HIV co-infection among persons diagnosed with hepatitis B: England, 2008-2014

G. Ireland[1,2], R. Simmons[1,2], K. Balogun[1], P. Kirwan[1], C.A. Sabin[2,3], S. Lattimore[1,2], V. Delpech[1,2], S. Mandal [1,2]

[1]National Infection Service, Public Health England, London, UK

[2] The National Institute for Health Research Health Protection Research Unit (NIHR HPRU) in Blood Borne and Sexually Transmitted Infections at University College London, UK

[3]Institute for Global Health, UCL, London, UK

Abstract word count: 248

Word count: 3183

Tables: 3

Figures: 0

Running title: Hepatitis B and HIV co-infection

Key words: Hepatitis B, HIV, Co-infection,

Correspondence to: Georgina Ireland, Immunisation department, Public Health England, 61 Colindale Avenue, London NW9 5EQ, United Kingdom. Georgina.ireland@phe.gov.uk

Funding: This report is independent research by the National Institute for Health Research. The research was funded by the National Institute for Health Research Health Protection Research Unit (NIHR HPRU) in Blood Borne and Sexually Transmitted Infections at UCL in partnership with Public Health England (PHE) and in collaboration with the London School of Hygiene and Tropical Medicine. The views expressed in this publication are those of the

author(s) and not necessarily those of the NHS, the National Institute for Health Research, the Department of Health or Public Health England.

Contribution of authors: RS matched the two datasets, GI undertook the analysis and had access to the complete dataset. GI drafted the paper and all authors provided critical input to the manuscript and approved all revisions.

Acknowledgements:

The NIHR HPRU in Blood Borne and Sexually Transmitted Infections Steering Committee: Caroline Sabin (Director), Anthony Nardone (PHE Lead), Catherine Mercer, Gwenda Hughes, Jackie Cassell, Greta Rait, Samreen Ijaz, Tim Rhodes, Kholoud Porter, Sema Mandal and William Rosenberg.

Abstract

Introduction: We estimate HIV prevalence among persons with HBV in England and examine associated risk factors.

Methods: Persons with a HBV surface antigen (HBsAg) test, reported to the PHE sentinel surveillance of blood borne virus testing, were linked to the PHE national HIV database. All persons aged ≥15yrs, presenting for an HBsAg test between 2008 and 2014 were included. Co-infection was defined as a HIV-diagnosis before, or in the 6 months following, a positive HBsAg test.

Results: Between 2008 and 2014, 1.3% (28,789/2,149,933) of persons tested for HBsAg were positive, of whom 3.9% (1,129) were HIV co-infected. Among co-infected persons born in Africa, 84% probably acquired HIV there. 95.3% of females reported heterosexual contact as their probable route of HIV infection, whereas 32.3% and 61.5% of males reported heterosexual contact and sex between men respectively. Significant predictors of co-infection included increased age (aOR:1.1), black ethnicity (male aOR:15.5, female aOR:16.4) or a male of white ethnicity (aOR:8.2) when compared to white females and been diagnosed with HBV in sexual health (aOR:55.0), specialist liver (aOR:6.7), emergency department (aOR:5.3) and renal services (aOR:2.8) compared to general practice.

Conclusions: Low HIV-HBV co-infection rates among those tested in England were found. The findings highlight the need to improve HBV vaccine coverage among MSM. Most persons of black ethnicity probably acquired both infections overseas, reinforcing existing recommendations for increased testing among migrants from high (and intermediate for

HBV) prevalence countries. The findings also support blood-borne virus testing in sexual health services and emergency departments.

Introduction

An estimated 180,000 persons are living with chronic persistent hepatitis B (HBV) infection and over 100,000 are living with HIV in the UK (1,2). In England, the most commonly reported transmission routes amongst persons diagnosed with acute HBV were heterosexual contact (57%), followed by sex between men (16%) and injecting drug use (4%)(3). In contrast, the majority (96%) of persons diagnosed with new chronic persistent HBV likely acquired the infection overseas, having been born or brought up in countries of intermediate or high prevalence of HBV prior to arrival in the UK, with a comparatively small proportion having acquired HBV through perinatal transmission in the UK (4).

Almost all (>95%) persons diagnosed with HIV in the UK acquired the infection sexually and men who have sex with men are at greatest risk of acquiring HIV within the UK (2)(5).

Coinfection with HBV and HIV can impact on disease outcomes, by prolonging the period of HBV infectivity and active hepatitis, accelerating progression to cirrhosis, end stage liver disease and hepatocellular carcinoma (HCC) and increasing liver-related mortality (6–11). As HBV is vaccine preventable, national guidelines recommend vaccination of risk groups including persons with HIV (12).

The prevalence of HBV infection in HIV cohorts in Europe varies, although it has generally been reported to be between 6 and 10% (8,13–15). In the UK Collaborative HIV Cohort Study (UK CHIC), 6.7% of HIV positive persons had a current HBV infection (14)(16), indicated through hepatitis B surface antigen (HBsAg) testing, and, whilst there have been a number of estimates of HBV prevalence in persons HIV positive, there are no large population-based estimates of HIV prevalence among persons with HBV in the UK.

Using information from the sentinel surveillance of blood borne virus testing (SSBBV) and the HIV and AIDS reporting System (HARS) held at Public Health England (PHE), we investigate the prevalence of diagnosed HIV in persons testing, and positive, for current HBV infection. We describe the characteristics of the co-infected population and examine predictors of co-infection.

Methods

HBV data

SSBBV collects information on hepatitis A-E, HIV and HTLV tests, regardless of result, from 23 participating sentinel laboratories in England. SSBBV coverage by Local Authority ranges from 0%-100%, but on average it is estimated to cover 40% of HBV testing in England. Alongside the test result, SSBBV collects information on person demographics and the service requesting the test. The methods have previously been described (17). In summary, data from the information systems at participating laboratories in England were extracted, individual records were deduplicated and linked to all other test results using a combination of Soundex (phonetic algorithm for indexing names), date of birth, sex, NHS number and hospital number.

Demographic and testing data on all hepatitis B surface antigen (HBsAg) testing, a marker of current HBV infection, between January 2008 and December 2014 were extracted from the SSBBV database. Individuals were excluded if the samples had been drawn for quality control or confirmation of diagnosis purposes, if they were participating in a study or less than 15 years of age when first tested.

A person's first positive HBsAg test was identified, along with requester service. For persons who tested negative between 2008 and 2014, their most recent negative test and associated information were used.

HIV data

Two PHE data sources were used to identify HIV positive persons, i) SSBBV and ii) HARS. HARS collects information on persons diagnosed with HIV and accessing care at a NHS HIV

service in England. From SSBBV, all positive HIV antibody tests were extracted and a person's first positive test date was identified. The HARS datasets were linked to SSBBV using deterministic and probabilistic methodology. Identifiers used for linking included clinic number, Soundex, first name initial, date of birth, sex and region of test. Following data linkage, the earliest date of HIV presentation between the two data sources was established and linked to their HBV testing records. Where available, information on ethnicity, route of HIV transmission, country of birth and country of probable infection was extracted from HARS.

Information on ethnicity was enhanced by Hospital Episode Statistics if not obtained from HARS or SSBBV.

Definitions

Unless otherwise stated, co-infection was defined as persons known to be living with HIV at the time of their first positive HBsAg test or newly diagnosed with HIV in the six months following their positive HBsAg test. Persons newly diagnosed with HIV more than six months following a HBV diagnosis were considered separately as they may have cleared their HBV infection prior to an HIV diagnosis following acute infection, treatment or spontaneous clearance; only 6-10% of healthy adults who have acute HBV infection progress to chronic infection (18).

Statistical Analysis

Statistical analysis was carried out in STATA SE (version 13) with Chi-squared and Fishers Exact tests being used to compare categorical variables and Wilcoxon rank-sum tests to compare continuous variables. A multiple logistic regression model, adjusted for sex, age at

date of HBsAg test (continuous), ethnicity (including where not reported, due to high levels of non-reporting through sexual health services), year of positive HBsAg test and speciality requesting HBsAg test (excluding HIV specialist services), was used to identify predictors of a coinfection. All proportions reported exclude those with missing or unknown values.

Results

HIV among persons tested for HBV infection

Between 2008 and 2014, 2,149,933 persons aged 15 years and over were tested for HBsAg, of whom 1.3% (28,789) were HBsAg positive. Overall, 1.5% (31,900) of persons tested for HBsAg had a reported HIV diagnosis (Table 1), 69.6% of whom (16,444) were of white ethnicity. Among those testing for HBV, persons HIV positive were older than those with no HIV diagnosis (33 years vs 40 years, $p<0.001$). Higher prevalence of diagnosed HIV infection was found in males (2.9%), persons of black ethnicity (5.0%) and persons tested within sexual health services (5.4%).

HIV co-infection amongst persons diagnosed with HBV infection

Of the 28,789 persons HBsAg positive, 3.9% (1,129/28,789) were co-infected with HIV. Most were male (74.8%), had HBV diagnosed within sexual health services (52.3%) and were older at HBV diagnosis than persons mono-HBV infected (34 years vs 40 years; $p<0.001$). A similar proportion of persons co-infected were of black and white ethnicity (45.6% and 42.7% respectively).

Higher prevalence of diagnosed HIV co-infection were found in males (5.1%), persons aged between 35 and 44 years (5.7%) and of black or white ethnicity (10.0% and 5.8% respectively). Co-infection prevalence varied by setting of HBV diagnosis, with the highest prevalence in persons tested in sexual health services (10.4%), specialist liver services (6.5%) and emergency departments (5.9%).

Route of HIV infection was available for 85.1% (961) of co-infected persons, with the most frequent HIV transmission route being heterosexual contact (47.9%), followed by sex

between men (46.2%) and injecting drug use (3.6%). Almost all (95.3%) females reported heterosexual contact as their probable route of HIV infection, whereas 32.0% of males reported heterosexual contact and 61.8% of males reported sex between men (table 2). In persons of white, Asian and other ethnicity, the most common route of HIV infection was sex between men (83.9%, 63.4% and 67.7% respectively), whereas among persons of black ethnicity heterosexual contact was most commonly reported (88.5%). Where country of birth was reported (83.7%, n=945), the majority of people co-infected were born in Africa (45.9%, n=434), followed by the UK (27.1%, n=256) and Europe (12.9%, n=122). In persons born in Africa with probable country of HIV acquisition reported (74.4%, 323/434), 87.9% (284) acquired HIV in Africa.

Overall, 5.9% (n=67) had a negative HBsAg test in SSBBV between HIV and HBV diagnosis. The majority of these were in males (n=46), persons of black (n=30) and white ethnicity (n=25) and in persons who acquired HIV through heterosexual contact (n=31) and sex between men (27).

Time between HIV and HBsAg diagnosis

Most (60.4%, n=682) co-infected persons were diagnosed with HIV more than six months before a HBV diagnosis, 20.2% (228) were diagnosed with HIV in the six months prior to HBV diagnosis, 15.1% (171) on the same day as HBV diagnosis and 4.3% were diagnosed with HIV in the six months following their HBV diagnosis. The median time between HIV and HBV diagnosis was 2.8 years (IQR: 0.0-10.4 years). Time between HIV and HBV diagnosis varied by age group, ethnicity, region of birth and route of HIV acquisition (table 2). Co-infected males who acquired their HIV through sex between men were diagnosed with HIV a median of 8.0 years (IQR: 0.4-15.4 years) before HBV, compared to 2.0 years (IQR: 0.0-7.3 years) and

3.5 years (IQR: 0.0-7.8 years) in male and females, respectively, who acquired HIV heterosexually.

Median time between HIV and HBV diagnosis varied by specialty requesting HBV test, with persons diagnosed with HBV in general practice and emergency departments diagnosed with both infections at a similar time (median: 0 years; IQR 0.0-3.5 years and 0.0-0.1 years respectively), whereas persons diagnosed with HBV in sexual health services and antenatal services were diagnosed with HIV 4.8 (IQR: 0.0-12.8 years) and 3.0 years (IQR: 0.0-6.2 years) respectively before HBV.

Predictors of co-infection in adults

In a multiple logistic regression model, increased age (aOR 1.14 per 10 year increase, 95% CI 1.07-1.20) was associated with co-infection (table 3). Co-infected persons were more likely to have been diagnosed with their HBV infection in sexual health services (aOR 54.48, 95% CI 41.84-70.93), specialist liver services (aOR 6.65, 95% CI 4.94-8.94), emergency department (aOR 5.24, 95% CI 3.07-8.95) and renal services (aOR 2.74, 95% CI 1.60-4.69) compared to general practice. Being of black ethnicity (female: aOR 16.35, 95% CI 10.31-25.92; male: aOR 15.52, 95% CI 9.84-24.49), a male of white ethnicity (aOR 8.29, 95% CI 5.32-12.93) or a male of other/mixed ethnicity (aOR 1.97, 95% CI 1.18-3.31) were predictors when compared to white females.

Testing HIV positive more than 6 months after HBsAg test

Of the 27,660 persons testing positive for HBsAg but not defined as co-infected at the time of or within 6 months of an HBV diagnosis, 0.19% (52) were subsequently diagnosed with HIV. Where known, the majority were male (81.6%, n=40), of white ethnicity (60.0%, n=30)

and diagnosed with their HBV in other secondary services (38.5%, n=20) or in general practice (32.7%, n=17). An almost equal proportion reported HIV acquisition following heterosexual contact (50.0%, n=19) and sex between men (47.4%, n=18).

Discussion

Between 2008 and 2014, 3.9% of persons testing positive for HBsAg had a record of a HIV diagnosis. Persons more likely to be co-infected with HIV and HBV fell largely in two groups: men and women of black ethnicity who probably acquired both infections heterosexually in Africa, and white men who have sex with men (MSM) who acquired both infections in the UK. The majority of persons co-infected were diagnosed with HIV more than six months before their positive HBsAg test.

The prevalence of diagnosed HIV infection in persons diagnosed with HBV was lower than the HBV rate observed in many European HIV cohorts (generally between 6 and 10%)(8,13–15), but was significantly higher than the HIV prevalence in the general population (0.2%). Additionally, fewer persons with HBV were diagnosed with HIV than in a similar study of persons with HIV and hepatitis C (HCV) infection (5.0%) (19). While one could speculate that persons with HCV are more at risk of HIV co-infection, it is likely a reflection of testing practices and a bias towards HCV rather than HBV testing in settings and populations where HIV diagnosis is considered.

The prevalence of diagnosed HIV infection in persons being tested for HBV, including among those who were HBsAg negative, was also higher than that observed in the general UK population, indicating the presence of overlapping risk factors in the tested population. Together with substantial HIV co-infection rates in people with HCV, these findings could support a pan-blood borne virus testing strategy targeting higher risk persons through specific settings where they access services, particularly if they do not regularly use health services and so may have missed opportunities for diagnosis and engagement in care. Our analysis of predictors significantly associated with co-infection indicate that such test

settings could include Emergency Departments and sexual health services, as well as liver and renal services. Frequent testing of renal patients as part of infection prevention and control protocol on dialysis units likely skews the findings but testing in other more routinely accessed settings should be considered as means of targeting risk groups for co-infection.

High rates of co-infection were found in MSM. In the UK all MSM are recommended to have and are eligible to receive free HBV immunisation in sexual health clinics, although vaccination coverage has been reported below target levels (90% in non-immune MSM at first genitourinary medicine clinic attendance) (20), however vaccine uptake data quality is variable. The negative impact of low vaccination rates in MSM was highlighted by a recent outbreak of acute HBV (21).

As HIV positive persons are recommended to be vaccinated against HBV (12), it is conceivable that some of the co-infections identified in this study could have been prevented, as co-infected MSM were diagnosed with HIV a median of eight years before a positive HBsAg test. Whilst the timing of HBsAg testing does not reflect incidence or recency of infection, rather, testing practices, and without conclusive prior negative test history to rule out long-standing chronic HBV infection, it is plausible that there may have been missed opportunities for HBV vaccine intervention during selective adult or universal infant immunisation programmes in the UK or abroad.

We also observed higher rates of co-infection in persons of black ethnicity, a large proportion of whom had probably acquired HIV infection in Africa. This is also likely to be true for their acquisition of HBV, with the majority of chronic HBV infections in England acquired prior to migration, most likely in childhood (4), in countries of high HBV

prevalence, such as those in Africa. However, even though it is likely that those co-infected had both infections prior to arriving in the UK, our data suggest that these infections were not diagnosed at the same time, with HIV diagnosed a median of 2.9 years before HBV. This indicates missed opportunities for earlier HBV diagnosis, despite NICE guidance recommending testing people from higher prevalence countries (22).

Rates of HIV co-infection were significantly lower in women diagnosed with HBV through antenatal testing (0.9%) than found overall in SSBBV, although SSBBV only captured 11% of women diagnosed with HBV through universal antenatal screening over the study period (23). The co-infection rates in antenatal services may be generalisable to the co-infection prevalence rates in women, as the antenatal screening programme is universal, “opt-out”, and consistently attains over 95% uptake among pregnant women.

Few co-infected people reported HIV acquisition through injecting drug use. While routine testing for HBV may have been poorly done in drug services and prisons, and as such these settings were not predictors for co-infection, the low rates likely reflect success from sustained HBV vaccination and harm reduction programmes in people who inject drugs (PWID), over the past decades. This is evident from survey data of PWID accessing drug services showing a current prevalence of HBsAg is <1%, increased uptake of HBV immunisation, and falling levels of sharing injecting paraphernalia among PWID(24).

While almost all women reported heterosexual contact as their probable route of HIV infection, a third of men reported heterosexual contact and two thirds of men reported sex between men. In persons of white, Asian and other ethnicity, the most common route of HIV infection was sex between men, whereas among persons of black ethnicity heterosexual contact was most commonly reported. Unfortunately probable route of transmission for

HBV is not routinely submitted by laboratories and is generally poorly enquired after. Further research or surveillance to gather such data would be useful to understand the contribution of transmission routes to the mono and co-infected populations in order to target vaccination.

Aside from the antenatal population, persons testing HBV positive within SSBBV are likely to have presented to care with symptoms or signs of infection or liver disease or have a risk factor identified by themselves or the clinician, whereas most infected people will remain asymptomatic and unaware of their infection, and hence not tested. Therefore, in test settings which adopt a targeted testing policy, co-infection using SSBBV data represents the diagnosed prevalence of HBV and HIV, as opposed to overall (diagnosed and undiagnosed) prevalence, and is biased by health-care seeking practices, patient and clinician awareness and testing practices. We do not know the prevalence of co-infection in undiagnosed persons which in turn would be influenced by the proportion of undiagnosed infections in different sub-populations. The undiagnosed burden of HBV in the UK has been estimated to be 81%, compared to 12% for HIV (25,26).

Interpretation of SSBBV testing data are limited by it being a sentinel system in a restricted time period, so HBV tests that occurred outside of the participating laboratories or study timeframe could have been missed, in turn impacting on co-infection estimates and interval between HIV and HBV diagnoses. In addition, data extracted from sexual health services have limited patient identifiers, possibly resulting in some true matches being missed when linking the datasets and a lower co-infection estimate. The definition of co-infection for the main analyses was restricted to individuals with an HIV test 6 months before or 6 months after a first positive HBsAg test to avoid inclusion of acute adult infections which would

most likely clear. However, including individuals with HIV diagnosis more than 6 months after HBsAg added an extra 52 co-infections, giving a co-infection rate of 4.1% .

Overall this study likely gives us a conservative estimate of HIV co-infection in the HBV infected population in England, which has not yet been well described. Along with revised HBV prevalence estimates, these data are important parameters for monitoring progress towards elimination of HIV and HBV as major public health threats, as set out in the WHO Global Health Sector Strategies for HIV and Viral Hepatitis (27).

The introduction of universal infant immunisation against HBV in the UK in 2017 will contribute to declines in HBV and HIV co-infection in the UK-born population, including in MSM and PWID, although it may take a few decades to see an impact. However, scale-up of prevention and treatment programmes globally to lower prevalence of HIV and HBV infections in migrants entering the UK are also required to reduce the burden of HIV and HBV mono- and co-infections in the UK.

Conclusion

Our study indicates that HIV co-infection affects specific groups of persons with HBV. Sexual transmission is the main transmission route for HIV and plausible for HBV in this co-infected population, with MSM of white ethnicity and heterosexual men and women of black ethnicity disproportionately affected. The delay between HIV and HBV diagnosis, while acknowledging that a positive test represents infection detection and not acquisition, still indicates missed opportunities for prevention and treatment interventions. These findings highlight the need to increase HBV vaccine uptake among MSM, sustain effective vaccination programmes in other risk groups (e.g. PWID and prisoners) and improve

implementation of HIV and HBV testing recommendations among people who have migrated from endemic countries.

References

1. NICE. Hepatitis B and C testing: people at risk of infection [Internet]. 2012 [cited 2017 Feb 1]. Available from: https://www.nice.org.uk/guidance/ph43/chapter/1-Recommendations

2. Public Health England. HIV in the UK - 2016 report [Internet]. 2016. Available from: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/574667/HIV_in_the_UK_2016.pdf

3. Public Health England. Infection reports/Immunisation- Acute hepatitis B (England): annual report for 2015. 2016.

4. Hahné S, Ramsay M, Balogun K, Edmunds WJ, Mortimer P. Incidence and routes of transmission of hepatitis B virus in England and Wales, 1995-2000: Implications for immunisation policy. Journal of Clinical Virology. 2004. p. 211–20.

5. Public Health England. HIV testing in England: 2016 report [Internet]. 2016. Available from: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/573596/HIV_testing_in_England_2016_Report_FinalNB301116.pdf

6. Colin JF, Cazals-Hatem D, Loriot M a, Martinot-Peignoux M, Pham BN, Auperin a, et al. Influence of human immunodeficiency virus infection on chronic hepatitis B in homosexual men. Hepatology. 1999;29:1306–10.

7. Gilson RJ, Hawkins a E, Beecham MR, Ross E, Waite J, Briggs M, et al. Interactions between HIV and hepatitis B virus in homosexual men: effects on the natural history of infection. AIDS [Internet]. 1997;11(5):597–606. Available from: http://www.ncbi.nlm.nih.gov/pubmed/9108941

8. Konopnicki D, Mocroft A, de Wit S, Antunes F, Ledergerber B, Katlama C, et al. Hepatitis B and HIV: prevalence, AIDS progression, response to highly active antiretroviral therapy and increased mortality in the EuroSIDA cohort. AIDS. 2005;19(6):593–601.

9. Rajbhandari R, Jun T, Khalili H, Chung RT, Ananthakrishnan AN. HBV/HIV coinfection is associated with poorer outcomes in hospitalized patients with HBV or HIV. J Viral Hepat. 2016;23(10):820–9.

10. Thio CL, Seaberg EC, Skolasky R, Phair J, Visscher B, Muñoz A, et al. HIV-1, hepatitis B virus, and risk of liver-related mortality in the Multicenter Cohort Study (MACS). Lancet. 2002;360(9349):1921–6.

11. Weber, Rainer. Liver-related deaths in persons infected with the human immunodeficiency virus: The d:a:d study. Arch Intern Med. 2006;166(15):1632–41.

12. Public Health England. The green book- Chapter 18 Hepatitis B [Internet]. 2017. Available from: https://www.gov.uk/government/publications/hepatitis-b-the-green-book-chapter-18

13. Price H, Bansi L, Sabin CA, Bhagani S, Burroughs A, Chadwick D, et al. Hepatitis B Virus Infection in HIV-Positive Individuals in the UK Collaborative HIV Cohort (UK CHIC) Study. PLoS One. 2012;7(11).

14. Thornton A. Viral hepatitis and HIV co-infection in the UK collaborative HIV cohort (UK CHIC) study. University College London; 2015.

15. Wandeler G, Gsponer T, Bihl F, Bernasconi E, Cavassini M, Kovari H, et al. Hepatitis B virus infection is associated with impaired immunological recovery during antiretroviral therapy in the Swiss HIV cohort study. J Infect Dis [Internet]. 2013;208(9):1454–8. Available from: http://www.ncbi.nlm.nih.gov/pubmed/23901088

16. Price H, Gilson R, Mercey D, Copas A, Parry J, Nardone A, et al. Hepatitis C in men who have sex with men in London--a community survey. HIV Med. 2013;14(9):578–80.

17. Brant LJ, Hurrelle M, Balogun MA, Klapper P, Ahmad F, Boxall E, et al. Sentinel laboratory surveillance of hepatitis C antibody testing in England: understanding the epidemiology of HCV infection. Epidemiol Infect [Internet]. 2007;135(3):417–26. Available from: http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=2870581&tool=pmcentrez&rendertype=abstract

18. Shepard CW, Simard EP, Finelli L, Fiore AE, Bell BP. Hepatitis B virus infection: Epidemiology and vaccination. Epidemiologic Reviews. 2006. p. 112–25.

19. Ireland G, Delpech V, Lattimore S, Kirwan P, Croxford S, Mandal S SR. HIV Infection in persons testing for Hepatitis C: England 2008-2014. HIV Med. 2016;17 (Supple:36.

20. Hill-Tout R, Mitchell H, Hughes G. P240: What is the Hepatitis B vaccination coverage in MSM in South West London? An audit of Hepatitis B vaccination coverage in “first attendee” MSM in a busy Teaching Hospital GUM clinic. Sex Transm Infect. 2016;92(Suppl 1):A99.

21. Shankar AG, Mandal S, Ijaz S. An outbreak of hepatitis B in men who have sex with men but identify as heterosexual. Sex Transm Infect [Internet]. 2016;92(3):227–227. Available from: http://sti.bmj.com/lookup/doi/10.1136/sextrans-2015-052490

22. National Institute for Health and Care Excellence. Hepatitis B and C testing : people at risk of infection [Internet]. 2012. Available from: https://www.nice.org.uk/guidance/ph43/resources/hepatitis-b-and-c-testing-people-at-risk-of-infection-1996356260293

23. Public Health England. National Antenatal Infections Screening Monitoring. Data tables : England 2006 - 2015. 2017;

24. Public Health England. Data tables of the Unlinked Anonymous Monitoring Survey of HIV and Hepatitis in People Who Inject Drugs [Internet]. 2016. Available from: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/537598/UAM_Survey_of_PWID_2016_data_tables_with_2015_data_FINAL.pdf

25. The Polaris Observatory Collaborators. Global prevalence, treatment, and prevention of hepatitis B virus infection in 2016: a modelling study. Lancet Gastroenterol Hepatol. 2018;

26. Public Health England. Towards elimination of HIV transmission, AIDS and HIV-related deaths in the UK: 2017 report [Internet]. 2017. Available from: https://www.gov.uk/government/publications/hiv-in-the-united-kingdom

27. World Health Organization. Global Health Sector Strategy on Viral Hepatitis 2016-2021- Towards ending viral hepatitis [Internet]. 2016. Available from: http://apps.who.int/iris/bitstream/10665/246177/1/WHO-HIV-2016.06-eng.pdf?ua=1

Table 1: Characteristics of adults diagnosed with HIV[1] among persons tested for HBsAg between 2008 and 2014 in sentinel laboratories in England.

		HBsAg Negative			HBsAg Positive			Total		
		n	HIV+ (n)	HIV+ (%)	n	HIV+ (n)	HIV+ (%)	n	HIV+ (n)	HIV+ (%)
Total		2,121,144	30,771	1.5	28,789	1,129	3.9	2,149,933	31,900	1.5
Sex										
	Male	781,552	22,567	2.9	16,360	834	5.1	797,912	23,471	2.9
	Female	1,316,136	7,925	0.6	11,774	281	2.4	1,327,910	8,206	0.6
	Not Reported	23,456	279	1.2	655	14	2.1	24,111	223	0.9
Age Group										
	15 - 24 years	403,698	1,695	0.4	4,133	54	1.3	407,831	1,749	0.4
	25 - 34 years	776,182	7,647	1.0	10,453	283	2.7	786,635	7,930	1.0
	35 - 44 years	448,577	10,683	2.4	7,426	425	5.7	456,003	11,108	2.4
	45+ years	485,384	10,721	2.2	6,709	364	5.4	492,093	11,085	2.3
	Not Reported	7,303	25	0.3	68	3	4.4	7,371	28	0.4
Ethnicity										
	White	1,309,798	15,989	1.2	7,910	455	5.8	1,317,708	16,444	1.2
	Asian	219,024	1,233	0.6	4,594	52	1.1	223,618	1,285	0.6
	Black	85,445	3,996	4.7	4,843	486	10.0	90,397	4,482	5.0
	Mixed/Other	97,960	1,348	1.4	5,840	72	1.2	103,800	1,420	1.4
	Not Reported	408,808	8,205	2.0	5,602	64	1.1	414,410	8,269	2.0
Speciality										
	Primary Care	1,033,465	21,571	2.1	15,863	706	4.5	1,049,328	22,277	2.1
	Secondary Care	620,579	8,315	1.3	10,601	403	3.8	631,168	8,718	1.4
	Antenatal testing	466,062	872	0.2	2,310	20	0.9	468,372	892	0.2
	Not Reported	1,050	13	1.2	15	0	0.0	1,065	13	1.2
Year of HBsAg test										
	2008	233,525	2,436	1.0	4,368	285	6.5	237,893	2,721	1.1
	2009	429,748	3,555	0.8	4,268	184	4.3	254,016	3,739	1.5
	2010	258,010	4,249	1.6	4,017	145	3.6	262,027	4,394	1.7
	2011	276,252	4,049	1.5	3,990	148	3.7	280,242	4,197	1.5
	2012	309,232	4,820	1.6	3,928	132	3.4	313,160	4,952	1.6
	2013	365,705	5,519	1.5	3,815	126	3.3	369,520	5,645	1.5
	2014	428,672	6,143	1.4	4,403	109	2.5	433,075	6,252	1.4

[1] Persons diagnosed with HIV before their HBsAg test and in the six months following their HBsAg test.

Table 2: Characteristics, by sex, of persons co-infected with HBV and HIV between 2008-2014 in England

	Sex^				Time between HIV and HBV diagnosis (years)	
	Male		Female			
	N	Percent*	N	Percent*	Median	IQR
Total	834	100	281	100	2.8	0.0-10.4
Age Group [$]						
15 - 24 years	34	4.1	20	7.1	0.0	0.0-1.9
25 - 34 years	190	22.8	91	32.5	0.4	0.0-4.4
35 - 44 years	305	36.6	114	40.7	3.5	0.0-10.4
45+ years	304	36.5	55	19.6	8.6	0.0-16.2
Not Reported	1		1			
Ethnicity						
White	427	54.0	27	10.3	6.2	0.0-16.2
Asian	42	5.3	10	3.8	0.0	0.0-5.8
Black	258	32.6	220	84.0	2.9	0.0-8.0
Mixed/Other	64	8.1	5	1.9	1.1	0.0-7.5
Not Reported	43		19			
Region of Birth						
UK	247	35.2	8	3.4	8.4	0.4-17.0
Europe (excluding UK)	114	16.2	8	3.4	2.8	0.0-11.2
Africa	226	32.2	201	86.3	2.5	0.0-7.5
Latin America and the Caribbean	63	9.0	4	1.7	5.1	0.0-10.8
Asia	41	5.8	12	5.2	0.1	0.0-5.8
Oceania	11	1.6	0	0.0	14.1	8.2-19.2
Not reported	132		48			
Route of HIV acquisition						
Men who have sex with men	444	61.8	-		8.1	0.4-15.4
Heterosexual contact	230	32.0	221	95.3	2.8	0.0-7.8
Injecting drug use	30	4.2	3	1.3	6.3	0.4-16.5
Blood products	8	1.1	2	0.9	22.8	11.6-25.0
Mother to child transmission	3	0.4	4	1.7	6.9	0.0-11.7
Other	3	0.4	2	0.9	0.0	0.0-6.2
Not reported	116		49			

^Excluding where sex was unknown (n=14); * where reported; [$] at HBV diagnosis

Table 3: Factors associated with a HIV diagnosis among adults testing HBsAg positive in England, 2008-2014

	HBsAg positive	Co-infected	Adjusted Odds Ratio	95% Confidence Intervals	p-value
Ethnicity & Sex					
White Female	3,136	22	1		
White Male	4,585	386	8.29	5.32-12.93	
Asian Female	1,630	7	0.79	0.33-1.87	
Asian Male	2,836	37	2.06	1.20-3.54	
Black Female	2,339	194	16.35	10.31-25.92	<0.0001
Black Male	2,328	230	15.52	9.84-24.49	
Other/Mixed Female	2,894	5	0.25	0.09-0.66	
Other/Mixed Male	2,723	51	1.97	1.18-3.31	
Not reported Female	1,699	17	0.15	0.08-0.28	
Not reported Male	3,714	40	0.14	0.08-0.24	
Age					
per 10 year increase			1.14	1.07-1.20	<0.0001
Year Positive					
per year from 2008			0.90	0.86-0.93	<0.0001
Requester Type					
General Practice	8,540	82	1		
Specialist drug service	220	3	1.28	0.40-4.12	
Sexual health services	5,361	462	54.48	41.84-70.93	
Prison services	318	3	1.22	0.38-3.92	
Emergency Department	297	18	5.24	3.07-8.95	<0.0001
Other Primary Care	580	8	1.13	0.54-2.36	
Antenatal Services	2,290	20	1.03	0.62-1.72	
Specialist liver service	1,697	112	6.65	4.94-8.94	
Specialist renal service	471	18	2.74	1.60-4.69	
Other Secondary Care	8,110	263	3.27	2.54-4.22	

Excluding persons tested in specialist HIV services and where age or requester service were not reported.