

Primary prevention of bloodborne pathogens among nursing staff of teaching hospitals of Kerman University of Medical Sciences

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Abstract

Introduction:

Primary prevention is the most important and effective way to prevent bloodborne pathogens in healthcare workers. This study aimed to evaluate primary prevention which includes compliance with standard precautions (SPs) and vaccination against hepatitis B in nursing staff of three teaching hospitals affiliated to Kerman University of Medical Sciences.

Materials and Methods:

This cross-sectional study recruited nursing staff of three teaching hospitals. Data were collected by a questionnaire with proper reliability and validity.

Results:

Of the 397 nurses, 86.9% were female. Most frequent full compliance with SPs pertained to wearing gloves before touching mucous membranes or non-intact skin of patients (64.8%), wearing gloves before touching blood and body fluids (59.6%) and putting the used needles and syringes in the safety box (56.4%). More than 96 percent (96.2%) of the nursing staff had received complete hepatitis B vaccination and 76.8% of the staff with full vaccination had been tested for the level of HBs antibody. Mean and standard deviation of the total score of compliance with SPs were 1.95 ± 0.47 (out of 3). Compliance with SPs was unfavorable in 51.4% of the staff. Logistic regression analysis showed that exposure to blood and body fluids (OR=2.16, 95% CI: 1.29-3.78) and age group (OR=1.75, 95% CI: 1.12-2.85) were the predictor variables for the status of compliance with SPs.

Conclusion:

This study showed that compliance with SPs was not favorable in nurses. Therefore, proper managerial and educational interventions should be designed for promoting compliance.

Keywords: Primary Prevention, Blood-Borne Pathogens, Hand Hygiene, Nursing Staff

Introduction

While taking care of patients, healthcare personnel are exposed to numerous biological pathogens, especially blood-borne pathogens such as hepatitis B, hepatitis C, and HIV which increase the risk of contracting infections with high

mortality and complications (1,2). The global annual rate of exposure to blood-borne pathogens in healthcare personnel is estimated at 5.9% for HBV, 2.6% for HCV, and 0.5% for HIV, causing about 16000

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HCV and 66000 HBV infections around the world (3).

The most important method of preventing blood-borne diseases is primary prevention, including methods which prevent the incidence of blood-borne diseases by reducing occupational exposure to blood and bodily fluids and increasing safety in healthcare personnel. Two major methods at this level of prevention are the use of standard precautions and vaccination against hepatitis B (4).

Standard precautions are a set of methods and measures which must be adhered to by the personnel while taking care of all patients, regardless of their disease type, in order to prevent the transmission of blood-borne infections from known and unknown sources (1, 5). The most important components of standard precautions are hand hygiene; wearing gloves, gowns, masks, glasses, and eye or face protection; and correct collection and disposal of infected sharp and pointed tools such as needles. Each of the noted points must be regarded in special situations while taking care of patients so that the risk of occupational exposure to blood and bodily fluids and, consequently, the incidence of blood-borne diseases would be reduced in healthcare personnel. Vaccination against hepatitis B is a primary prevention method with high effectiveness and efficiency and can prevent the incidence of hepatitis B in healthcare personnel (4,6).

Research shows that the status of primary prevention of blood-borne diseases is not desirable among healthcare personnel (7,11). For example, some studies report the low adherence to standard precautions in healthcare personnel, especially in developing countries, leading to a high prevalence of exposure to patient blood and bodily fluids and, thus, increased risk of

blood-borne diseases (7,8). Moreover, despite the high coverage of hepatitis B vaccination, the measurement of antibody and ensuring a desirable immunity are less than favorable (9, 11).

Numerous factors, including personal and managerial factors as well as environmental conditions, affect the improvement of adherence to standard precautions (12). Due to occupational responsibilities in taking care of patients, nurses are at risk of a high occupational exposure to patient blood and bodily fluids (13, 14). Primary prevention methods can decrease the risk of these diseases (15, 17). Thus, the present study examined the status of primary prevention and related factors among nurses in teaching hospitals affiliated with Kerman University of Medical Sciences, Iran.

Methods and Materials

This cross-sectional study was conducted from April to July 2014 in three teaching hospitals affiliated with Kerman University of Medical Sciences. The studied population comprised 397 members of the nursing team, including nurses, midwives, and nurse assistants. Inclusion criteria were a minimum one-year work experience in the studied hospitals and direct participation in taking care of patients. Thus, team members who had managerial and administrative positions were excluded from the study.

Data were collected using a two-part questionnaire. The first part included questions on personal characteristics, e.g. age, sex, work experience, weekly working hours, occupational rank, level of education, and questions regarding the history of vaccination, antibody measurement, and receiving training on methods of preventing blood-borne

diseases. The second part comprised 10 items on hand washing; wearing gloves, gowns, masks, and glasses; and the correct collection and disposal of infected sharp and pointed tools which form the major components of standard precautions. Questions in the second part were answered “Never”, “Sometimes”, “Often”, or “Always”, scored from 0 to 3, respectively. The average score of the 10 items was considered as the total score of adherence to standard precautions for each person. A total score of 2 or higher indicated a desirable status, while scores below 2 indicated an undesirable status. For each item, answers “Never”, “Sometimes”, “Often”, and “Always” were regarded as non-adherence, weak adherence, good adherence, and full adherence to standard precautions, respectively. The validity of the questionnaire was confirmed by the opinions of experts and some participants, and its reliability was approved by the correlation coefficient of 0.76 using the test-retest method.

The study sample was selected through multi-stage sampling. Questionnaires were distributed among the nursing team in each hospital and during various work shifts, and the completed questionnaires were then collected. Questionnaires were anonymous and participants were free in deciding to complete them. Effort was made to keep the collected data confidential. Data were analyzed in SPSS 18, and results are presented using descriptive statistics (mean and SD). Also, the correlation among variables was assessed using chi-squared test, Mann-Whitney U test, and logistic regression, at the significance level of <0.05 .

Results

A total of 397 members of the nursing team in three teaching hospitals took part in this study. The level of education in approximately four-fifths of the participants (i.e. 79.6%) was B.Sc. or above, and 86.9 of them were women. About two-thirds (64.9%) were nurses and 35.1% were midwives or nurse assistants. Mean and SD of age, work experience, and mean weekly working hours were 33.1 ± 7.37 years, 10.2 ± 7.2 years, and 351 ± 13.8 hours, respectively. Over four-fifths (83.6%) had taken part in an educational program on adherence to standard precaution the previous year. The frequency of occupational exposure to blood and bodily fluids was 61.5% a year among nurses, and the most prevalent way of exposure was needle injury (Table 1).

The frequency of full vaccination (3 series) against hepatitis B was 96.2% (382 individuals). Moreover, 2% of the nursing team (8 individuals) had been vaccinated once or twice, while 1.8% (7 individuals) had not been vaccinated. The measurement of antibody level was done in 76.8% (292 individuals) with full vaccination. Among these, 78.6% (231 individuals) reported the antibody titer of 10 IU/L or above (desirable immune level), 14% (12 individual) reported it below 10 IU/L, and 17.3% (51 individuals) did not know the level of antibody.

The highest adherence to standard precautions respectively belonged to wearing gloves while contacting patient mucus or skin (64.8%), wearing gloves while contracting patient blood or body fluids (6.59%), and disposing of the needle and syringe in the safety box (56.4%). The lowest adherence to standard precautions belonged to wearing gowns (14.1%), wearing glasses (17.5%), wearing masks

(29.4%), and not recapping the used needles (29.9%). The highest ratios of non-adherence or weak adherence to standard precautions belonged to wearing gowns (72.5%), wearing glasses (60%), and not recapping the used needles (57.4%), and the lowest ratios were related to wearing gloves while contacting patient mucous or skin (7.95%), wearing gloves while contacting patient blood and bodily fluids (13.7%), and washing hands after contacting the patient (17.8%) (Table 2).

The frequency of full or high adherence to hand washing before any activity was 69.9%. The frequency of this item significantly differed across various hospitals ($P=0.01$). The frequency of full or high adherence to hand washing after any therapeutic measure was 82.2%, lower among midwives (61.0%) than nurses (84.8%) and nurse assistants (84.5%) ($P=0.00$). The frequency of full or high adherence to wearing gloves was 86.3% while contacting blood and bodily fluids, and 92.1% while contacting patient mucus or skin (Table 3). The frequency of full or high adherence to hand washing after removing the gloves was 78.2%, lower in men (67.3%) than women (79.7%) ($P=0.040$), and lower among midwives (68.3%) than nurses (76.7%) and nurse assistants (86.6%) ($P=0.030$). Furthermore, this frequency significantly differed across the studied hospitals ($P=0.030$) (Table 3).

The frequency of full or high adherence to wearing glasses, gowns, and masks was

40%, 27.5%, and 54.3%, respectively. The frequency of full or high adherence to wearing glasses significantly differed across hospitals ($P=0.01$). The frequency of full or high adherence to wearing gowns was higher among midwives (43.9%) than nurses (25.7%) and nurse assistants (25.8%) ($P=0.04$) and significantly differed across hospitals ($P=0.00$). The frequency of full or high adherence to not recapping the used needles and disposing of the used needles in the safety box without separating the syringes was 42.6% and 77.6%, respectively, not differing significantly based on any of the independent variables (Table 3).

Mean and SD of the total score of adherence to standard precautions was 1.95 ± 0.47 (out of 3). The first, second, and third quartiles were 1.60, 1.90, and 2.30, respectively. The status of adherence to standard precaution was undesirable (scores below 2) and desirable in 51.4% (204 individuals) and 48.6% (193 individuals), respectively. Logistic regression showed that the variables of exposure to blood and bodily fluids and age predicted the adherence to standard precautions. The probability of desirable adherence to standard precautions was 2.16 times higher in the group not exposed to blood and bodily fluids than the exposed group ($OR=2.16$, $CI\ 95\%=1.29-3.78$), and 1.75 times higher in the age group of over 30 years than the age groups of 30 years of below ($OR=1.75$, $95\%\ CI=1.12-1.85$).

Table 1: Frequency distribution of demographic characteristics in the studied sample

Variable	Categories	Number	Percentage
Sex	Female	344	86.9
	Male	52	13.1
Occupational rank	Nurse	257	64.9
	Midwife	41	10.4
	Nurse assistant	98	24.7
Workplace	Hospital 1	140	35.3
	Hospital 2	160	40.3
	Hospital 3	97	24.4
Level of education	B.Sc. or above	316	79.6
	Below B.Sc.	81	20.4
Receiving training on standard precautions in the past year	Yes	237	83.6
	No	64	16.4
Method of exposure of blood and bodily fluids	Needles	150	37.8
	Mucus	91	22.9
	Unhealthy skin	81	20.4
	Total	244	61.5

Table 2. Frequency distribution of the status of adherence to standard precautions in the studied sample

Item	Full adherence		High adherence		Weak adherence or non-adherence	
	Number	Percentage	Number	Percentage	Number	Percentage
Q1: Hand hygiene prior to taking care of the patient	122	30.8	155	39.1	119	30.1
Q2: Hand hygiene after taking care of the patient	167	42.2	158	40.0	70	17.8
Q3: Wearing gloves before contacting blood and bodily fluids	237	59.6	106	26.7	54	13.7
Q4: Wearing gloves before contacting mucus or unhealthy skin	256	64.8	108	27.3	31	7.9
Q5: Hand hygiene after removing the gloves	168	42.3	142	35.9	59	21.8
Q6: Wearing glasses during blood or bodily fluids splash	69	17.5	89	22.5	237	60.0
Q7: Wearing gowns during blood or bodily fluids splash	56	14.1	53	13.4	287	72.5
Q8: Wearing masks during blood or bodily fluids splash	116	29.4	98	24.9	180	45.7
Q9: Not recapping the used needles	118	29.9	50	12.7	226	57.4
Q10: Disposing of the used needles in the safety box without bending or breaking them	221	56.4	83	21.2	88	22.4

Table 3: Frequency of full or high adherence to various items of standard precautions based on sex, occupational group, level of education, and workplace

Item	Hospitals (%) number				Level of education (%) number			Occupational rank (%) number				Sex (%) number		
	1	2	3	P	B.Sc. or above	Below B.Sc.	P	Nurse	Midwife	Nurse assistant	P	Male	Female	P
Q1	93(66.9)	105(65.6)	79(81.4)	0.01	203(67.9)	74(76.3)	0.11	180(70)	23(56.1)	73(75.3)	0.08	36(69.2)	240(70)	0.91
Q2	112(80)	127(79.4)	86(90.5)	0.05	244(81.9)	81(83.5)	0.71	218(84.8)	25(61)	82(84.5)	0.00	38(73.1)	286(83.6)	0.06
Q3	123(87.9)	136(85)	84(86.6)	0.77	255(85.3)	88(89.8)	0.16	218(84.8)	36(87.7)	88(89.8)	0.45	43(82.7)	299(86.9)	0.39
Q4	130(94.2)	150(93.8)	84(86.6)	0.06	274(92.3)	90(91.8)	0.52	234(91.8)	38(92.7)	91(92.9)	0.93	47(90.4)	316(92.4)	0.58
Q5	104(74.8)	121(75.6)	87(87.9)	0.03	227(75.9)	83(85.6)	0.04	197(76.7)	28(68.3)	84(86.6)	0.03	35(67.3)	272(79.7)	0.04
Q6	42(30.4)	73(45.6)	43(44.3)	0.01	113(38)	45(45.9)	0.16	98(38.4)	17(41.5)	43(43.9)	0.63	18(39.6)	139(40.6)	0.40
Q7	38(27.1)	32(20.1)	39(40.1)	0.00	81(27.1)	28(28.9)	0.73	66(25.7)	18(43.9)	25(25.8)	0.04	12(23.1)	96(28)	0.45
Q8	75(54)	84(52.5)	55(57.9)	0.70	155(52.4)	59(60.2)	0.17	139(54.7)	17(41.5)	58(59.2)	0.15	29(55.8)	184(59)	0.80
Q9	53(38.1)	65(40.9)	50(52.1)	0.08	133(44.9)	35(35.7)	0.12	117(46.1)	15(36.6)	36(36.7)	0.19	21(40.4)	146(42.8)	0.74
Q10	104(75.4)	125(78.6)	75(78.9)	0.74	235(79.4)	69(71.9)	0.15	198(78)	36(87.8)	69(71.9)	0.11	42(88.8)	261(77)	0.54

Discussion

Mean total score of adherence to standard precautions was 1.95 (out of 3) in the present study. A study in Egypt reported this value to be 72.9 (out of 92), and a study in Nigeria reported it to be 47.6 (out of 60), consistent with the present study. In all three studies the score of adherence to standard precautions was about two-thirds of the maximum score (18, 19). Results of the present study showed that the chance of desirable adherence to standard precautions is higher in nurses not exposed to patient blood or bodily fluids in the age group of over 30 years, and a better adherence to standard precautions reduces the exposure to blood and bodily fluids (14-16). Moreover, a higher job experience and skill justifies the higher chance of adherence to standard precautions among the age group of over 30 years (4, 14).

Hand hygiene is among the most important activities in standard precautions, with a significant role in preventing disease transmission to healthcare personnel and patients, forming a central part of patient safety (5). In this study, the frequency of

full or high adherence to hand washing was 69.9% prior to any care to patients, 82.2% after care, and 78.2% after removing the gloves. Results of a study in Cyprus showed that 84% and 87.8% of the personnel always washed their hands after taking care of the patient and after removing their gloves, respectively (14). In line with various studies in developing country, the results of this study show that further attention to improving hand hygiene while taking care of patients is required to increase the quality and safety of care in hospitals (20-22).

In the present study, the frequency of full or high adherence to wearing gloves was 86.3% while contacting blood and bodily fluids and 92.1% while contacting patient mucus or skin. Other studies in developing countries report lower frequencies of wearing gloves by the personnel (20-22). The use of personal protective equipment while taking care of patients reduces the exposure of personnel to patient blood and bodily fluids (4). Based on the principles of standard precaution, wearing gloves in

necessary when there is a risk of exposure to patient blood and bodily fluids (1).

The frequency of full or high adherence to wearing glasses, gowns, and masks was 40%, 27.5%, and 54.3%, respectively. A study in Nigeria showed that the use (always or often) of gowns and glasses was 96.7% and 31.2%, respectively (1). Another study reported the use of gloves and gowns to be 56.7% and 58.3%, respectively (6). Personnel education and effective supervision can increase the use of protective tools (5).

Results of the present study showed that the frequency of full or high adherence to not recapping the used needles and disposing of the needles in the safety box without separating the syringes equaled 42.6% and 77.6%, respectively. The most important reasons for needle injury are recapping, handling, and separating them from the used syringes (4). Therefore, the high frequency (37.8%) of exposure through skin damage by needles in the past year is expected in the present study. The damage caused by needles and infected sharp and pointed tools while taking care of patients is among the most important factors threatening the health of healthcare personnel, exposing them to various pathogens, e.g. hepatitis B, hepatitis C, and HIV viruses (4). Research shows the high prevalence of these damages among nurses (4, 16, 17). The correct collection and disposal of infected needles is the most important way to decrease these damages (6).

Results of this study showed that the frequency of adherence (always or often) to items of hand washing prior to any activity for the patient and after removing the gloves, as well as the frequency of using (always or often) glasses and gowns differ across hospitals. Organizational conditions in the workplace are essential factors for adherence to standard precautions (23).

Effective management of hospitals provides desirable conditions in terms of personnel education, prioritizing safety by the managers, supporting safe behaviors, and easy access to personal protection equipment (23, 24). In the present study, no significant correlation was observed between most items of standard precautions and personal factors. However, in most studies, personal factors affect the adherence to standard precautions (22, 23). Hepatitis B vaccination and measurement of antibody level following a full vaccination are necessary for healthcare personnel as a high-risk group (4). Results of this study revealed that slightly more than 23% of those vaccinated against hepatitis B had measured their level of antibody after vaccination despite the desirable coverage of hepatitis B vaccination (96.2%). In spite of the low coverage of vaccination in some countries, results of the present study were consistent with other studies in Iran in terms of the high coverage of vaccination and low ratio of antibody titer measurement (4, 10, 11). One of the limitations of this study was the use of the self-report method for examining the status of primary prevention. Research has shown that this method usually overestimates the adherence to standard precautions compared to the personnel observation method (2, 4). Effort was made to reduce the effect of this limitation by ensuring the personnel of the anonymity of questionnaires.

Conclusion

Primary prevention methods are the most important and effective methods of preventing occupational infections in healthcare personnel and patients. However, in line with other studies in developing countries, results of the present study revealed the undesirable status of adherence to standard precautions (5,7, 25).

Thus, the present conditions must be improved by increasing awareness among the personnel, improving working conditions, preparing relevant guidelines, using personal protection equipment, and providing effective supervision and management.

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Conflict of Interest

None to declare