Prevalence of Hepatitis B Infection among African Immigrants in the Greater Philadelphia Area

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ABSTRACT

Prevalence Hepatitis B Infection among African immigrants in The Greater Philadelphia Area

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Hepatitis B virus (HBV) infection is a major global health problem. It is the most important life threatening viral hepatitis and most common liver infection worldwide. The prevalence of HBV in the Asian and Pacific Islander immigrant communities in the U.S has been well described. However in the African immigrant community, data are sparse. The main objective of this study was to determine the prevalence of HBV among African immigrants residing in the Greater Philadelphia area. A structured questionnaire was administered to 87 adults, 18 years and older. Blood samples were collected from participants and tested for HBsAg and anti-HBs at the Quest diagnostic laboratory. A total of 41 males (47.7%) and 45 females (52.3%) were screened. The mean age was 39.4 years (SD=12.89). The mean duration of stay is 11.4 years (SD=11.7 years) and 51.7% of those screened had lived in the U.S for ≤ 10 years. Of those screened, 10 (5 males and 5 females) were HbsAg positive indicating current infection and prevalence of 11.49%. Also 41 (47.13%) of those screened were anti-HBs positive indicating immunity due to past infection or vaccination. Ten out of 21(41.4%) of those who self reported a vaccination history had a positive anti-HBs result. There was no statistically significant relationship between the outcome variable HbsAg or anti-HBs and the risk factors studied. This study reveals that 1 in 9 of every African immigrant screened was infected with HBV. This indicates a need for increased seroprevalence surveillance, increased vaccination and education about hepatitis B in this group.

Key words: African immigrant, Hepatitis B, Prevalence
INTRODUCTION

Hepatitis is defined as the inflammation of the liver characterized by liver damage or cell death. It is often caused by viruses, certain drugs, chemicals, or poisons. It may either be acute /of limited duration or chronic /continuing (Gale Encyclopedia of Medicine, 2008). According to the World Health Organization (W.H.O), hepatitis B is a major global health problem caused by hepatitis B virus. An estimated two billion people worldwide have been infected with the hepatitis B virus (W.H.O, 2008). This accounts for an estimated one-third of the world’s population.

Infection with hepatitis B virus causes both significant morbidity and mortality accounting for an estimated 400 million chronic liver infections and diseases. It is the most important life threatening viral hepatitis predisposing infected individuals to death from liver cirrhosis and liver cancer (W.H.O, 2008). An estimated 1 million people die annually from these chronic HBV and associated complications and pathologies (W.H.O, 2001). The hepatitis B virus is of particular importance in the field of cancer biology, as its contribution to understanding cancers in humans cannot be overemphasized.

Hepatitis B virus (HBV) infection is endemic in China, other parts of Asia and Western Pacific countries with chronic HBV infection accounting for an estimated prevalence of 2.4% - 16%. Chronic HBV infection rates are equally high in the Amazon and the southern parts of eastern and central Europe. An estimated 2% to 5% of the population is chronically infected in the Middle East and Indian sub-continent. Less than 1% of the population in Western Europe and North American is chronically infected (W.H.O, 2008). In studies by Kew (1996) and Kiire (1996), HBV infection was found to be endemic in Africa. In the study by Kiire in 1996, an estimated 50 million people were infected with Chronic HBV with an approximate 25% mortality risk. In the study by Kew, approximately 10.4% are chronically infected. This percentage also differs between the different countries and within each country in the region.

The world has been broadly classified into regions of high, intermediate and low HBV endemicity. A major part of Africa especially the Sub-Saharan region has been classified as
having high endemicity and parts of North Africa has been classified as having intermediate endemicity (WHO, 2011).

Figure 1: Hepatitis B world distribution map

![Hepatitis B world distribution map](image)

WHO, 2011

Table 1. Prevalence of hepatitis B around the world

<table>
<thead>
<tr>
<th>Area</th>
<th>% of population positive for</th>
<th>infection</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>HBsAg</td>
<td>anti-HBs</td>
</tr>
<tr>
<td>Northern, Western, and Central Europe, North America, Australia</td>
<td>0.2-0.5</td>
<td>4-6</td>
</tr>
<tr>
<td>Eastern Europe, the Mediterranean, Russia and the Russian Federation, Southwest Asia, Central and South America</td>
<td>2-7</td>
<td>20-55</td>
</tr>
<tr>
<td>Parts of China, Southeast Asia, tropical Africa</td>
<td>8-20</td>
<td>70-95</td>
</tr>
</tbody>
</table>
Generally, a high prevalence of chronic HBV is categorized as $\geq 8\%$, intermediate (2-8\%) and low (<2\%) (W.H.O 2011). Several studies in the United States also support the argument that there is high burden of infectious diseases including Hepatitis B among immigrant communities (Hwang et al., 2008; Kim et al., 2004; Venter and Gany, 2009). However, most of the studies were done in the Asian and Pacific Islander immigrant communities. This is so because HBV is endemic in these communities with prevalence of chronic HBV estimated to be between 2.4\% and 16\% (Centers for Disease Control and Prevention [CDC], 2006).

With the increasing number of African immigrants in developed western countries, some studies have shown an increase in the burden of infectious diseases and re-emerging infectious diseases (Gibney et al., 2009). In a study by Kim et al., (2004), chronic HBV infection was predominantly the condition seen among immigrants in the mid western community studied. This is so for many reasons including high burden of infectious disease in less developed countries, poverty, familial predisposition, inadequate access to medical care, poor nutrition and stress associated with relocating and living in developed countries (López-vélez et al., 2003). However, in the African immigrant community, data on the burden of HBV infection are sparse and this needs to be addressed considering the public health significance of HBV infection. In order to be able to provide some answers about the disease burden in the African immigrant community, this project was done in conjunction with Hepatitis B Foundation (HBF).

It is unclear how many Americans who are chronically infected with HBV are aware of their status. Knowing this number represents an important goal of HBF since awareness of HBV status is necessary in initiating access to care. Empirical evidence from the HBF, as well as community reports, suggest that of the estimated 1.4 - 2 million Americans who are chronically infected with HBV, only 20-30\% of people know they are infected. This self awareness status also differs within risk groups and ethnic groups. It has been estimated that this could be as low as 8\% and as high as 60\% of the infected population in the United States (Cohen et al., 2010). This is significant considering health disparities documented by the Department of Health and Human Services in the minority population represented in the United States.
The exact population of African immigrants residing in the City of Philadelphia is unknown. The historical Society of Pennsylvania (2001) estimates that 40,000 to 55,000 African immigrants reside in the Greater Philadelphia area with the largest communities from Nigeria, Liberia, Ethiopia and Ghana. However, considering the risk factors associated with the transmission of the virus and the challenges associated with access to health care among this group, it is important to have a good knowledge of the burden of hepatitis B in this group.

In addressing this issue of underestimation of HBV infection, in partnership with HBF this research was carried out in the African immigrant community. This project aims to provide the basis for a better understanding and estimation of HBV burden in this population. It will also provide useful information on how to address this disease among members of this immigrant community, identify risk factors and provide the basis for implementation of future preventive and treatment programs. The lack of detailed information about the burden and prevalence of hepatitis B in this group is the main problem addressed by this study. This is necessary for the prevention of emerging and re-emerging diseases in the United States, reduction of overall disease burden and development of tools needed to address the problem of infectious diseases in this group.

**HEPATITIS B FOUNDATION**

The hepatitis B Foundation is the only national nonprofit organization that specifically addresses the issue of Hepatitis B disease. The organization is solely dedicated to finding a cure for Hepatitis B. The foundation was established in 1991 to address the unmet needs of those affected by the disease, providing necessary support for families. Paul and Janine Wittes, Dr Timothy and his wife Joan, with the support of Dr Baruch Blumberg who won the Nobel Prize for the discovery of hepatitis B virus, established the foundation. The Hepatitis B Foundation has since grown into a professional organization with a global reach. The foundation recently celebrated its 20th year anniversary.

The mission of the foundation is deeply rooted in its history. It is dedicated to finding a cure for hepatitis B and improving the quality of life for those affected by hepatitis B worldwide. Its commitment includes funding focused research, promoting disease awareness, supporting
immunization and treatment initiatives, and serving as the primary source of information for patients and their families, the medical and scientific community, and the general public. The overall arching goal of the organization is to improve the lives of those affected by hepatitis B through a comprehensive program of research, education and patient advocacy.

The mission of Hepatitis B Foundation is affirmed daily by their response to numerous individuals in need of their help. Hep B free Philadelphia has helped to further create awareness about hepatitis B and also educate the public. Hep B Free Philadelphia is a public awareness and education campaign – based on the enormously successful San Francisco Hep B Free campaign. It is being launched to address the growing severity of hepatitis B and liver cancer in the U.S. This foundation provides trainings for health care providers, distribute literature, and help sponsor vaccinations. Customized information for ethnic communities at high risk for hepatitis B within the U.S. and abroad is been done through the comprehensive "Language Chapters" in Traditional Chinese, Simplified Chinese, Korean, Vietnamese and Spanish.

The Hepatitis B foundation caters to all groups of people who are infected or affected by Hepatitis B with focus on high risk ethnic groups, the Asians, Pacific Islanders and African Immigrants. It does through organization of outreach programs city wide and also at the community levels especially in geographical locations where the high risk ethnic groups are. These groups are also those with low socio-economic status with limited English proficiency. Hence the need for the customized language information for these diverse groups.

The foundation does patient advocacy to ensure that there is continuous funding for Hepatitis B prevention education and research programs. They also meet the needs of those affected with the disease by building a stronger and more visible Hepatitis B community by starting and sponsoring the only national conference for those living with chronic hepatitis B. Patients and their loved ones, parents of children, and health care providers all gather to share their stories and information in a caring and supportive environment.

The Hepatitis B foundation, through its research program is bringing hope to affected individuals through the work of its scientist. The foundation sponsors activities that help keep the national research focus on hepatitis B and promote innovative scientific exchange among academia,
industry and government. The Hepatitis B Foundation (HBF) laboratory was established to advance the mission to find a cure for chronic hepatitis B and help improve the quality of life for all those affected worldwide. This foundation funds its own laboratory with scientist committed to Hepatitis B research. This has resulted in a highly productive synergy of effort between these scientists and outreach staff who benefit directly from each other’s work.

The Hepatitis B Foundation has been very successful in establishing effective partnerships to accomplish its goals. These partnerships have helped to maximize resources and extend the reach of Hepatitis B foundation. These partners include, American Liver Foundation, Answer To Cancer, Asian Liver Center (ALC) at Stanford University, Asian Pacific Liver Center (APLC) at St. Vincent Medical Center, Centers for Disease Control and Prevention, Division of Viral Hepatitis, Chinese Health Information Center (CHIC) at Thomas Jefferson University Hospital, Children's Hospital of Philadelphia - Vaccine Education Center, Delaware Valley Hepatitis Treatment, Research and Education Center (HepTrec), Drexel Institute for Biotechnology and Virology Research of Drexel University College of Medicine, Hepatitis B Adoption ListServ, Hepatitis B Information and Support ListServ (HB-L). The Foundation has been sustained by its ability to generate fund from numerous sources. Programs are generally funded by federal, state, and private grants, as well as fund-raising efforts. There is good accountability in this foundation with clear, specific goals and focus.
BACKGROUND AND SIGNIFICANCE

LITERATURE REVIEW

HEPATITIS B VIRUS (HBV)

History:
The hepatitis B virus was discovered in 1967 by Dr Baruch Blumberg and his team. Two years later, in 1969, Drs. Blumberg and Irving Millman invented the hepatitis B vaccine. Dr Blumberg and his colleagues focused on establishing the etiological relationship between HBV and primary liver cancer/hepatocellular carcinoma (Blumberg, 2012). It was not until 1976 that Merck and Company Inc signed an agreement to produce the HBV vaccine. The vaccine first became available in 1982 (W.H.O, 2011). The HBV vaccine was made from small HBV surface antigen particles, made in the liver cells of the human host guided by the surface antigen gene introduced by the virus. Several doses were subsequently produced using the recombinant method. Presently, over a billion doses had been administered and it is considered one of the most widely used vaccines in the world (W.H.O, 2011 and Blumberg, 2012).

HBV vaccine is the first "cancer vaccine", that is, a cancer preventing vaccine produced. With this vaccine, the prevalence of HBV carriers and cases has dropped dramatically in the impacted populations (Blumberg, 2012). HBV vaccination is second only to the smoking prevention campaigns as a cancer prevention program. Routine hepatitis B vaccination was recommended for some U.S. adults and children beginning in 1982, and for all children in 1991 (CDC, 2012). Since 1990, new hepatitis B infections among children and adolescents have dropped by more than 95% and by 75% in other age groups (CDC, 2012). Vaccination has also reduced the rate of chronic infection from between 8% to 15% to less than 1% among immunized children (W.H.O 2011). In 2009, 177 countries have included the hepatitis B vaccine into their national infant immunization program compared to 31 countries in 1992 (W.H.O, 2011). In 1992, the World Health Assembly passed a resolution recommending global vaccination against hepatitis B (W.H.O, 2011).
HBV structure and pathobiology:
The hepatitis B virus (HBV) is an incompletely double stranded DNA virus of the family Hepadnaviridae causing serum hepatitis (Grob, 1998 and Hunt, 2011). The HBV is enveloped and also surrounded by the host cell-derived envelope. It is stable to organic solvents, heat and pH resistant. The virus has a diameter of about 40nm and it infects both humans and chimpanzees. It is a hepatotropic virus which replicates in the hepatocytes (liver cells) (Hunt, 2011). The HBV particle consists of both an inner core and an outer surface protein coat containing the surface antigen (HbsAg). The inner core particle surrounds the viral DNA and the enzyme DNA polymerase (WHO, 2002 and Locarnini, 2004). Its genome is made up of almost 3200 base pairs with various genes (Howard, 1995). These are the pre-S1, Pre-s2 and S gene which contain the program for the 3 lipoproteins on the viral envelope, which contains the HbsAg. The pre-C/C gene codes for polypeptides and a protein which after post-translational processing is measurable in the blood as Hbe antigen. The exact function of the Hbe antigen is unknown but it is a marker for an ongoing viral replication and infectivity (Grob, 1998 and Howard, 1995).

Figure 2: The structure of HBV

Upon entry in to the individuals’ body the HBV evades the immune system and replicates in the liver. During this period, several biochemical and histological changes occur in stages after HBV infection. The HBV may account for 80% of all cases of hepatocellular carcinoma (W.H.O,
Transmission, Risks Factors, Treatment and Statistics

The highest concentration of the virus is found in the blood with lower concentrations in other body fluids such as semen, vaginal secretions and wound exudates. HBV is efficiently transmitted by percutaneous or mucous membrane exposure to infectious blood or body fluids that contain blood. The primary risk factors that have been associated with infection are unprotected sex with an infected partner, birth to an infected mother, unprotected sex with more than one partner, men who have sex with other men (MSM), history of other sexually transmitted diseases (STDs), household contacts with chronically infected persons and injection drug use (CDC, 2008).

Infection with hepatitis B virus could be self limiting or chronic. The incubation period from the time of exposure to onset of symptoms is between 6 weeks and 6 months (CDC, 2008). All infected individuals with the hepatitis B surface antigen are potentially infectious. Blood is usually infective before the onset of symptoms throughout the acute phase and infected individuals may transmit the virus to uninfected individuals (WHO, 2002). However, vaccinated individuals and those with prior exposure to HBV who have recovered with antibodies to HBV (antiHbs) are not susceptible to HBV infection.
Age is an important determining factor in predicting the chronicity of HBV infection. The risk of developing chronic infection is inversely related to age at infection. Young children are particularly susceptible to developing chronic infections. This is of particular importance in endemic countries where majority of the infections occur at birth or during early childhood. Approximately 90% of infected infants and 25-50% of infected children between age 1-5 years become and remain chronically infected (CDC, 2008, W.H.O, 2002).

This is in contrast to the pathogenesis in adults where about 90-95% of healthy adults who are infected with HBV recover and are completely rid of the virus within six months without becoming chronically infected (CDC, 2008). The remaining 5-10% may develop chronic lifelong infection (WHO, 2012). Approximately 25% of adults who become chronically infected during childhood and 15% after childhood die from HBV-related liver cancer or cirrhosis. Also in adults, only approximately half of newly acquired/acute HBV infections are symptomatic, and approximately 1% of these cases result in acute liver failure and death. Generally, the risk of premature death from hepatocellular cancer or cirrhosis among chronically infected individuals is 15%–25% (CDC, 2010).

There is no treatment for acute HBV infection but supportive care is given to alleviate symptoms such as nausea, vomiting, joint pain, jaundice, fatigue, abdominal pain, loss of appetite and itching (Academy for Educational Development, 2002, CDC, 2007). However, several antiviral drugs and immune modulators have been developed and used for the treatment of chronic infection. These immune modulators include interferon alfa-2b and pegylated interferon alfa-2a. The antiviral drugs include adefovir dipivoxil, lamivudine, entecavir, tenofovir and telbivudine (U.S Food and Drug Administration [FDA], 2011). Regular medical evaluation and monitoring is needed to assess the progression of the disease and identify the occurrence of hepatic damage or disease (CDC, 2008). However, not all individuals with chronic hepatitis are treated. The choice of treatment depends on the extent of liver damage and their disease state.

In the United States, the Centers for Disease Control and Prevention [CDC], (2008), estimate that between 800,000 and 1.4 million people in the U.S have chronic HBV infection. However, some studies disagrees with this number, stating that it is an underestimation and estimates that
approximately 2 million people are infected (Cohen et al., 2008; Kowdley et al., 2006). This is because a large percentage of chronically infected individuals are not diagnosed and the highest risk populations are underrepresented in surveillance studies. An estimated 50% of those chronically infected are Asian Americans, Native Hawaiians and other Pacific Islanders. Infection with chronic HBV results in an estimated 5,000 annual deaths in the U.S (CDC, 2008).

The mode of transmission of the virus influences the type of statistics obtained in different parts of the world. Infection in Asia and Sub-Saharan Africa and other developing countries is usually acquired perinatally or during early childhood, unsafe injection practices, blood transfusions and sexual contact accounting for the high prevalence rate in these regions (W.H.O, 2008). This is unlike the means of transmission in the western developed nations which is mainly through sexual contact and IV drug use. These modes of transmission with the introduction of routine vaccination of infants and children in the United States accounts for the much lower prevalence rate (CDC, 2008, W.H.O, 2008). However, immigration to the U.S is beginning to make this number increase.

The CDC estimate of 2009 reported that cases of acute hepatitis B decreased 84.2%, from 21,277 in 1990 to 3,371 in 2009. Adjusting for underreporting, the number of acute hepatitis B cases decreased 84.8%, from 59,000 in 1990 to 9,000 in 2009 (CDC, 2011). This decline is attributed to increased effort on HBV vaccination especially among children. However, in most developing nations, especially in Africa, HBV infection is a major health problem and has not been addressed as so. As stated above in the study by Kiire (1996), an estimated 50 million people were infected with Chronic HBV with an approximate 25% mortality risk. It should be noted that infection with hepatitis B virus is 100 times more infectious than Human Immunodeficiency Virus [HIV] (WHO, 2008). Liver cancer caused by HBV is one of the three leading causes of cancer death in men and a major cause of cancer in women (WHO, 2008).

There is evidence in several studies done in the United States which supports the argument that there is a high burden of infectious diseases including hepatitis B among immigrant communities (Hwang et al., 2008; Kim et al., 2004; Venter and Gany, 2009). However, as noted above, most
of the studies were done in the Asian and Pacific Islander immigrant communities. This is so because HBV is endemic in these communities with prevalence of chronic HBV estimated to be between 2.4% to 16% (CDC, 2006). In a review by Adair and Nwaneri (1999), the authors noted that there is lack of detailed information about health of immigrants. Of the 102 cases who had emigrated 5 years prior, 10 had Hepatitis B, 55% had antibodies to hepatitis B. In another study done in Spain by López-Vélez et al., (2003), they observed a hepatitis B prevalence rate of 10% among African immigrants which was similar in both adults and children.

In Nigeria, West Africa, for example, HBV is endemic for several reasons including late incorporation of HBV vaccination in the immunization program, the absence of a national HBV surveillance program and unavailability of HBV vaccine. This is despite the availability of a safe and effective vaccine since 1982. However the HBV vaccine was not included in the immunization program until 1995 and only became available in 2004 (Emechebe et al., 2010; Sadoh and Eregie, 2009). This unavailability of the vaccine poses a serious challenge toward the reduction in the incidence and prevalence of this disease in the population. These findings further underscore the need to determine with good accuracy the prevalence of HBV infection in the African immigrant community.

With the increasing level of immigration and number of African immigrants in developed western countries, there is a need to continuously screen for HBV in order to prevent an increase in infection rate, indirectly reduce the costs associated with health care and improve the overall health of the public. This is because chronic HBV infection is associated with increased risk of cirrhosis, hepatocellular carcinoma and continued transmission of infection to unaffected persons.

**Diagnosis of HBV infection and interpretation of test results**

Diagnosis of hepatitis B infection is done by identifying serological markers for HBV in the blood. These markers are several hepatitis B virus (HBV) specific antigens and antibodies. The following markers will be discussed below:
(a) Hepatitis B surface Antigen (HBsAg): This is the protein found on the surface of the HBV. The presence of HBV in high levels in the serum indicates that the individual is infectious. It is an indicator of acute infection and chronic infection if it persists for more than 6 months (CDC, 2008; MMRW, 2005). It should be noted that the same HbsAg is been used to produced the hepatitis B vaccine. HBs Ag is produced in response to both acute and chronic infection. An infected individual will have a positive test result. A negative test result indicates that an individual is not infected. It is very useful marker for the diagnosis of and blood screening for HBV (CDC, 2008; MMRW, 2005).

(b) Hepatitis B surface antibody (anti-HBs): This is the antibody produced as an immune response to acute HBV infection and it is the specific antibody for HbsAg. Its detection 1-4 months after onset of clinical symptoms indicates recovery and subsequent immunity to HBV (CDC, 2008; MMRW, 2005). Anti-HBs is also produced in an individual who was successfully vaccinated against hepatitis B. A positive test result indicate that an individual is recovering from acute HBV infection or just recently got vaccinated (CDC, 2008; MMRW, 2005).

(c) Total hepatitis B core antibody (anti-HBc): This antibody is produced in response to the core antigen of the HBV. It is often detected at the onset of symptoms in acute hepatitis B and usually persists for life (CDC, 2008; MMRW, 2005). The presence of anti-HBc indicates previous or ongoing infection with hepatitis B virus in an undefined time frame. A full interpretation of result of this test depends on the results of the above previously mentioned test (CDC, 2008; MMRW, 2005).

(d) IgM antibody to hepatitis B core antigen (IgM anti-HBc): A positive test result indicates an acute, recent infection usually within the last 6 months (CDC, 2008; MMRW, 2005).

(e) Hepatitis B “e” Antigen (HBeAg): This is usually detected during active HBV infection and indicates high level of infectivity. This means an infected individual with high levels of this marker can easily spread the virus to others. This test has also been useful in monitoring the effectiveness of treatment for chronic hepatitis B infection (CDC, 2008; MMRW, 2005).

(f) Hepatitis B e Antibody (HBeAb or anti-HBe): This is an antibody similar to anti-HBs that is produced in response to the Hepatitis B “e” antigen. A positive test indicates that
an individual has chronic Hepatitis B virus infection but is at lower risk of liver problems due to low levels of Hepatitis B virus in his or her blood (CDC, 2008; MMRW, 2005).

(g) Hepatitis B Viral DNA: This test detects the presence of Hepatitis B virus DNA in serum. A positive test result indicates that the individual is highly infectious and can infect others with the virus. This test is also used to monitor the effectiveness of drug therapy for chronic Hepatitis B virus infection (CDC, 2008; MMRW, 2005).

These markers either individually or in combination are useful in identifying the different phases of HBV infection or to determine whether a patient has acute or chronic HBV infection, are immune to HBV as a result of prior infection or vaccination, or is susceptible to infection.

In this study only the HBsAg and anti-HBs assays were done. Below is an extract of the test performed and its interpretation (CDC, 2008 and WHO, 2011).

Table 2. Hepatitis B diagnostic assays and result interpretation

<table>
<thead>
<tr>
<th>Assay Results</th>
<th>Interpretation</th>
</tr>
</thead>
<tbody>
<tr>
<td>HBsAg</td>
<td>Anti-HBs</td>
</tr>
<tr>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>+</td>
<td>-</td>
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<td>+</td>
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STUDY OBJECTIVE AND SPECIFIC AIMS

The overall objective of this study is to determine the prevalence of HBV among African immigrants residing in the Greater Philadelphia area before May, 2012.

Specific aims of this study are:

- To obtain a descriptive statistics of the demographic variables of study participants such as age, gender, number of years lived in the United States, country of origin, prior vaccination history of the individuals from which samples were collected.

- To determine the proportion of individuals infected with HBV relative to the rest of the population sampled. Infected individuals test positive for the hepatitis B surface antigen (HbsAg).

- To determine the proportion of individuals that have immunity to HBV or need to be immunized against hepatitis B relative to the rest of the population sampled. Those individuals with positive hepatitis B surface antibody (anti-Hbs) test results are those who have received hepatitis B vaccination or are immune due to recovery from natural infection. Those that need to be immunized have negative hepatitis B surface antibody test results.

- To determine the association between a positive hepatitis B virus test (HbsAg) and risk factors such as age, country of origin, educational status, duration of stay in the United States, prior HBV testing, family history of HBV, prior vaccination, family history of liver cancer. Also to determine the association between these risk factors and protection status, that is positive anti-Hbs among this group.

- To determine the accuracy of self reported vaccination history compared with positive hepatitis B surface antibody (anti-Hbs) test results obtained.
RESEARCH DESIGN AND METHODS

This was a cross-sectional study that involved the use of a structured questionnaire administered to 87 adults, 18 years and older in the African immigrant community. This study was designed to determine whether or not an individual is infected with hepatitis B virus and the prevalence of HBV in the African immigrant community. Only African immigrants residing in the Greater Philadelphia area, 18 years and older who were able to appropriately understand the consent form were recruited into the study. In this study, all participants have been recruited at health fairs and HBV screening events organized for the African immigrant communities.

A structured paper and pencil survey was administered to interested study participants with the explanation of the study. The data collection form was developed in partnership with CDC Division of Viral Hepatitis. It was tested at a number of sites throughout the US, including Philadelphia for usability. It is the universal screening tool for HBV used at all community screening events across the U.S. and qualitative feedback has been collected on its use. The data collection form has been translated by a certified health translator using an IRB approved protocol into Mandarin, Vietnamese, Korean, Khmer, Laotian, Indonesian, French and Gujarati. Paper forms were handed out at each event, including data collection form and informed consent. At each event, certified multi-lingual translators were present to offer assistance to participants. The HBF ensured that they generally target the forms with participant recruitment to maintain consistency in all screening events. Each participant was assigned a one-on-one trained volunteer or staff member to assist with the filling and completion of the forms.

The study made use of IRB-approved forms and protocol for data collection, informed consent and blood sample collection. Information on demographics, geographical origin, educational status and duration of stay in the United States was obtained from the questionnaire. Blood samples were drawn by licensed phlebotomists. 87 data forms and test results were made available for the study. This is a convenience sample considering the fact that some individuals are not easily convinced to get tested for HBV. The samples were de-identified and tested at the Quest Diagnostic Laboratory for HBV surface antigen (HbsAg) and surface antibody (anti-HBs) under the direction/supervision of the Hepatitis B Foundation. A positive hepatitis B surface
antigen (HBsAg) test indicates that an individual has a hepatitis B infection. A negative test indicates that the individual is not infected. A positive antibody to HBsAg (anti-HBs) test result is indicative of recovery from a prior HBV infection or HBV vaccination. This indicates that a person is protected against HBV. It should be noted that all samples have already been collected for testing for the HBV antigen and antibody. The enrolled participants were not placed in any harmful situation. Experienced and certified phlebotomists collected all samples ensuring that they were properly labeled and stored. Confidentiality of all collected information was maintained in a secure working environment. Prior IRB approval has been obtained by Hepatitis B Foundation. A letter of non-human research determination was obtained from the Drexel office of regulatory research compliance (IRB ID: 1203001068) approving the use of the de-identified data for research.

**STATISTICAL ANALYSIS**

Two groups was identified, that is, those infected with HBV, identified by a positive HbsAg test and those with immunity to HBV, identified by a positive anti-HBs test. All statistical analysis was done using the SAS 9.2 program. Absence (non event) or presence (event) of HBsAg was coded as binary outcome, 1 and 2. Absence (non event) or presence (event) of anti-Hbs was also coded as binary outcome, 1 and 2. All other independent variables were coded by name accordingly. A p< 0.05 was considered statistically significant.

- **Aim 1** was to determine the demographic characteristics of study participants. Analysis was limited to those individuals identified as African immigrants in the survey. Mean and Standard Deviation was calculated for age and duration of stay in the U.S. The number (N) of participants in each group and sub group of variables age, gender, country of origin, years lived in the U.S, vaccination history, family history of hepatitis B, family history of hepatocellular carcinoma and living with an individual with hepatitis B was calculated using the frequency count and chi-square test. The number of those who are HbsAg+ and anti-HBS+ were calculated using chi-square test.

- **Aim 2** was to determine the proportion of individuals infected with HBV relative to the rest of the population sampled. This was calculated using the chi-square test and the corresponding row percent value was reported.
• Aim 3 was to determine the proportion of individuals that have immunity to or need to be immunized against hepatitis B relative to the rest of the population sampled. This was calculated using the chi-square test and the corresponding row percent value was reported.

• Aim 4 was to use the results of the study to determine the association between a positive HbsAg test, positive anti-HBs test and risk factors. The outcome variables are positive HbsAg test and positive anti-Hbs test. Predictor variables are: age, country of origin, educational status, duration of stay in the United States and prior testing, family history of HBV, prior vaccination, family history of liver cancer. Bivariate and multivariate logistic regression was used to predict the probability of occurrence of HbsAg+ and anti-HBs+ (HBV infection) from gender, prior vaccination history, family history of Hepatitis B and liver cancer, country of origin, educational status, living with an individual with HBV and duration of stay in the United States. The adjusted and unadjusted odds ratio (OR) was reported. Any association with P values < 0.05 was considered statistically significant.

• Aim 5 was to determine the accuracy of self reported vaccination history compared with positive hepatitis B surface antibody test results obtained. A reliability test using kappa statistics was calculated to measure the agreement between self reported vaccination history and the results from anti-Hbs test.

Assuming the prevalence rate of HBV is 10% in this study population, 95% confidence interval and an estimated power of 80%, the required sample size needed to achieve this was estimated to be about 86. Thus, for this study, the sample size was adequate.
RESULTS
A total of 87 African immigrants were screened for hepatitis B infection. Of these 47.7% (n=41) were males and 52.3% (n=45) were females. The gender of one of the screened participant is unknown. The mean age was 39.4 years (SD=12.89). All the participants were born outside of the United States and most originated from the Western part of Africa. The duration of stay in the U.S was categorized into 10 year interval and the mean duration of stay was 11.37 years (SD=11.67 years). Approximately 51.7% of those screened had lived in the U.S for about ≤10 years.

Of the 87 participants screened, a total of 10 tested positive for HBsAg [(5 males (12.2%) and 5 females (11.11%)] with a prevalence of 11.49%. Majority of the participants, approximately 62% are from Sierra Leone (26.7%), Mali (23.26%) and Guinea (15.12%). Mali and Guinea are predominantly French speaking while Sierra Leone is predominantly English speaking. 68.97% of participant reported that English is not the primary language spoken. 25.61% reported self vaccination history against hepatitis B and approximately 6% each reported having a family member with hepatitis B and hepatocellular carcinoma.

41 out of the 87 participants had positive anti-HBs test with a prevalence of 47.13%. Of these 21 (24.42%) were males and 20 (23.26%) were females. Of those who self reported a vaccination history, only 10 out of the 21 (41.4%) had a positive antiHBs result. Approximately 64.4% of those who attended the screening events were recommended by family member (27.6%), recruited at the health fair (24.1%) or saw/heard an advertisement for it (12.6%). 5 (6%) participants each reported having a family member with HBV and hepatocellular carcinoma (HCC). 27 (31.76%) reported having a regular doctor and only 21 (24.42%) of those tested had health insurance. Table 3 shows a detailed demographic description of screened participants.
Table 3. Demographic Characteristics of Hepatitis B infection among Screened participants

<table>
<thead>
<tr>
<th>CHARACTERISTICS</th>
<th>N (%)</th>
<th>HBsAg positive, N (%)</th>
<th>Anti-HBS positive, N(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Gender</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>41(47.67)</td>
<td>5(12.20)</td>
<td>21(51.22)</td>
</tr>
<tr>
<td>Female</td>
<td>45(52.33)</td>
<td>5(11.11)</td>
<td>20(44.44)</td>
</tr>
<tr>
<td><strong>Age group</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18-29</td>
<td>16(18.82)</td>
<td>2(12.50)</td>
<td>10(62.50)</td>
</tr>
<tr>
<td>30-39</td>
<td>26(30.59)</td>
<td>5(19.23)</td>
<td>11(42.31)</td>
</tr>
<tr>
<td>40-49</td>
<td>24(28.24)</td>
<td>2(8.33)</td>
<td>11(45.83)</td>
</tr>
<tr>
<td>50-79</td>
<td>19(22.35)</td>
<td>1(5.26)</td>
<td>8(42.11)</td>
</tr>
<tr>
<td><strong>Country of origin</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sierra Leone</td>
<td>23(26.74)</td>
<td>4(17.39)</td>
<td>13(56.52)</td>
</tr>
<tr>
<td>Ghana</td>
<td>2(2.33)</td>
<td>0(0.00)</td>
<td>1(50.00)</td>
</tr>
<tr>
<td>Nigeria</td>
<td>4(4.65)</td>
<td>0(0.00)</td>
<td>2(50.00)</td>
</tr>
<tr>
<td>Benin</td>
<td>3(3.49)</td>
<td>1(33.33)</td>
<td>0(0.00)</td>
</tr>
<tr>
<td>Mauritania</td>
<td>4(4.65)</td>
<td>0(0.00)</td>
<td>2(50.00)</td>
</tr>
<tr>
<td>Guinea</td>
<td>13(15.12)</td>
<td>0(0.00)</td>
<td>9(69.23)</td>
</tr>
<tr>
<td>Ivory Coast</td>
<td>8(9.30)</td>
<td>1(12.50)</td>
<td>3(37.50)</td>
</tr>
<tr>
<td>Mali</td>
<td>20(23.26)</td>
<td>4(20.00)</td>
<td>7(35.00)</td>
</tr>
<tr>
<td>Burkina Faso</td>
<td>3(3.49)</td>
<td>0(0.00)</td>
<td>1(33.33)</td>
</tr>
<tr>
<td>Gambia</td>
<td>3(3.49)</td>
<td>0(0.00)</td>
<td>2(66.67)</td>
</tr>
<tr>
<td>Niger</td>
<td>1(1.16)</td>
<td>0(0.00)</td>
<td>1(100.00)</td>
</tr>
<tr>
<td>Congo</td>
<td>1(1.16)</td>
<td>0(0.00)</td>
<td>0(0.00)</td>
</tr>
<tr>
<td>Liberia</td>
<td>1(1.16)</td>
<td>0(0.00)</td>
<td>0(0.00)</td>
</tr>
<tr>
<td><strong>Education</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Less than high school</td>
<td>22(26.83)</td>
<td>2(9.09)</td>
<td>10(45.45)</td>
</tr>
<tr>
<td>High school diploma/GED</td>
<td>26(31.71)</td>
<td>2(7.69)</td>
<td>14(53.85)</td>
</tr>
<tr>
<td>Technical/Vocational training/some college</td>
<td>16(19.51)</td>
<td>2(12.50)</td>
<td>8(50.00)</td>
</tr>
<tr>
<td>College/Graduate degree</td>
<td>18(21.95)</td>
<td>2(11.11)</td>
<td>7(38.89)</td>
</tr>
<tr>
<td><strong>English as primary Language</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>27(31.03)</td>
<td>4(14.81)</td>
<td>13(48.15)</td>
</tr>
<tr>
<td>No</td>
<td>60(68.97)</td>
<td>6(10.00)</td>
<td>28(46.67)</td>
</tr>
<tr>
<td><strong>Duration of stay in the U.S(years)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0--10</td>
<td>45(51.72)</td>
<td>7(15.56)</td>
<td>18(40.00)</td>
</tr>
<tr>
<td>11--20</td>
<td>30(34.48)</td>
<td>3(10.00)</td>
<td>14(46.67)</td>
</tr>
<tr>
<td>21--30</td>
<td>12(13.79)</td>
<td>0(0.00)</td>
<td>9(75.00)</td>
</tr>
<tr>
<td><strong>Vaccination history(Self Report)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>21(25.61)</td>
<td>3(14.29)</td>
<td>10(47.62)</td>
</tr>
<tr>
<td>No</td>
<td>46(56.10)</td>
<td>6(13.04)</td>
<td>24(52.17)</td>
</tr>
<tr>
<td>Don’t know</td>
<td>15(18.29)</td>
<td>0(0.00)</td>
<td>4(26.67)</td>
</tr>
<tr>
<td><strong>Family with HBV</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>5(5.95)</td>
<td>2(40.00)</td>
<td>1(20.00)</td>
</tr>
<tr>
<td>No</td>
<td>49(58.33)</td>
<td>4(8.16)</td>
<td>28(33.33)</td>
</tr>
<tr>
<td>Don’t know</td>
<td>30(35.71)</td>
<td>3(10.00)</td>
<td>11(36.67)</td>
</tr>
<tr>
<td><strong>Family with HCC</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>5(6.02)</td>
<td>2(40.00)</td>
<td>1(20.00)</td>
</tr>
<tr>
<td>No</td>
<td>61(73.49)</td>
<td>4(6.56)</td>
<td>34(55.74)</td>
</tr>
<tr>
<td><strong>Living with anyone with HBV</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>1(1.30)</td>
<td>1(100.00)</td>
<td>0(0.00)</td>
</tr>
<tr>
<td>No</td>
<td>76(98.70)</td>
<td>8(10.53)</td>
<td>38(50.00)</td>
</tr>
</tbody>
</table>
Hepatitis B Surface Antigen (HbsAg) and Associated Risk Factors

The crude and adjusted odds ratio (AOR) for the association between positive HbsAg and risk factors are presented in Table 4. No statistically significant association was found between positive HBsAg test result and the associated risk factors listed in the table. After adjusting for other variables, females had a slightly higher risk of having HBV compared to males (AOR: 1.163 C.I:0.305, 4.434). The risk of having HBV decreased with age. The AOR is: 0.378 C.I:0.033, 4.388 in age group 50-79 compared to AOR 1.00 in age group 18-29.

In addition, participants with technical/vocational training and some college degree have a non-significantly higher risk of having HBV compared to those with less than high school, those with high school diploma/GED or those with college degree. Also, those in which English is not the primary language are also at a non-significantly higher risk of having HBV compared to primary English speakers (AOR1.087 C.I: 0.218, 5.412). The association between duration of stay in the U.S and the risk of HBV infection is also not statistically significant. However, the risk of HBV decreased with increasing number of years in the U.S. Those that had lived in the U.S for 21-30 years had an AOR 0.546 C.I 0.032, 9.395 compared to those that had lived in the U.S for 11-20 years (AOR 1.330 C.I 0.243, 7.285). Not living with anyone with HBV also decreases the risk of HBV as expected.

Hepatitis B surface antibody (anti-HBs) and associated risks factors:

The crude and adjusted odds ratio (AOR) for the association between positive anti-HBs test and key risk factors are presented in Table 4. Only duration of stay of between 21 and 30 years had a statistically significant association between it and a positive anti-HBs test result. No other statistically significant association was found. However, females have a slightly higher levels of anti-HBs compared to males (AOR: 1.140 (0.409, 3.173). The presence of anti-HBs was also observed to decrease with increasing age. Compared to the reference group aged 18-29, participants aged 50-79 had an AOR: 0.267 C.I 0.046, 1.556. Also, participants who had some form of technical/vocational training also have decreased protective effect (AOR: 0.840 C.I:0.057, 12.461) compared to the rest of the group. With increasing number of years in the U.S, the level of anti-HBs against HBV increases. A participant who had lived in the U.S for 21-
30 years (AOR: 8.583 C.I 1.340, 54.966) had almost a 6x fold increase in the levels of anti-HBs compared to an individual who had lived in the U.S for 11-20 years (AOR: 1.667 C.I 0.471, 5.895). The presence of anti-HBs also increases when an individual is not living with an individual with HBV.

Table 4: Unadjusted and adjusted odds ratio (OR) with 95% Confidence Intervals (CI) for HBsAg, anti-HBs and risk factors

<table>
<thead>
<tr>
<th>Variables</th>
<th>HBsAg Positive</th>
<th>HBsAg Positive(adjusted)</th>
<th>P value</th>
<th>AntiHBs positive</th>
<th>AntiHBs positive(adjusted)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>OR (95% CI)</td>
<td>Adjusted OR (95% CI)</td>
<td></td>
<td>OR (95% CI)</td>
<td>Adjusted OR (95% CI)</td>
<td></td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>1.00</td>
<td>1.00</td>
<td></td>
<td>1.00</td>
<td>1.00</td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>0.976(0.277,3.441)</td>
<td>1.021(0.273,3.825)</td>
<td>0.9748</td>
<td>0.883(0.394,1.977)</td>
<td>1.160(0.434,3.102)</td>
<td>0.7679</td>
</tr>
<tr>
<td>Age group (years)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18-29</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>30-39</td>
<td>1.905(0.326,11.117)</td>
<td>1.015(0.162,6.373)</td>
<td>0.9876</td>
<td>0.467(0.137,1.590)</td>
<td>0.434(0.100,1.886)</td>
<td>0.2657</td>
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<tr>
<td>40-49</td>
<td>0.727(0.092,5.724)</td>
<td>0.583(0.066,5.164)</td>
<td>0.6274</td>
<td>0.538(0.156,1.865)</td>
<td>0.352(0.068,1.837)</td>
<td>0.2156</td>
</tr>
<tr>
<td>50-79</td>
<td>0.445(0.037,5.378)</td>
<td>0.378(0.033,3.388)</td>
<td>0.4368</td>
<td>0.463(0.124,1.723)</td>
<td>0.267(0.046,1.556)</td>
<td>0.1419</td>
</tr>
<tr>
<td>Education level</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>Less than high school</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>High school diploma/GED</td>
<td>0.479(0.080,2.873)</td>
<td>0.720(0.111,4.665)</td>
<td>0.7302</td>
<td>1.458(0.494,4.303)</td>
<td>1.570(0.406,6.066)</td>
<td>0.5134</td>
</tr>
<tr>
<td>Tech/Vocational training/some college</td>
<td>0.821(0.133,5.084)</td>
<td>1.486(0.156,14.140)</td>
<td>0.7302</td>
<td>1.250(0.362,4.318)</td>
<td>0.870(0.159,4.760)</td>
<td>0.8722</td>
</tr>
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<td>College/graduate degree</td>
<td>0.719(0.117,4.407)</td>
<td>1.082(0.130,9.010)</td>
<td>0.9422</td>
<td>0.795(0.236,2.679)</td>
<td>1.189(0.223,6.352)</td>
<td>0.8396</td>
</tr>
<tr>
<td>English as Primary Language</td>
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<td></td>
<td></td>
<td></td>
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<td>Yes</td>
<td>1.00</td>
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<td>1.00</td>
<td>1.00</td>
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</tr>
<tr>
<td>No</td>
<td>0.639(0.165,2.479)</td>
<td>0.982(0.198,4.866)</td>
<td>0.9825</td>
<td>0.942(0.379,2.340)</td>
<td>1.048(0.297,3.700)</td>
<td>0.9417</td>
</tr>
<tr>
<td>Duration of stay in the U.S(years)</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0--10</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>11---20</td>
<td>0.653(0.164,2.597)</td>
<td>1.330(0.243,7.285)</td>
<td>0.7421</td>
<td>1.306(0.514,3.319)</td>
<td>1.667(0.471,5.895)</td>
<td>0.4279</td>
</tr>
<tr>
<td>21--30</td>
<td>0.205(0.010,4.321)</td>
<td>0.546(0.032,9.395)</td>
<td>0.6768</td>
<td>4.035(0.987,16.493)</td>
<td>8.583(1.340,54.966)</td>
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</tr>
<tr>
<td>Vaccination history(Self Report)</td>
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<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Yes</td>
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<td>1.00</td>
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</tr>
<tr>
<td>No</td>
<td>0.802(0.213,3.029)</td>
<td>0.965(0.190,4.906)</td>
<td>0.9661</td>
<td>1.089(0.416,2.850)</td>
<td>0.906(0.264,3.114)</td>
<td>0.8752</td>
</tr>
<tr>
<td>Don't Know</td>
<td>0.161(0.007,3.530)</td>
<td>0.279(0.024,3.289)</td>
<td>0.3108</td>
<td>0.391(0.100,1.529)</td>
<td>0.206(0.034,1.230)</td>
<td>0.083</td>
</tr>
<tr>
<td>Family with HBV</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Yes</td>
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<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>No</td>
<td>0.148(0.026,0.860)</td>
<td>0.368(0.023,5.925)</td>
<td>0.4809</td>
<td>4.00(0.733,21.838)</td>
<td>0.743(0.073,7.573)</td>
<td>0.8023</td>
</tr>
<tr>
<td>Don't know</td>
<td>0.185(0.029,1.193)</td>
<td>0.186(0.008,4.295)</td>
<td>0.2938</td>
<td>1.737(0.298,10.138)</td>
<td>0.758(0.061,9.393)</td>
<td>0.8289</td>
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<td>Family with HCC</td>
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<td>Yes</td>
<td>1.00</td>
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<tr>
<td>No</td>
<td>0.140(0.846,22.965)</td>
<td>0.269(0.019,3.717)</td>
<td>0.3268</td>
<td>4.407(0.846,22.965)</td>
<td>5.113(0.533,49.012)</td>
<td>0.1517</td>
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<td>Don’t know</td>
<td>0.429(0.066,2.765)</td>
<td>1.373(0.057,32.872)</td>
<td>0.8448</td>
<td>1.458(0.221,9.617)</td>
<td>2.806(0.191,41.214)</td>
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<td>Living with anyone with HBV</td>
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<td></td>
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<tr>
<td>Yes</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>No</td>
<td>0.863(0.335,2.223)</td>
<td>0.695(0.279,1.731)</td>
<td>0.4351</td>
<td>1.592(0.777,3.264)</td>
<td>1.394(0.615,3.162)</td>
<td>0.4262</td>
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Reliability of self-rated vaccination status

Based on observed and expected agreement between self reported vaccination history and positive antiHBs result, the kappa statistic obtained is $\kappa = -0.0389$. This indicates that there is no agreement between the test results and self report of vaccination against HBV. Thus self report of vaccination is not reliable in this group.
DISCUSSION

This study quantitatively assessed the burden of HBV among African immigrants aged 18 years and older residing in the Greater Philadelphia area. HBV infection is highly endemic in Africa with varying prevalence greater than 2% (WHO, 2012). The most common modes of transmission are perinatal (from mother to baby at birth), blood transfusions, sexual contact, unsafe injections practices and early childhood infections (inapparent infection through close interpersonal contact with infected household contacts). With the introduction of universal newborn/child vaccination, the incidence of HBV has greatly reduced in the U.S. However with increasing immigration from endemic countries, the prevalence of HBV is set to rise.

The cross sectional prevalence of HBV infection in this screening fair population of African immigrants was 11.49% based on the HbsAg test result. This is 1 in 9 of every participant screened for hepatitis B. This rate is within the range previously reported. The United States Citizenship and immigration Service reported that the fastest growing immigrant populations in the past two decades have been from Africa, Asia and South/Central America. In endemic countries, the prevalence rate of HBV is greater than 8%. In a study by Rein et al, 2009, the prevalence of HbsAg among refugees from Africa was 8.1% compared to refugees from Asia(4.8%), Eastern Europe(2.6%), South/Central America and Caribbean(1.0%). According to the study by Rein et al, 2009, the highest prevalence observed among African refugees was from Eritrea (15.5%). These results are consistent with the findings in this study where the prevalence was 11.49%.

No doubt, the burden of hepatitis B remains considerably high in Africa. In this study, participants from Mali, Sierra Leone and Guinea has the highest number of people infected with hepatitis B. In Mali approximately 1 in 5 persons are carriers of the HBV. This is approximately 2.6 million people and half of all young people between ages 18 to 25 (Koffigan, 2011). This is consistent with the findings in this study where 23% those who tested positive are from Mali. In this study, prevalence of hepatitis B based on countries or Africa as a whole is consistent with the statistics provided by the centers for Disease Control and Prevention.
The risk of becoming infected with HBV was observed to decrease with age. This is most likely due to the fact that the older one is, the less likely one is engaged in risky behaviors. The higher risk observed in persons with technical/Vocational training and college degree compared to other participants with other educational levels is worth mentioning. The job description of these participants was not provided but it is well documented that certain jobs especially those that requires contact with human body fluids increases the risk of hepatitis B (WHO, 2012).

The level of immunity against HBV is relatively low in the group studied, approximately 47%. This is likely so because progress in the area of vaccinations in most parts of Sub-Saharan Africa has been slow. This low levels of immunity is also attributable to the late introduction of hepatitis B vaccine in 2000(WHO, 2012). This introduction was initially limited to Botswana, Gambia, Mauritius, Seychelles, South Africa, Swaziland and Zimbabwe (Arevshatian et al, 2007). The reasons for this late introduction are associated with high vaccine cost, weak infrastructure and low financing priority among donors. However, in 2005, 61% of the countries had reported using the HepB vaccine. Coverage ranged from 8% in Nigeria to 100% in Sao Tome, indicating a highly variable degree of implementation (Arevshatian et al, 2007). This is unlike in the United States where vaccination coverage for children is almost 100% and for high risk adults about 45% in 2004(CDC, 2006).

The level of anti-HBs was observed to decrease with increasing age and this is quite normal. Although immunologic memory usually remains intact for at least 20 years among healthy vaccinated individuals who initiated Hepatitis B vaccination >6 months of age, antibody levels might become low or decline below detectable levels. However, the vaccine usually confers long-term protection against clinical illness and chronic Hepatitis B virus infection and cellular immunity appears to persist. Also, the longer an individual has resided in the U.S, the higher the anti-HBs levels. This is attributable to many factors, which includes vaccination of vulnerable population, like pregnant women, those in high risk job environment and refugees.

It is well documented that HBV is associated with a number of outcomes including cirrhosis, liver cancer/failure and eventually death. The effects of HBV on the health of communities, the cost and burden on the health care system cannot be overemphasized. However, underestimation
of HBV infection, the probable underestimation of African immigrants residing in the Greater Philadelphia area may make these estimations a difficult one. This in conjunction with few of the participants having regular doctor and health insurance, hepatitis B has become an endemic in the African immigrant community. All studies done in Africa agree that hepatitis B is endemic in this region (Kiire, 1996; Rein et al, 2009; Adigbli, 2011)

This study has several strengths and limitations. The good usability survey tool, the reliability and validity of the screening tests are major strengths of this study. The study tool was designed in collaboration with CDC and has been the standard tool used at all sites participating in HBV screening. The screening tests were also performed at a renowned diagnostic laboratory which follows standardized procedures. These diagnostic procedures ensured that all tests performed were consistent which further strengthened the internal validity of this study. The study design is such that there is no loss to follow up. All participants who signed the consent form had their blood samples tested for HBV. This study also provided an opportunity to have a better understanding and baseline knowledge about HBV infection in African immigrants in the Greater Philadelphia area considering the relatively sparse information about the prevalence of HBV in this population. It should be noted that nearly 60% of the foreign-born living in metropolitan Philadelphia arrived in the United States after 1990 (Singer, et al., 2008).

There are limitations in this study. First is the HBV screening sites were located in the greater Philadelphia area. Therefore the findings of this study may not be generalizable to other African immigrant population in other parts of the United States. Secondly, the inability to establish a causal relationship and temporal relationship between the risk factors and hepatitis B was a potential weakness. Also, there was a risk of selection bias since it is highly likely that only those interested in knowing their hepatitis B status participated in the screening program. This might eliminate a significant number of infected individuals who otherwise did not participate in the program. It was also difficult to determine how those who participate in screening events differ from those who do not participate, hence affecting the external validity of the study. However, the convenience sample does provide some answers to the research questions of interest in this population and it is an important starting point for this research. It will however be
useful if future studies can focus on a nationwide screening of the African immigrant population and enlisting the help of community leaders to increase participation rate.

**Public health implications, recommendations and conclusion**

Hepatitis B is a major global public health problem and it is 50-100 times more infectious than HIV. HBV has not been given much attention compared to diseases such as HIV, Tuberculosis and Malaria. This study further proves that more public health efforts and resources are needed to create awareness, screen and treat HBV infection.

The World Health Organization (WHO) realizes that achieving universal immunization coverage for hepatitis B is a goal that is still unmet. However, steps could be taken to achieve these goals in the near future and the following recommendations are made. Firstly, with the United States taking the lead, infrastructure should be put in place ensuring that each country represented in the WHO develops and sustains a strong Hepatitis B seroprevalence. Secondly, governments in endemic countries of Africa should be encouraged to incorporate hepatitis B vaccine in the routine child immunization 100%. All high risk individuals should be vaccinated and if possible, every individual in highly endemic countries. Thirdly, a Public-Private partnership should be established that would further encourage the incorporation of hepatitis B vaccination in the routine immunization schedule in Africa.

In reducing the prevalence and incidence of hepatitis B in the United States, policies should be put in place mandating all health care providers to provide routine screening for patients from countries with high endemicity. Policies should be put in place ensuring that immigrants from highly endemic countries are screened for hepatitis B upon arrival in the U.S. However, considering the financial status of most immigrants, it should be a moral imperative to provide care and treatment for HBsAg positive individuals at little or no cost. This intervention may lead to improved outcomes by preventing long term consequences of chronic HBV while reducing health care costs associated with treating the chronic complications of hepatitis B. These policies should also ensure that stakeholders in the immigrant communities, community leaders, advocacy groups and the general public are enlightened and educated about Hepatitis B and its consequences.
Hepatitis B, though endemic in Africa and parts of Asia, is a global problem and should be addressed as such. It is a vaccine preventable disease and its eradication should be a top priority in the public health community.

**Recommendations for future studies**

It will be useful to conduct a structured research designed specifically to determine the prevalence of hepatitis B in the African immigrant community. The results obtained in this study provides some information about the prevalence of hepatitis B in this study population, however it was limited to participants recruited at screening events.

**REFERENCES**


Arch Intern Med/Vol 159, Jan 11,199


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http://www.who.int/immunization/topics/hepatitis_b/en/index.html 2011 Immunization, Vaccines and Biologicals

Hepatitis B Screening Form

Date of Birth: _______  □ check this box if age is 89 or older
Age: _______
Gender:  □ M  □ F
1. Ethnicity:  □ Black  □ White  □ Hispanic  □ Asian/Pacific Islander
   □ Native American/Alaska Native  □ Other:
2. Highest level of education:  □ Less than high school  □ High school diploma
   □ Technical/vocational training  □ Some college
   □ College degree  □ Graduate degree

Alternatively, if your native education system is different, how many years of school did you attend? _______
3. How many people live with you now? _______
4. Are you currently living with anyone with Hepatitis B?  □ Yes  □ No  □ Don’t Know
5. Country of birth: ________________
6. Year arrived in US: __________
7. Mother’s country of birth: _________  8. Father’s country of birth: _________
9. If you are woman, are you currently pregnant or do you suspect that you are pregnant?
   □ Yes  □ No  □ Don’t know
10. Is English your primary language?  □ Yes  □ No
11. Do you have health insurance?  □ Yes  □ No
12. Do you have a regular doctor or health care provider?  □ Yes  □ No
13. Why are you here for testing?
   □ My doctor recommended I come in for testing
   □ My insurance won’t cover testing and I want to be tested
   □ I think I might be infected with hepatitis B
   □ A family member or personal contact is infected with hepatitis B
   □ I saw/heard an ad for it
   □ My family member recommended I come in
   □ I was here or at an event and someone recruited me
   □ Other reason: ________________________________
14. Have you ever been tested for HBV before today or has a doctor ever told you that you had hepatitis B?  
☐ Yes  ☐ No  ☐ Don’t know  
If yes, what was the outcome of the test?  
☐ Positive  ☐ Negative  ☐ Don’t know  

15. Were you ever given medicine to treat hepatitis B?  
☐ Yes  ☐ No  ☐ Don’t know  

16. Have you ever received vaccination or shots to protect you from hepatitis B?  
☐ Yes  ☐ No  ☐ Don’t know  

17. Do you have any family members with hepatitis B?  
☐ Yes  ☐ No  ☐ Don’t know  
If yes, who has hepatitis B?  
☐ Spouse  ☐ Mother  ☐ Father  ☐ Sibling  
☐ Child  ☐ Cousin  ☐ Grandparent  
☐ Aunt/Uncle  ☐ other:  

18. Do you have any family members with liver cancer?  
☐ Yes  ☐ No  ☐ Don’t know  
If yes, who has liver cancer?  
☐ Spouse  ☐ Mother  ☐ Father  ☐ Sibling  
☐ Child  ☐ Cousin  ☐ Grandparent  
☐ Aunt/Uncle  ☐ other:  

19. At the end of this screening, if you test positive, do you intend on seeking treatment within the next 6 months?  
☐ Yes  
☐ I’d like to, but I cannot pay for treatment if I’m positive  
☐ No, I don’t want to be treated right now for non-financial reasons  

For Office Use Only  
Screen ID (place sticker here): __________________________  
Date of Screening: __________________________  
Screening Site (Code): __________________________
APPENDIX B

DREXEL UNIVERSITY
COLLEGE OF MEDICINE

Office of Regulatory Research Compliance

NOT HUMAN RESEARCH DETERMINATION

April 2, 2012

Dr. Ed Gracely
2900 Queen Lane
Philadelphia, PA 19129
215 991-8466
eg26@drexel.edu

Dear Dr. Gracely:

On 03/30/2012 the IRB reviewed the following protocol:

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<td>Title:</td>
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<tr>
<td>Investigator:</td>
<td>Ed Gracely</td>
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<tr>
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<td>Documents Reviewed:</td>
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The IRB determined that the proposed activity is not research involving human subjects as defined by DHHS and FDA regulations.

Sincerely,

[Signature]

IRB Manager