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Human Immunodeficiency Virus -1 and Hepatitis B Virus Co-Infections among Injecting Drug Users in Malindi, Kenya

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Abstract:
Currently no published data addressing the burden of Human Immunodeficiency Virus (HIV) and Hepatitis B Virus (HBV) co-infection among injecting drug users (IDUs) in Kenya exists. These two viruses share similar routes of transmission, with illicit drug use by injection being the major route of infection. Injecting drug use is a rapidly growing problem in coastal towns of Kenya and the problem is aggravated by sex tourism.This study aimed at determining the prevalence of HBV in HIV positive IDUs and correlating the findings with socio-demographic factors of the study population.A cross-sectional study was conducted using structured questionnaires and laboratory testing of blood samples. Surface antigens for HBV (HBsAg) and anti-HIV antibodies were screened using rapid kits followed by Enzyme Linked Immunosorbent assay tests on positive samples using Hepanostika and Vironostika test kits, for HIV and HBV, respectively. The CD4+ T-cell count was determined by flow cytometry.The prevalence of HIV/HBV co-infection was 14.3% (13/91) with a mean age of 33.2 (SD ± 8.1) years. The mean CD4+ cell count in the HIV/HBV co-infected individuals was significantly lower than HIV mono-infection. Needle sharing and duration of active injection of drugs were significantly associated with HIV/HBV co-infections.This study concludes a potentially high prevalence of HBV/ HIV co-infection in injecting drug users in Malindi, Kenya. With limited evidence on IDU prevalence and its consequences in sub-Saharan Africa, the results of this study highlight the need for a more refined policy on HIV treatment strategy among IDUs. There is a further need for triple testing for HIV, HBV and HCV among suspected IDUs and other associated risk groups like the commercial sex workers before commencement of treatment.
Keywords: Injecting drug users, HIV-1, HBV, viral co-infection, Malindi, Kenya

1. Introduction

There is still limited data on the true rate of illicit injecting drug use (IDU) in sub-Saharan Africa. It is however estimated that Kenya, Mauritius, and South Africa combined record an estimated 300-350,000 IDUs (Mathers *et al*., 2008)

Most IDUs stand a high risk of contracting human immunodeficiency virus (HIV), hepatitis C virus (HCV) and hepatitis B virus (HBV) (Aceijas *et al*., 2004). Due to shared routes of transmission, there is also an increased risk of co-infection with the three disease agents, but especially HIV/HBV co-infection due to their relatively high prevalence rates compared to HCV. HIV infections among IDUs have been documented worldwide (Mathers *et al*., 2008, Dewing *et al*., 2004, McCurdy 2006). The few similar studies done in Kenya have reported a variation in the prevalence rates from one region to another (Mathers *et al*., 2008, Odek-Ogunde *et al*., 2004, Odek-Ogunde *et al.,* 2012).

HIV infection among IDUs has constantly been on the rise within the Kenyan coast (Beckerleg et al., 2005) where an estimated 17% of new HIV infections are within this group (Nieburg *et al*., 2011). It is however notable that limited information on the rates of HBV mono- and HIV/HBV co-infections within this population of IDUs exists for this region. In Malindi, a tourist town within the Kenyan coast and reported to have a very high number of drug injecting population (Nieburg *et al*., 2011), no studies have been conducted to document the true prevalence of HBV mono- or HIV/HBV co-infections. It is notable that a rise in IDUs in this town could partly be aggravated by the rising sex tourism. HIV/HBV co-infection changes the natural course of either HIV or HBV disease leading to adverse effects. Resistance to treatment by either of the viruses could greatly affect the outcome of the treatment of the other, and ultimately the spread of the diseases within the population could have a detrimental public health effect. It is thus necessary to establish the rates of HIV/HBV co-infections so as to aid in designing and implementing appropriate and specific intervention strategies. In this study, we report the results of a cross-sectional study, conducted to estimate the prevalence of HBV mono-, and HIV/HBV co-infections among IDUs in Malindi district in Kenya.

2.0 Materials and Methods

2.1 Study design

This was a cross-sectional study involving consenting adult IDUs from Malindi district in Kenya.

2.2 Study site and population

This study was carried out within the confines of a drug rehabilitation program in Malindi district, along the Kenyan coast. Currently referred to as Malindi sub-county, Malindi is a major tourist destination in Kenya attracting tourists from all over the world but mainly from Germany, Italy and Britain. The town is situated north of Mombasa, along Indian Ocean and west of Lamu, another major tourist destination. The town is cosmopolitan with the major religion being Islam.

2.3 Sample collection

The consenting participants to this study were interviewed using structured questionnaires to collect information on socio-demographic characteristics. Information on behavioral risk factors included the duration of active injecting drug use, number of times the needle was shared, engagement in commercial sex work (CSW) and men having sex with other men (MSM).

Eventually, 5 mL of venous blood was collected for use in serological screening for HIV and HBV, as well as for CD4 T lymphocyte counts. Any non-responsive or uncooperative participant was excluded from the study.

2.4 Serological screening for HIV and HBV

Testing for HIV antibodies and HBV surface antigen (HBVsAg) was carried out using rapid tests and ELISA assay platforms. Screening for HIV infection was done as recommended by the revised Kenya National guidelines (NASCOP 2008). Colloidal Gold Kit which detects anti-HIV IgG antibodies was used as the initial test. Samples reactive in this first test were re-tested using a second antibody test, the First Response Kit, (Shanghai Kehua Bio-engineering Co., Ltd., China).

Indeterminate results were confirmed using the Vironostica HIV ELISA (Wantai Biological Pharmacy Enterprise Co., Ltd, Beijing, China) as a tie breaker. Screening for HBVsAg was done using the KEMRI HEPCELL kit and confirmed using the Hepanostika HBV ELISA kit (Shanghai Kehua Bio-engineering Co., Ltd., China). All testing was done according to manufacturers' instructions. Those samples which tested positive for both HIV and HBV were considered to be HIV/HBV co-infected. CD4+ T-cell count was determined by flow cytometry.

2.5 Ethical clearance

The study was approved by the ethical committee of the Kenya Medical Research Institute, ERC number 2444. Participation was voluntary and total confidentiality was observed. HIV and or HBV status was only communicated back to the clinicians for purposes of clinical interventions and management.

2.6 Data analysis

Data was analyzed using SPSS for windows (Version 16.0, 2007, SPSS Inc, Chicago, IL, USA).
Significance of difference was initially assessed with the chi-square. $P \leq 0.05$ was used to indicate statistical significance.

3.0 Results

3.1 Baseline characteristics of IDU participants

In total 91 (49 male and 42 female) IDUs were recruited. The mean age recorded was 33.2 (SD ± 8.1) years (Table 1), where 34.0% (31) were aged below 29 years, 47.3% (43) between 30 – 39 years, 16.5% (15) between 40-49 years and 2.2% (2) were aged between 50-60 years (Table 2).

Table1. The prevalence of HIV/HBV co-infection and the estimated CD4+ T-lymphocyte count among the intravenous drug users in Malindi

Categories	All N=91	Male (n=49)	Female (n=42)	P	HIV	HBV	HIV/HBV
Prevalence {n}(%)	91(100.0)	49(53.8)	42(46.2)		91(100.0)	13(14.3)	13(14.3)
Age(yrs) mean(SD)	33.2(±8.1)	35.29(±8.3)	30.29(±6.9)	0.001*	33.2(±8.1)	33.58(±7.35)	33.58(±7.35)
CD4+T cell count mean(SD)		530.9(±405.1)	461(±326.4)	0.388	495.5(±366.5)	171.3(±94.4)	171.3(±94.4)*
HIV (%)		49/49(100.0)	42/42(100.0)	0.018			
HBV (%)		7/91(7.7)	6/91(6.6)				
HIV/HBV (%)		7/49 (14.3) **	6/42 (14.3) **				

*a significantly reduced CD4+ T-lymphocyte count compared to HIV mono-infection (p=0.001)
** shows prevalence of HIV/HBV co-infection within the individual groups

3.2 Prevalence of HBV infection and HIV/HBV co-infection

As shown in table 1, the prevalence of HIV/HBV co-infection in the male population was 7.7% (7/91) of the male participants and 6.6% (6/91) of the female. However, within the specific groups of the HIV infected IDUs, HBV accounted for 14.3% in each case. Although the mean CD4+ T-cell count in all the HIV infected was approximately 496 cells/μL, there was a significantly low CD4+ T-cell count for the HIV/HBV co-infected, accounting for only 171 cells/μL of blood compared to the HIV mono-infected (p=0.001).

3.3 Behavioral factors that aggravate transmission

Analysis of behavioral characteristics that aggravate HIV/HBV transmission as shown in table 2 revealed that only 90.4% (47) of the 52 respondents in this category were strict IDUs. Another

1.9% (1/52) was both an IDU and MSM, while the remaining 9.6% (5/52) were confirmed to be both IDUs and CSW. Although strict IDUs accounted for the highest number of HIV infections compared to the other 2 groups, the difference was not significant (p=0.809). On the other hand IDU-MSM and IDU-CSW combinations were at a higher risk of HIV/HBV (p=0.001) co-infection compared to strict IDUs. Further those who shared needles with more than 2 partners also recorded a higher risk HIV/HBV co-infections (p=0.001). Based on the duration of needle use, participants who responded to injecting for more than 10 years were associated with high rate co-infections (p=0.000).

Table 2: Table 2: Prevalence of HIV/HBV co-infection within the different groups and clusters assessed

Characteristics	**Total**	**HIV n(%)**	**P**	**HIV/HBV n(%)**	**P**
Age groups	N=91		0.776		0.206
≤29		31(34)		3(23)	
30-39		43(47)		8(61)	
40-49		15(16)		1(8)	
≥50		2(3)		1(8)	
Total		91(100)		13(100)	
Sex	N=91		0.357		0.969
F		42(46)		6(46);(14)**	
M		49(54)		7(54);(14)**	
Total		91(100)		13(100)	
Marital status	N=52		0.829		0.004*
Single		47(90)		13(100);(28)**	
Married		3(6)		0(0.0)	
Divorced		2(4)		0(0.0)	
Total		52(100)		13(100)	
Level of education	N=52		0.697		0.004*
Primary		37(71)		9(69);(24)**	
Secondary		12(23)		4(31);(33)**	
College		3(6)		0(0.0)	
Total		52(100)		13(100)	
Risk behaviors	N=52		0.809		0.030
IDU		46(89)		9(69);(20)**	
IDU,FCSW		5(9)		3(23);(60)**	
IDU,MSM		1(2)		1(8)	
Total		52(100)		13(100)	
Number of partners sharing needle	N=52		0.158		0.000*
< 1		1(2)		0(0.0)	
1-2		37(71)		0(0.0)	
> 2		14(27)		13(100);(93)**	
Total		52(100)		13(100)	
Duration of needle use (years)	N=52		0.274		0.000*
< 10		19(36)		0(0.0)	
10-20		27(52.0)		8(62);(30)**	
> 20		6(12)		5(38);(83)**	
Total		52(100.)		13(100)	

** The rates within individual clusters. * statistically significant.
FCSW – Female Commercial sex worker; MSM – Men having sex with Men, IDU-Injecting Drug Users

3.4 Co infection with HBV/HIV and age

The IDUs aged between 30 and 39 years recorded the highest rate of HIV/HBV co-infection whereas IDUs above 50 years showed the lowest rate {7.7% (1/13) (p=0.000)} and the least infection rate in all categories (Table 2)

3.5 HIV/HBV co-infections and marital status

Assessment of the marital status showed that 90.4% (47/ 52) of the HIV infected participants were single, 5.8% (3/52) married and 3.8% (2/52) divorced. Co-infection of HIV and HBV was only observed (100%) among the cluster of participants of the "single" status, contributing to approximately 28% (13/47) within of all the HIV infected IDUs within this cluster.

3.6 HIV/HBV co-infections and the level of education

Those participants with only basic primary education accounted for 71% (37 /52), with the least being those with tertiary education accounting for 5.8% (3/52). Of the HIV/HBV co-infected patients, once again those with the basic primary education accounted for 69% (9/13) with the remaining 31% (4/13) being individuals with secondary education. However, within the cluster of those with primary education, only 24% (9/37) as opposed to the 33% (4/12) of those with secondary education were co-infected. HIV/HBV HIV infected individuals in this study with tertiary education had no co-infection with HBV

4. Discussion

Different African countries have embarked on intensive public health measures for the prevention of transmission of HIV within and outside the "hard to reach" populations such as intravenous drug users. With the availability of anti-retroviral therapy for HIV and the fact that infection by HBV and its subsequent resistance to therapy could change the course of HIV treatment, there is a need for a clear data on the HIV/HBV co-infections.

In this study we report a prevalence of 14.3% for HIV/HBV co-infection among active IDUs in this sub-county within the Kenyan coast. The prevalence rate reported in this study was higher than 6% rate of HIV/HBV co-infections previously reported for Kenya (Muriuki *et al.,* 2013, Harania *et al*., 2008). This finding of a higher prevalence was however expected since as opposed to the previous studies which were within the general population of HIV sero-positive patients, this study targeted a high risk population. The implication of the three findings in Kenya strengthens the need for a more defined policy on the treatment strategy for the high risk population infected with HIV. We note that apart from exposure to risky behaviours potentially exposing our cohort to multiple co-infections, the dynamic life style of our cohort would literally expose them as well to high default rate on treatment. Although not having been part of this study, it is would also be interesting to assess the resistance patterns to the current HIV and HBV treatment regimen.

When compared to HBV mono-infection, the prevalence in this study was once again higher compared to HBV mono-infection among the IDUs previously reported at 4.5% (Odek-Ogunde *et al.,* 2004), an indication that hepatitis infection in HIV-infected persons may be higher than that of the general population.

On behavioral characteristics that aggravate HIV/HBV co-infection transmission, the fact that IDU-MSM and IDU-CSW showed a significantly higher risk of transmission presents a major public health concern. The legal and the cultural factors associated with MSM and CSW further aggravates the risk of infection and co-infection. Apart from engaging in the two practices when under intoxication, the two groups also fail to seek medical intervention in cases of infections for fear of arrest and rebuttal from the local community. It suffices to note that these 2 groups of MSM and female CSW provide a link of transmission of the viruses from the circle of IDUs to the general population. Further, Malindi, just as other towns in the coastal Kenya, being a sex tourism town, there is a potential for further transmission across the border, with countries standing at a risk of cross border transmission mainly being in Europe. This therefore calls for continuous monitoring of these two categories in terms of potential sexually transmissible infections, intense harm reduction strategies such as "one syringe-one needle", advocacy of condom use mainly to the potential clients like the revelers and tourists and molecular surveillance of circulating genotypes of HIV and HBV in the region. At present, harm reduction strategy remains paramount to ensure a reduction in risky practices such as sharing needles and syringes.

Results obtained from the assessment of the marital status and the levels of education strengthen the assertion that high levels of poverty contribute significantly to transmission of diseases. The fact that co-infection was not found among those with tertiary education and low within the married, points to the fact that these two categories command some sense of responsibility and self sustenance thus reducing the risks of sharing needles as well as involving in sex for commercial purposes. This assertion can further be strengthened by the fact that compared to similar studies done, lower prevalence were reported in China (0.3%), USA (7%) and France (8%) (Zhou *et al*., 2012, Weinbaum *et al*., 2008, Larsen *et al*., 2004), as opposed to the high prevalence in this study. We however acknowledge that the HIV prevalence of 6% in Kenya´s general population (NACC 2014) cannot be underestimated to contribute to the differences in prevalence in the studies cited. Increased risk of transmission through sharing or long term use of needles among IDUs has well been elucidated in various studies (Zhou et al., 2012, Zarocostas 2011, Zhou et al., 2011).

Further, the influx of sex tourists in this region is cannot be underestimated as a factor that aggravates the problem of IDUs. Sex tourism promises easy money to this group, both in heterosexual, homosexual or both. Although not included in this study, our preliminary findings showed that a significant number of participants

engage in these sexual orgies under intoxication, leading to a high number of sexual clients per night and failure to use protective measures like condoms. The risk to health is not only exportation of the local strains of the viruses, but also importation of the foreign viral strains not known to circulate within the region.

Of interest in this study is the fact that the HBV prevalence in our finding among this group is similar to those already recorded by some other regions in south Asia, like Bangladesh (9.4%), India (10.2%) and Iran (17.3%) where illicit drug use is also an acknowledged problem (Nelson *et al*., 2011, Rahimi-Moraghar 2015). In comparison to some western countries like France (4.8%), Germany (7.2%), United Kingdom (8.9%) (Nelson *et al*., 2011) and USA (11%) (Weinbaum *et al.,* 2009), our finding of 14% is high. Our findings of prevalence above those in the western countries within the population of IDUs is of special importance, since it shows that contrary to the popular belief that HBV infection in Africa mainly appears in early childhood (Barth *et al*., 2010), and that IDU is less influential in transmission compared to the western countries (Cooper *et al.,* 2009, Lavanchy 2004, Modi 2007) there seem to be a dramatic shift, and transmission by IDU is currently surpassing those seen in the western countries.

5. Conclusion

In conclusion, different studies have documented the burden of HIV, HBV and HBV co-infections among IDUs (Zhou *et al*., 2012, Zarocostas 2011, Zhou *et al*., 2011) in different parts of the world. We have however, not found any data documenting the burden of HIV/HBV co-infection within Malindi, a county with the highest illicit drug use in Kenya and a hub for international sex tourism. To the best of our knowledge therefore, this is the first study assessing and documenting the burden of HIV/HBV co-infection within this region. The high prevalence determined within this high risk group is of special importance to intervention strategies by the different stakeholders, both local and international. We have further managed to show in our study group, the burden of other risk factors (such as MSM and CSW) associated with illicit intravenous drug use.

A major limitation of this study is the fact that it was mainly carried out in a cohort of the IDUs undergoing rehabilitation, hence the data on all IDUs in the general population is not captured in this study. This is important especially taking into consideration that the behavior patterns for the two groups may be different as a result of the rehabilitation process. Further, MSM and CSW in the general population away from illicit drug use were not tested for further comparison.

Therefore the results of this study remain only limited HIV/HBV co infections within the IDU population.

We further recommend the need for molecular surveillance of the circulating strains of these viruses, treatment and resistance profiles of the drugs in use, and a further investigation of the

IDUs outside the rehabilitation program as well as non IDUs who engage other high risk behaviors such as CSW and MSM in order to get the true prevalence of the co-infections.

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