



## Prevalence of Hepatitis B Co-Infection among HIV Positive Patients: Narrative Review Article

**Azam ASKARI<sup>1</sup>, Hamid HAKIMI<sup>1</sup>, Behzad NASIRI AHMADABADI<sup>1</sup>, Gholamhossein HASSANSHAHI<sup>2</sup>, \*Mohammad KAZEMI ARABABADI<sup>1</sup>**

1. *Immunology of Infectious Diseases Research Center, Rafsanjan University of Medical Sciences, Rafsanjan, Iran*
2. *Molecular Medicine Research Center, Rafsanjan University of Medical Sciences, Rafsanjan, Iran*

**\*Corresponding Author:** Email: dr.kazemi@rums.ac.ir

(Received 21 Oct 2013; accepted 10 Feb 2014)

### Abstract

Hepatitis B virus (HBV) is the most prevalent viral infection and is among the leading causes of human liver diseases. Nearly 360 millions of people are world widely infected with prolonged forms of hepatitis B including active and inactive chronic forms. Chronic hepatitis B (CHB) is associated with cirrhosis and hepatocellular carcinoma (HCC) in patients suffering from congenital and/or acquired immunodeficiency and also following immunosuppressive therapy. The target cell of human acquired immunodeficiency virus (HIV) is CD4 positive T cells. These cells play central role(s) in both cellular and humoral immunity so that the HIV attack of CD4 positive T cells causes suppression of both cell-mediated and humoral immune responses. One of the frequent complications in HIV positive patients is HBV co-infection and as a result, the co-transmission of these viral diseases is common. Due to the paramount importance of the co-infection of HBV and HIV, it is noteworthy to investigate the prevalence of hepatitis B in these patients for planning of an effective therapeutic strategy. Based on these considerations, the main aim of this review article was to collect and analyze the recent and relevant studies regarding the prevalence rate of hepatitis B co-infection among HIV positive patients world widely.

**Keywords:** HIV, Chronic hepatitis B infection, Co-infection

### Introduction

Hepatitis B virus (HBV) is the most important and prevalent infectious agent leading to inflammation of human liver (1, 2). Recent reports stated that 360 millions of people are globally suffering from the chronic forms of HBV infection (CHB) (3). It has been documented that prolonged forms of hepatitis B, including active and in-active CHB, can be considered as major candidates for induction of several complications such as hepatocellular carcinomas (HCC) and cirrhosis (4). In addition to HCC and cirrhosis development, hepatitis B infection is also able to develop active and acute forms of HBV infection in congenital and/or ac-

quired immunodeficiency and also following immunosuppressive therapy (5). Human acquired immunodeficiency virus (HIV) attacks CD4<sup>+</sup>T cells, as critical cells in both cellular and humoral immunity, leading to defective cell-mediated and humoral immune responses (6, 7) and predisposing patients to future infectious diseases (7).

It has been documented that one of the frequent complications of HIV infection is hepatitis B co-infection and due to the common methods of transmission of these two viruses, the incidence rate of co-infection is increasing (8). It has been established that following reduction in the CD4

positive cells count to lower than 200 cells/ml, the immune system of HIV positive patients fails to develop an adequate immune response against microbial agents and as a result re-activation of HBV infection and its related complications will occur (9).

Due to the vital aspects of this co-infection, the present study was conducted to investigate the prevalence of this condition in the hope that more effective therapeutic plans for patients are developed.

## Methods

The presented data in this review was obtained by searching the HIV, HBV, hepatitis B and co-infection as key words in PubMed, Google Scholar and SCOPUS databases. All the publications which had evaluated HBV co-infection with HIV were included to the current review article. The data which have presented in patients suffering from co-infection with other infectious diseases have excluded from the review article. There was no date limitation for the included studies.

### *Worldwide prevalence of HIV-HBV co-infection*

Several studies are performed in the field of HIV-HBV co-infection worldwide as follows (Table 1).

### *HIV-HBV co-infection in European countries*

The co-infection of HIV-HBV has been well investigated in European countries. Several studies have been established that the prevalence of HIV in European countries is lower than others especially African and Asian countries. 15.4% (27 cases) out of 175 HIV positive Italian patients were co-infected with HBV (10). A study in the Netherlands identified that 3.6% of HIV-infected patients were HBsAg positive (11). In Germany reported among 232 HIV-infected patients 9.48% of cases suffered from CHB (12). In France, investigators indicated that 45% of 383 HIV positive patients had detectable HBV-DNA (13, 14), while, isolated anti-HBC antibodies was positive in only 12% of patients (13, 14). A study on 166

French HIV positive patients revealed that 7.8% of patients had also HBV infection (15). A similar study in this country indicated that the frequency of occult hepatitis B infection (OBI) in HIV-infected patients was 5.4% (16). Another investigation on 508 Spanish HIV positive patients and revealed that 4.7 percent of the patients had OBI/HIV co-infection (17). Interestingly, Nikolopoulos et al., using a larger sample size of 1729 cases of HIV positive Greece patients, displayed that 6% of these patients were positive for HBV co-infection (18). In western and central European countries as well as in Ukraine, 1050 HIV-infected women were enrolled in the European collaborative study and the results demonstrated that 4.9% of the subjects were HBsAg positive (19).

Based on the results of the relevant studies conducted in the European countries, it can be inferred that although the rate of hepatitis B is comparatively low, the frequency of HBV co-infection is partially high in HIV positive patients.

### *HBV Co-infection in Asian HIV positive patients*

HBV infection is endemic in Asia especially in south-eastern parts (20). Although the number of studies is limited, a relatively high prevalence of co-infection has been reported in Iran. For instance, in a population of 899 of Iranian injecting drug abusers, 7.8% were co-infected by HIV, HBV and also HCV (21). Another study on Iranian population revealed that 28.6% of HIV positive individuals were infected with HBV (22). There is another report showing that the HIV co-infection in HBV positive patients is 1.8% among 168 HBV positive patients (23). The rates of 14.5 and 11.25 % of HBV co-infection have been demonstrated in Iranian HIV positive patients (24, 25).. In China as endemic area for hepatitis B, 29.34% of 92 HIV positive individuals were co-infected with OBI form (26). Moreover, another study from China showed that among 395 HIV positive patients, 6.07 percent were co-infected with HBV (27). Interestingly, a same study by Japanese researchers showed that among 394 HIV infected homosexual men, 7.9% cases were posi-

tive for HBsAg (28). Additionally, another study on Japanese HIV positive patients identified that 11.9% and 3.2% were also infected with HBV (29, 30). Studies from India demonstrated that 9, 10.7, 7.28 and 13.7 % of HIV positive patients had suffered from HBV co-infection (31-34). Also, finding of a study on 874 HIV-infected patients in India indicated that 8.35 percent of them were infected with HBV (35). Based on the aforementioned studies which performed in Asian countries, it appears that the rate of HIV/HBV co-infection is lower than European countries. The plausible reasons to explain why the rate of HIV/HBV co-infection is higher in European than Asian countries, are discussed in next sections.

#### ***HIV/HBV co-infection among American countries***

America is known as the continent with the least HBV prevalence but the HIV-HBV co-infection is frequent in America as well (36). A study from Atlanta which carried out on a big HIV infected population (2818 cases) showed that 59.8% of cases had HBV co-infection (37). In Canadian HIV positive patients, it has been evidenced that 10.46 percent of 1223 patients were also co-infected with HBV (38). The prevalence of hepatitis B infection among 5639 cases of HIV positive in New York city has been reported as 4.47% (39). Interestingly, another large population revealed that 4.6% out of 4721 HIV infected patients were co-infected with HBV (40). An investigation on 401 Brazilian HIV infected patients demonstrated that the overall prevalence of hepatitis B markers was 40.9%, with 8.5% for HBsAg, 39.7% for total anti-HBcAg and 5.5% for anti-HBsAg (41). Another study showed that the prevalence of hepatitis B in a sample of 406 Brazilian adult patients with HIV infection was 51% for HBsAg, 45.1% for anti-HBc and 32.3% for anti-HBs (42). It has also been reported that the prevalence of anti-HBc and HBsAg were 40% and 3.7% of, respectively, in HIV positive patients (43). Interestingly, high prevalence of HBV infection among HIV patients were also reported (44). The study displayed 30.4% of HIV positive patients were co-infected with HBV (44). Based on the aforemen-

tioned studies, although the prevalence rate of co-infection in European and American is comparatively lower, American population has a higher prevalence of co-infection.

#### ***Epidemiology of HBV co-infection among African HIV infected patients***

Previous studies demonstrated that sub-Saharan Africa is highly endemic for HBV and HIV infections (45). Hence, it seems that HBV infection is also prevalent in African HIV positive patients. Recent studies confirmed this hypothesis. For instance, a study revealed that 12.17% out of 115 pregnant HIV positive women in Borkinafaso were infected with HBV (46). HIV-HBV co-infection was also reported in Mali by evaluation of a large sample size of 11592 blood donors. This study identified that the prevalence of HIV and HBV were 4.5% and 14.9%, respectively, while the prevalence of HIV/HBV co-infection was only 1.13% in this population (47). Investigators in Abidjan (eastern part of Africa) also showed HIV/HBV co-infection in 9.01% individuals of 499 pregnant women (48). 21% of Cameroon HIV positive patients were also infected with HBV (49). Another study from sub-Saharan Africa which carried out on 200 HIV positive patients revealed that the HBV co-infection was prevalent in 10% of evaluated patients (45). Lodenyo and colleagues identified that 3% of HIV positive patients were diagnosed as HIV/HBV co-infected individuals (50). High levels of HBV/HIV co-infection were also reported from South Africa (51). The study identified that 20% of 537 HIV infected individuals were HBsAg positive (51). Another study from Nigeria on a large sample of HIV-infected patients, total of 1779, identified that HBsAg was present in 11.9% of cases (52). Interestingly, their results demonstrated that HBsAg was more common among males than females (52). High levels of HIV/HBV co-infection from Nigeria also was reported by researchers (53). Their results showed that HBsAg was detectable in 28.4% of 102 HIV infected patients (53). Interestingly, it has been demonstrated that 9.7% of 342 HIV positive Nigerian patients has suffered from HIV/HBV co-infection (54). Also a study on 401 Nigeria HIV positive pregnant women revealed that 6.5% of

them had HBV co-infection (55). According to the presented studies, it seems that the rate of HIV/HBV in the African countries is the same as

Asian countries and is lower than of the American and European countries.

**Table 1:** A summary of the literature reviewed in HIV positive patients

| Diseases       | Country      | Racial Information | Sample size | Percent of HBV/HIV co-infection | Ref.  |      |
|----------------|--------------|--------------------|-------------|---------------------------------|-------|------|
| <b>Europe</b>  | Italy        | Italian            | 175         | 15.4                            | (13)  |      |
|                | Spain        | Spanish            | 508         | 4.7                             | (21)  |      |
|                | Germany      | Germany            | 232         | 9.4                             | (15)  |      |
|                | Finland      | Finland            | 22          | 59.0                            | (16)  |      |
|                | France       | French             | 383         | 45.0                            | (18)  |      |
|                | France       | French             | 111         | 5.4                             | (20)  |      |
|                | France       | French             | 166         | 7.8                             | (19)  |      |
|                | Netherlands  | Netherlands        | -           | 3.6                             | (14)  |      |
|                | Greece       | Greeks             | 1729        | 6                               | (22)  |      |
|                | <b>Asia</b>  | Iran               | Iranian     | 391                             | 14.5  | (28) |
|                |              | Iran               | Iranian     | 80                              | 11.3  | (29) |
|                |              | Iran               | Iranian     | 899                             | 7.8   | (25) |
| Iran           |              | Iranian            | -           | 28.6                            | (26)  |      |
| Iran           |              | Iranian            | 168         | 1.8                             | (72)  |      |
| China          |              | Chinese            | 395         | 6.1                             | (31)  |      |
| China          |              | Chinese            | 92          | 27                              | (30)  |      |
| India          |              | Hindi              | 58          | 13.7                            | (38)  |      |
| Japan          |              | Japanese           | 394         | 7.9                             | (73)  |      |
| Japan          |              | Japanese           | 700         | 11.9                            | (33)  |      |
| Japan          |              | Japanese           | 126         | 3.2                             | (34)  |      |
| India          |              | Hindi              | 500         | 9.0                             | (35)  |      |
| India          |              | Hindi              | 837         | 7.28                            | (37)  |      |
| India          |              | Hindi              | 874         | 8.3                             | (39)  |      |
| India          |              | Hindi              | 112         | 10.7                            | (36)  |      |
| <b>America</b> |              | Australia          | Australian  | 537                             | 20.0  | (55) |
|                |              | Canada             | Canadian    | 1223                            | 10.46 | (42) |
|                | Canada       | Canadian           | 1050        | 4.9                             | (23)  |      |
|                | Cameron      | Cameroonian        | 159         | 21.0                            | (53)  |      |
|                | America      | American           | 2818        | 59.8                            | (41)  |      |
|                | America      | American           | 5639        | 4.47                            | (43)  |      |
|                | America      | American           | 4721        | 4.6                             | (44)  |      |
|                | Cuba         | Cuba               | 325         | 30.4                            | (74)  |      |
|                | Brazil       | Brazilian          | 401         | 8.5                             | (45)  |      |
|                | Brazil       | Brazilian          | 406         | 7.9                             | (46)  |      |
|                | Brazil       | Brazilian          | 1000        | 3.7                             | (47)  |      |
| <b>Africa</b>  | Nigeria      | Nigerian           | 1779        | 11.9                            | (56)  |      |
|                | Nigeria      | Nigerian           | 102         | 28.4                            | (18)  |      |
|                | Nigeria      | Nigerian           | 342         | 9.7                             | (58)  |      |
|                | Nigeria      | Nigerian           | 401         | 6.5                             | (59)  |      |
|                | Borkina faso | Burkinan           | 115         | 12.17                           | (50)  |      |
|                | Ivory Coast  | Ivory Costian      | 499         | 9.0                             | (52)  |      |
|                | Africa       | African            | 200         | 10.0                            | (49)  |      |
|                | Africa       | African            | 100         | 3.0                             | (54)  |      |
|                | Mali         | Malian             | 11592       | 1.13                            | (51)  |      |

## Discussion

Based on the aforementioned studies, it seems that the prevalence of HBV co-infection among HIV positive patients are 3.7 to 59.8, 3.6-59, 1.8-28.6 and 1.1-28.4 percent in the American, European, Asian and African countries, respectively. According to this information, it can be concluded that, although, Africa (56, 57) and Asia (58, 59) are endemic areas for HIV, but the incidence of HIV/HBV co-infection is higher in the American and European populations. It appears that several mechanisms may be responsible for this higher rate of co-infection as follows; 1. American and European countries employ excremental techniques with a higher sensitivity enabling them to detect the minimum rate of co-infection. 2. The sample size of studies conducted in these countries was larger than the African countries. 3. Previous studies demonstrated that American and European populations carrying CCR5 delta 32 mutation in more than 15% of individuals which leads to protection from HIV infection (60, 61). Since the HBV infection rate is the same as Asian and African countries, it has increased the chance of HIV/HBV co-infection. 4. While, the mode of transmission for these two viral infections can be various in Asian and African countries, in American and European countries, these infections are mostly transmitted sexually (62-67).

## Conclusion

HIV-HBV co-infection is worldwide frequent. According to the findings of this study, the incidence of HIV/HBV co-infection in the American and European countries are higher than the Asian and African population which may attract more attention in this regard. Finally, the higher prevalence of HBV in HIV positive patients may be ascribed to the suppression of immune responses in HIV positive patients against HBV infection rather than to the other background reasons. Further studies and attention are warranted in this aspect for planning of more effective prophylactic or therapeutic strategies.

## Ethical considerations

Ethical issues (Including plagiarism, Informed Consent, misconduct, data fabrication and/or falsification, double publication and/or submission, redundancy, etc.) have been completely observed by the authors.

## Acknowledgments

This project was granted by the Rafsanjan University of Medical Sciences. The authors declare that there is no conflict of interests.

## References

1. Arababadi MK, Pourfathollah AA, Jafarzadeh A, Hassanshahi G, Rezvani ME (2009). Association of exon 9 but not intron 8 VDR polymorphisms with occult HBV infection in south-eastern Iranian patients. *J Gastroenterol Hepatol*, 25 (1): 90-3.
2. Arababadi MK, Hassanshahi G, Yousefi H (2009). HBV-DNA in hemodialysis patients infected by HCV. *Saudi J Kidney Dis Transpl*, 20 (3): 398-401.
3. Torbenson M, Thomas DL (2002). Occult hepatitis B. *Lancet Infect Dis*, 2 (8): 479-86.
4. Karimi-Googheri M, Daneshvar H, Nosratabadi R, Zare-Bidaki M, Hassanshahi G, Ebrahim M, et al. (2014). Important roles played by TGF-beta in hepatitis B infection. *J Med Virol*, 86 (1): 102-8.
5. Berger A, Doerr HW, Weber B (1998). Human immunodeficiency virus and hepatitis B virus infection in pregnancy: diagnostic potential of viral genome detection. *Intervirology*, 41 (4-5): 201-7.
6. De Milito A (2004). B lymphocyte dysfunctions in HIV infection. *Curr HIV Res*, 2 (1): 11-21.
7. Bowen DL, Lane HC, Fauci AS (1985). Immunopathogenesis of the acquired immunodeficiency syndrome. *Ann Intern Med*, 103 (5): 704-9.
8. Chen J-J, Yu C-B, Du W-B, Li L-J (2011). Prevalence of hepatitis B and C in HIV-infected patients: a meta-analysis. *Hepatobiliary & Pancreatic Diseases International*, 10 (2): 122-7.

9. Vergis EN, Mellors JW (2000). Natural history of HIV-1 infection. *Infect Dis Clin North Am*, 14 (4): 809-25.
10. Morsica G, Ancarani F, Bagaglio S, Maracci M, Cicconi P, Cozzi Lepri A, et al. (2009). Occult hepatitis B virus infection in a cohort of HIV-positive patients: correlation with hepatitis C virus coinfection, virological and immunological features. *Infection*, 37 (5): 445-9.
11. Smit MC, Haverkamp MH, Weersink AJ, Boucher CA, Hoepelman IM (2004). (Patients co-infected with HIV and hepatitis-B virus (HBV): the favourable effect of lamivudine, as part of combined antiretroviral therapy, on HBV may be dependent upon the number of CD4-cells). *Ned Tijdschr Geneeskde*, 148 (47): 2330-4.
12. Rockstroh JK (2006). Influence of viral hepatitis on HIV infection. *J Hepatol*, 44 (1 Suppl): S25-7.
13. Bloquel B, Jeulin H, Burty C, Letranchant L, Rabaud C, Venard V (2014). Occult hepatitis B infection in patients infected with HIV: report of two cases of hepatitis B reactivation and prevalence in a hospital cohort. *J Med Virol*, 82 (2): 206-12.
14. Bloquel B, Jeulin H, Burty C, Letranchant L, Rabaud C, Venard V (2010). Occult hepatitis B infection in patients infected with HIV: report of two cases of hepatitis B reactivation and prevalence in a hospital cohort. *J Med Virol*, 82 (2): 206-12.
15. Aparicio C, Mourez T, Simoneau G, Magnier JD, Galichon B, Plaisance P, et al. (2012). (Proposal of HIV, HBV and HCV targeted screening: short period feasibility study in a free-access outpatient medical structure). *Presse Med*, 41 (10): e517-23.
16. Piroth L, Lafon ME, Binquet C, Bertillon P, Gervais A, Lootvoet E, et al. (2008). Occult hepatitis B in HIV-HCV coinfecting patients. *Scand J Infect Dis*, 40 (10): 835-9.
17. Tuma P, Medrano J, Resino S, Vispo E, Madejon A, Sanchez-Piedra C, et al. (2010). Incidence of liver cirrhosis in HIV-infected patients with chronic hepatitis B or C in the era of highly active antiretroviral therapy. *Antivir Ther*, 15 (6): 881-6.
18. Nikolopoulos GK, Paraskevis D, Hatzitheodorou E, Moschidis Z, Sypsa V, Zavitsanos X, et al. (2009). Impact of hepatitis B virus infection on the progression of AIDS and mortality in HIV-infected individuals: a cohort study and meta-analysis. *Clin Infect Dis*, 48 (12): 1763-71.
19. Landes M, Newell ML, Barlow P, Fiore S, Malyuta R, Martinelli P, et al. (2008). Hepatitis B or hepatitis C coinfection in HIV-infected pregnant women in Europe. *HIV Med*, 9 (7): 526-34.
20. Nordenstedt H, White DL, El-Serag HB (2010). The changing pattern of epidemiology in hepatocellular carcinoma. *Digestive and Liver Disease*, 42: S206-S14.
21. Rahimi-Movaghar A, Razaghi EM, Sahimi-Izadian E, Amin-Esmaili M (2009). HIV, hepatitis C virus, and hepatitis B virus co-infections among injecting drug users in Tehran, Iran. *Int J Infect Dis*, 14 (1): e28-33.
22. Ramezani A, Mohraz M, Aghakhani A, Banifazl M, Eslamifar A, Khadem-Sadegh A, et al. (2009). Frequency of isolated hepatitis B core antibody in HIV-hepatitis C virus co-infected individuals. *Int J STD AIDS*, 20 (5): 336-8.
23. Moradi A, Khodabakhshi B, Sadeghipour M, Besharat S, Tabarraei A (2011). Concurrent infections of hepatitis C and HIV in hepatitis B patients in the north-east of Iran. *Tropical doctor*, 41 (3): 129-31.
24. Mohammadi M, Talei G, Sheikhan A, Ebrahimzade F, Pournia Y, Ghasemi E, et al. (2009). Survey of both hepatitis B virus (HBsAg) and hepatitis C virus (HCV-Ab) coinfection among HIV positive patients. *Viral J*, 6 (202): 202.
25. Babamahmoodi F, Heidari Gorji MA, Mahdi Nasehi M, Delavarian L (2012). The prevalence rate of hepatitis B and hepatitis C co-infection in HIV positive patients in Mazandaran province, Iran. *Med Glas Ljeka komore Zenicko-dobojski kantona*, 9 (2): 299-303.
26. Liang HX, Chen YY, Zhou R, Zhang Q, Pan YF, Gu JS, et al. (2010). (A cross-sectional survey of occult hepatitis B virus infection in HIV-infected patients in acquired immune deficiency syndrome area). *Zhonghua Shi Yan He Lin Chuang Bing Du Xue Za Zhi*, 24 (6): 442-4.
27. Maimaiti R, Zhang Y, Pan K, Wubuli M, Andersson R (2012). Frequent Coinfection with Hepatitis among HIV-Positive Patients in Urumqi, China. *J Int Assoc Physicians AIDS Care (Chic)*, 18: 18.

28. Fujisaki S, Yokomaku Y, Shiino T, Koibuchi T, Hattori J, Ibe S, et al. (2011). Outbreak of infections by hepatitis B virus genotype A and transmission of genetic drug resistance in patients coinfecting with HIV-1 in Japan. *J Clin Microbiol*, 49 (3): 1017-24.
29. Tsuchiya N, Pathipvanich P, Rojanawiwat A, Wichukchinda N, Koga I, Koga M, et al. (2012). Chronic hepatitis B and C co-infection increased all-cause mortality in HAART-naïve HIV patients in northern Thailand. *Epidemiol Infect*, 1: 1-9.
30. Anggorowati N, Yano Y, Heriyanto DS, Rinonce HT, Utsumi T, Mulya DP, et al. (2012). Clinical and virological characteristics of hepatitis B or C virus co-infection with HIV in Indonesian patients. *J Med Virol*, 84 (6): 857-65.
31. Saravanan S, Velu V, Kumarasamy N, Nandakumar S, Murugavel KG, Balakrishnan P, et al. (2007). Coinfection of hepatitis B and hepatitis C virus in HIV-infected patients in south India. *World J Gastroenterol*, 13 (37): 5015-20.
32. Panigrahi R, Majumder S, Gooptu M, Biswas A, Datta S, Chandra PK, et al. (2012). Occult HBV infection among anti-HBc positive HIV-infected patients in apex referral centre, Eastern India. *Ann Hepatol*, 11 (6): 870-5.
33. Gupta S, Singh S (2010). Occult hepatitis B virus infection in ART-naïve HIV-infected patients seen at a tertiary care centre in north India. *BMC Infect Dis*, 10 (53): 53.
34. Rai RR, Mathur A, Mathur D, Udawat HP, Nepalia S, Nijhawan S (2007). Prevalence of occult hepatitis B & C in HIV patients infected through sexual transmission. *Trop Gastroenterol*, 28 (1): 19-23.
35. Pal A, Panigrahi R, Biswas A, Datta S, Sarkar N, Guha SK, et al. (2012). Influence of HIV-associated degree of immune suppression on molecular heterogeneity of hepatitis B virus among HIV co-infected patients. *Virology*, 7 (12): 00550-8.
36. Delfino CM, Berini C, Eirin ME, Malan R, Pedrozo W, Krupp R, et al. (2012). New natural variants of hepatitis B virus among Amerindians from Argentina with mainly occult infections. *J Clin Virol*, 54 (2): 174-9.
37. Osborn MK, Guest JL, Rimland D (2007). Hepatitis B virus and HIV coinfection: relationship of different serological patterns to survival and liver disease. *HIV Med*, 8 (5): 271-9.
38. Gillis J, Cooper C, Rourke S, Rueda S, O'Brien K, Collins E, et al. (2012). Impact of hepatitis B and C co-infection on health-related quality of life in HIV positive individuals. *Qual Life Res*, 17: 17.
39. Kim JH, Psevdos G, Suh J, Sharp VL (2008). Co-infection of hepatitis B and hepatitis C virus in human immunodeficiency virus-infected patients in New York City, United States. *World J Gastroenterol*, 14 (43): 6689-93.
40. Kim JH, Psevdos G, Jr., Sharp V (2012). Five-year review of HIV-hepatitis B virus (HBV) co-infected patients in a New York City AIDS center. *J Korean Med Sci*, 27 (7): 830-3.
41. Souza MG, Passos AD, Machado AA, Figueiredo JF, Esmeraldino LE (2004). (HIV and hepatitis B virus co-infection: prevalence and risk factors). *Rev Soc Bras Med Trop*, 37 (5): 391-5.
42. Monteiro MR, do Nascimento MM, Passos AD, Figueiredo JF (2004). (Seroepidemiological survey of hepatitis B virus among HIV/AIDS patients in Belem, Para--Brasil). *Rev Soc Bras Med Trop*, 37 Suppl 2: 27-32.
43. de Almeida Pereira RA, Mussi AD, de Azevedo e Silva VC, Souto FJ (2006). Hepatitis B Virus infection in HIV-positive population in Brazil: results of a survey in the state of Mato Grosso and a comparative analysis with other regions of Brazil. *BMC Infect Dis*, 6 (34): 34.
44. Marite B, Montalvo MC, Rodriguez Lde L, Sariago S, Verdasquera D, Vincent M, et al. (2011). Occult hepatitis B in Cuban HIV patients. *MEDICC Rev*, 13 (2): 32-7.
45. Mayaphi SH, Roussow TM, Masemola DP, Olorunju SA, Mphahlele MJ, Martin DJ (2012). HBV/HIV co-infection: the dynamics of HBV in South African patients with AIDS. *S Afr Med J*, 102 (3 Pt 1): 157-62.
46. Ilboudo D, Simpore J, Ouermi D, Bisseye C, Sagna T, Odolini S, et al. (2010). Towards the complete eradication of mother-to-child HIV/HBV coinfection at Saint Camille Medical Centre in Burkina Faso, Africa. *Braz J Infect Dis*, 14 (3): 219-24.
47. Tounkara A, Sarro YS, Kristensen S, Dao S, Diallo H, Diarra B, et al. (2009). Seroprevalence of HIV/HBV coinfection in Malian blood donors. *J Int Assoc Physicians AIDS Care (Chic)*, 8 (1): 47-51.

48. Rouet F, Chaix ML, Inwoley A, Msellati P, Viho I, Combe P, et al. (2004). HBV and HCV prevalence and viraemia in HIV-positive and HIV-negative pregnant women in Abidjan, Cote d'Ivoire: the ANRS 1236 study. *J Med Virol*, 74 (1): 34-40.
49. Mbougua JB, Laurent C, Kouanfack C, Bourgeois A, Ciaffi L, Calmy A, et al. (2010). Hepatotoxicity and effectiveness of a Nevirapine-based antiretroviral therapy in HIV-infected patients with or without viral hepatitis B or C infection in Cameroon. *BMC Public Health*, 10 (105): 105.
50. Lodenyo H, Schoub B, Ally R, Kairu S, Segal I (2000). Hepatitis B and C virus infections and liver function in AIDS patients at Chris Hani Baragwanath Hospital, Johannesburg. *East Afr Med J*, 77 (1): 13-5.
51. Iser DM, Lewin SR (2009). Future directions in the treatment of HIV-HBV coinfection. *HIV Ther*, 3 (4): 405-15.
52. Otegbayo JA, Taiwo BO, Akingbola TS, Odaibo GN, Adedapo KS, Penugonda S, et al. (2008). Prevalence of hepatitis B and C seropositivity in a Nigerian cohort of HIV-infected patients. *Ann Hepatol*, 7 (2): 152-6.
53. Balogun TM, Emmanuel S, Ojerinde EF (2012). HIV, Hepatitis B and C viruses' coinfection among patients in a Nigerian tertiary hospital. *Pan Afr Med J*, 12 (100): 100.
54. Ejele OA, Nwauche CA, Erhabor O (2004). The prevalence of hepatitis B surface antigenaemia in HIV positive patients in the Niger Delta Nigeria. *Niger J Med*, 13 (2): 175-9.
55. Okeke TC, Obi SN, Okezie OA, Ugwu EO, Akogu SP, Ocheni S, et al. (2012). Coinfection with hepatitis B and C viruses among HIV positive pregnant women in Enugu south east, Nigeria. *Niger J Med*, 21 (1): 57-60.
56. Gouws E, Williams BG, Sheppard HW, Enge B, Karim SA (2002). High incidence of HIV-1 in South Africa using a standardized algorithm for recent HIV seroconversion. *Journal of acquired immune deficiency syndromes*, 29 (5): 531.
57. Kuo C, Reddy MK, Operario D, Cluver L, Stein DJ (2013). Posttraumatic Stress Symptoms Among Adults Caring for Orphaned Children in HIV-Endemic South Africa. *AIDS Behav*, 29: 29.
58. Ruxrungtham K, Brown T, Phanuphak P (2004). HIV/AIDS in Asia. *The Lancet*, 364 (9428): 69-82.
59. Hoffmann CJ, Thio CL (2007). Clinical implications of HIV and hepatitis B co-infection in Asia and Africa. *The Lancet infectious diseases*, 7 (6): 402-9.
60. Martinson JJ, Chapman NH, Rees DC, Liu YT, Clegg JB (1997). Global distribution of the CCR5 gene 32-basepair deletion. *Nat Genet*, 16 (1): 100-3.
61. Libert F, Cochaux P, Beckman G, Samson M, Aksenova M, Cao A, et al. (1998). The deltaCCR5 mutation conferring protection against HIV-1 in Caucasian populations has a single and recent origin in Northeastern Europe. *Hum Mol Genet*, 7 (3): 399-406.
62. Sanou Sobze M, Fokam J, Guetiya Wadoum R, Russo G, Onohiol JF, Djeunang Dongho B, et al. (2013). Condom perception and prevention of Hiv/Aids infection in Cameroon: appraisal of knowledge, attitudes and practices among level one students of the University of Dschang. *Ig Sanita Pubbl*, 69 (2): 183-94.
63. Mertens TE, Low-Beer D (1996). HIV and AIDS: where is the epidemic going? *Bull World Health Organ*, 74 (2): 121-9.
64. Miralles C, Mardarescu M, Sherr L (2013). What do we know about the situation of women living with HIV in Europe? *Antivir Ther*, 18 Suppl 2: 11-7.
65. Casari S, Suligoi B, Camoni L, Pavan A, Macchi L, Capelli M, et al. (2012). Epidemiological and clinical characteristics and behaviours of individuals with newly diagnosed HIV infection: a multicentre study in north Italy. *J Prev Med Hyg*, 53 (4): 190-4.
66. Takacs J, Kelly JA, T PT, Mocsonaki L, Amirkhanian YA (2013). Effects of Stigmatization on Gay Men Living with HIV/AIDS in a Central-Eastern European Context: A Qualitative Analysis from Hungary. *Sex Res Social Policy*, 10 (1): 24-34.
67. Bourne A, Hickson F, Keogh P, Reid D, Weatherburn P (2012). Problems with sex among gay and bisexual men with diagnosed HIV in the United Kingdom. *BMC Public Health*, 12 (916): 916.