



## Original Research Article

# Interventional knowledge, attitude and practice study of standard precautions among health care workers at a tertiary care hospital in Western India

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## ABSTRACT

**Background:** Standard precautions are the backbone of any efficient infection control program. Compliance with standard precautions has been a major challenge for health care workers, especially in developing countries.

**Aim:** To access the impact of the training program on health care workers (HCW) knowledge, attitude, and practice towards standard precautions.

**Materials and Methods:** We conducted an interventional Knowledge, Attitude, and Practice (KAP) study among 150 HCW (50 Doctors, 50 Nurses, and 50 Technicians) in a tertiary care hospital from June 2019 to December 2019. We carried out educational interventions through training sessions with pre- and post-test questionnaires. We compared pre and post questionnaire mean scores to access the impact of short educational videos and seminars on HCWs using unpaired t-tests.

**Results:** HCWs have poor KAP on important aspects of standard precautions. Pre-intervention KAP mean scores were highest among doctors, followed by lab technicians and nurses. After training intervention, improvement in knowledge, attitude, and practice among all 3 types of HCWs were statistically significant (P-value <0.005, unpaired t-test).

**Conclusion:** Low pre-intervention knowledge and attitude practice scores regarding standard precautions among doctors, nurses, and lab technicians were improved after training significantly. Hence, we recommend training programs regarding standard precautions should be regularly conducted in health-care facilities to promote good infection control practices and mitigate the risk of hospital-acquired infection. This has future implications in terms of reduced morbidity and mortality in resource limited settings.

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## 1. Background

Healthcare-associated infections are a major burden for patients, society, and health care management. The prevalence of HCAs in developed and developing countries is approximately 7% and 10% respectively.<sup>1,2</sup> An infection control program reduces patients' morbidity, mortality, length of hospital stay, and the cost associated with it. Awareness and implementation of infection control programs restrict the spread of infection among patients and

health care workers.

Standard precautions (SP) are the backbone of any efficient infection control program. Standard precautions apply to the blood and body substances of all patients at all times, regardless of diagnosis and infection status. Components of standard precautions include appropriate handling of patient care equipment, environmental cleaning and spill management, and handling of biomedical waste.<sup>3-9</sup> Compliance with standard precautions has been a major challenge for health care workers, especially in developing countries.<sup>2,10,11</sup>

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We conducted this study to examine the KAP components of standard precautions among doctors, nurses, and laboratory technicians in a tertiary hospital in Western India in the state of Gujarat. We also wanted to assess the impact of the training program on KAP for HCWs regarding standard precautions. The findings of the study may guide the development and implementation of infection control activities at the study site and in other health facilities.

## 2. Materials and Methods

We carried out a prospective interventional KAP study regarding standard precautions among HCWs in a tertiary care hospital in western India from July 2019 to December 2019. The hospital has a total bed capacity of 1200 and provides a tertiary level of patient care covering major medical and surgical disciplines. We got ethical approval for the study from the Institutional Ethical Review Board, and all study participants gave consent for the study. We used a stratified random sampling method to enroll doctors, nurses, and laboratory technicians willing to take part and consent. We excluded HCWs who were not present in their workplace during the study period or did not consent. Then, we allotted them under the total number of source populations got. Finally, we selected the respondents by a simple random sampling technique using the lottery method. We determined the sample size using a single population proportion formula:  $[n=z^2p(1-p)/d^2]$  considering 95% CI and 50% prevalence, which is 384. Since the total population is less than 10,000, the final corrected sample size was 150 using the population correction formula including three groups: Group A: Doctors (n=50), Group B: Laboratory Technicians (n=50), and Group C: Nurses (n=50).

We compared pre and post questionnaire mean scores. We conducted educational intervention through regular training sessions about standard precautions every month for all the participants. We collected pre- and post-test data using a pre-validated self-administrated structured questionnaire comprising three parts: Knowledge, attitude, and practice assessment. We used 11, 10, and 9 questions (multiple-choice and yes or no questions) based on guidelines by the WHO, CDC, and ICMR, to assess the Knowledge, Attitudes, and Practices of HCWs respectively. We gave 4 points for every correct response and 0 for an incorrect response, but 5 points each for two questions for practices. We maintained the confidentiality of all the data. We analyzed the data using the Statistical Package for Social Sciences (SPSS) version 23. Pre and post questionnaires mean scores were compared to assess the impact of short training videos and seminars on HCWs using unpaired t-tests. We considered a  $P < 0.05$  as statistically significant.

## 3. Results

Only 57.33% (86) of the total participants had previously heard about standard precautions. However, 83.33% (125) of HCWs knew that they should practice standard precautions on all patients and laboratory specimens irrespective of diagnosis. Post-intervention 99.33% and 98% of participants knew about standard precautions and applicability in all patients, respectively. We have found that 6.67% (10) and 36% (54) participants were able to mark all the correct responses for all the various microbes that can spread because of hand hygiene lapses pre and post-intervention, respectively. We noted that 45.33% (68) participants knew that they should wear gloves, only after drying the alcohol rub on their hands, which increased post-intervention 87.33% (131) participants. We found that 17.33% (26) and 86% (129) participants knew that they should remove PPEs other than respirators before leaving the patient care area pre- and post-intervention. When asked about the PPE to use for airway suctioning 90.66% (136), 80.66% (121), 52.66% (79) and 38% (57) responded mask, gloves, goggles/face shield, and gown respectively which improved to 94.67% (142), 100% (150), 80.66% (121) and 80% (120). We found that 77.33% (116) participants knew that they should use gloves before starting intravenous lines, the lowest being doctors (68%). Post-intervention 100% (150) participants knew about it. We observed that 19.33% (29) health care workers (doctors (52%), nurses (4%), and lab technicians (2%)) knew correctly about all the infections transmitted by blood. Post-intervention 73.33% (110) participants knew the correct answer; highest being doctors (88%). We noted that 66% (33) doctors, 44% (22) nurses, and 44% (22) lab technicians knew that they should not keep multi-dose vials in the immediate patient treatment area. In post-test 86% (43) doctors, 98% (49), and 68% (34) lab technicians answered correctly. Only 62% (31) doctors, 70% (35) nurses, and 58% (29) lab technicians knew that segregation is the most important step in biomedical waste management. However, 85.33% (128) participants knew that they should use the yellow bin for discarding soiled dressing material. Post-intervention 99.33% (149) and 100% (150) participants knew about both the facts correctly. (Table 1)

In the pre-test, 77.33% (116) participants considered that healthcare-associated infections are a significant problem which increased to 96% in the post-test. Before the intervention, 78.67% (118) participants believed that all body fluids are infectious, which increased to 98.66% (148) post-intervention. Hand-washing with soap and water was the preferred method compared to alcohol-based hand rubs for hand hygiene by 68% (102) of participants pre-test, which increases to 90.67% (136) post-test. In the pre-test, 24% (16) participants (18% (9) doctors, 24% (12) lab technicians, and 6% (3) nurses) preferred the use of gloves as an alternative method of hand hygiene. The

training decreased this misconception to 2% (3) post-test (6% (3) nurses). The adherence to hand hygiene was perceived easy by 76% (114) participants (58% (29) doctors, 88% (44) lab technicians and 82% (41) nurses) and 89.33% (134) participants (78% (39) doctors, 92% (46) and 98%(49) nurses) pre-test and post-test, respectively. We noted that 68% (102) participants (70%(35) doctors, 66%(33)lab technicians, and 68% (34) nurses)believed that PPEs are worn for their safety pre-intervention which went up to 93.33%(140) post-intervention (92%(46) doctors, 96%(48) lab technicians and 92%(46)nurses). The attitude about changing gloves in between attending different patients was noted in 76.67%(115) participants pre-intervention (96%(48) doctors, 58%(29) lab technicians, and 76%(38) nurses) and high among a group of doctors 98%(48) and increases after intervention up in 94.67%(142) overall participants (96%(48) doctors and lab technicians each and, 92%(46) nurses. Attitude for further attending programs to upgrade their knowledge on Biomedical waste management was found strongly positive in 99.33%(149) health care workers (98%(49) doctors, 100%(50) lab technicians and nurses each) after the intervention compared to pre-test as 82.67%(124) health care workers (84%(42) doctors, 78%(39) lab technicians and 86%(43) nurses). Pre-intervention 50.67% (76) participants believed not to recap needles after use which improved to 74.67% (112) post-intervention. Only 57.33%(86) health care workers (68%(34) doctors, 40%(20) lab technicians, 64%(32) nurses) were found of wearing gloves while giving injection as useful before the intervention. We have noticed a good attitude about wearing gloves while giving an injection in 83.33%(125) health care workers (88%(44) doctors, 84%(42) lab technicians, and 78%(39) nurses) post-intervention which is highly remarkable. 72%(108) health care workers (80%(40) doctors, 78%(39) lab technicians, and 76%(38) nurses) don't believe that safe management of biomedical waste as a financial burden. After the intervention, almost 90%(135) health care workers (94%(47) doctors, 100%(50) lab technicians, and 76%(38) nurses) found that biomedical waste management is not a financial burden. (Table 2)

Only 42.67% (64) health care workers (16% (8) doctors, 46% (23) lab technicians, 66% (33) nurses) have attended training regarding standard precautions before our intervention. We knew that only 33.33%(50) participants (26% (13) doctors, 20% (10) lab technicians, 54% (27) nurses) were practicing all 5 moments of hand hygiene. We noted practicing all 5 moments of hand hygiene in 84% (126) participants after the intervention. In the nurses' group, it was noticeable that the habit of practicing hand hygiene improved from 54% (27) to 94% (47) of participants. We found that the habit of wearing gloves while drawing blood and handling laboratory specimens almost similar to 67.33% (101) and 64.67% (97) health

care workers pre-intervention. We observed the practice of wearing gloves while drawing blood and handling laboratory specimens in 90.67% (136) and 85.33% (128) participants, respectively. Only 64.67% (97) participants (58% (29) doctors, 66% (33) lab technician, 70% (35) nurses) were practicing hand-washing after taking off the gloves. We found improvement in the habit of hand-washing after gloves removal in 87.33%(131) of health care workers (86% (43) doctors, 78% (39) lab technicians, 98% (49) nurses). Almost 66% (99) participants admitted that they had needle stick injuries in the last 1 year. We found that 72% (108) participants admitted washing of needle stick injury site with soap and water, but only 54.66%(82) reported to the supervisor and 56.66(85%) had taken medical treatment. Overall, the doctors' group was more aware and the following steps after needle stick injuries followed by the lab technician and nurses group. Pre-intervention 61.33% (92) participants (54% (27) doctors, 56% (28) lab technicians, 74% (37) nurses) were discarding used needles in the white color biomedical waste container and 98.67% (148) of health care workers (98% (49) doctors and lab technicians, 100% (50) nurses) post-intervention. We noted practicing segregation of the waste at generation site in 24% (36) of participants (36% (18) doctors, 30% (15) lab technicians, 6% (3) nurses) and improved to 76.67% (115) after intervention especially in 86% (43) of doctors group. (Table 3)

We observed pre-intervention KAP mean-score highest among group A-resident doctors followed by group C-nurses and group B-lab technicians. Post-interventional KAP mean scores were highest among lab technicians followed by Resident Doctors and Nurses. Improvement in knowledge, attitude, and practice of all study participants was extremely statistically significant ( $p < 0.0001$ ). (Table 4)

#### 4. Discussion

We carried out this study to know the level of awareness, attitude, and practices regarding standard precautions for infection control among the health care workers in a tertiary care hospital of western India. Though there are many KAP studies regarding standard precautions, hardly any interventional study on standard precautions has been conducted among health care workers.

The training intervention has improved knowledge about standard precautions from 57.33% to 99.33% of the participants. The study by Ogonia et al. shows a lack of knowledge of standard precautions was preventing them from the practice of standard precautions in almost 19.5% of HCWs.<sup>10</sup> The intervention made more participants aware of the fact that standard precautions apply to all the patients. The study by Sandra Enyonam A et al. shows more knowledge of application of standard precautions for all the patients in almost 93% of HCWs.<sup>11</sup> The participants had poor knowledge about various microbes

**Table 1:** Correct responses for questions on knowledge regarding standard precautions

S.No.	Objective of Question	Doctor n=50(%)		Lab Technician n=50(%)		Nurse n=50(%)		Total n=150(%)	
		Pre-test	Post-test	Pre-test	Post-test	Pre-test	Post-test	Pre-test	Post-test
1	What are standard precautions?	27 (54%)	49 (98%)	27 (54%)	50 (100%)	32 (64%)	50 (100%)	86 (57.33%)	149(99.33%)
2	Standard precautions apply to all patients.	48 (96%)	50 (100%)	35 (70%)	48 (96%)	42 (84%)	49 (98%)	125 (83.33%)	147 (98%)
3	Spread of various microbes because of lapses in hand hygiene.	2 (4%)	23 (46%)	4 (8%)	17 (34%)	4 (8%)	14 (28%)	10 (6.67%)	54 (36%)
4	Wear gloves after drying of alcohol rub on hands.	37 (74%)	50 (100%)	16 (32%)	49 (98%)	15 (30%)	32 (64%)	68 (45.33%)	131 (87.33%)
5	Remove PPEs other than respirator before leaving the patient care area.	18 (36%)	46 (92%)	6 (12%)	45 (90%)	2 (4%)	38 (76%)	26 (17.33%)	129 (86%)
<b>Knowledge about type of PPE to be used for Airway suctioning</b>									
6	Gown	22 (44%)	36 (72%)	18 (36%)	41 (82%)	17 (34%)	43 (86%)	57 (38%)	120 (80%)
	Mask	48 (96%)	48 (96%)	41 (82%)	47 (94%)	47 (94%)	47 (94%)	136 (90.66%)	142 (94.67%)
	Goggles/face shield	34 (68%)	42 (84%)	24 (48%)	39 (78%)	21 (42%)	40 (80%)	79 (52.66%)	121 (80.66%)
	Gloves	32 (64%)	50 (100%)	42 (84%)	50 (100%)	47 (94%)	50 (100%)	121 (80.66%)	150 (100%)
7	Wear gloves before starting intravenous lines.	34 (68%)	50 (100%)	43 (86%)	50 (100%)	39 (78%)	50 (100%)	116 (77.33%)	150 (100%)
8	Major infections transmitted by blood.	26 (52%)	44 (88%)	2 (4%)	38 (76%)	1 (2%)	28 (56%)	29 (19.33%)	110 (73.33%)
9	Do not keep multi-dose vials in the immediate patient treatment area.	33 (66%)	43 (86%)	22 (44%)	49 (98%)	22 (44%)	34 (68%)	77 (51.33%)	126 (84%)
10	Segregation is the critical step of biomedical waste management.	31 (62%)	50 (100%)	35 (70%)	50 (100%)	29 (58%)	49 (98%)	95 (63.33%)	149 (99.33%)
11	Use yellow bin for soiled dressing disposal as per biomedical waste management and handling rules.	46 (92%)	50 (100%)	39 (78%)	50 (100%)	43 (86%)	50 (100%)	128 (85.33%)	150 (100%)

Table 2: Positive responses for questions on attitude regarding standard precautions

S.No.	Objective of Question	Doctor n=50(%)		Lab Technician n=50(%)		Nurse n=50(%)		Total n=150(%)	
		Pre-test	Post-test	Pre-test	Post-test	Pre-test	Post-test	Pre-test	Post-test
1	Health care-associated infections are a significant problem.	46 (92%)	50 (100%)	29 (58%)	47 (94%)	41 (82%)	47 (94%)	116 (77.33%)	144 (96%)
2	All body fluids are infectious	47 (94%)	50 (100%)	31 (62%)	48 (96%)	40 (80%)	48 (96%)	118 (78.67%)	148 (98.66%)
3	Hand wash with soap and water	33 (66%)	45 (90%)	26 (52%)	47 (94%)	43 (86%)	47 (94%)	102 (68%)	136 (90.67%)
4	Alcohol based Hand rub Gloves	8 (16%)	5 (10%)	12 (24%)	3 (6%)	4 (8%)	3 (6%)	24 (16%)	11 (7.33%)
		9 (18%)	0 (0%)	12 (24%)	0 (0%)	3 (6%)	3 (6%)	24 (16%)	3 (2%)
4	It is easy to adhere to hand hygiene practices.	29 (58%)	39 (78%)	44 (88%)	46 (92%)	41 (82%)	46 (92%)	114 (76%)	134 (89.33%)
5	Wear PPEs for self-safety while delivering health care services.	35 (70%)	46 (92%)	33 (66%)	48 (96%)	34 (68%)	48 (96%)	102 (68%)	140 (93.33%)
6	Change gloves in between attending different patients.	48 (96%)	48 (96%)	29 (58%)	48 (96%)	38 (76%)	48 (96%)	115 (76.67%)	142 (94.67%)
7	Never recap needle.	25 (50%)	30 (60%)	26 (52%)	44 (88%)	25 (50%)	44 (88%)	76 (50.67%)	112 (74.67%)
8	Wear gloves while giving injections.	34 (68%)	44 (88%)	20 (40%)	42 (84%)	32 (64%)	42 (84%)	86 (57.33%)	125 (83.33%)
9	Safe management of Biomedical waste is not a financial burden.	40 (80%)	47 (94%)	39 (78%)	50 (100%)	29 (58%)	50 (100%)	108 (72%)	135 (90%)
10	Willingness to attend training programs to upgrade their knowledge on biomedical waste management.	42 (84%)	49 (98%)	39 (78%)	50 (100%)	43 (86%)	50 (100%)	124 (82.67%)	149 (99.33%)

**Table 3:** Correct responses for questions on practice regarding standard precautions

S.No.	Question objective	Doctor n=50(%)		Lab Technician n=50(%)		Nurse n=50(%)		Total n=150(%)	
		Pre-test	Post-test	Pre-test	Post-test	Pre-test	Post-test	Pre-test	Post-test
1	Past training regarding standard precautions	8 (16%)	50 (100%)	23 (46%)	50 (100%)	33 (66%)	50 (100%)	64 (42.67%)	150 (100%)
2	Perform all 5 moments of hand hygiene (Score 5)	13 (26%)	37 (74%)	10 (20%)	42 (84%)	27 (54%)	47 (94%)	50 (33.33%)	126 (84%)
3	Wear gloves while drawing blood	31 (62%)	43 (86%)	36 (72%)	43 (86%)	34 (68%)	50 (100%)	101 (67.33%)	136 (90.67%)
4	Wear gloves while handling laboratory specimens	30 (60%)	38 (76%)	35 (70%)	42 (84%)	32 (64%)	48 (96%)	97 (64.67%)	128 (85.33%)
5	Wash hands after taking off the gloves	29 (58%)	43 (86%)	33 (66%)	39 (78%)	35 (70%)	49 (98%)	97 (64.67%)	131 (87.33%)
6	No needle stick injury in last year	18 (36%)	18 (36%)	45 (90%)	45 (90%)	36 (72%)	36 (72%)	99 (66%)	99 (66%)
7	Wash the site with soap and water	40 (80%)	48 (96%)	36 (72%)	49 (98%)	32 (64%)	46 (92%)	108 (72%)	143 (95.33%)
8	Report to the supervisor	32 (64%)	41 (82%)	25 (50%)	45 (90%)	25 (50%)	32 (64%)	82 (54.66%)	118 (78.66%)
	Seek medical treatment	34 (68%)	43 (86%)	37 (74%)	46 (92%)	14 (28%)	31 (62%)	85 (56.66%)	120 (80%)
	Discard used needles in white bin	27 (54%)	49 (98%)	28 (56%)	49 (98%)	37 (74%)	50 (100%)	92 (61.33%)	148 (98.67%)
9	Segregate biomedical waste at generation site	18 (36%)	43 (86%)	15 (30%)	41 (82%)	3 (6%)	31 (62%)	36 (24%)	115 (76.67%)

**Table 4:** Mean scores of correct responses (pre and post-intervention) for questions on Knowledge, Attitude and Practice regarding Standard precautions among subgroups of Doctors, Laboratory technicians, and Nurses

	Doctor (n=50)	Lab. Technician (n=50)	Nurse (n=50)
	<b>Knowledge (Total score 44) (mean score± SD)</b>		
Pre-test score	29.2±7.06	22.56±8.28	22.22±7.12
Post-test score	41.74±2.32	41.44 ±2.56	36.66±5.43
Absolute gain	12.54±4.74	18.88 ± 5.72	14.44 ± 1.69
P value	<0.0001	<0.0001	<0.0001
	<b>Attitude (Total score 40) (mean score± SD)</b>		
Pre-test score	30.56±4.71	26.28±7.50	30.1±7.69
Post-test score	36.9±3.29	38.08±2.78	36.02±4.78
Absolute gain	6.34 ± 1.42	11.8±4.72	5.92 ± 2.91
P value	<0.0001	<0.0001	<0.0001
	<b>Practice (Total score 38) (mean score± SD)</b>		
Pre-test score	22.98±5.92	23.86±5.38	22.99±6.07
Post-test score	33.67±2.65	33.53±2.65	31.67±3.49
Absolute gain	10.69 ± 3.27	9.67± 2.73	8.68 ± 2.58
P value	<0.0001	<0.0001	<0.0001

that can spread because of lapses in hand hygiene, which improved after the training. We noted that participants were not aware that they should wear gloves should only after the drying of alcohol rub on hands. Knowledge about all microorganisms transmitted by blood-borne was lower in nurses followed by lab technicians and doctors which improved after the intervention. The training intervention has made participants aware that they should not keep multi-dose vials in the immediate treatment area. Segregation at the point of generation is an important step for successful biomedical waste management. We found that 58% of nurses knew this, which is higher in comparison with a study by Mehta TK et al. (14.5%) and low compared to a study by Soyam GC et al. (79.2%).<sup>12,13</sup> The training also improved the knowledge of the correct bin for biomedical waste disposal as per biomedical waste management and handling rules, 2018.

In our study, 77.33% (pre-test) and 96% (post-test) of the health care workers believed that healthcare-associated infection is a significant problem. This is higher than the study done in South India by Anusha Taarinie Jha et al. (50%).<sup>14</sup> We found that 78.67% (pre-test) and 98.66% (post-test) of the health care workers believed that all body fluids are infectious. This is higher than the study by Anusha Taarinie Jha et al. (60.5%).<sup>14</sup> We also noted the poor attitude of laboratory technicians for healthcare-associated infections and body fluids pre-test, which improved after the intervention. We found that participants preferred hand-washing with soap and water to alcohol-based hand rub before and after the intervention. This is contrary to the study by Ansari SK.<sup>15</sup> The participants perceived adherence to hand hygiene was easy, which enhanced after the intervention. This is like the study by Arthi E et al. (79%).<sup>16</sup> The intervention strengthened the belief of participants that PPES were for their safety while

delivering health care services. We noticed that 76.67% and 94.67% of participants felt the need of changing glove pairs between attending two different patients before and after the intervention. In a study by Unakal et al., 87.7% of participants agreed to a new pair of gloves to use for each new patient.<sup>17</sup> In our study, 50% and 74.67% of participants believed not to recap the needle before and after the intervention. We found similar results in a study done in Nigeria and a study by Jaydeep Devaliya et al. stating that less than 50% of participants were performing the wrong practice of recapping the needles.<sup>10,18</sup> We noted an improvement in the attitude of the participants after the intervention for wearing gloves while giving injections. This is comparable to the findings of the study by D Ogoina.<sup>10</sup> The intervention has strengthened the belief of participants that biomedical waste was not a financial burden. This is like a study by Tabis S et al.<sup>19</sup> We found a positive attitude towards attending training to upgrade the knowledge regarding biomedical waste management. This is like a study by Ogoina D et al. and Munda K et al.<sup>11,20</sup>

In the present study, only 42.67% of participants have taken training regarding standard precautions previously. This is comparable to the study by D Ogonia et al. (47.6%).<sup>10</sup> Pre-intervention nurses and laboratory technicians have attended the training regarding standard precautions more compared to the doctors' group. Pre-intervention, 64.67% of healthcare workers washed their hands after taking off gloves (64.67%). A study by Ogonia et al. also noted similar findings (63.6%).<sup>10</sup> We observed compliance regarding the same in 87.33% of the healthcare workers, especially nurses followed by doctors, post-intervention. We observed that 33.33% (pre-test) and 84% (post-test) of health care workers performed all five moments of hand hygiene. A study in New Delhi, India by Dabet Rynga et al. showed a 14.6% hand hygiene

compliance rate among health care workers.<sup>21</sup> We observed nurses are more compliant with hand hygiene than doctors and lab technicians. We found the average practice habit of wearing gloves while withdrawing blood and before handling of laboratory specimens was 67.33% and 64.67% respectively among participants before the intervention. In a study by Kermode et al., 67.6% of participants had used gloves when possibly exposure to blood or body fluids.<sup>22</sup> The training program improved compliance with wearing gloves while withdrawing blood (90.67%) and before handling laboratory specimens (85.33%). Almost 34% of participants mentioned having needle stick injuries in the last year. This is comparable to a study by C Unakal et al. (32.7%).<sup>17</sup> More than 50% of participants reported to the supervisor after injury, which is like the finding of a study by Anusha Jha et al.<sup>14</sup> We found that discarding of used needles in an appropriate biomedical waste bin in 61.33% participants. We see similar findings in a study by Munda K et al.<sup>20</sup> Post-intervention 98.67% of health care workers responded to discard used needle in an appropriate biomedical waste bin. Pre-intervention 36% doctors, 30% lab technicians, and 6% nurses responded that they practice segregation of the biomedical waste at the generation site. This low in comparison with a study by Mehta TK et al. for all three groups.<sup>12</sup> After the training program, 76.67% of participants accepted to follow this practice.

In our study, we found low Pre-intervention knowledge and attitude practice scores regarding standard precautions among doctors, nurses, and lab technicians. Similar findings were noted in other studies done in the past.<sup>10,23,24</sup> Scores were improved after educational training significantly. We would recommend future researchers to do a study on a larger population of health care workers for a longer duration to further confirm the results of this study. The limitation of our study was that we could not assess every aspect of KAP as it was based on a multiple-choice questions questionnaire. More details on problems faced by healthcare workers and their suggestions could not be obtained by this format.

## 5. Conclusion

The present study found low Pre-intervention knowledge and attitude practice scores regarding standard precautions among doctors, nurses, and lab technicians. However, these scores were improved after training significantly. Hence we recommend training programs regarding standard precautions should be regularly conducted in health-care facilities to promote good infection control practices and mitigate the risk of hospital acquired infection. This has future implications in terms of reduced morbidity and mortality in resource limited settings.

## 6. Ethical approval

We got ethical approval for the study from the Institutional Ethical Review Board.

## 7. Conflict of Interest

The Author(s) declare(s) that there is no conflict of interest.

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