;57:188-96.*
5. *Zingg W, Mutters NT, Harbarth S, Friedrich AW. Education in infection control: a need for European certifcation. Clin Microbiol Infect. 2015;21:1052-56*
6. *Zingg W, Holmes A, Dettenkofer M, et al. Hospital organisation, management, and structure for prevention of health-careassociated infection: a systematic review and expert consensus. Lancet Infect Dis 2015;15:212-24.*
7. *Zhang Y, Sun Z, Latour JM, Hu B, Qian J. Hospital response to the COVID-19 outbreak: The experience in Shanghai, China. J Adv Nurs. 2020;76 :1483-85*
8. *Septimus E, Weinstein RA, Perl TM, Goldmann DA, Yokoe DS. Approaches for preventing healthcare-associated infections: go long or go wide? Infect Control Hosp Epidemiol 2014;35:797-801.*
9. *Colet PC, Cruz JP, Alotaibi KA, Colet MKA, Islam SMS. Compliance with standard precautions among baccalaureate nursing students in a Saudi university: A self-report study. J Infect Public Health. 2017;4:421-30.*
10. *Cruz JP, Bashtawi MA. Predictors of hand hygiene practice among Saudi nursing students: A cross-sectional self-reported study. J Infect Public Health. 2016 ;4:485-93*
11. *Boyce JM. Measuring healthcare worker hand hygiene activity: current practices and emerging technologies. Infect Control Hosp Epidemiol 2011;32: 1016-28.*

12. *Center for Disease Control and Prevention (2007). 2007 Guideline for isolation precautions: Preventing transmission of infectious agents in healthcare settings. http://www.cdc.gov/ncidod/dhqp/pdf/isolation2007.pdf.*
13. *Oli AN, Ekejindu CC, Ejiofor OS, Oli AH, Ezeobi I, Ibeh CC. The knowledge of and attitude to hospital-acquired infections among public and private healthcare workers in South-East, Nigeria. Br J Med Med Res 2016;11:1-10.*
14. *Akujobi CN, Ilo IA, Egwuatu CC, Ezeanya CC. Prevalence of Methicillin-Resistant Staphylococcus aureus (MRSA) among healthcare workers in a tertiary institution in Nigeria. Orient J Med 2013;25:82-87.*
15. *Hessels AJ, Larson E. Relationship between patient safety climate and standard precaution adherence: A systematic review of the literature. J. Hosp. Infect. 2016;92: 349-62*
16. *Kim E, Kim SS, Kim S. Effects of Infection Control Education for Nursing Students Using Standardized Patients vs. Peer Role-Play. Int. J. Environ. Res. Public Health 2021;18:107-21.*
17. *Murray A, Huang MJ, Hardnett F, Sutton MY. Strengthening HIV knowledge and awareness among undergraduate students at historically black colleges and universities. J Health Disparities Res Pract 2014;7:33-45.*
18. *Okpala PU, Uwak R, Nwaneri AC, Onyiapat JL, Emesowum A, Osuala EO, et al. Nurses' knowledge and attitude to the care of HIV/AIDS patients in South East, Nigeria. International Journal Of Community Medicine And Public Health 2017;4:547-53.*
19. *Seo JH, Jung EY. Factors influencing nursing students' performance on standard precautions of infection control. J. Korean Biol. Nurs. Sci. 2017;19:69-75.*
20. *Cha JE, Cho J, Kim YG, Nam GH, Lee S, Lee SY, et al. Nursing student safety-climate, perception and performance of standard precautions for healthcare-associated infection control. J. Korean Acad. Ind. Coop. Soc. 2017;18:72-83.*
21. *Jeong M. "Survey of Exposure to Blood and Body Fluids, Knowledge, Awareness and Performance on Standard Precautions of Infection Control in Nursing Students." The Journal of the Korea Contents Association. 2015;15: 316-29..*
22. *Wang J, Liu F, Zhou M, Lee YF. Will the status of infection prevention and control (IPC) professionals be improved in the context of COVID-19? Am J Infect Control. 2020;48:729-30*

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