Original Article

To assess the impact of training about hospital infection control measures related to hemodialysis services on the knowledge of healthcare providers (HCPs) at the teaching institution of Haryana

Sukhbir Singh[1,2], Hari Kishan Aggarwal[3], Shekhar Pal[4], Hem Chandra[2]

[1]Department of Hospital Administration, Pandit Bhagwat Dayal Sharma, Postgraduate Institute of Medical Sciences, Rohtak, Haryana, India, [2]Vice Chancellor, Hemwati Nandan Bahuguna Uttarakhand Medical Education University, Dehradun, Uttarakhand, India, [3]Department of General Medicine, Pandit Bhagwat Dayal Sharma, Postgraduate Institute of Medical Sciences, Rohtak, Haryana, India, [4]Department of Microbiology, Government Doon Medical College, Dehradun, Uttarakhand, India

Abstract

Background: Adequate knowledge among nursing professionals toward hospital infection control measures related to hemodialysis (HD) services is essential to decrease infection among patients. **Objective:** This study assessed nursing professionals' knowledge about hospital infection control measures related to HD services and the effect of training interventions. **Settings and Designs:** It was a single group, a pre–post-interventional study conducted on nursing professionals of a single apex medical college of Haryana. **Materials and Methods:** A pretested questionnaire consisting of two parts was used as a study tool. **Statistical Analysis:** Various statistical tests such as paired *t*-test and Pearson's correlation were used. **Results:** The pre-intervention group had a lower mean knowledge score (mean knowledge = 90.2786, strongly disagree [SD] = 15.52682, standard error [SE] = 1.09518) and then the post-intervention mean knowledge score (mean knowledge = 137.5622, SD = 9.72252, SE = 0.68577). **Conclusions:** The training program or educational intervention proved very useful for enhancing nursing professional's knowledge about hospital infection control measures related to HD services.

Keywords: Healthcare providers (HCPs), hemodialysis services, knowledge, training program

Introduction

Among individuals who receive hemodialysis (HD), infection is the second leading cause of death. A study[1] on dialysis patients found a 0.73 occurrence rate of access-related bloodstream infections per 100 patient months. To effectively prevent catheter-associated bloodstream infections (CLABSI), it is essential to strictly follow the guidelines set by the centre for disease control (CDC), the society for healthcare epidemiology of America, and the European renal association.[2-4] The most effective ways to treat infections in dialysis patients have been identified by guidelines set by the CDC,[5] association for professionals in infection control and epidemiology,[6] and world health organization (WHO).[7] The acquisition of an infection while receiving HD was the leading cause of hospitalization.[8,9] Hands that have been infected with healthcare providers' (HCPs)' infections are one of the most common ways in which hospital-acquired infections (HAIs) are spread.[10] Patients with chronic

Address for correspondence: Dr. Sukhbir Singh, Department of Hospital Administration, Pandit Bhagwat Dayal Sharma, Postgraduate Institute of Medical Sciences, Rohtak - 124 001, Haryana, India.
E-mail: drbrar1980@gmail.com

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kidney disease who need HD services also visit primary care physicians for the treatment of various ailments, which do not require secondary or tertiary care treatment.

Teaching healthcare professionals to prevent catheter-associated bloodstream infection (CRBSI) can reduce primary bloodstream infections. When made mandatory, these education initiatives can significantly lower CRBSI[11]-related healthcare costs and patient morbidity. Studies on preventing healthcare-associated infections have mainly focused on intensive care unit (ICU), with little attention given to HAIs in HD environments. Research indicates that enhancing nurses' abilities decreases the probability of CRBSI.

Our study aimed to evaluate how training and educational intervention can improve healthcare providers' understanding of hospital infection control measures in HD services. Nursing professionals, for instance, who are directly or indirectly involved in patient care activities in the delivery of HD services, are knowledge-dependent professionals. Improving their knowledge about hospital infection control measures can boost their self-efficacy, which in turn will positively impact HD treatment circumstances and patient outcomes. This study received institute ethics committee approval.

Materials and Methods

Study setting and design

A pre–post-single group intervention study was conducted in 2022 among the nursing professionals of the state apex medical college in Haryana.

Sample and sampling

All nursing professionals from the identified study areas were recruited (n = 208).

Inclusion criteria

All nursing professionals posted in study areas were enrolled in the study.

Exclusion criteria

All other healthcare providers such as faculty, resident doctors, paramedical staff, and other support staff posted in the study areas were excluded from the study. The nursing professionals posted outside the study area were excluded from the study. The eligible nursing professionals who failed to furnish informed consent were also excluded from the study.

Study tool

The structured questionnaire was designed based on a review of literature and guidelines issued by the government of India regarding standard treatment for HD, Indian Society of Nephrology Guidelines for Haemodialysis Units and CDC., and WHO guidelines to assess knowledge about hospital infection control measures related to HD services. The questionnaire had two parts. The first part included the participant's socio-demographic details such as age, gender, education level, and residence. The second part tests knowledge about hospital infection control measures related to HD services. The validity of questionnaire was tested by applying Cronbach's alpha test for reliability analysis.

Our scale's consistency is acceptable with a Cronbach's alpha over 0.70. Ten experts pilot-tested the questionnaire's content, applicability, comprehension, and validity.

Tool administration

The participants were contacted and were invited in batches for administering the pre-intervention (pretest) questionnaire for assessing their baseline knowledge about the study topic. Before administering the questionnaire to the participants, their written informed consents were taken. The filled questionnaire was received back from the participants. Immediately after administering the pretest, these study participants were imparted a structured training program. The training program was prepared after an extensive literature review, relevant guidelines, and focused group discussion with the subject experts. The teaching program was designed in the English language and has dedicated lectures through audio–visual aids and hands-on training for the participants. After imparting the training program to the study population, they were again subjected to the same structured questionnaire for assessing the impact of education and training intervention on their knowledge after taking their written informed consent. Similarly, the pretest assessment, structured training, and posttest assessment of all selected participants were completed in batches.

Data analysis

All knowledge assessment questions were scored. Correct answers were worth five points. Incorrect answers were not penalized. There were two groups based on two different periods, that is, pretraining and post-training. Two-time periods' knowledge scores were calculated. Overall mean and question-by-question pretest and posttest differences were calculated. We used paired t-test to compare knowledge scores across periods.

Results

This study included 201 total respondents. 39% of respondents were aged 21–30, 39% aged 31–40, and only 13% aged 50 years. The maximum were females (86%) followed by the male participants (14%). The majority of the respondents were married (84%) followed by unmarried participants (16%). It was found that 105 (52.2%) responded were general nursing midwifery (GNM) followed by 90 (45%) participants with BSc Nursing degree and the rest six (3.00%) participants were having MSc Nursing degree. The majority of them were from urban background (81%) followed by rural background (19%). 177 (88%) participants were nursing officers, and the remaining 24 (12%) were senior nursing officers. The majority of the respondents (78 (39%)) were having 0–5 years of experience followed by 49 (24%) participants with 6–10 years of experience.

The 108 (54%) respondents were posted in different ICUs, and the remaining 93 (46%) were working in different ward areas.

The pretraining group scored an average of 90.2786 (SD 15.52682, SE 1.09518). The post-training group scored 137.5622 (SD 9.72252, SE 68577). Hence, the mean knowledge score after the structured training program was significantly higher than before the training program (t statistic = -49.616, *P*- value = 0.001) [Table 1].

After analyzing the pretest and posttest mean knowledge scores among different age groups, it was found that the posttest group had a significantly higher knowledge score than the pretest group in all age groups (*P*- value < 0.001) [Table 2]. The results demonstrate that for both married and unmarried participants, the mean knowledge score of the posttest group was considerably greater than that of the pretest group (*P*- value < 0.001) [Table 3]. There was a statistically significant increase in the mean knowledge score of both male (t-value = -17479, df = 28, *P*- value = 0.001) and female groups (t-value = -46.914, df = 171, *P*- value = 0.001) in the posttest group compared with the pretest group [Table 4]. The mean knowledge score of the posttest group was notably higher than that of the pretest group in GNM, BSc Nursing, and MSc Nursing categories (t-value = -40.411, df = 104, *P*- value = 0.001; t-value = -29.936, df = 89, *P*- value = 0.001; t-value = -7.135, df = 89, *P*- value = 0.001, respectively) [Table 5].

It was found that the posttest group was having statistically significant more mean knowledge compared with the pretest group in both the categories, that is, rural (t-value = -22.637, df = 38, *P*- value = 0.001) and urban (t-value = -44.213, df = 161, *P*- value = 0.001) [Table 6]. On comparison, it was revealed that the mean knowledge in the posttest group was higher than the pretest group in both nursing officers (t-value = -45.356, df = 176, *P*- value = 0.001) and senior nursing officers categories (t-value = -21.996, df = 23, *P*- value = 0.001) [Table 7]. The mean knowledge was significantly higher among the posttest group across all experiences, that is, 0–5 years (t-value = -45.356, df = 176, *P*- value = 0.001), 6–10 years (t-value = -45.356, df = 176, *P*- value = 0.001), 11–15 years (t-value = -45.356, df = 176, *P*- value = 0.001), and more than 15 years group (t-value = -45.356, df = 176, *P*- value = 0.001) [Table 8]. The posttest

Table 1: Mean knowledge score among the pretest and posttest groups of the participants

Parameter	Mean	*n*	Std. deviation	Std. error mean	*t* statistic, *P*
Knowledge pretest group	90.2786	201	15.52682	1.09518	-49.616, 0.001
Knowledge posttest group	137.5622	201	9.72252	0.68577	

Table 2: Mean knowledge score among the pretest and posttest groups of the participants based on age group

Age group (in yrs)	Parameter (knowledge)	Mean	*n*	Std. deviation	Std. error mean	*t*	df	*P*
21–30	Pretest group	95.2821	78	13.98877	1.58392	-32.482	77	0.001
	Posttest group	139.4231	78	9.46562	1.07177			
31–40	Pretest group	86.3974	78	16.07639	1.82029	-29.217	77	0.001
	Posttest group	136.1538	78	10.19049	1.15385			
41–50	Pretest group	90.2632	19	15.40866	3.53499	-15.811	18	0.001
	Posttest group	139.4737	19	9.84529	2.25867			
>50	Pretest group	86.9231	26	14.90483	2.92308	-21.065	25	0.001
	Posttest group	134.8077	26	7.93483	1.55615			

Table 3: Mean knowledge score among the pretest and posttest groups of the participants based on marital status

Marital status	Parameter (knowledge)	Mean	*n*	Std. deviation	Std. error mean	*t*	df	*P*
Married	Pretest group	89.0888	169	14.99835	1.15372	-47.23	168	0.001
	Posttest group	137.0118	169	9.90009	0.76155			
Unmarried	Pretest group	96.5625	32	16.96474	2.99897	-16.73	31	0.001
	Posttest group	140.4688	32	8.26569	1.46118			

Table 4: Mean knowledge score among the pretest and posttest groups of the participants based on gender/sex group

Sex group	Parameter	Mean	*n*	Std. deviation	Std. error mean	*t*	df	*P*
Male	Knowledge pretest group	96.0345	29	17.49384	3.24852	-17.479	28	0.001
	Knowledge posttest group	138.4483	29	11.73391	2.17893			
Female	Knowledge pretest group	89.3081	172	15.00968	1.14448	-46.914	171	0.001
	Knowledge posttest group	137.4128	172	9.37325	0.71470			

Table 5: Mean knowledge score among the pretest and posttest groups of the participants based on educational qualification

Educational qualification	Parameter	Mean	*n*	Std. deviation	Std. error mean	*t*	df	*P*
GNM	Knowledge pretest group	86.4381	105	14.54	1.41938	-40.411	104	0.001
	Knowledge posttest group	135.7143	105	9.91	0.96749			
BSc Nursing	Knowledge pretest group	94.1667	90	15.58	1.64262	-29.936	89	0.001
	Knowledge posttest group	139.1667	90	9.13	0.96198			
MSc Nursing	Pretest group	99.1667	6	15.63	6.37922	-7.135	5	0.001
	Posttest group	145.8333	6	7.36	3.00463			

Table 6: Mean knowledge score among the pretest and posttest groups of the participants based on place of residence

Place of residence	Parameter	Mean	*n*	Std. deviation	Std. error mean	*t*	df	*P*
Rural	Knowledge pretest group	87.0513	39	17.46116	2.79602	-22.637	38	0.001
	Knowledge posttest group	136.6667	39	10.96246	1.75540			
Urban	Knowledge pretest group	91.0556	162	14.97959	1.17691	-44.213	161	0.001
	Knowledge posttest group	137.7778	162	9.42443	0.74045			

Table 7: Mean knowledge score among the pretest and posttest groups of the participants based on designation

Designation	Parameter	Mean	*n*	Std. deviation	Std. error mean	*t*	df	*P*
Nursing officer	Knowledge pretest group	90.2486	177	15.83	1.18990	-45.356	176	0.001
	Knowledge posttest group	137.6554	177	9.87	0.74202			
Senior nursing officer	Knowledge pretest group	90.5000	24	13.36	2.72801	-21.996	23	0.001
	Knowledge posttest group	136.8750	24	8.70	1.77576			

Table 8: Mean knowledge score among the pretest and posttest groups of the participants based on year of experience

Experience group	Parameter	Mean	*n*	Std. deviation	Std. error mean	*t*	df	*P*
0–5 yrs	Knowledge pretest group	92.2051	78	17.54945	1.98708	-27.400	77	0.001
	Knowledge posttest group	137.3077	78	10.21497	1.15662			
6–10 yrs	Knowledge pretest group	90.6122	49	14.70660	2.10094	-24.469	48	0.001
	Knowledge posttest group	140.0000	49	8.59990	1.22856			
11–15 yrs	Knowledge pretest group	86.3611	36	14.07765	2.34627	-22.832	35	0.001
	Knowledge posttest group	135.5556	36	10.19648	1.69941			
>15 yrs	Knowledge pretest group	89.6053	38	13.06851	2.11999	-27.713	37	0.001
	Knowledge posttest group	136.8421	38	9.33035	1.51358			

group showed significant knowledge improvement in both ward and ICU settings compared with the pretest group. Statistical analysis values are as follows: t = -45.356, df = 176, and $P = 0.001$ for both settings [Table 9].

Table 9: Mean knowledge score among the pretest and posttest groups of the participants based on place of posting

Place of posting	Parameter	Mean	*n*	Std. deviation	Std. error mean	*t*	df	*P*
Ward	Knowledge pretest group	88.5914	93	15.36812	1.59360	-38.127	92	0.001
	Knowledge posttest group	137.3118	93	10.64647	1.10399			
ICUs	Knowledge pretest group	91.7315	108	15.58672	1.49983	-33.236	107	0.001
	Knowledge posttest group	137.7778	108	8.89538	0.85596			

Discussion

This study was conducted at Pandit Bhagwat Dayal Sharma Post Graduate Institute of Medical Sciences, Rohtak, to assess the impact of training about hospital infection control measures related to HD services on the knowledge of HCPs. The response rate of the study was 97%. The mean knowledge score among the pre-intervention group was 58.24% of the total achievable score, and the mean knowledge score among the post-intervention group was 88.74% of the total achievable score. This depicts that the educational intervention lead to considerable enhancement in the HCPs' knowledge toward various aspects related to hospital infection control measures related to HD services. The current study's findings were corroborated by a prior investigation conducted in Kanpur,[12] which aimed to evaluate the efficacy of an educational intervention on nurses' knowledge about preventing CLABSI in ICU and HD unit at selected hospitals. The results indicate a significant rise in knowledge after the posttest. This discovery aligns with the outcomes of prior research studies,[13-17] which indicated that their professional education and training impacted nurses' knowledge.

The educational intervention also had a positive impact on mean knowledge score across different subgroups made based on age groups, marital status, gender, educational qualification, place of residence, designation, year of experience, place of posting and type of family structure, etc., However, caution should be exercised when considering these differences due to the inadequate sample size for the subgroup analysis. Before administering education/training (i.e. in the pre-intervention phase), the baseline mean knowledge was highest among the participants in the 21–30 years of age group. However, in the post-intervention phase, the mean knowledge was maximum among the participants in the 41–50 years of age group, which was marginally higher than their counterparts in the 21–30 years of age group. The mean knowledge scores and age groups were not linearly related. The baseline mean knowledge score (i.e. in the pre-intervention phase) was higher among the unmarried, male respondents and participants from nuclear families and urban background compared with their married, female, joint family, and rural background counterparts, respectively. The educational intervention leads to improvement in knowledge among both the subgroups created based on gender, marital status, type of family, and place of residence, but the maximum improvement in mean knowledge was observed among the unmarried, male respondents and participants from nuclear family and urban background. This may be explained by the fact that the baseline knowledge of these groups was already higher than their counterparts before imparting the educational/training intervention. On education-wise analysis, it was found that the baseline mean knowledge of postgraduates was maximum, followed by the graduates and GNM diploma holders. This finding may be explained on the basis that the participants with higher qualification may have more exposure to the research topic during their formal training of nursing curriculum. The educational interventions lead to improvement of knowledge among all educational groups, but the maximum improvement was observed among the postgraduates followed by the graduates and GNM diploma holders. The same analogy that the baseline knowledge was already higher among the higher educational group, which leads to maximum improvement in mean knowledge in this group, may explain this finding. The association of baseline mean knowledge scores with years of experience reflected that the participants with 0–10 years had higher mean scores compared with those with greater experience of 10 years or more. It seems that those who are in the middle of experience know more. Probably, they are more directly involved in patient care activities and those at higher levels also become busy in administrative responsibilities. On subgroup analysis based on place of posting, it was observed that the respondents who were posted in ICUs had more baseline knowledge (i.e. pre-intervention phase) than their counterparts posted in ward areas. This finding may be explained by the reason that the nursing officers posted in ICUs were more exposed to the management of critical patients needing central line and HD. Similarly, the educational interventions lead to the improvement of mean knowledge among both groups, but the maximum improvement was observed among the participants posted in the ICUs. In the above discussion, it was clear that the different socio-demographic variables have a statistically significant association with the mean knowledge of the participants. However, a study conducted in Kanpur[12] showed that there was no significant correlation between the pretest knowledge scores of the participants and their socio-demographic factors, such as age, gender, education level, and work experience. In our study, a significant positive association of educational qualification of the participants with the mean score was established, that is, the higher the educational qualification, the more improvement in the mean

score after educational intervention. This finding was supported by the findings of descriptive study conducted by Abdelsatir[18] that included 50 HD nurses practicing in Khartoum State, but the difference was not statistically significant.

The present study has thrown light on various aspects of infection control measures related to HD services, which will also help primary care physicians in providing better care to these patients.

Strength of the study

This study is notable for its focus on HD services, which is a departure from most literature studies that concentrate on ICUs. The educational intervention provided to healthcare professionals was effective, as evidenced by a significant difference in scores before and after the intervention. Participants were able to understand the study module, objectives, and questionnaire without assistance or references, providing truthful answers. The attrition rate was below 4%, despite the initial sample size being deemed sufficient. The study tool resulted in useful findings and guidance for improving infection control measures and reducing the occurrence of CRBSIs in individuals undergoing HD.

Limitations of the study

This study was conducted at a single center and focused on a specific category of healthcare providers. The study tool developed by the research scholar lacked prior testing in other studies, which may raise concerns regarding the reliability and validity of certain questions.

Conclusions

This research analyzed how healthcare professionals understand infection control protocols in HD services and how training affects their knowledge. The results show that the participants' knowledge scores improved significantly after the educational intervention. The study also identified areas where healthcare professionals need further improvement. The educational intervention was effective in improving the participants' knowledge. However, more research is needed to examine whether they follow evidence-based guidelines and retain their knowledge.

Acknowledgement

The source of study tool is acknowledged in the study.

Key message

This study is notable for its focus on HD services. The findings show that the participants' knowledge scores improved significantly after the educational intervention. The study resulted in useful findings and guidance for the HCPs including primary care physicians to improve infection control measures and reduce the occurrence of catheter-associated bloodstream infections (CRBSIs) in patients undergoing HD.

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Conflicts of interest

There are no conflicts of interest.

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