

Pharmacology

KEYWORDS: Post Exposure Prophylaxis against HIV, Nurses, Paramedical workers

ASSESSMENT ON KNOWLEDGE AND PRACTICE OF POST EXPOSURE PROPHYLAXIS OF HIV AMONG STAFF NURSES AND PARAMEDICAL WORKERS AT A TERTIARY CARE HOSPITAL IN SOUTH INDIA



Volume - 5, Issue - 4, April - 2020

ISSN (O): 2618-0774 | ISSN (P): 2618-0766

Harsha vardhini

Harsha vardhini, Third year MBBS, Sri Manakula Vinayagar Medical College and Hospital, Puducherry

Nitya Selvaraj*

Nitya Selvaraj, Associate Professor, Department of Pharmacology, Sri Manakula Vinayagar Medical College and Hospital, Puducherry.*Corresponding Author drnityapharmacology@gmail.com

R Meenakshi

R Meenakshi, Postgraduate, Department of pharmacology, Sri Manakula Vinayagar Medical College and Hospital, Puducherry.

INTERNATIONAL JOURNAL
OF PURE MEDICAL RESEARCH

**ABSTRACT:**

Background: Adequate knowledge about Post Exposure Prophylaxis (PEP) against HIV is imperative. **Objective:** To assess and compare the knowledge and practice of PEP against HIV among Staff Nurses and Paramedical workers at a tertiary care hospital in South India. **Methods:** A descriptive cross-sectional questionnaire study about the knowledge and practice of PEP against HIV among Staff nurses and Paramedical workers in a tertiary care hospital in South India. **Results:** About 339 Nurses and 66 paramedical workers participated in the study. An overall of 65.4% of the study participants had a good level of knowledge, higher ($p < .001$) among nurses (71.1%) compared to paramedical workers (36.3%). However only 23% nurses and 14.3% paramedical workers received PEP after needle prick injury. **Conclusion:** This study revealed a low-level practice of HIV PEP among staff nurses and paramedical workers despite their good knowledge.

INTRODUCTION

Human Immuno-Deficiency virus (HIV) / Acquired Immuno-deficiency syndrome (AIDS) is one of the most serious public health challenge, and also a leading cause of mortality prevailing across the globe.¹ At the end of 2016, WHO statistics highlighted that 36.7 million people are living with HIV.² And in the same year (2016) India was declared to be the third most HIV epidemic country having 2.1 million sufferers.³ Out of which 0.27% are residing in Tamil Nadu seen during 2014.⁴ The Indian Centre for Disease Control have charted out the guidance to prevent the occurrence of new infection by providing technical assistance, as well as increasing the access to service for people who are living with HIV by strategies like strengthening laboratory systems and district-level capacity to address HIV.⁵

World Health Report emphasizes that among the HIV patients, 2.5% have acquired owing to occupational exposure.⁶ Over 90% of such occupationally acquired diseases occur in countries with low economic status.⁷ The incidence is mainly attributed to the higher prevalence and increased exposure to occupational hazards due to lack of stringent safety procedures and standards at work place.⁸ Health care workers especially in the cadre of nurses and paramedical workers are potentially at a higher risk of exposure to needle stick injuries and percutaneous exposure to HIV transmission.^{6,7} The average risk of acquiring HIV after a percutaneous exposure to blood is about 0.3% and 0.09% to mucous membrane.^{7,10}

To prevent the transmission of the virus after an exposure and to minimise the development of the disease subsequent to the exposure, Post Exposure Prophylaxis (PEP) must be followed.^{8,9} The PEP process includes first aid, counselling, risk management, relevant laboratory investigations, followed by a short course of Anti-Retroviral Therapy (ART) for 28 days along with a follow-up evaluation.⁸⁻¹⁰ PEP is said to prevent 81% of the seroconversion, and currently is the only resource available to reduce the risk of acquiring HIV.¹⁰ However, The Euro Surveillance reports that between 1999 and 2002 there were 24 cases who were found out to be seropositive, even after PEP uptake.¹¹

Recognizing this threat, adequate knowledge about the presence of PEP against HIV is imperative for Health care workers due to higher risk of acquiring blood borne infections.⁶⁻¹⁰ Thus, this Study focuses on to estimate and compare the difference in knowledge and practice of post exposure prophylaxis against HIV among nurses and paramedical workers in a tertiary care hospital in South India.

Subjects and Methods:**Methodology:**

A cross sectional study was conducted between April 2018 and June 2019 among the staff nurses and Paramedical workers at a Tertiary Health Care Hospital in South India after obtaining prior Institutional Human Ethics committee clearance and as per GCP guidelines.

Data collection and procedure:

About 339 staff nurses and 66 paramedical workers employed at the tertiary care hospital were included in the study after obtaining consent from the participants. Confidentiality of the study participants was maintained. A pretested semi-structured questionnaire obtained from the work done by Amind et al along with some questions designed in alignment with NABH guideline on PEP against HIV was used for data collection.

The questionnaire included 16 questions on knowledge of the participants about the prevalence of PEP (questions like if they have ever heard of PEP; source of knowledge; if they ever had training on PEP; if they were aware of the hospital policy for HIV; what to do in case of exposure, indication, drugs and drug regimen for PEP for HIV) and 12 questions addressing their practice (whether they consider themselves to be at a risk of HIV acquisition at their work place; if they ever had occupational exposure to HIV in the past; what type of exposure; how many exposures they had in 12 months; circumstances of the exposure; did screening / test for HIV; if no, why not; have they received PEP after exposure; what was the time lapse from exposure to which PEP was received after exposure; reasons for

not receiving PEP; post exposure screening of the source exposure; what was the HIV status of the exposure). The questionnaire does not include the name of the staff nurse or other personal identifiers.

Scoring and knowledge of the participants:

Each question contains equal marks and the knowledge is judged on the following basis:

- More than or equal to 12 correct responses (≥ 75%)- Good knowledge
- 8-11 correct responses (50-69%)– Average knowledge
- Less than or equal to 7 correct responses (<50%) – Poor knowledge

Analysis:

The data was analysed using SPSS software version 24. The descriptive analysis was summarised as frequencies, percentages, mean and standard deviation. The statistical tests used to compare the knowledge between nurses and paramedical workers was Chi-square test. p value <0.05 was considered statistically significant.

Results:

Out of 405 participants, 339 (83.7%) were nurses and 66 (16.3%) were paramedical workers. The mean age was 34.2±8.6 years with a range of 21 and 44 years. Most of the participants (65% nurses and 72.3% paramedical workers) were in the age group between 20-30 years. About 3/4th of the staff nurses (74.9%) and paramedical workers (75.8%) belonged to 1-5 years of service period. (Table 1).

Table1. Sociodemographic details

Variables		Nurses n=339 (%)	Paramedical workers N=66 (%)
Age	20-30 years	220 (65)	47(72.3)
	30-40 years	93 (27.3)	12(24.1)
	40-50 years	26(7.7)	7(4.6)
Sex	Females	254(75.8)	21(31.3)
	Males	81(24.2)	45(69.7)
Length of service	6-12months	74(22.1)	10(16.3)
	1-5 years	216(64.9)	38(57.8)
	>5 years	49(13.5)	18(27.2)
Marital status	Married	91(27.1)	17(24.2)
	Unmarried	248(72.9)	49(75.8)
Health insurance	yes	23(7.4)	3(4.5)
	No	316(92.6)	63(95.5)
Socioeconomic status	Middle class	294(87.6)	57(87.9)
	Lower middle class	45(12.4)	9(12.1)

Values are expressed as frequency and percentages.

Awareness of PEP was higher among the nurses (325 [95.9%]) than paramedical workers (56 [84.8%]). Majority of the study participants, stated their source of knowledge to be PEP training and had a good knowledge about how soon PEP must be followed after a needle stick injury. All the nurses (100%) who participated in this study were aware about 'washing thoroughly with soap and water' as a first aid measure after needle stick injury while only 2 of the 66 paramedical workers answered otherwise. A large number of study participants had poor knowledge about the duration and the ideal drug regimen of PEP to be followed and about if antiseptics have to be used after an exposure to needle stick injury. Amongst the minority that answered correctly, the nurses had an edge over the paramedical workers. (Table 2).

Table2. Knowledge about PEP against HIV among nurses and paramedical workers

Variables	Responses	Nurses n=339 (%)	Paramedical workers n=66 (%)
-----------	-----------	---------------------	---------------------------------

Have you ever heard about PEP?	Yes	325(95.9)	56(84.5)	
	No	14(4.2)	10(15.2)	
	Source of knowledge (multiple responses)	Newspapers /journals	0(0)	0(0)
		Radio	0(0)	0(0)
		Television	0(0)	0(0)
		Seminar/workshop	22(6.5)	4(6.1)
		Ward rounds	260(23.3)	14(21.2)
PEP training		223(65.8)	38(57.6)	
Can't remember	1(0.3)	5(7.6)		
Aware of hospital's PEP policy?	Yes	328(96.8)	61(92.4)	
	No	11 (3.2)	5(7.6)	
Have you had ever had training on PEP?	Yes	223(65.8)	38(57.6)	
	No	116(34.2)	32(42.4)	
How soon after a needle prick injury should PEP be followed	Within 1 hour	337 (99.4)	64(97)	
	After 72 hours	1(0.3)	1(1.5)	
	Don't know	1(0.3)	1(1.5)	
Which of the following fluids are at a higher risk of transmission of HIV? (multiple answers acceptable)	Breast milk	212(62.5)	40(60)	
	Urine	21(6.2)	5(7.6)	
	Peritoneal fluid	11(3.2)	2(30)	
	Saliva	94(27.7)	19(28.8)	
	Pleural fluid	07(2.06)	1(1.5)	
	Cerebrospinal	9(2.6)	3(4.5)	
	Feces	3(0.8)	1(1.5)	
Synovial fluid	4(1.1)	0(0)		
Indication for initiation of PEP (multiple answers acceptable)	Needle prick injury	308(90.9)	60(90.9)	
	Splashing of blood/body fluid on Mucosa	33(9.7)	5(7.6)	
	Rape	4(1.2)	0(0)	
	Infants born with HIV	13(3.8)	1(1.5)	
First aid measure to institute following a needle stick injury	Promotive active bleeding of the wound	0(0)	2(1.5)	
	Wash thoroughly with soap and water	339(100)	64(98.5)	
	Don't know	0(0)	0(0)	
Are you supposed to apply antiseptics /skin washes after an exposure to clean the surrounding area?	Yes	220(64.9)	42(63.6)	
	No	119(35.1)	24(36.4)	
Are you supposed to squeeze the wound to let it bleed?	Yes	125(36.8)	25(37.9)	
	No	214(63.2)	42(62.1)	
What Is the ideal HIV-PEP regimen following needle stick injury?	One drug regimen	51(15)	10(15.2)	
	Two Drug regimen	57(16.8)	9(13.3)	
	Expanded three drug regimen	173(51)	33(50)	
	Don't know	58(17.1)	13(19.7)	

Which of the following drugs are used in PEP? (multiple answers acceptable)	Zidovudine	261(77)	50(75.8)
	Glimepiride	0(0)	0(0)
	Jevirapine	31(9.1)	6(9.1)
	Lamivudine	64(18.9)	10(15.2)
	Levimasole	1(0.3)	0(0)
	Stavudine	0(0)	0(0)
	Famotidine	7(2.1)	1(1.5)
Duration of PEP	Nevirapine	0(0)	0(0)
	For life	11(3.2)	2(3)
	4 weeks	114(36.6)	24(36.4)
	28 weeks	0(0)	5(7.5)
When is the expanded three drug regimen used?	6 months	212(62.5)	39(59.1)
	When the status of the source is clinically symptomatic and it is a moderate to severe exposure	180(53.1)	34(51)
	When the status of the exposure is clinically asymptomatic and it's a mild exposure	51(15)	12(18.2)
	Expanded 3 drug regimen is an ideal HIV-PEP regimen and should be given to anyone who is exposed to HIV	108(31.9)	19(28.5)
When the source is unknown	0(0)	0(0)	
	0(0)	0(0)	
What is the proportion of needle prick injury results in HIV?	1/100	33 (9.7)	7(10.6)
	1/500	15(51)	10(15.2)
	3/1000	124(36.6)	25(37.9)
	Don't know	105(31)	21(21)
Should the source be screened for HIV?	Yes	295(87)	57(86.4)
	No	44(13)	9(13.6)

Values are expressed as frequency and percentages. About 65.4% of the study participants had a good level of knowledge, higher among nurses (71.1%) compared to paramedical workers (36.3%). An overall significant difference (p < .001) in Knowledge between the nurses and paramedical workers was present. (Table 3).

Table 3. Level of Knowledge and Comparison about PEP against HIV between nurses and paramedical staffs:

Level	Nurses n = 339 (%)	Paramedical workers n = 66 (%)	Total %	p
Good (≥75%)	241(71.1)	24(36.4)	265(65.4)	< .001*
Average (50-75%)	74(21.8)	28(42.4)	102(25.2)	
Poor(<50%)	24(7.1)	14(21.2)	38(9.4)	

Values are expressed as frequency and percentages. *Chi-square test: p < .001 = significant.

Our study shows a higher incidence of nurses being susceptible for occupational exposure to HIV (52[15.3%]) compared to the paramedical workers (7[10.6%]). Approximately 85.3% of the nurses

had encountered exposure through needle prick while giving injections. On the other hand, majority of the paramedical workers (57.1%) were exposed during collection of blood samples. Out of which 12 (23.1%) of the nurses and 2 (28.6%) of the 7 paramedical workers had screened for HIV. On questioning their reason for not screening for HIV, majority of these participants (26 [65%]) nurses and (4 [71.4%]) paramedical workers assumed the patient to be HIV negative. (Table 4).

Table 4. Practice of PEP against HIV among Nurses and Paramedical workers

Variables	Responses	Nurses n (%)	Paramedical workers n (%)
Do you consider yourself to be at a risk of HIV acquisition at your work place? (n=339,66)	Yes	339 (100)	65 (98.5)
	No	0 (0)	1 (1.5)
Have you ever had occupational exposure to HIV in the past? (n =52,7)	Yes	52 (15.3)	7 (10.6)
	No	287 (84.7)	59 (89.4)
What type was it? (n=52,7)	Needle prick	49 (95.1)	6 (85.7)
	Splashing of blood/body fluid on mucosal surfaces	2 (2.8)	1 (14.2)
	Both needle prick and splashing of	1 (2.1)	0 (0)
How many exposures have you had in 12 months? (n=52,7)	1	38 (73.1)	6 (85.7)
	2-3	14 (26.9)	1 (14.3)
	>5	0 (0)	0 (0)
What were the circumstances of exposure? (multiple answers accepted) (n=52,7)	Setting up IV line	20 (38.5)	0 (0)
	During surgery	8 (15.7)	0 (0)
	Giving injections	43 (84.3)	4 (57.1)
	Collecting blood samples	28 (53.8)	6 (85.7)
	Recapping	28 (54.9)	3 (42.7)
	During delivery	2 (2.8)	0 (0)
If you ever had occupational exposure to HIV, did you screen or test for HIV? (n=52,7)	Other	0 (0)	0 (0)
	Yes	12 (23.1)	2 (28.6)
If no, why did you not test for HIV? (n=40,5)	No	40 (76.9)	5 (71.4)
	Not aware	11 (27.5)	1 (20)
	Assumed patient was HIV negative	26 (65)	4 (71.4)
	Other reasons	3 (18.5)	0 (0)
Did you receive PEP after exposure? (n=52,7)	Yes	12 (23.1)	1(14.3)
	No	40 (76.9)	6 (85.7)
What was the time lapse from exposure to which PEP was received after exposure? (n=12,1)	<24 hours	8 (66.6)	1 (100)
	>24 hours	4 (33.3)	0 (0)
Reasons for not receiving PEP? (n=40, 6)	Not necessary	6 (15)	1 (16)
	ARVs not available	0 (0)	0 (0)

	Source of HIV was negative	22 (55)	2 (33.3)
	Not aware of need to take PEP after exposure	0 (0)	2 (33.3)
	Not aware of the hospital protocol concerning PEP at the time.	12 (30)	1 (16)
Post exposure screening of the source exposure? (n=52,7)	Screened	34 (65.4)	3 (42.9)
	Not screened	18 (34.6)	4 (57.1)
What was the HIV status of the exposure? (n=34,3)	Positive	12 (35.5)	1 (33.3)
	Negative	22 (64.7)	2 (66.6)

Discussion:

Abiding to universal health precautions and safe injection practice are pertinent in primary prevention against HIV among healthcare workers. However adequate knowledge about the Post Exposure Prophylaxis (PEP) regimen against HIV is imperative following occupational exposure. Periodic assessment about the knowledge about PEP among healthcare workers enables us to recognize the problems and efficient ways to improve.

Almost 3/4th of our participants had good knowledge about PEP against HIV, which was much higher compared to the study conducted among Rural Cameroonian Nurses wherein only 1/4th of the participants had good knowledge about the same.¹⁰ Majority of our study participants had known about PEP for HIV (95.9% nurses). PEP training (65.8%) was the main source of knowledge for participants in our study. This is at variance of findings from a study conducted by Aminde et al, whose participants learnt about PEP from ward rounds.¹⁰ All but 2 nurses (99.4%) knew how soon PEP was to be initiated following needle stick injury. Our findings are higher than those obtained in a study carried out in Mumbai wherein 64% of the participants correctly stated the time for initiation.²⁰ All the nurses who were part of our study identified the correct first aid method to institute following a needle prick injury, that is, to wash thoroughly with soap and water. This is much higher compared to findings of a study conducted amid interns of a medical college in West Bengal wherein 84.6% of the study participants answered correctly.¹² The knowledge observed in our study is most likely due to regular NABH training sessions and lectures on occupational exposures held by the hospital management, their work experience gained through ward rounds and also to their self-awareness.

In spite of regular training sessions, a large number of the nurses participated in the study (64.9%) did not know antiseptics could cause more damage to the skin and on the contrary the interns who participated in the study in West Bengal had better knowledge in this regard.¹² This poor knowledge might be due to informal source of information gained among the study participants.¹⁰

Although three-fourth of the participants were able to correctly identify breast milk as a high risk fluid, they were not able to identify other non blood high risk fluids. Unlike results obtained in the study conducted amongst Cameroonian nurses, more than four-fifth of the participants in our study could not identify the high risk fluids for HIV transmission correctly.¹⁰ In our study only one-third of the participants were able to identify the correct duration of PEP whereas less than one-third of the participants in the Cameroonian study were able to identify the same. ¹⁰ These facts alert us to improve our training sessions on PEP against HIV to be in-depth and paced at regular intervals and to enhance their knowledge on antiviral drugs by the Hospital Antibiotic Policy Committee.

All the nurses considered themselves to be at risk of acquiring HIV at their work place with 52 of them (15.3%) admitted to have experienced such exposure in the past. This is lesser when compared to the 61% exposure reported in a study conducted in Army college of dental Sciences in India.⁷ Thus, this may be attributed to higher awareness or even low reporting rates due to high patient load and long working hours may be the other contributing factor.^{22,23}

Consistent with the findings of Chulalongkorn university and Gupta et al, in India the circumstances of exposure included recapping needles as well as setting up intra-venous lines.^{18,19} Although the rate of occupational exposure is low among our participants, only 12 (23.1%) out of the 52 exposed received PEP which was similar to the study conducted in Lagos University.⁶ Two third of the participants received PEP within 24 hours, wherein in a study conducted by Aminde et al only half of the participants received PEP within 24 hours.¹⁰ Among those exposed, 3/4th of the participants took PEP screening of the exposure which and in comparison only 1/4th of participants took PEP screening for HIV in a study overseen by Prasuna et al.²¹ The reason behind majority of our study participants not screened for HIV following exposure are the sources of exposure were HIV negative and also negligence about the hospital protocol concerning PEP at that time.

Conclusion:

This study revealed a low-level practice of HIV PEP among staff nurses and paramedical workers despite their good knowledge. Moreover, there is a huge gap between the knowledge and practice of PEP among nurses and paramedical workers. This can be improved by providing formal training sessions to all the health care workers and other strategies such as hanging posters in every ward regarding proper guidelines toward utilisation of PEP and establishing a 24 hours accessible PEP centre.

Financial support and sponsorship: Nil.

Conflicts of interest: There are no conflicts of interest.

Acknowledgment: We would like to thank our Medical Superintendent for giving us permission to conduct the study and also the Department of Community medicine for technical support.

References:

- Mehra B, Bhattar S, Bhalla P, Rawat D. HIV/AIDS awareness among VCT clients: a cross-sectional study from Delhi, India. *BioMed Research International*. 2014;2014:269404.
- HIV/AIDS [Internet]. World Health Organization. 2018 [cited 12 January 2018]. Available from: <http://www.who.int/gho/hiv/en/>
- HIV and AIDS in India [Internet]. AVERT. 2017 [cited 2018Jan13]. Available from: <https://www.avert.org/professionals/hiv-around-world/asia-pacific/india>
- State fact sheet 2013-2014 [Internet]. 2018 [cited 13 January 2018]. Available from: http://naco.gov.in/sites/default/files/State_Fact_Sheet_2013_14.pdf
- CDC in India [Internet]. 2015 [cited 12 January 2018]. Available from: <https://www.cdc.gov/globalhealth/countries/india/pdf/india.pdf>
- Ajibola S, Akinbami A, Elikwu C, Odesanya M, Uche E. Knowledge, attitude and practices of HIV post exposure prophylaxis amongst health workers in Lagos University Teaching Hospital. *Pan Afr Med J*. 2014;19:172.
- Bindra S, Ramana Reddy KV, Chakrabarty A, Chaudhary K. Awareness About Needle Stick Injuries and Sharps Disposal: A Study Conducted at Army College of Dental Sciences. *J Maxillofac Oral Surg*. 2014;13(4):419–424.
- Mashoto K, Mubyazi G, Mushi A. Knowledge of occupational exposure to HIV: a cross sectional study of healthcare workers in Tumbi and Dodoma hospitals, Tanzania. *BMC Health Serv Res*. 2015;15(1):29.
- Mathewos B, Birhan W, Kinfe S, et al. Assessment of knowledge, attitude and practice towards post exposure prophylaxis for HIV among health care workers in Gondar, North West Ethiopia. *BMC Public Health*. 2013;13:508
- Aminde LN, Takah NF, Dzudie A, et al. Occupational post-exposure prophylaxis (PEP) against human immunodeficiency virus (HIV) infection in a health district in Cameroon: assessment of the knowledge and practices of nurses. *PLoS One*. 2015;10(4):e0124416.
- Tomkins S, Ncube F. Occupationally acquired HIV: international reports to December 2002. *Euro Surveill*. 2005;10(3):E050310.2.
- Mukherjee S, Bhattacharya A, Biswanath Sharma Sarkar, Goswami DN, Ghosh S, Samanta A. Knowledge and practice of Standard Precautions and Awareness Regarding Post- Exposure Prophylaxis for HIV among Interns of a Medical College in West Bengal, India. *Oman Med J*. 2013 Mar;28(2):141–45.
- Sheth SP, Leuva AC, Mannari JG. Post Exposure Prophylaxis for Occupational Exposure to HIV and Hepatitis B: Our Experience of Thirteen Years at a Rural Based Tertiary Care Teaching Hospital of Western India. *Journal of Clinical and Diagnostic Research*. 2016 Aug, 10(8):OC39–44.
- Park K. Park's textbook of preventive and social medicine. 24th ed. Banarsidas Bhanot Publishers. 2017.

15. Owolabi RS, Alabi P, Ajayi S, et al. Knowledge and practice of post-exposure prophylaxis (PEP) against HIV infection among health care providers in a tertiary hospital in Nigeria. *J Int Assoc Physicians AIDS Care (Chic)*. 2012;11(3):179–183.
16. Agaba PA, Agaba EI, Ocheke AN, Daniyam CA, Akanbi MO, Okeke EN. Awareness and knowledge of human immunodeficiency virus post exposure prophylaxis among Nigerian Family Physicians. *Niger Med J*. 2012 Jul;53(3):155–60.
17. Bandalier E. Occupational exposure to hospital employees in Italian hospitals over 5.5 years. London: AstraZeneca group; 2003.
18. Wiwanitkit V. Needle stick injuries during medical training among Thai pre-clinical year medical students of the Faculty of Medicine, Chulalongkorn University. *J Med Assoc Thai*. 2001;84(1):120–24.
19. Gupta A, Anand S, Sastry J, et al. High risk for occupational exposure to HIV and utilization of post-exposure prophylaxis in a teaching hospital in Pune, India. *BMC Infect Dis*. 2008;8:142
20. Chogle NL, Chogle MN, Divatia JV, Dasgupta D. Awareness of post-exposure prophylaxis guidelines against occupational exposure to HIV in a Mumbai hospital. *Natl Med J India*. 2002;15(2):69–72.
21. Prasuna J, Sharma R, Bhatt A, Arazoo, Painuly D, Butola H, et al. Occurrence and knowledge about needle stick injury in nursing students. *J Ayub Med Coll Abbottabad* 2015;27(2):430-33.
22. Madhavan A, Asokan A, Vasudevan A, Maniyappan J, Veena K. Comparison of knowledge, attitude, and practices regarding needle-stick injury among health care providers. *Journal of Family Medicine and Primary Care*. 2019;8(3):840.
23. Jahangiri M, Rostamabadi A, Hoboubi N, Tadayon N, Soleimani A. Needle Stick Injuries and their Related Safety Measures among Nurses in a University Hospital, Shiraz, Iran. *Safety and Health at Work*. 2016;7(1):72-77.
24. Nag V, Hada V, Saurabh K, Sharma A, Gadepalli R, Maurya A. Nursing students: A vulnerable health-care worker for needlesticks injuries in teaching hospitals. *Journal of Family Medicine and Primary Care*. 2018;7(4):717.