



# Seroprevalence of Blood-borne Viral Infections in Post HAART Era at a Tertiary Care Hospital in South India: A Five Year Trend Analysis (2008-2012) and a Comprehensive Review

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## Authors' contributions

*This work was carried out in collaboration between all authors. Author KVR designed the study, performed the statistical analysis, wrote the protocol, and wrote the first draft of the manuscript. Other authors managed the analyses of the study and the literature searches. All authors read and approved the final manuscript.*

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## ABSTRACT

**Aim:** Human Immunodeficiency Virus (HIV), Hepatitis B (HBV) and Hepatitis C (HCV) viruses are the major causes of chronic viral infections globally and their prevalence has been extensively reported in the literature in various study groups including general population, health care workers, sex workers, homosexuals, pregnant woman. There are only fewer reports of Seroprevalence in tertiary care centers. We aim to study the trends of such infections in a tertiary care teaching hospital located at South India.

**Study Design:** This is a prospective study conducted over a 5 year period (2008-2012).

**Place and Duration of Study:** Department of Microbiology, Prathima Institute of Medical Sciences, Karimnagar, Andhrapradesh, India from 2008-2012.

**Methodology:** We performed a prospective study of patients presenting at the Prathima institute of medical Sciences, a rural tertiary care teaching hospital over a period of 5-years (Jan 2008 to Dec 2012). Screening for anti-HIV I and 2, HBsAg detection and anti-HCV antibodies test were carried out by commercially available enzyme linked immunosorbent assay (ELISA).

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**Results:** Of the 16796 individuals tested a total of 570 (3.3%) showed seropositivity to one of the three viral infections tested. Among the population tested 258(1.5%) were seropositive for antibodies against HIV-1, and none showed HIV-2 seroprevalence (0%). Prevalence of Hepatitis B and Hepatitis C were found as 305(1.8%) and 7(0.04%) respectively. Co-infection of HIV-1 with Hepatitis B was observed only in 10(0.06%) cases.

**Conclusion:** The present study revealed that there was a slight increasing trend for Seroprevalence of HIV- 1 antibodies among the tested population. Hepatitis B surface antigen Seroprevalence has shown a gradual increase during the last five years. Seroprevalence rates of Hepatitis C viral infection also showed an increasing trend through a five year period.

*Keywords: Human immunodeficiency virus (HIV); hepatitis B virus and hepatitis C virus; seroprevalence; trends; tertiary care centre.*

## 1. INTRODUCTION

Human Immunodeficiency Virus (HIV), Hepatitis B (HBV) and Hepatitis C (HCV) viruses are the major causes of chronic viral infections globally [1]. Transmitted from one person to the other through various modes including sexual, mucosal contact, needle stick injuries, blood and blood product transfusion and from mother to child through transplacental barrier (congenital), these viral infections have become a cause for major health concern both in the developing and developed nations [2]. The Anti viral therapy, though is available for most of these viral infections, the cause of concern is inability to completely clear the virus from blood, chronicity of infections, high transmissibility, the morbidity they cause and unavailability of an approved vaccine (except HBV vaccine). Since the introduction of Highly Active Antiretroviral Therapy (HAART) in 1995, there has been a gradual decrease in morbidity and mortality among HIV seropositive patients [3]. The availability and accessibility of HAART in developing and low socioeconomic countries paved the way for better life expectancy among the HIV infected individuals [3]. Screening for such viral pathogens becomes crucial since it helps us in understanding the burden of such infections. Seroprevalence of HIV, HBV and HCV have been extensively reported in the literature in various study groups including general population, health care workers, sex workers, homosexuals and pregnant women [4, 5, and 6]. Significant reduction in transmission of these blood borne viral infections has been achieved due to screening blood of voluntary blood donors. Risk groups who are predisposed to such viral infections include homosexuals, drug addicts, patients on haemodialysis and thalassemia patients who require frequent blood and blood product transfusions [7, 8]. World Health Organization (WHO) estimates that about 5-7% of the world population is harboring HBV [9]. Based on the prevalence rates of HBV, countries or a region is categorized as high (>8%), intermediate (2-7%) and low (<2%) endemic areas. South-East Asia and South Asia fall in to regions with high and intermediate HBV endemicity respectively [10]. In India the overall HBV prevalence ranges from 2-4.7% [11, 12]. WHO 1999 estimate, shows that 3% of the world population is infected with HCV [13]. Prevalence rates of HCV have been different in various parts of the world. African people are among those with high HCV prevalence (5.3%) and European population reveal lower rates of HCV positivity (1.03%) [14]. Though a national network is available for monitoring the burden of HIV (National AIDS Control Organization (NACO)); we must impress on trends of such infections in various tertiary care centers and compare them with the national scenarios. A thorough literature search revealed that there were only fewer other studies from around the globe that have reported HIV, HBV and HCV Seroprevalence

among the hospital patients [9, 15]. We aimed to study the Seroprevalence and trends of HIV, HBV and HCV viral infections in patients attending tertiary care teaching hospital over a period of 5 years (2008-2012).

## **2. MATERIALS AND METHODS**

### **2.1 Study Design**

This is a prospective study conducted over a 5 year period (2008-2012).

### **2.2 Place and Duration of Study**

Department of Microbiology, Prathima Institute of Medical Sciences, Karimnagar, Andhrapradesh, India from 2008-2012.

### **2.3 Methodology**

We performed a prospective study of patients presenting at the Prathima institute of medical Sciences, a rural tertiary care teaching hospital based general and surgical practice that includes, inpatient, and outpatient surgical consultations and all trauma and emergency services over a period of 5-years (Jan 2008 to Dec 2012). Data collected included, Age, sex, HIV, hepatitis B, and hepatitis C test results. The study was approved by institutional review board and an informed verbal consent was obtained from each study subject.

A total of 16796 study subjects were screened over a five year period to assess the prevalence of infectious disease markers. Year wise distribution of samples included from 2008-2012 were 3735, 2743, 2947, 2947, 3521 and 3850 respectively. All the subjects below 15 years were excluded from the study.

#### **2.3.1 Laboratory Analysis**

Five milliliters of blood was collected from each subject, the blood was allowed to clot and then centrifuged at 1000 rpm for 10 minutes. Screening for anti-HIV I and II was performed based on National AIDS Control Organization (NACO) guide lines where three different ELISA methods (conventional ELISA, Immunocomb and tridot) were performed including immunocomb for confirmation [16]. HBsAg detection and anti-HCV antibody test was carried out by commercially available enzyme linked immunosorbent assay (ELISA) provided by J Mitra and co. Pvt. Ltd. Samples were processed as per the manufacturers' guidelines.

### **2.4 Statistical Methods**

Percentage and analysis of the data was performed using Microsoft word and Excel to generate graphs, tables etc.

## **3. RESULTS AND DISCUSSION**

Of the 16796 respondents tested included 6324(37.6%) out patients (OP) and 10472(62.3%) in-patients (IP). A total of 570(3.3%) showed seropositivity to one of the three viral infections tested. 10,170(60.5%) male and 6,626 (39.45%) females were included in the study. The mean age of the study subjects were 40.5 years with a range of 17 years -85 years. Among

the population tested 258(1.5%) were seropositive for antibodies against HIV-1. None showed HIV-2 seroprevalence (0%). Prevalence of hepatotropic viruses including Hepatitis B and Hepatitis C was found to be 305(1.8%) and 7(0.04%) respectively. Co-infection of HIV-1 with Hepatitis B was observed only in 10 (0.06%) cases. Results revealed an increasing trend in Hepatitis B and Hepatitis C seropositivity over a 5 year period as shown in the Fig. 1.

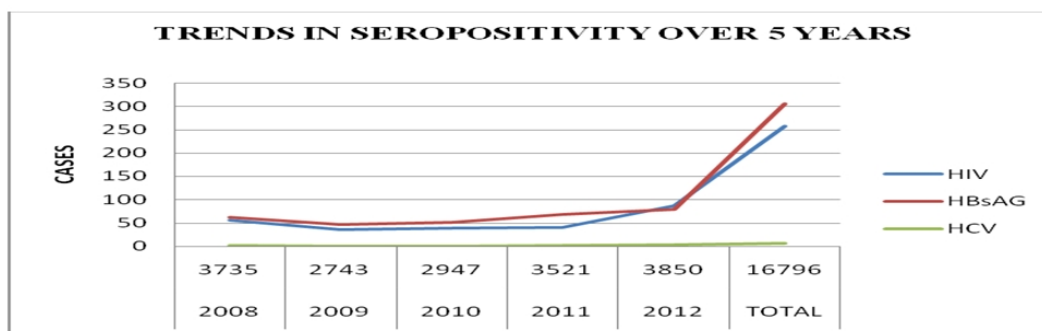


Fig. 1. Graph depicting HIV, HBV and HCV incidences over a 5 year period

Year wise samples and HIV 1, Hepatitis B and Hepatitis C prevalence is shown in Table 1.

Table 1. Year wise distribution of HIV, HBV and HCV incidences over a 5 year period

Year(n)	Inpatients / Outpatients	Total samples tested per year (n)	Sero positive viruses n=570 (3.3%)		
			HIV n (%)	HBV n (%)	HCV n (%)
2008 n=3735	Inpatients	2091	31 (1.4%)	45 (1.6%)	1 (0.05%)
	Outpatients	1644	25	17	1
2009 n=2743	Inpatients	1888	24 (1.3%)	35 (1.6%)	0
	Outpatients	855	12	11	0
2010 n=2947	Inpatients	1980	21 (1.3%)	35 (1.6%)	0
	Outpatients	967	18	15	0
2011 n=3521	Inpatients	2360	31 (1.1%)	55 (1.9%)	0
	Outpatients	1161	9	13	1
2012 n=3850	Inpatients	2153	50 (2.2%)	46 (2%)	3 (0.1%)
	Outpatients	1697	37	33	1
	Total	16796	258 (1.5%)	305 (1.8%)	7 (0.04%)

The present study revealed that there was a slight increasing trend for Seroprevalence of HIV- 1 antibodies among the tested population. Hepatitis B surface antigen Seroprevalence has shown a gradual increasing trend during the last five years. The Seroprevalence rates of Hepatitis C viral infection also showed an increasing trend through a five year period. Hepatitis C viral infection also showed an increasing trend through a five year period. Blood-borne viral infections also known as transfusion transmitted viral infections (TTI's) have been

a cause of concern in the hospitals, though a significant improvement has been achieved regarding the testing methodologies over time. Our study also revealed a low HIV-HBV co-infection (0.06%) and there was neither co-infection with HCV nor a triple infection including HIV/HBV/HCV in the subjects included in the study. The increase in non- HIV virus infection rates can be attributed to policies, which have been more concentrated in dealing with HIV infection and ignoring the other viral infections including HBV and HCV that are even more infectious and can result in chronic infections and severe morbidity in infected populations. Previous studies have been in voluntary blood donors, patients attending Sexually transmitted Disease (STD) clinics, hospital for drug addicts and infertility clinics. Studies have also reported HIV, HBV and HCV infection rates in various patient groups including patients posted for surgeries, orthopedic clinics and pregnant women. Very few studies have reported the prevalence of blood-borne viral infections in tertiary care centers. Our study results showed that overall Seroprevalence (3.3%) was higher when compared to a recent north Indian study which reported a prevalence rate of 2.5%, for HIV(1.24%), HBV(1.56%) and HCV(0.2%). Only 0.8% had co-infection of HIV and HBV and there was no co-infection with HIV and HCV [17]. The rates of HIV-HBV co-infection in our study was low (0.06%) as compared to hospital based study from north India by Swathi et al. (5.32%) who included only HIV seropositive subjects and compared them with blood donors (1.4%) [18]. Ankur et al. in their study which included inpatients in a tertiary care hospital in north India revealed a prevalence rate of 4.04 % for HIV and 1.7% and 1.1% rates of co-infection of HIV with HBV and HCV respectively [19]. A study from south India by Gowri et al. in a tertiary care centre revealed lower rates of HCV Seroprevalence of 0.22% similar to our study (0.06%) [20]. Study from central India by Hardik et al. among thalassaemia patients revealed alarmingly high seropositivity for HIV (9%), HBV (6%) and HCV (18%), which highlights the importance of TTI's in high risk groups who undergo frequent blood transfusions [8]. A recent study from Jammu in north India by Malik et al. which included blood donors revealed significantly lower rates of HBV (0.52%) and HIV (0.12%) infection with zero incidence of HCV [21]. Hussain et al. in their study from north India which included patients attending STD clinic revealed a HIV, HBV and HCV infection at 2.4%, 2.9% and 1% respectively [5]. Co-infection rates of HIV-HBV (0.2%) and HBV-HCV (0.1%) were significantly low and there was no triple infection [5]. Ganesh et al. in their study from south India have included patients with liver disease and normal controls that revealed HIV, HBV and HCV prevalence rates of 5.2%, 9.5% and 5.6% respectively [22]. Only 1.4% among the control population was positive for HBV and all were negative for HIV and HCV [22]. Anupkumar et al. in their study from central India that included tribal population attending STD clinic has shown the prevalence of HIV, HBV and HCV at 0%, 3.4% and 3.9% respectively [23]. Spyros et al. from Greece have evaluated the Seroprevalence of HIV, HBV and HCV among the orthopedic patients and found that 0.1%, 1.7% and 2% prevalence rates respectively [24]. A study from Ethiopia by Tessema et al. in blood donors at a university teaching hospital revealed that 9.5% of them have either of HIV(3.8%), HBV(4.7%) and HCV(0.7%) and 0.8% had multiple infections [25]. Obi et al. in their recent study from Owerri, Nigeria have reported a 23%, 0.2% and 0% prevalence rates for HIV, HBV and HCV respectively among pregnant women attending ante-natal clinic [6]. Ozgur et al. in their study from north Anatolia that included all preoperative patients in a hospital showed prevalence rates of 0%, 3.4% and 1.8% for HIV, HBV and HCV respectively [26]. Denué et al. from Nigeria have studied the Seroprevalence of HBV (12.3%) and HCV (0.5%) among HIV positive patients attending a tertiary health institution [15].

Previous studies in Seroprevalence of TTI's among the blood donors also revealed that the rate of positivity in replacement donors (patient relatives/unknown person obliges on who is not a voluntary donor) was higher than voluntary blood donors. A study by Chatterjee et al.

from North India have demonstrated that the pre conversion seronegativity (Window period) can be minimized by using the advanced diagnostic techniques including the fourth generation serological tests (ELISA) and the nucleic acid tests (NAT) [27]. From the current study as well as a survey of relevant literature it is evident that Transfusion transmitted viral infections are a cause of concern in the hospital as well as to general population. A Scenario where population getting infected with HIV is on decline, there is an increasing trend in the infection rates with hepatotropic viruses including HBV and HCV which should be considered as alarming sign.

#### **4. CONCLUSION**

Existing literature clearly indicates that there is an upward trend in the prevalence rates of hepatitis B and hepatitis C infection as compared to HIV-1 post HAART era among various groups of population. Considering the fact that both these hepatotropic viruses are responsible for chronic infections and severe morbidity and their ability to eventually cause hepatocellular carcinoma, there is urgent needs to develop mechanisms to diagnose such TTI's and initiate measures for control and prevention. Hepatitis B vaccination though is freely available now and has been included in the immunization schedule, the developing and financially poor countries still have minimal access. Health care workers should increase the awareness among the rural and urban population, the significance of such TTI's and initiate preventive measures. Physicians must provide necessary counseling, immunization and treatment to population at high risk including the patients on haemodialysis, thalassaemia patients, other patients requiring repeated blood and blood product replacement therapies, drug addicts, children born to seropositive mothers, health care and emergency medical and public safety workers. Government policies should be aimed at identifying the risk groups and highlighting the importance of supply of safe blood and blood products and ensuring their constant supply, avoiding reuse of syringes, regular and mandatory maternal screening for TTI's to prevent perinatal transmission, extensive immunization programmes, hygiene, improved living conditions, proper nutrition, and access to quality health care.

#### **CONSENT**

All authors declare that 'written/verbal informed consent was obtained from the patient/Patient guardian (in case minor) (or other approved parties) for participation in the study.

#### **ETHICAL APPROVAL**

All authors hereby declare that all experiments have been examined and approved by the appropriate ethics committee and have therefore been performed in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki.

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## COMPETING INTERESTS

Authors have declared that no competing interests exist.

## REFERENCES

1. World Health Organization. The world health report Life in the 21st century: a vision for all: report of the Director-General. Geneva. Hepatitis-B Fact Sheet No. 204. Geneva; 1998. Available at: [http://www.who.int/media\\_centre/fact\\_sheet/fs164/en/](http://www.who.int/media_centre/fact_sheet/fs164/en/) accessed; Hepatitis-C Fact Sheet No. 164. Geneva; Available at: [http://www.who.int/me-dia\\_centre/fact\\_sheet/fs164en/](http://www.who.int/me-dia_centre/fact_sheet/fs164en/) accessed.
2. James Edeh, Pamela Spalding. Screening for HIV, HBV and HCV markers among drug users in treatment in rural south-east England. *Journal of Public Health Medicine*, 2000;22(4):531-539.
3. Madhu Vajpayee and Teena Mohan Current practices in laboratory monitoring of HIV infection Indian. *J Med Res*. 2011;134(6):801–822. doi: 10.4103/0971-5916.92627.
4. Anupkumar R. Anvikar, Vikas G. Rao, Deepali D. Savargaonkar, Yadav Rajiv, Manoj Kumar Bhondeley, Balkrishna Tiwari, Atul Karkare, Canina Luke, Vijay Gadge, Mahendra Ukey, Purushottam Patel. Seroprevalence of sexually transmitted viruses in the tribal population of Central India. *International Journal of Infectious Diseases*. 2009;13:37—39.
5. Hussain T, Kulshreshtha KK, Shikha Sinha, Yadav VS, Katoch VM. HIV, HBV, HCV, and syphilis co-infections among patients attending the STD clinics of district hospitals in Northern India. *International Journal of Infectious Diseases*. 2006;10:358-363.
6. Obi RK, Nwanebu FC, Ohalete CN, Onyemekara NN. A prospective study of three blood-borne viral pathogens among pregnant women attending ante-natal care in Owerri, Nigeria. *Journal of Public Health and Epidemiology*. 2012;4(9):226-229.
7. Nasir A, Todd CS, Stanekzai MR, Bautista CT, Botros BA, Scott PT, et al. Prevalence of HIV, hepatitis B and hepatitis C and associated risk behaviours amongst injecting drug users in three Afghan cities. *Int J Drug Policy*. 2011;22:145–52.
8. Hardik Bhavsar, Kanu Patel, Mahendra Vegad, Molly Madan, Anita Pandey, Ashish Asthana, Kalpesh Mistry. Prevalence of HIV, Hepatitis B and Hepatitis C infection in Thalassemia major patients in tertiary care hospital, Gujarat. *NJIRM*. 2011;2(3):47-50.
9. World Health Organization. Hepatitis B. World Health Organization Fact Sheet 204 (Revised August 2008). Available: <http://who.int/inf-fs/en/fact204.html>.
10. Pankaj Puri, Sharad Srivastava. Lower prevalence of hepatitis B in south asia despite all odds: Bucking the trend of other infectious diseases. *Tropical Gastroenterology*. 2012;33(2):89–94
11. Thyagarajan SP, Jayaram S, Mohanavalli B. Prevalence of HBV in general population in India. In: Sarin SK, Singal AK, editors. *Hepatitis B in India: problems and prevention*. New Delhi: CBS. 1996;5–16.
12. Abraham P. Viral Hepatitis in India. *Clin Lab Med*. 2012; <http://dx.doi.org/10.1016/j.cll.2012.03.003>.
13. WHO. Global surveillance and control of hepatitis C. Report of a WHO Consultation organized in collaboration with the Viral Hepatitis Prevention Board, Antwerp, Belgium. *J Viral Hepat*. 1999;6:35–47.
14. Theodore Sy, M. Mazen Jamal. Epidemiology of Hepatitis C Virus (HCV) Infection. *International Journal of Medical Sciences*. 2006;3(2):41-46.

15. Ballah Akawu Denu, Babajide Ajayi, Abubakar Usman Abja, Abubakar Abdullahi Bukar, Cecilia Akawu, Ernest Ekong and Mohammed Bashir Alkali. A survey of hepatitis B and C virus prevalence in human immunodeficiency virus positive patients in a tertiary health institution in North Eastern Nigeria. *International Journal of Medicine and Medical Sciences*. 2012;4(1):13-18.
16. HIV/AIDS. Epidemiological surveillance and estimation report. National AIDS Control Organization, New Delhi. Available: <http://www.aidsportal.org/repos/Fnlapil08rpt.pdf>
17. Ronald Roche, Shriyan Amrita, Leslie, Ranjana Nayak. Prevalence of the Human Immunodeficiency Virus, the Hepatitis B and Hepatitis C among the patients at a tertiary health care center: A five year study. *Journal of Clinical and Diagnostic Research*. 2012;6(2):623-626.
18. Swati Gupta, Sarman Singh. Hepatitis B and C virus co-infections in human immunodeficiency virus positive North Indian patients. *World J Gastroenterol*. 2006;12(42):6879-6883.
19. Ankur Goyal, Sapna Goyal, Ankit Lal, Arti Agarwal. Very low prevalence of hepatitis B and C co-infection in HIV-positive medical patients in a tertiary care hospital in Agra (UP), North India. *India Journal of Sexually Transmitted Diseases and AIDS*. 2012;33(2):147-148.
20. Gowri V, Chandraleha C, Vanaja R. The current Seroprevalence of Hepatitis C virus in a tertiary care center in Vellore, Tamilnadu. *Indian Journal of Community Medicine*. 2012;37(2):137.
21. Suhail Malik, Sharma PR, Urmil Kanta Verma, Arvind Khajuria, Manzoor Ahmad Wani, BB Sharma. A study of seroprevalence of hepatitis B and HIV in healthy blood donors at a tertiary care hospital in Jammu. *JK-Practitioner*. 2012;17:1-3.
22. Ganesh Kumar Anbazhagan, Sridharan Krishnamoorthy, Thirunalasundari Thiyagarajan. Seroprevalence of HCV and its co-infection with HBV and HIV among liver disease patients of South Tamil Nadu. *World J Hepatol*. 2010;27:2(1):42-48.
23. Anupkumar R. Anvikar, Vikas G. Rao, Deepali D. Savargaonkar, Yadav Rajiv, Manoj Kumar Bhondeley, Balkrishna Tiwari, Atul Karkare, Canina Luke, Vijay Gadge, Mahendra Ukey, Purushottam Patel. Seroprevalence of sexually transmitted viruses in the tribal population of Central India. *International Journal of Infectious Diseases*. 2009;13:37-39.
24. Spyros G. Pneumatos, Christiana Savvidou, Aristotelis Tsiakalos, Nikolaos V. Sipsas. Seroprevalence of HIV, HBV and HCV in orthopaedic patients at a tertiary hospital in Greece. *European Journal of Orthopaedic Surgery & Traumatology*. 2012;22(1):57-60.
25. Tessema, Belay; Yismaw, Gizachew; Kassu, Afework; Amsalu, Anteneh; Mulu, Andargachew; Emmrich, Frank; Sack, Ulrich. Seroprevalence of HIV, HBV, HCV and syphilis infections among blood donors at Gondar University Teaching Hospital, Northwest Ethiopia: declining trends over a period of five years. *BMC Infectious Diseases*. 2010;10(1):111.
26. Özgür Günal, Hüseyin Şener Barut, Ramazan Tetikçok, Nagehan Yıldız Çeltek and Ilker Etikan. Seroprevalences of hepatitis B virus (HBV), hepatitis C virus (HCV) and human immunodeficiency virus (HIV) in preoperative patients admitted to a hospital in Northern Anatolia. *African Journal of Microbiology Research*. 2011;5(31):5669-5673.



27. Chatterjee K, Coshic P, Borgohain M, Premchand, Thapliyal RM, Chakroborty S, Sunder S. Individual donor nucleic acid testing for blood safety against HIV-1 and hepatitis B and C viruses in a tertiary care hospital. *Natl Med J India.* 2012;25:207–9.

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