Original Article

Epidemiological Data of Occupational Exposure to HIV amongst Health Care Professionals who received Post-exposure Prophylaxis at a Health Care Centre at Nagpur

Milind Bhrushundi[1]

ABSTRACT

Introduction : High number of People living with HIV (PLHIV) in the state, put Health Care Professionals (HCPs) at risk of contracting the disease through occupational injuries. Still there is lack of data from the state on epidemiology of factors associated with occupational exposure to HIV among HCPs requiring Post-exposure Prophylaxis (PEP).

Materials and Methods : In this retrospective observational study, which was conducted at a Private healthcare centre at Nagpur, record of all 153 HCPs, who received PEP, was collected from 2009 to 2016 as per the protocol based on NACO recommendations. Descriptive analysis was done of collected data in the form of frequencies and percentage.

Results : Among the study population, 53% were women. 61% HCPs were from the age group 21-30 years. Nurses (32%) and resident doctors / interns (22%) were at higher risk as they required and received PEP the most. The most accident-prone modes of exposure were IV line securing / injection (34%) and recapping of needle (23%). 92% of exposed HCPs reported injury within first 72 hours. In 81% HCPS receiving PEP, HIV status of source patient was known to be positive at the time of accidental exposure. Out of these, 27% were having CD4 + count less than 200 cells/mm 3.78% HCPs who received PEP completed all follow up schedules and none of them had sero-conversion.

Discussion : HCPs are at higher risk of occupational exposure to HIV. Nurses and resident doctors/ interns are particularly at greater risk as they work in close contact with patients' blood and body fluids. Needle-stick injuries are the commonest form of occupational accidents especially through recapping of needle and IV line setting. Awareness among HCPs regarding occupational injuries seemed to be fair as majority of study population reported within 72 hours of accidental exposure. PEP course seemed to be effective as none of the PEP recipients showed sero-conversion.

Conclusion : Despite fair awareness of occupational injuries to HIV source, the occurrence of avoidable practices like needle-stick injuries was found to be most prevalent. This warrants the need for better training, stress management and safety practices in health care set up.

Introduction :

The pandemic of Human Immunodeficiency Virus / Acquired Immunodeficiency Syndrome (HIV / AIDS) in its third decade has blown into a major public health problem of enormous size.[1] Globally, India has the third largest HIV epidemic. Prevalence of HIV, in 2013, was estimated to be 0.3%. Though India is categorized as a low HIV prevalence nation but considering 120 crore Indian population this equates to 22.1 lakh people living with HIV. An estimated 130,000 people died from AIDS-related illnesses in 2013.[2] Among Indian states, Maharashtra stands second in having highest number of PLHIV (3.01 Lakh) preceded by Undivided Andhra Pradesh and Telangana (3.95 lakh)[3] There is no enough data available on HIV in Vidarbha. According to A study estimated sero-prevalence of HIV infection in tertiary care hospital at Akola (Vidarbha) was 4.5%.[4]

Healthcare Professionals (HCPs) run a risk of infection with HIV after an occupational injury. Approximately 30 lakh percutaneous exposures occur globally among HCPs each year.[5] Average risk for HIV transmission after a percutaneous exposure to HIV-infected blood and to mucous membrane has

[1]Consultant Physician
Lata Mangeshkar Hospitals, Nagpur

Address for Correspondence -
Dr. Major Milind Bhrushundi
E-mail : bmili@yahoo.com

been estimated to be approximately 0.3%[6] and 0.09%[7] respectively. Though episodes of HIV infection after non-intact skin exposure have been documented, the average risk for the transmission by this route is not known but is estimated to be less than that for mucous membrane exposures. The average risk for transmission of HIV after exposure to fluids or tissues other than HIV-infected blood also has not been quantified but is estimated to be lower than that for blood exposures.[8] Medical and nursing students who are at a higher risk of blood-borne infection from unsafe practices 11-33% reported injuries with sharp instruments while on duty.[9] The factors associated with higher risk of HIV transmission are : deeper injuries, visibility of blood on the sharp device, a procedure involving a needle that was in the source patient's artery or vein. Though the absolute risk of HIV transmission appears to be small, the occupational injury often induces stress and anxiety in exposed individuals.[10]

Post-Exposure Prophylaxis (PEP) comprises of administering a short course of Anti-Retroviral Therapy (ART) to lessen the probability of sero-conversion following exposure to HIV. A combination of drugs with activity at different stages in the viral replication cycle may offer a greater preventative effect in PEP. Largely, PEP process encompasses first aid, counselling, risk assessment, relevant laboratory investigations with the consent of the exposed individual and source, followed by administration of a short course of ART for a period of 28 days with monitoring.[11,12] PEP is believed to prevent sero-conversion by as much as 81%.[13] Rapidity of thought and act is critical as the space for opportunity to prevent systemic viral dissemination is tiny. Based on these outcomes, CDC (Centre for Disease Control) and NACO (National AIDS Control Organization) recommended the use of PEP program to prevent HIV sero-conversion which was adopted and adapted at our centre.

Despite the high number of PLHIV in Maharashtra, which places HCPs at a high risk of contracting HIV at their work places, there is little data available of occupational exposure to HIV. There is dearth of appropriate documentation showing the extent of PEP use among HCPs following exposure. This study assessed use of PEP and its associated factors among HCPs at Nagpur region of Maharashtra with a belief that interpretations of this study, will be beneficial not only to HCPs in enhancing their awareness about PEP but also to establish an effective local planning for care, treatment and preventive strategies.

Materials and Methods :

Study Design and Setting **-** This was a retrospective observational study. It was done at Private hospital situated at Nagpur.

Study Duration and Study Population **-** In the present study, records of exposed HCPs were maintained starting from 2009 to 2016. 153 such exposed HCPs received PEP during this period.

Data Collection and analysis **-** The data was collected as per the protocol developed for the study which was largely based on the guidelines given by NACO[14,15] and CDC[16,17]

Based on guidelines, till 2014-15 PEP regimen was decided according to Exposure Code (EC) and Source code (SC). Basic regimen containing two drugs, Zidovudine (ZDV) and Lamivudine (3TC) or Tenofovir (TDF) and Lamivudine (3TC), was offered to mild (EC2 SC1 or EC1 SC2) exposure. Expanded regimen containing three drugs combination i.e. TDF / 3TC or ZDV / 3TC and a Protease inhibitor Lopinavir and ritonavir was offered to severe (EC2 SC2 and more) exposure. During later years Exposed individuals were given TDF / Emtricitabine (FTC) + raltegravir for 28 days (CDC recommendations) or TDF/FTC + Efavirenz (EFV) (NACO recommendations). Expert consultation was considered for complex cases. While starting PEP regimen the details which include ART regimen of source patient, adherence and drug failure were taken into consideration.

Demographic and clinical data were collected. A risk assessment was performed after taking into account the mode of injury, the HIV status of the source patient, the HIV viral load of the source patient and the circumstances surrounding the injury

(the depth and extent of injury etc) as per the recommendations. This was done on a one-on-one basis for all exposed HCPs. Based on the results of the assessment, the level of risk of the exposure was assessed and the decision was made to initiate PEP (basic or expanded) for 28 days as per guidelines.[14-17] Appropriate regimens were considered depending upon the Exposure and status code of source patient, type of regimen and failure status.

Further, the data on Adherence and completion of PEP course, follow-up status and final outcome of HIV testing was also recorded. Individuals with > 95% adherence to therapy were labelled as 'adherent' and those who missed doses or discontinued therapy due to adverse Drug Reactions (ADRs) were defined as 'non-adherent'. ADRs observed were recorded as per DAIDS grading system.[18] Repeat testing for HIV of exposed HCP was done at six weeks, three months and six months. Descriptive analysis was done of collected data in the form of frequencies and percentage.

Ethical clearance - Institutional Ethics Committee approval was taken. This being a retrospective study, waiver of consent was considered by Ethics Committee. Confidentiality of source patients and exposed HCPs was sustained at all levels.

Results :

1. ***Characteristics of HCPs started on PEP :*** Among 153 exposed HCPs, 72(47%) were men and 81(53%) were women.

   Majority (61%) exposed HCPs were from age group of 21-30 years. Only 1 (<1%) HCP was below the age of 20 years and 3% were above the age of 50 years.

   Figure 1 shows that nurses at the highest risk as 32% of exposed HCPs were nurses who were started on PEP after accidental exposure followed by Resident doctors / interns (22%) other health care professionals (20%) and General practitioners (GPs) (13%). While Gynaecologists and Dentists were at least risk as only 1% of them were started on PEP post- risk analysis.

2. ***Exposure Description : Figure 2*** depicts the risk of accidental exposure involved with various modes (practices) in health care set up. The commonest mode which made 34% HCPs to start on PEP was during setting up IV line/ injection in patients. 23% of HCPs seek PEP following exposure to HIV during recapping of needles, while 12% were initiated with PEP after accidental exposure to infected spills from source patients. Least chances of accidental injuries was found to be with procedures like blood sample collection (1%), FNAC procedure (3%) and exposure to splash during surgery or delivery. All needle-stick injuries among HCPs counted for 73% (111) and others were 27% (42).

Figure 1 : **Occupation of the exposed HCPs**

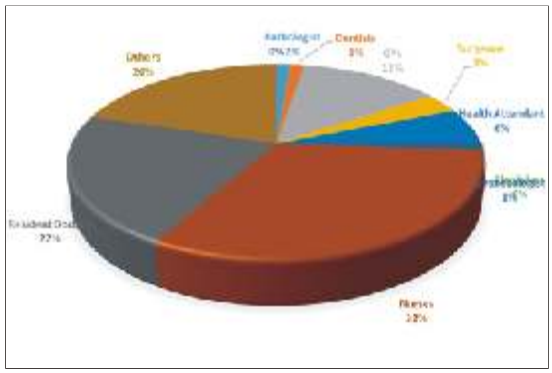
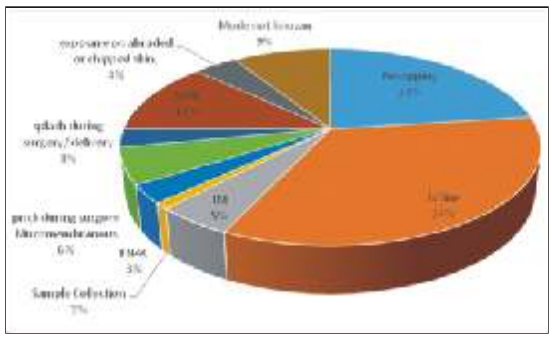
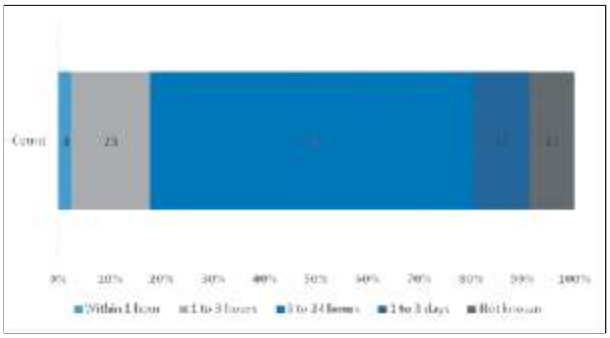


Figure 2 : **Mode (incidence) of exposure to HIV**



Even being in a healthcare profession, variability in time to report the accidental injury was seen among the exposed HCPs which is shown in ***Figure 3.*** 63% (96) exposed HCPs who received PEP succeeded in reporting the accident within 24 hours of the exposure. 92% (140) actually reported the injury and started on PEP within 72 hours of accidental exposure while only 8% (13) took more than 72 hours to report.

Figure 3 : **Time to report HIV clinic post-exposure**

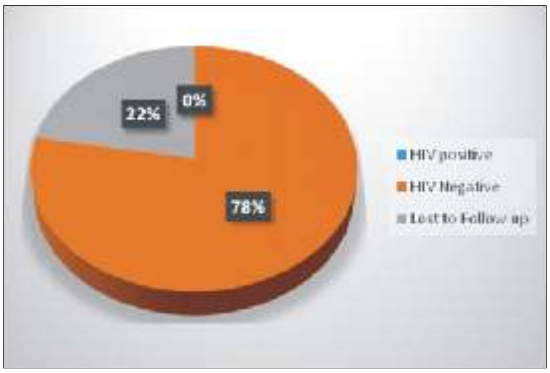


3. ***Source Description :*** Out of all 153 HCPs who received PEP, 81% (124) accidental exposures occurred from known HIV positive sources while in 19% accidents HIV status of the source was not known at the time of exposure but became evident only when source patient was tested for sero-status after the occupational exposure.

   Out of 124 HIV+ sources, 27% (33) were with CD4+ count less than 200 cells/mm^3 while 13% (16) source cases were having CD4+ count more than 500 cells/mm^3.

4. ***Final outcome : Figure 4*** depicts, at the end of 6 months of follow-up, no exposed HCP was found to be HIV positive. 119 (78%) exposed HCPs found to be HIV negative at the end of follow-up period while 34 (22%) were lost to follow up.

Figure 4 : **Outcome of HIV testing at the end of follow-up period**



Discussion :

Maharashtra is the state with estimated HIV prevalence (0.44%) which is greater than national prevalence (0.26%). This places the HCPs in Maharashtra professionally at major risk. Ironically, only a few studies have been published on occupational exposures in HCPs who received PEP. With an attempt to generate local data which would be of help in enhancing awareness, planning strategies and assessing impact of PEP among exposed HCPs, this study was planned.

Nurses have a major caring role that brings them in close contact with patients' blood and body fluids. In our study, among the HCPs, highest 49 (32%) nurses received PEP. Hence, proper understanding of their professional behaviour is essential to evaluate and decrease the occupational exposure to HIV among them. This is in sync with few other studies who also found nurses at highest risk of acquiring occupational injury.[20-22]. A study conducted on HCWs (Health care workers) in Pune, great number of exposure reported among resident doctors (22.8%).[23] Almost similar number (22%) of residents / interns also exposed to HIV and received PEP in our study. Data from a large study of US residents found that stretched work duration and night work among internsis associated with increased risk of percutaneous injuries.[24] This may be due to their inexperience in practical procedures. Clarke *et al*. in their study, found that the likelihood of ever having a needle-stick injury was inversely related to years of experience.[25] According to our study, least number of Gynecologists (1%) were exposed to Occupational injury to HIV which is contradictory to the finding of the study conducted in 1955 HCWs in Pune where nearly half of the reported exposures came from the Medicine and Obstetrics / Gynecology departments.[23] This can be explained in a way as the above mentioned study collected data department-wise and was conducted in a teaching institute where resident doctors and interns constituted a major part of study population who do the most of the sample collections and other intervention-related work while our study had included consultant Gynecologists (who usually have trained staff for sample collection and routine innterventions) and resident doctors / interns separately.

In current study, commonest mode which caused accidental injury among HCPs was IV line setting up/ injection (34%) followed by recapping of needle (23%). Mode of highest number of exposures was needlestick (73%) in our study. Similar results were also found with a study where needlestick injuries were found to be 75.1%.[23] Further, results of a study in Iran introduced injection / blood sampling, surgical procedures and disposal of either the needle or angio-catheter as the most prevalent causes.[26] While according to a study conducted by Kamali and Motamedi injuries due to recapping were most prevalent[27]

The various reasons for needle-stick injuries being the commonest at workplace can be as follows: firstly, an important line of defence, wearing gloves, is several times bypassed by HCPs, especially by nurses.[28,29] Secondly, majority of the injuries occur not during use of needle itself, but rather during the handling between use and its disposal.[30] Thirdly, physical fatigue due to long work hours and work-related stress can cause such accidents at work place.[29,31,32] This warrants the implementation of better training, stress management and safety practises in health set up.

NACO guidelines recommend that the first dose of PEP should be administered within the first 72 hours of exposure and hence, the reporting of the accident should be as soon as possible.[11] Shokuhi *et al* in their study of 650 HCWs with occupational injury found out that 79.4% of exposed HCWs reported their injury in first 24 hours of injury.[33] Winnie Sin et studied occupational exposure in 1525 HCWs concluded that majority (89.6%) received HIV post-exposure prophylaxis within 24 hours of exposure as they reported early.[34] In present study, maximum 63% HCPs reported their injury within first 24 hours while 92% of total study population reported within 72 hours which points towards the awareness of reporting of occupational injury among HCPs was fair.

In our study, 81% (124) accidental exposures occurred from known HIV positive sources occupational while in 19% accidents HIV status of the source was not known at the time of occupational exposure and became evident only when source patient was tested for HIV with due consent after exposure. Out of 124 HIV positive sources, 27% (33) were with CD4+ count less than 200 cells/mm^3 while 13% (16) source cases were having CD4+ count more than 500 cells/mm^3. This information is of particular importance in evaluating risk of disease transmission to exposed individuals. There is also the need to investigate every occupational exposure for blood borne diseases like HIV, HBV and HCV.

In the current study, 119 (78%) exposed HCPs found to be HIV negative at the end of follow-up period while 34 (22%) were lost to follow up. At the end of 6 months of follow-up, no exposed HCP tested HIV sero-positive. Similar results with PEP regimens were found in other studies also.[13, 35-37]

Conclusion :

HCPs, in particular, nurses and resident doctors / interns are at higher risk of contracting HIV through occupational injuries. Despite fair awareness of occupational injuries to HIV source, the occurrence of avoidable practices like needle-stick injuries was found to be the commonest. This warrants the need for better training, stress management and safety practices in health care set up.

Bibliography :

1. Dash M, Padhi S, Sahu S, Mohanty I, Panda P, Parida B, Sahoo M K. HIV counseling and testing in a tertiary care hospital in Ganjam district, Odisha, India. J Postgrad Med 2013;59:110-4.
2. UNAIDS (2014) 'The Gap Report'.
3. India HIV Estimation (2015) 'Technical Report'.
4. Nitin Arun Ambhore, Poonam C. Sayare, Rajesh P. Karyakarte and Rupali S. Mantri. 2016. Trends of Seroprevalence and Epidemiology of HIV Infection: A Five Year Tertiary Care Hospital Based Study. Int.J.Curr.Microbiol.App.Sci. 5 (11) : 733-740.
5. Pruss-Ustun, A., Rapiti, E., Hutin, Y. Estimation of the global burden of disease attributable to contaminated sharps injuries among healthcare workers. Am J Ind Med. 2005; 48 (6) : 482-90.
6. Bell DM. Occupational risk of human immunodeficiency virus infection in healthcare workers : an overview. Am J Med 1997; 102 (5B) : 9-15.
7. Ippolito G, Puro V, De Carli G; Italian Study Group on Occupational Risk of HIV infection. The risk of occupational human immunodeficiency virus infection in health care workers : Italian multicenter study. Arch Intern

Med 1993;153(12):1451-1458.

8. Kuhar DT et al. Updated US Public Health Service Guidelines for the Management of Occupational Exposures to Human Immunodeficiency Virus and Recommendations for Postexposure Prophylaxis. Infect Control Hosp Epidemiol. 2013; 34 (9) : 875-892.
9. Adefolalu AO. Needle Stick Injuries and Health Workers : A Preventable Menace. Ann Med Health Sci Res. 2014 Jul-Aug; 4 (Suppl 2) : S159-S160.
10. Dufresne MD, Alfandari S, Fontier C, e.a. Tolerance, compliance and psychological consequences of post-exposure prophylaxis in healthcare workers. Int J Std AIDS. 1998; 9 (10) : 591-4.
11. Ministry of Health and Family Welfare : Government of India National AIDS Control Organisation. Management of Occupational exposure including Post exposure prophylaxis for HIV. NewDelhi : NACO; 2009.
12. Mathewos B, Birhan W, Kinfe S, Boru M, Tiruneh G, Addis Z, 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 May 25; 13 (1) : 508.
13. Cardo DM, Culver DH, Ciesielski CA, Srivastava PU, Marcus R, Abiteboul D, Heptonstall J, Ippolito G, Lot F, McKibben PS, Bell DM : A case-control study of HIV seroconversion in health care workers after percutaneous exposure. Centers for Disease Control and Prevention Needlestick Surveillance Group. N Engl J Med. 1997, 337 (21) : 1485-1490.
14. National AIDS Control Organization (IN). Management of Occupational Exposure including Post Exposure Prophylaxis for HIV. New Delhi, India: Ministry of Health & Family Welfare, Government of India; 2009 Jan. Pp: 1-46.
15. National AIDS Control Organization (IN). Antiretroviral therapy guidelines for HIV infected adults and adolescents including post exposure prophylaxis. New Delhi, India : Ministry of Health & Family Welfare, Government of India; 2007 May. Pp:1-136.
16. Centre for Disease Control and Prevention (US). Updated U.S. Public Health Service Guidelines for the Management of Occupational Exposures to HBV, HCV, and HIV and Recommendations for Post exposure Prophylaxis. Morbidity and Mortality Weekly Report. Recommendations and Reports. 2001. Atlanta, GA : Department of Health and Human Services; 2001 June 29. 50 (RR-11) : 1-52.
17. Centers for Disease Control and Prevention (US). Updated U.S. Public Health Service guidelines for the management of occupational exposures to HIV and recommendations for Post exposure Prophylaxis. Morbidity and Mortality Weekly Report. Recommendations and Reports. 2005. Atlanta, GA : Department of Health and Human Services; 2005 Sep 30. 54 (RR-9) : 1-17.
18. Division of AIDS (DAIDS) Table for Grading the Severity of Adult and Pediatric Adverse Events, December 2004. Available : http://rcc.tech-res.com/docs/default-source/safety/table_for_grading_severity_of_adult_pediatric_adverse_events.pdf?sfvrsn=6 last accessed in December 2016.
19. The World Health Report 2002 : Reducing Risks, Promoting Healthy Life. Geneva, Switzerland : World Health Organization; 2002.
20. Mponela J, Oleribe OO, Abade A and Kwesigabo G. Post exposure prophylaxis following occupational exposure to HIV: a survey of health care workers in Mbeya, Tanzania, 2009-2010. Pan African Medical Journal. 2015; 21:32.
21. Wnuk AM. Occupational exposure to HIV infection in health care workers. Med SciMonit. 2003 May; 9 (5) : CR197-200.
22. Kermode M, Jolley D, Langkham B, Thomas MS, Crofts N. Occupational exposure to blood and risk of bloodborne virus infection among health care workers in rural north Indian health care settings. Am J Infect Control. 2005; 33 : 34-41.
23. Gupta A 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.
24. Ayas NT, Barger LK, Cade BE, Hashimoto DM, Rosner B, Cronin JW, Speizer FE, Czeisler CA. Extended work duration and the risk of self-reported percutaneous injuries in interns. JAMA. 2006; 296 : 1055-1062.
25. Clarke SP, Rockett JL, Sloane DM, Aiken LH. Organizational climate, staffing and safety equipment as predictors of needlestick injuries and near misses in hospital nurses. Am J Infect Control. 2002; 30 : 207-16.
26. Vahedi MS, Ahsan B, Ardalan M, Shahsavari C. Evaluation of the prevalence, etiologies and practice of health care workers of Kordestan University of Medical Sciences in injuries caused by sharp objects in 2004. Scientific J Kordestan. 2006; 15 : 43-50.
27. Kamali K, Heravi M. Manual for prevention of HIV, Hepatitis B, and Hepatitis C to health care workers. 1st ed. Tehran: Seda Publishers; pp. 13-15.
28. Askarian M, Malekmakan L. The prevalence of needle stick injuries in medical, dental, nursing and midwifery students at the University teaching hospitals of Shiraz, Iran. Indian J Med Sci. 2006; 60 : 227-32.
29. Sharma R, Rasania S, Verma A, Singh S. Study of Prevalence and Response to Needle Stick Injuries among Health Care Workers in a Tertiary Care Hospital in Delhi, India. Indian Journal of Community Medicine? : Official Publication of Indian Association of Preventive & Social Medicine. 2010; 35 (1) : 74-77.
30. Ebrahimi H, Khosravi A. Needlestick injuries among nurses. J Res Health Sc. 2007; 7 : 56-62.
31. Ilhan MN, Durukan E, Aras E, Türkçüoðlu S, Aygün R. Long working hours increase the risk of sharp and needlestick injury in nurses: The need for new policy implication. J AdvNurs. 2006; 56 : 563-8.

32. Ayas NT, Barger LK, Cade BE, Hashimoto DM, Rosner B, Cronin JW, et al. Extended work duration and the risk of self-reported percutaneous injuries in interns. JAMA. 2006; 296 : 1055-62.
33. Shokuhi S, Gachkar L, Alavi-Darazam I, Yuhanaee P, Sajadi M. Occupational Exposure to Blood and Body Fluids among Health Care Workers in Teaching Hospitals in Tehran, Iran. Iranian Red Crescent Medical Journal. 2012;14(7):402-407.
34. Sin WWY et al. HIVManagement of health care workers following occupational exposure to hepatitis B, hepatitis C, and human immunodeficiency virus. Hong Kong Med J 2016;22:472-7.
35. Li H-C et al. Safety, tolerability and effectiveness of HIV non-occupational prophylaxis in Taiwan. Journal of the International AIDS Society 2014, 17(Suppl 3):19736.
36. Shriyan A, Roche R and Annamma. Incidence of occupational exposures in a tertiary health care center. Indian J Sex Transm Dis. 2012 JulDec; 33(2): 91-97.
37. Sheth SP et al., Post Exposure Prophylaxis for HIV and Hepatitis B. Journal of Clinical and Diagnostic Research. 2016 Aug, Vol-10(8): OC39-OC44.