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Hepatitis B Virus among Pregnant Women:  
Prevalence and Risk Factors in Khartoum State 2005-2006.

By;

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*To my parents, husband & children*

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### List of abbreviations

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ALT	Alanine aminotransferase
AST	Aspartate aminotransferase
Au	Australia antigen
CDC	Centre for disease control
CSW	Commercial sex workers
CS	Cesarean section
DPT	Diphtheria , pertusis & Tetanus
EPI	Expanded programme on immunization
GAVI	Global Alliance for Vaccine and immunization
HBV	Hepatitis B Virus
HBcAb	Hepatitis B core Antibody
HBcAg	Hepatitis B core Antigen
HBsAb	Hepatitis B Surface Antibody
HBeAb	Hepatitis B Surface Antibody
HBeAg	Hepatitis B Surface Antigen
HBsAg	Hepatitis B Surface Antigen
HCC	Hepatocellular carcinoma
HIV	Human immunodeficiency virus
NGOs	Non governmental organizations
NVD	Normal vaginal delivery
[NPV]	Negative Predictive Value
[PPV]	Positive Predictive Value
Sd	Standard deviation
S/R	Simple/Rapid
STDs	Sexually transmitted diseases
WHO	World health organization

## **Abstract**

This is a cross-sectional, health facility based study. The main objective of this study was to estimate the prevalence of HBsAg, HBeAg among pregnant women, attending ANC unit in Khartoum state 2005 and the frequency of perinatal transmission of hepatitis HBV, and to relate the possible risk factors, in order to use this information to decide whether the first dose of HB vaccine to be administered at birth or with DPT-1.

Three hundred and twenty pregnant women were selected in this study from 20 health facilities that provide ANC services in Khartoum state using two stage cluster sample technique.

Women were screened using ELISA test, for hepatitis B surface and e antigen. Where (12/320) 3.75% (95% CI: 3.77-3.73) women tested positive for HBsAg and only one woman out of the 12 rate {8.33 % (95% CI: 8, 49-8.17)} was hepatitis B e antigen positive. Prevalence of HBsAg & HBeAg positive mothers is 0.31%, Frequency of HBV carriers in population due to perinatal infection is 0.25%. In relating the risk factors for HBV to the prevalence of HBV, the relation was found to be statistically insignificant. It was concluded that there is moderate endemicity of HBV infection and low perinatal transmission of the disease in Khartoum state.

It is thus recommended to continue giving the HBV vaccine with the DPT as scheduled, to conduct other studies for young children to define the relative importance of perinatal versus childhood transmission, to screen all pregnant women for HBV during antenatal care visits, and giving appropriate management for neonates of +ve mothers, and to study the prevalence in other states.

الهدف الرئيسي من هذه الدراسة هو تقدير مدى انتشار مولد المضاد السطحي ومولد المضاد الغلافي لفيروس التهاب الكبد الفيروسي البائي بين النساء الحوامل اللائي يترددن على عيادات رعاية الحمل بولاية الخرطوم عام 2005 ،ومن الاهداف الاخرى تقدير تواتر انتقال التهاب الكبد الفيروسي البائي ، كذلك محاولة الربط بين عوامل الخطر بإعتبار ان هذه المعلومات ستكون مفيدة في تحديد ما اذا كانت الجرعه الاولى من لقاح التهاب الكبد الفيروسي البائي يجب ان يعطى للاطفال عند الولادة او مع اللقاح الثلاثي ( الشلل، التتنس والدفتريرا) .  
ثلاثائه وعشرون من النساء الحوامل اخترن لهذه الدراسة في 20 من المرافق الصحية التي تقدم خدمات رعاية الحمل في الخرطوم في دراسة مقطعية.وقد تم اختيار العينة بطريقة عنقودية من مرحلتين.

اختبرت عينات من النساء الحوامل للكشف عن وجود مولدات المضادات للتهاب الكبدى البائي. حيث وجد أن معدل الانتشار يساوي 3.75% (320/12) وبإبعاد ثقة عند 95% : (3.73-3.77) بينما اعطت امرأة واحدة نتيجة ايجابية لاختبار مولد المضاد الغلافي لفيروس التهاب الكبد الفيروسي البائي بمعدل انتشار يساوي 8.33% وبإبعاد ثقة عند 95% : (8.17-8.49) . وأن معدل الانتشار للنساء اللواتي اعطين نتائج ايجابية لمولدات المضادات السطحية و الغلافية معاً لتهاب الكبدى البائي كان 0.31% .  
وتواتر انتقال الاصابة من الامهات الي الاطفال اثناء الحمل والولادة كان 0.25% . وربط البحث بعض عوامل الخطر بمعدل الاصابة، فلم تكن العلاقة قوية احصائيا. وقد استنتج من البحث ان هناك مستوى متوسط لتوطن المرض في ولاية الخرطوم. ومن ثم تمت التوصية بمواصلة اعطاء لقاح التهاب الكبد للاطفال كما كان مقررا مع اللقاح الثلاثي، مع ضرورة اجراء دراسات اخرى في الاطفال لتحديد الاهميه النسبيه للاصابة اثناء فترة الطفولة مقابل فترة الحمل، كذلك أوصى بفحص جميع النساء الحوامل اللائي يترددن على مراكز رعايه الحوامل لتحديد الاصابة بالمرض،ومن ثم يتمكن من معالجة اطفال المصابين عند الولادة، وأوصت الدراسة كذلك بدراسة معدلات الانتشار في الولايات الاخرى.

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## Chapter 1

Hepatitis is an inflammation of the liver. It is usually caused by viral infection, toxic agents or drugs but may be an auto immune response.<sup>1</sup>

Hepatitis B is a serious disease caused by a virus that attacks the liver. The virus, which is called hepatitis B virus (HBV), can cause lifelong infection, cirrhosis (scarring) of the liver, liver cancer, liver failure, and death.<sup>2</sup>

It was estimated that approximately 2 billion people have serological evidence of past or present HBV infection. More than 350 million are chronic carriers of HBV. Approximately 75% of chronic carriers live in Asia and the Western Pacific. It was reported that 15-40% of HBV infected patients would develop cirrhosis, liver failure, or HCC, and 500,000 to 1.2 million people die of HBV infection annually.<sup>3</sup>

The frequency and patterns of HBV transmission vary markedly in different parts of the world. Approximately 45% of the world's population live in areas where the prevalence of chronic HBV infection is high (>8% of the population is HBsAg-positive); 43% live in areas where the prevalence is moderate (2%–7% of the population is HBsAg-positive); and 12% live in areas of low endemicity (<2% of the population is HBsAg-positive).<sup>4</sup>

Most studies in Sudan suggest there is a higher prevalence of HBV infection among residents of the south compared with those of the north. Overall, most studies indicate that there is high endemicity in Sudan with a prevalence of chronic infection ranging from 4% to 30%.<sup>4</sup>

HBV is spread through contact with infected body fluids and the only natural host is human. Blood is the most important vehicle for transmission, but other body fluids have

also been implicated, including semen and saliva. Currently, three modes of HBV transmission have been recognized: perinatal, sexual and parenteral / percutaneous transmission. There is no reliable evidence that airborne infections occur and feces are not a source of infection. HBV is not transmitted by contaminated food or water, insects or other vectors.<sup>5</sup>

The main risk factors for hepatitis B are engaging in unsafe sex, particularly unprotected receptive anal sex, having sex with more than one partner or with a partner who has or has had more than one partner or who uses or has used IV drugs, sharing needles, recent history of STI infection, having a blood transfusion or treatment with infected blood products, getting a tattoo or piercing, having a job (such as a health care worker) that exposes one to blood or other body fluids, traveling or living in areas with high rates of HBV infection (including Southeast Asia, the Amazon basin in South America, the Pacific Islands, and the Middle East)<sup>6</sup>

Prevention is the only safeguard against the epidemic of viral hepatitis. The best way to prevent hepatitis B is to avoid the practices that increase the risk of infection. Knowing the facts and having proper attitudes and behaviors are also critical to prevent the spread of these infections. Family practitioners who work as primary and first level health care providers and who are engaged with patients and their families in the areas of prevention, cure and care can play an important role by increasing public awareness and understanding of these diseases.<sup>7</sup>

Advisory Group to the World Health Organization recommended that all countries integrate hepatitis B vaccine into national immunization programs by 1997. Currently,

80 countries have done so and several others are planning to. Many countries have reported dramatic reductions in the prevalence of chronic HBV infection among children born since the hepatitis B vaccine was introduced into infant immunization schedules. Recent reports from Taiwan indicate a reduction in the incidence of liver cancer among children as a result of widespread hepatitis B vaccination programs.<sup>8</sup>

Hepatitis B vaccine has been introduced into Sudan's routine immunization programme by the year (2004) in 3 states which are Khartoum, Gezira and Blue Nile states. The vaccine is given as 3 doses at 6, 10 and 14 months with the three doses of DPT.<sup>9</sup>

### **Justification**

Hepatitis B vaccine has been introduced into Sudan's routine immunization programme in the year (2004), so, knowing the prevalence of HBsAg and HBeAg among pregnant women will reveal the relative importance of mother –to-child transmission in the population and this information will be useful in deciding whether the first dose of HB vaccine to be administered at birth or with DPT-1.

Also Information obtained from one's own country may be more convincing to policy – making health officials.<sup>10</sup>

**General objective:**

To study the distribution and determinants of hepatitis B virus infection among pregnant women attending ANC units in Khartoum state 2005.

**Specific objectives:**

1/ To measure the prevalence rate of HBs &e Ag among pregnant women, attending ANC unit in Khartoum state 2005.

2/ To relate the prevalence of HBV infection to risk factors and socio demographic factors (age, education, race, multiple sexual partners, blood transfusion, unsafe injection, history of jaundice, history of renal dialysis, risky work, family size) .

3/ to estimate the proportion of perinatal transmission of hepatitis BV.

4/to define the socio-demographic factors associated with HBV infection among pregnant women attending ANC unit in Khartoum state 2005.

Hepatitis B is endemic throughout the world, especially in tropical and developing countries. Its prevalence varies from country to country and depends upon a complex mix of behavioral, environmental and host factors. In general it is lowest in countries or areas with high standards of living, sixty six percent of all worlds' population live in areas where there is high level of infection .<sup>11</sup>

The distribution of hepatitis B infection varies greatly throughout the world. In areas where the prevalence is high, such as Southeast Asia, China, and Africa, more than half the population is infected at some time in their lives, and more than 8 percent are chronic carriers of the virus, the result of either neonatal transmission (vertical) or transmission from one child to another (horizontal). Areas with low levels of endemicity include North America, Western Europe, and Australia, where only a minority of people come into contact with the virus, as a result of horizontal transmission among young adults. The World Health Organization estimates that the number of HBV carriers will reach 400 million by the year 2000. The numbers will continue to increase until neonatal vaccination and immunization are universally accepted.<sup>12</sup>

The largest reported outbreak of hepatitis B was in 1942 during World War II when 28,585 American soldiers inoculated with yellow fever vaccine developed jaundice and 62 of them died. This outbreak was linked to a specific vaccine that contained human serum.<sup>13</sup> A follow-up study in the 1980s demonstrated that 97% of recipients of the serum-containing vaccine had serological evidence of hepatitis B virus (HBV) infection compared with 13% of people who received yellow fever vaccine that did not contain human serum, thus confirming that HBV was the cause of this outbreak.<sup>13</sup>

The groundbreaking studies of Krugman and colleagues in 1967 firmly established the existence of at least two types of hepatitis, one of which (then called serum hepatitis, and now called hepatitis B) was parenterally transmitted. Links to the virus responsible for this form of hepatitis were derived by serologic studies conducted independently by Prince and colleagues and by Blumberg and colleagues.<sup>14</sup> Blumberg and colleagues, searching for serum protein polymorphisms linked to diseases, identified an antigen termed Australia antigen (Au) in serum from patients with leukemia, leprosy, and hepatitis, though the relationship of this antigen to hepatitis was initially unclear. By systematically studying patients with transfusion-associated hepatitis, Prince and coworkers independently identified an antigen, termed SH, that appeared in the blood of these patients during the incubation period of the disease, and further work established that Au and SH were identical.<sup>14</sup> The antigen represented the hepatitis B surface antigen (HBsAg). These seminal studies made possible the serologic diagnosis of hepatitis B and opened up the field to rigorous epidemiologic and virologic investigation.<sup>14</sup>

A few years later, in 1970, Dane visualized the hepatitis B virus (HBV) virion. Since then, considerable progress has been made regarding the epidemiology, virology, natural history, and treatment of this hepatotropic virus.<sup>15</sup>

Hepatitis B virus is a DNA virus of hepadnaviridae family of viruses. It replicates within infected liver cells (hepatocytes).<sup>16</sup> It is an extremely resistant strain capable of withstanding extreme temperatures and humidity. It can survive when stored for 15 years at -20°C, for 24 months at -80°C, for 6 months at room temperatures, and for 7 days at 44°C.<sup>5</sup>

The virus is a spherical particle with a diameter of 42nm and is composed of an outer shell composed of several proteins known collectively as HBs or surface proteins, and this outer shell is frequently referred to as the surface coat<sup>16</sup>. Hepatitis B surface antigen (HBsAg) is a protein antigen produced by HBV. This antigen is the earliest indicator of acute hepatitis B and frequently identifies infected people before symptoms appear. HBsAg disappears from the blood during the recovery period<sup>17</sup>. In some people (particularly those infected as children or those with a weak immune system, such as those with AIDS), chronic infection with HBV may occur and HBsAg remains positive.<sup>17</sup>

The presence of hepatitis B surface antibody (anti-HBs) is an indicator of previous exposure to HBV, but the virus is no longer present and the person cannot pass on the virus to others. The antibody also protects the body from future HBV infection. In addition to exposure to HBV, the antibodies can also be acquired from successful vaccination. This test is done to determine the need for vaccination <sup>17</sup>(if anti-HBsAg is absent), or following the completion of vaccination against the disease, or following an active infection. <sup>17</sup> Then follows the outer surface coat surrounds an inner protein shell. composed of HBc protein , this inner shell is referred to as the core particle .The core particle surrounds the viral DNA ( D ) and an enzyme DNA polymerase ( p ) .<sup>16</sup> The core antigen, HBcAg, is the protein that encloses the viral DNA. It also can be expressed on the surface of the hepatocytes, initiating a cellular immune response.<sup>17</sup> Anti-hepatitis B core antigen (anti-HBc) is an antibody to the hepatitis B core antigen. The core antigen is found on virus particles but disappears early in the course of infection. This antibody is produced during and after an acute HBV infection and is usually found in chronic HBV carriers as well as those who have cleared the virus, and usually persists for life. Anti-

HBcAg testing is either specific for the IgM antibody, anti-HBc, IgM, which indicates acute infection, or measures total antibody, anti-HBc, which indicates past infection, either acute or chronic.<sup>18</sup> The e antigen, HBeAg, comes from the core gene and is a marker of active viral replication. Usually, HBeAg can be detected in patients with circulating serum HBV DNA<sup>17</sup>. Unlike the surface antigen, the e-antigen is found in the blood only when there are viruses also present. When the virus goes into “hiding,” the e-antigen will no longer be present in the blood. HBeAg is often used as a marker of ability to spread the virus to other people (infectivity). Measurement of e-antigen may also be used to monitor the effectiveness of HBV treatment; successful treatment will usually eliminate HBeAg from the blood and lead to development of antibodies against e-antigen (anti-HBeAg).<sup>18</sup>

Anti-HBeAg is an antibody produced in response to the Hepatitis B e antigen. In those who have recovered from acute hepatitis B infection, anti-HBeAg will be present along with anti-HBcAg and anti-HBs. In those with chronic hepatitis B, usually anti-HBeAg becomes positive when the virus goes into hiding or is eliminated from the body. In strains that do not make HBe antigen, anti-HBeAg is also positive.<sup>18</sup>

There are several tests used to detect the presence of hepatitis B viral antigens.

HBsAg is the most commonly used marker of infection for diagnostic and blood screening. An individual positive for HBsAg is considered to be infected with HBV, and is therefore potentially infectious. Confirmation of a reactive HBsAg ELISA screening test is usually done by performing a neutralization test using a specific anti-HBs antiserum in the same screening ELISA. Where a simple/rapid HBsAg test is used and no

neutralization reagents are available, confirmation of an acute or chronic infection for diagnostic purposes may be concluded based upon symptoms and appropriate monitoring tests. Other HBV markers which can be used diagnostically to monitor an HBV infection include HBeAg. The presence of HBeAg indicates an individual is of higher infectivity, and sero-conversion to anti-HBeAg correlates with reduced infectivity. In an acute infection this suggests that the infected person is progressing towards resolving their infection. Individuals who have sero-converted from HBsAg to anti-HBs have resolved their infection and are immune to further HBV infection.<sup>19</sup>

The most widely used HBsAg screening test worldwide is ELISA as they are the most appropriate for screening large numbers of specimens on a daily basis, as is the case in blood transfusion services in industrialized countries. Several simple, instrument and electricity-free screening tests have been developed including agglutination, immune-filtration (flow through) and immuno-chromatographic (lateral flow) membrane tests. In general, these simple/rapid (S/R) tests are most suitable for use in laboratories that have limited facilities and/or process low numbers of specimens daily.<sup>19</sup> Care should be taken however to ensure that the test meets any regulatory specifications, e.g. in some countries the use of tests with a minimum detection level of 0.5ng/ml HBsAg for testing of donated blood is mandatory. The probability that a test will accurately determine the true infection status of a person being tested varies with the prevalence of HBV infection in the population from which the person comes. Generally, the higher the prevalence of HBV infection in the population, the greater the probability that a person testing positive is truly infected (i.e. the greater the positive predictive value [PPV]). Thus, with increasing prevalence, the proportion of serum samples testing false-positive decreases; conversely,

the likelihood that a person showing negative test results is truly uninfected (i.e. the negative predictive value [NPV]), decreases as prevalence increases. Therefore, as prevalence increases, so does the proportion of samples testing false negative.<sup>19</sup>

The principal screening test for detecting current HBV infection or carrier state in asymptomatic persons is the identification of hepatitis B surface antigen (HBsAg). The immunoassay for detecting HBsAg has a reported sensitivity of 97.5 percent and a specificity of 98 percent. Spontaneous clearance of HBsAg occurs each year in 1 to 2 percent of the carriers<sup>19</sup>.

The course of hepatitis B may be extremely variable. Hepatitis B virus infection has different clinical manifestation depending on the patient's age at infection and the immune status, and the stage at which the disease is recognized<sup>20</sup>

The spectrum of the symptomatology varies from subclinical hepatitis, icteric hepatitis to hyperacute, acute, and subacute hepatitis during the acute phase and from an asymptomatic carrier state to chronic hepatitis, cirrhosis, and HCC during the chronic phase.<sup>17</sup> About 30% of persons have no signs or symptoms. Signs and symptoms are less common in children than adults.<sup>21</sup>

Acute HBV infection is subclinical in 70 percent of adults and 90 percent of children younger than five years. The incubation period after infection lasts one to four months. Symptoms of acute HBV infection include nausea, anorexia, fatigue, low-grade fever, and right upper quadrant or epigastric pain. Clinical jaundice appears as constitutional symptoms are resolving. Extrahepatic manifestations of acute HBV infection include

myalgias, joint pain, and urticaria. Symptoms of acute disease resolve by one to three months, although some persons have prolonged fatigue. Treatment for acute infection is generally supportive, although some patients require hospitalization<sup>22</sup>. Most adults get better in a few weeks or a few months. Some adults (and more children and babies) feel like they are getting better, but the virus stays in their liver. These people have chronic HBV infection<sup>23</sup>.

Chronic HBV infection is defined as hepatitis B surface antigen (HBsAg) positivity for at least six months. Current thinking endorses the concept of four distinct stages of HBV infection, which may be used to describe acute and chronic disease<sup>23</sup>.

The first stage, the "immune tolerant" phase, is characterized by high levels of HBV DNA replication, hepatitis B e antigen (HBeAg) positivity, and normal serum transaminase levels. In the acutely infected child or adult, this stage represents the incubation period before immune response to HBV. In neonates, the immune-tolerant stage may last for years to decades<sup>23</sup>.

The second stage reflects the "immune response," which is the inflammatory process that results in the destruction of HBV-infected cells, elevating transaminase levels. Persistence of the immune response phase beyond six months is considered chronic HBV infection. This stage carries the highest risk of progression to cirrhosis and hepatocellular carcinoma<sup>23</sup>.

The third stage, the "inactive carrier" state, is thought to mark the end of active viral replication. HBeAg becomes negative, hepatitis B e antibody (anti-HBeAg) appears

(sero-conversion), and transaminase levels normalize. A low level of HBV DNA still may be present. The majority of adults with acute HBV infection enter this stage rapidly. In most chronically infected neonates and some children and adults, the conversion rate is 5 to 15 percent per year; a higher rate is associated with increasing age and elevated ALT levels. From 10 to 30 percent of carriers will have disease flares similar to acute HBV infection<sup>23</sup>.

The fourth, or "immune," stage is characterized by the clearance of HBsAg. HBV DNA is usually undetectable, and reactivation or reinfection is uncommon. Progression from the third to the fourth stage occurs in approximately 3 percent of HBV-infected persons per year<sup>23</sup>.

HBV can be transmitted at perinatal, childhood or adult ages. The main modes of transmission are mother-to-child, child-to-child, sexual and parenteral<sup>5</sup>. HBV is spread through contact with infected body fluids and the only natural host is human. Blood is the most important vehicle for transmission, but other body fluids have also been implicated, including semen and saliva. Currently, three modes of HBV transmission have been recognized; perinatal, sexual and parenteral / percutaneous transmission. There is no reliable evidence that airborne infections occur and feces are not a source of infection. HBV is not transmitted by contaminated food or water, insects or other vectors.<sup>5</sup>

In the Middle East, there is limited information on sexual transmission in its societies.<sup>24</sup>In the United States; it is most commonly spread through sexual contact or injection drug use. Health care workers and others exposed to infected blood or body fluids are also at high risk for infection. However, approximately 30% of those infected have no known

risk factors. Worldwide, it is most commonly spread to infants by their infected mothers.<sup>25</sup>

Sexual transmission remains the major mode of spread of HBV in developed countries. It is estimated that sexual transmission accounts for more than 50 percent of acute hepatitis B in the United States.<sup>26</sup>

The incidence of transfusion-related hepatitis B decreased significantly after the exclusion of paid blood donors and the introduction of hepatitis B surface antigen (HBsAg) screening of donors. Patients requiring multiple transfusions, such as hemophiliacs and thalassemics, are at increased risk of contracting HBV infection<sup>26</sup>. A study of hepatitis B showed a prevalence of 12 % among blood donors in Sudan<sup>27</sup>.

In the past, recipients of blood and blood products were at high risk (for HBV infection). Over the last 25 years, testing blood donations for HBsAg has become a universal requirement. Testing procedures have made major progress in sensitivity in the last 15-20 years. However 19% of countries reported that they were not testing all blood donations for HBsAg (WHO Global Database on Blood Safety, unpublished data). In the many countries where pretransfusion screening of blood donations for HBsAg is carried out systematically, the residual risk of HBV transmission is minimal. Moreover, plasma derived medicinal products (including antihaemophilic factors) undergo additional viral inactivation and removal procedures resulting in greatly reduced or no transmission of HBV by these products.<sup>28</sup>

Blood donors may not be representative of the general population. In some settings, blood donors tend to be healthier than individuals in the general population and consequently are more willing and capable of donating blood. In Saudi Arabia, blood donors appeared to have a lower prevalence of HBsAg (13.9%) when compared to the general population (16.7%) ( $P = 0.4$ ). On the other hand, in countries where donors are paid for their blood, these individuals may have higher rates of infection than the general population. Additionally, blood donors who are relatives of patients suffering from chronic liver disease (CLD) and requiring blood transfusions may themselves have higher rates of viral hepatitis and liver disease than the general population. In the Republic of Yemen, it was found blood donors to have a significantly higher prevalence of HBsAg (20.6%) than non-donor apparently healthy individuals (12.1%) ( $P = 0.02$ ). It is unclear whether these blood donors were paid or volunteer blood donors. Therefore, one cannot generalize findings based on studies conducted on blood donors.<sup>24</sup>

Percutaneous transmission usually happens among intravenous drug users who share syringes and needles. Household contacts can also transmit hepatitis B through the sharing of razors or toothbrushes. Certain practices like acupuncture, tattooing, and body piercing have also been associated with transmission of hepatitis B.<sup>26</sup>

The risk is still present in many developing countries. Contaminated and inadequately sterilized syringes and needles have resulted in outbreaks of hepatitis B among patients in clinics and physicians' offices. Occasionally, outbreaks have been traced to tattoo parlors and acupuncturists. Rarely, transmission to patients from HBsAg positive health care workers has been documented.<sup>28</sup>

In the Middle East, Parenteral transmission in health institutions should be limited due to routine screening of blood products. The number of intravenous drug users in the Middle East remains low compared to other regions, but there is little information on unsafe injection practices.<sup>24</sup>

Transmission, in health care facilities, usually occurs from patient to patient or from patient to health care provider via contaminated instruments or accidental needle sticks. Healthcare workers, particularly surgeons, pathologists, and physicians working in hemodialysis and oncology units, have the highest risks of HBV infection<sup>28</sup>. The prevalence of hepatitis B virus infection were estimated to be 6 % among health workers at Khartoum state .<sup>29</sup>

Children may acquire HBV infection through horizontal transmission via minor breaks in the skin or mucous membranes or close bodily contacts with other children. In addition, HBV can survive outside the human body for a prolonged period; as a result, transmission via contaminated household articles such as toothbrushes, razors, and even toys may be possible<sup>26</sup>. The prevalence of hepatitis BsAg was found to be 3.9% in children with sickle cell disease in some Khartoum hospitals .<sup>30</sup>

Transmission of HBV from carrier mothers to their babies can occur during the perinatal period, and appears to be the most important factor in determining the prevalence of the infection in high endemicity areas, particularly in China and Southeast Asia. Before HBV vaccine was integrated into the routine immunization program, the proportion of babies that become HBV carriers is about 10-30% for mothers who are HBsAg-positive but HBeAg-negative. However, the incidence of perinatal infection is even greater, around 70-90%, when the mother is both HBsAg-positive and HBeAg-positive. There are three

possible routes of transmission of HBV from infected mothers to infants: trans-placental transmission of HBV in utero; natal transmission during delivery; or postnatal transmission during care or through breast milk.<sup>5</sup>

Among infants born to women in whom sera are positive for both the hepatitis B surface antigen and the e antigen, 85% to 90% are infected with hepatitis B virus and become chronic hepatitis B surface antigen carriers.<sup>31</sup>

The infection rate among infants born to HBeAg-positive mothers is as high as 90 percent. Maternal-infant transmission may occur in utero, at the time of birth, or after birth. The high protective efficacy of (95 percent) of neonatal vaccination suggests that infection occurs predominantly at or after birth.<sup>26</sup> There is no evidence that cesarean section prevents maternal-infant transmission.<sup>26</sup> Breast-feeding does not appear to increase the risk of transmission.<sup>32</sup> Although HBV DNA has been detected in the colostrums of HBsAg positive mothers, a study on 147 infants born to carrier mothers revealed no evidence for a relationship between breast-feeding and the subsequent development of chronic HBV infection in the babies.<sup>33</sup> Transplacental passage of HBV is very rare. The risk of transmission during amniocentesis is also low, particularly in mothers who are HBeAg negative and when the procedure is done using a 22-gauge needle under continuous guidance transplacental passage of HBV is very rare.<sup>26</sup> The high frequency of perinatal transmission in endemic areas is probably related to the high prevalence (40 to 50 percent) of HBeAg in women of reproductive age. These women remain infectious because of the slow rate of HBeAg seroconversion during the first two decades of life. Studies in Chinese children, for example, have found HBeAg in as many

as 90 percent below the age of 5, and up to 80 percent below the age of 20. The risk of maternal-infant transmission is related to the HBV replicative status of the mother. It is 85 to 90 percent in infants born to HBeAg positive mothers and 32 percent in infants born to HBeAg negative mothers. A survey in an urban South-East Asia country estimated the overall risk of perinatal transmission in all HBsAg positive mothers to be 40 percent.<sup>32</sup>

The high prevalence of hepatitis B surface antigen (HBsAg) and hepatitis B e antigen (HBeAg) in pregnant women is considered to be the most important factor contributing to the high carrier rate of HBsAg in some populations. Several factors, including the age at which infection occurs, predispose to the acquisition and frequency of the carrier state. The proportion of infected people who become chronic carriers ranges from about 80 to 95% for babies born to HBsAg/HBeAg-positive mothers.<sup>33</sup>

Between 1977 and 1980, 1442 pregnant women in Thies, Senegal, were tested for serologic markers of hepatitis B virus (HBV) infection. Of these, 9.8% were HBsAg (+ve), Of 116 HBsAg (+ve) pregnant women, only 19.8% were HBeAg (+ve), a much lower proportion of infectious carriers than seen in Asian populations. Cord blood from 1353 babies was HBsAg(-ve), implying that the babies were not infected prior to birth. Four hundred sixty-two babies, including 88 born to HBsAg (+ve) mothers, were observed for 2 weeks to 38 months after birth. In contrast to observations in Asia, none of the babies became HBsAg(+ve) before 5 months of age, and only three of the 16 born to HBeAg(+ve) mothers became HBsAg(+ve) within the first year of life; all three developed chronic infections (i.e., HBsAg(+)) for greater than or equal to 6 months. In the second year of life, six of 34 babies born to HBsAg(+ve), HBeAg(-ve)/anti-HBe(-ve) mothers became infected with HBV, and four of the six developed chronic infections.

During the first 3 years of life, infections occurred at a higher rate in infants born to HBsAg(+ve) (17%) than to HBsAg(-) (4%) women. The latter group of infants included 4.0% of those born to anti-HBsAg (+ve) mothers, 4.6% born to anti-HBcAg(+ve), and 3.2% born to uninfected women. These observations indicate that HBV infection in Senegal usually do not occurs perinatally, but do occur at high incidence later in infancy and childhood. Such infections can be prevented by the use of hepatitis B vaccine alone; administration of hepatitis B immune globulin should not be needed.<sup>34</sup>

A total of 7.1% of the women in Oman, 1% in Qatar and 1.5% in UAE were HBsAg-positive. Three (0.5%) women in Oman were HBeAg-positive.<sup>35</sup> Risk factors identified for being HBsAg-positive were younger age, being a national (i.e. not an expatriate) and residing outside the city. Results from this study have shown that hepatitis B virus (HBV) prevalence in pregnant women is of intermediate endemicity in Oman and of low endemicity in Qatar and UAE. Thus, universal vaccination of all female adolescents before potential pregnancy is recommended in Oman in order to prevent perinatal infection, as well as to minimize horizontal transmission of the HBV in the community.<sup>35</sup>

In the Middle East, the majority of infections occur through childhood and perinatal transmission. Studies on the magnitude of perinatal and childhood transmission in the Middle East have produced differing results. While some studies suggest that childhood transmission is the major mode of transmission of HBV infection with perinatal transmission being uncommon, others propose that perinatal transmission plays an important role in contributing to the pool of chronic carriers. Considering the heterogeneity of Middle East populations and the difference in the prevalence of chronic

carriers and HBeAg positivity amongst women of childbearing age within them, intercountry differences in the mode of transmission probably exist.

Supporting the role of childhood transmission in the Middle East, person-to-person, non-sexual, non-parenteral and intra-familial contact was the major mode of transmission between asymptomatic HBV carriers and susceptible individuals.<sup>24</sup> A combined study in four Middle East countries found that only 21% (25/120) of children born to HBsAg-positive mothers became chronic carriers. This was attributed to the low prevalence of HBeAg (13%) amongst HBsAg-positive mothers, although 94% (15/16) of HBeAg-positive mothers transmitted HBV to their infants.<sup>24</sup>

A study in Kuwait found the prevalence of HBsAg among pregnant women to be 2.9% (45/1554), 7.3% of whom were positive for HBeAg. Based on the low prevalence of HBeAg amongst pregnant women, they predicted a low transmission rate of infection to offspring.<sup>24</sup> In Lebanon, similar prevalence rates of HBsAg (2.9%) (16/558) and HBeAg (6.3%) was found amongst pregnant women and accordingly one would expect a low mother-to-child transmission as in Kuwait.<sup>24</sup>

A study in the Jizan area in Saudi Arabia, suggested that perinatal transmission was unlikely to play an important role in HBV hyper-endemicity in Jizan due to the low HBeAg positivity of 9% (6/67) in carrier males and females alike associated with a low prevalence of HBsAg in females of childbearing age (4.9%).<sup>24</sup>

Another study conducted on mother-to-child transmission of HBV in Saudi Arabia, found 2.8% (140/5000) of pregnant women positive for HBsAg. A two-year follow-up of 50 HBsAg-positive women, 12% of whom (6/50) were positive for HBeAg and their neonates showed that none of the children became HBsAg-positive. A similar study by

Ramia et al. conducted on 3020 women showed the overall prevalence of HBsAg to be 3.9% amongst pregnant women in Saudi, 11% of whom (13/119) were positive for HBeAg.<sup>24</sup> Another study by the same authors looking into transplacental transmission of HBV infection by HBsAg carrier mothers suggested a lack of evidence for perinatal transmission.<sup>24</sup>

On the other hand, there are studies supporting the role of perinatal transmission of HBV infection in the Middle East. Due to a high rate of HBsAg (9.7%) amongst children aged 1 year in Saudi Arabia, suggested the possibility of significant HBV transmission during the perinatal period or soon after.<sup>26</sup> In the Republic of Yemen, approximately 17% (40/243) of pregnant women were HBsAg positive and 32% (9/28) of HBsAg-positive pregnant women were HBeAg-positive. This high prevalence of HBeAg in pregnant Yemeni women indicates a potentially high rate of perinatal transmission of HBV.<sup>25</sup> Another small study suggested the rate of mother-to-child transmission to be 50% (10/20) from HBsAg-positive mothers, based on cord blood positive for HBsAg.<sup>24</sup>

Studies in Egypt also suggest that perinatal transmission is relatively high. A study has detected HBsAg in 8% (12/150) among pregnant mothers and 17% (2/12) of their infants. None of the HBsAg-positive mothers or their infants was HBeAg positive. In another study conducted in Egypt, 17% (6/35) of infants born to HBsAg-positive mothers were HBeAg-positive, and HBsAg was positive in 25%, 22% and 37% of cord, 3-month and 6-month blood specimens respectively. Out of 6 babies who became infected from HBeAg-positive mothers, 5 (83%) showed infection at 3 months and 1 did not show infection until 6 months.<sup>24</sup>

Mother to child transmission was studied in juba , southern Sudan , on 88 mother child pairs (mean age 15.5 months) where on 9 HBsAg positive mothers , five of their children were also HBsAg positive (55.5%)whereas on 79 HBsAg negative mothers only 9 children became HBsAg positive .<sup>36</sup>

A large study in the Gezira area showed that 70% of the HBsAg positive women of child bearing age were HBeAg positive , indicating that maternal-infant transmission might be an important risk factor in this part of the country.<sup>36</sup>

In Khartoum state, the seroprevalance of HBsAg in pregnant women was found to be 16.4% in a study carried out at an antenatal clinic<sup>36</sup>. Another cross sectional hospital based study was conducted, in Omdurman Maternity Hospital, among 391 randomly selected delivering women and 353 newborn for the women found that HBsAg was 4.1% among the women and 1.52% among the neonates .<sup>37</sup>

In developed countries like United States to identify newborns who require immunoprophylaxis to prevent perinatal HBV infection, all vaccine advisory groups have recommended routine HBsAg screening of all pregnant women during an early prenatal visit in each pregnancy.<sup>38</sup>Federal funding to support perinatal hepatitis B-prevention programs became available in 1990, and by 1992, programs had been implemented in all 50 states and the District of Columbia. Specific objectives of these programs are to ensure that all pregnant women are tested for HBsAg, and infants born to HBsAg-positive women receive hepatitis B immune globulin (HBIG) and hepatitis B vaccine at birth, with follow-up doses of vaccine at ages 1 and 6 months. This describes the case-management features of successful hepatitis B-prevention programs in Connecticut during 1994-95 and in the United States during 1994. Connecticut .<sup>38</sup> In many previous

studies in countries with low endemicity, such as Britain and North America, have looked at selective versus universal antenatal screening. When a direct comparison has been made, selective screening failed to identify about half of the women whose babies were at risk. Among the reasons for the failure of selective systems are the difficulties of discussing risk behaviors in a busy antenatal clinic, the possibility that women with no risk factors might have been infected by a partner with a "risk history," and many infected women have no recognized risk factors. As a result of the study in the Netherlands the Dutch national health authority has adopted as policy non-selective screening for hepatitis B infection.<sup>38</sup>

The main risk factors for hepatitis B are Engaging in unsafe sex, particularly unprotected receptive anal sex, having sex with more than one partner or with a partner who has or has had more than one partner or who uses or has used IV drugs, sharing needles, IV drugs, and drug , Recent history of STI infection, having a blood transfusion or treatment with infected blood products, getting a tattoo or piercing, having a job (such as a health care worker) that exposes one to blood or other body fluids, traveling or living in areas with high rates of HBV infection (including Southeast Asia, the Amazon basin in South America, the Pacific Islands, the Middle East).<sup>6</sup>

The incidence of HBV infection differs significantly by race and ethnicity with the highest rates among blacks; rates are higher among Hispanics than non-Hispanics. Incidence also varies by age with the highest rates reported among persons 20-39 years of age. Less than 5% of the HBV infections that occur among children are reported as cases of acute hepatitis B to CDC because HBV infections that occur in infants and children rarely produce signs or symptoms of disease. Furthermore, chronic HBV infection

develops in approximately 90% of children infected at birth and 30%-60% of children infected between 1 to 5 years of age compared with 2%-6% of older children and adults; thus, prior to routine immunoprophylaxis of infants and children, cases occurring in children accounted for a disproportionate amount of the disease burden due to chronic infection.<sup>39</sup>

A study was conducted in the United States to estimate race/ethnicity-specific prevalence of hepatitis B surface antigen (HBsAg) in pregnant urban women and to evaluate factors associated with maternal HBsAg testing , showed that HBsAg prevalence among white non-Hispanics was 0.60% (95% confidence interval [CI]: 0.22–0.98), black non-Hispanics 0.97% (95% CI: 0.48–1.47), Hispanics 0.14% (95% CI: 0.01–0.26), and Asians 5.79% (95% CI: 4.42–7.16). HBsAg testing rates increased from 56.6% in 1990 to 78.2% in 1993.<sup>40</sup>

The risk of chronic infection decreases with age when the infection has been acquired<sup>41</sup>. The earlier the disease is acquired, the greater the chance of developing chronic infection. Infants (mainly infected through vertical transmission) have a 90% chance, children have a 25-50% chance, adults have an approximately 5% chance, and persons who are elderly have an approximately 20-30% chance of developing chronic disease.<sup>17</sup>

A model was developed to calculate the age-specific risk of acquiring HBV infection, acute hepatitis B (illness and death), and progression to chronic HBV infection. HBV-related deaths among chronically infected persons were determined from HBV-related cirrhosis and hepatocellular carcinoma (HCC) mortality curves, adjusted for background mortality. The effect of hepatitis B vaccination was calculated from vaccine efficacy and

vaccination series coverage, with and without administration of the first dose of vaccine within 24 h of birth (i.e. birth dose) to prevent perinatal HBV infection. RESULTS: For the year 2000, the model estimated 620 000 persons died worldwide from HBV-related causes: 580 000 (94%) from chronic infection-related cirrhosis and HCC and 40 000 (6%) from acute hepatitis B. In the surviving birth cohort for the year 2000, the model estimated that without vaccination, 64.8 million would become HBV-infected and 1.4 million would die from HBV-related disease. Infections acquired during the perinatal period, in early childhood (<5 years old), and  $\geq 5$  years of age accounted for 21, 48, and 31% of deaths, respectively. Routine infant hepatitis B vaccination, with 90% coverage and the first dose administered at birth would prevent 84% of global HBV-related deaths. Globally, most HBV-related deaths result from the chronic sequel of infection acquired in the perinatal and early childhood periods. Inclusion of hepatitis B vaccine into national infant immunization programs could prevent >80% of HBV-related deaths.<sup>42</sup>

This study identifies the risk factors for hepatitis B virus (HBV) and hepatitis C virus (HCV) and measures the prevalence of hepatitis B surface antigen (HBsAg) and antibody to hepatitis C (anti-HCV) in the general population of Jakarta. A population-based sample of 985 people aged 15 and above was surveyed. Risk factors were identified through questionnaires and home visits. Serum was analyzed for HBsAg, antibody to hepatitis B surface antigen (anti-HBs), anti-HCV, aspartate aminotransferase (AST) and alanine aminotransferase (ALT). The seroprevalence was: 4.0% (39/985) for HBsAg, 17.2% (170/985) for anti-HBs, and 3.9% (38/985) for anti-HCV. The risk factors for hepatitis B and hepatitis C infection had little in common. Low socioeconomic status was a strong risk factor for HBsAg (adjusted odds ratio (OR) 18.09; 95% confidence interval (CI)

2.35-139.50). In addition, the Chinese group has 2.97 higher risk of having HBV infection compared with the Malayan ethnic group (adjusted OR 2.97; 95% CI 1.22-7.83). There was moderate positive trend between family size and risk of HBsAg positivity (P = 0.130). Age over 50 (adjusted OR 14.72; 95% CI 4.35-49.89) and history of transfusion were significant risk factors for hepatitis C (adjusted OR 3.03; 95% CI 1.25-7.33). Hepatitis B and hepatitis C infections have different risk factors in Jakarta, a high risk in population for both diseases. Hepatitis B transmission is associated with low socioeconomic status, Chinese ethnic group and large family size, while hepatitis C is associated with an older age and a history of transfusions.<sup>43</sup>

The most common factors found to be associated with HBV infection and carrier status in the Middle East, other than the risk of perinatal transmission associated with HBsAg/HBeAg status of the mother, are family size, socioeconomic status, age, educational status and a history of previous blood transfusion, surgery or contact with a jaundiced person.<sup>24</sup>

Most HBV infections in developed countries result from sexual activity, injection-drug use, or occupational exposure. Other, less frequent causes of infection include household contact, hemodialysis, transmission from a surgeon, and receipt of organs or blood products. No clear risk factors are found in 20 to 30 percent of patients, perhaps because of a reluctance to report high-risk behavior or possibly mucosal or other unrecognized routes of infection.<sup>12</sup>

Evidence supporting the role of large family size in increasing the risk of HBV infection came from the observation of pronounced familial clustering of HBV infection in Jordan.

A significant correlation was found between family size and the proportion of HBsAg-positive family members. Also in Jordan, there was a significantly greater HBsAg prevalence in lower (14.4%) than in upper (2.4%) socioeconomic classes. Another study supporting this evidence showed the prevalence of HBsAg to be 11% and 4% respectively amongst low and high socioeconomic classes. Earlier studies have also shown the prevalence of HBsAg to be 6.9% and 0.7% respectively in lower and upper socioeconomic classes. Similar findings have been reported from the Syrian Arab Republic and Egypt, where the risk of infection was found to be greater in children of low compared to children of high socioeconomic status.<sup>24</sup> The association of a history of jaundice, previous blood transfusions and surgery with HBV infection and carrier status has been reported in Jordan, Egypt and the Republic of Yemen. In the Republic of Yemen, a multivariate analysis found age, a history of jaundice and a combined history of blood transfusion and surgery to be associated with HBV infection. The odds ratio associated with increasing 10-year age intervals was 1.37 and 1.51 for carrier status and total markers respectively. <sup>24</sup> The adjusted odds ratio for a combined history of surgery and blood transfusion was 2.76 (95% CI: 1.11–6.82). The adjusted odds ratio for a history of jaundice was 1.42 (95% CI: 1.01–2.01). <sup>24</sup> Toukan et al. reported similar findings in Jordan [18]. In addition, they also found past or present HBV infection to be associated with a rural background, injections, tattooing, sexual exposure and surgical procedures. <sup>24</sup>In Egypt, Ghaffar et al. examined risk factors for perinatal transmission. Apart from the proven importance of HBeAg/anti-HBe status in perinatal transmission, they found that maternal history of schistosomal infection was significantly associated with perinatal transmission. <sup>24</sup> A possible explanation for this association was that schistosomal

infection resulted in impaired cell-mediated immunity(indicator of low socio-economic status ) and hence increased viraemia and infectivity. They also found higher rates of HBV transmission in rural areas as well as in mothers with low educational status.<sup>24</sup> A negative correlation between prevalence of HBV infection and educational levels has also been observed in the Islamic Republic of Iran.<sup>24</sup>

History of jaundice, contact with jaundiced patient, blood transfusion past history of operation ,tattooing contact with blood was found statistically insignificant in a study conducted among pregnant women in Omdurman maternity hospitals .<sup>37</sup>

Study conducted among children of sickle cell anemia in pediatrics hospitals in Khartoum, found that there is no significant relation between HBV prevalence and blood transfusion, tribal markers, surgery, parents' education and mother occupation .<sup>30</sup>

Hepatitis B Immune Globulin (HBIG) is a sterile solution of ready-made antibodies against hepatitis B. HBIG is prepared from human blood from selected donors who already have a high level of antibodies to hepatitis B and used in passive immunoprophylaxis. Passive immunoprophylaxis is used in four situations; newborns of mothers infected with hepatitis B, after needle stick exposure, after sexual exposure, and after liver transplantation.

Immunoprophylaxis is recommended for all infants born to HBsAg positive mothers. Current dosing recommendations are 0.13ml/kg HBIG immediately after delivery or within 12 hours after birth in combination with recombinant vaccine. The combination results in a higher-than-90% level of protection against perinatal acquisition of HBV.<sup>44</sup>

About 3.7% to 9.9% of infants still acquire HBV perinatal infection from HBV-infection mothers, despite immuno-prophylaxis. Failure of passive and active immuno-prophylaxis in this setting may be the result of in utero transmission of HBV infection, perinatal transmission related to a high inoculum, and/or the presence of surface gene escape mutants.<sup>44</sup> To study the interruptive effect of HBIG before delivery in attempt to prevent intrauterine transmission of HBV, a large-scale, random-control study was conducted in China . In this study, nine hundred and eighty HBsAg carrier pregnant women were randomly divided into HBIG group and control group. Each subject in the HBIG group received 200 IU or 400 IU of HBIG intramuscularly at 3, 2 and 1 month before delivery, in addition to newborns receiving HBIG intramuscularly. By this way, the rate of intrauterine transmission in this group fall to 5.7%, compared to 14.3% in control group. (P < 0.001). However, the preventive effect of HBIG administration before delivery needs to be confirmed by more study in the future. <sup>5</sup>

Hepatitis B immune globulin remains a central component of prophylaxis in HBV-infected patients undergoing liver transplantation. HBIG monotherapy given at a high dosage can prevent recurrence in 65% to 80% of patients. Because the cost of long-term prophylaxis with high-dose HBIG is extremely high and combination therapy using HBIG with a nucleoside analog is more uniformly effective, the current protocol is combination HBIG with a nucleoside analog after liver transplantation. These combination protocols have reduced the rate of virologic breakthrough to 10% or less .<sup>5</sup>

Prevention of primary infection by vaccination is an important strategy to decrease the risk of chronic HBV infection and its subsequent complications. The first-generation

hepatitis B vaccine, an inactive plasma-derived vaccine, became available in 1982;<sup>7</sup> consequently; the second generation of HB vaccine, a DNA recombinant HB vaccine was also available for general use in 1986. Both of the vaccines were proven to be safe and efficacious in preventing HBV infection. In 1991, the World Health Organization (WHO) recommended that hepatitis B vaccination should be included in national immunization system in all countries with a hepatitis B carrier prevalence (HBsAg) of 8% or greater by 1995 and in all countries by 1997. By May 2002, 154 countries had routine infant immunization with hepatitis B vaccine .<sup>7</sup>

Vaccines are given in three doses (at 0, 1, and 6 months) of 10-30 µg (usually 20 µg for adults and 10 µg for children). The vaccines are extremely safe and induce antibodies that will neutralize HBsAg (anti-HBsAg) in most (> 95%) recipients; antibody levels in excess of 10 U/ml are considered protective. Certain groups—people aged over 40, obese people, those with chronic renal failure, haemo-dialysis recipients, immuno-suppressed individuals, organ transplant recipients—have poorer response rates. The protection lasts for at least 15 years, and because of strong immunological memory it continues after anti-HBs have become undetectable. Immunity is thus believed to be life long, and boosters are not recommended routinely; however, these may have a role in immuno-suppressed individuals and those at a particularly high risk of exposure. Non-responders to three doses may benefit from additional doses of the vaccine. <sup>44</sup>

Regarding immunogenicity in Neonates, it was found that immunization with 10 mcg at 0, 1, and 6 months of age produced seroconversion in 100% of infants by month 7, with a geometric mean antibody titer (GMT) of 713 IU/ml (N = 52), and the seroprotection rate

was 97%. 3 Clinical trials indicate that administration of hepatitis B immune globulin at birth does not alter the response to ENGERIX-B.<sup>40</sup>

Immunization with 10 mcg at 0, 1, and 2 months of age produced a seroprotection rate of 96% in infants by month 4, with a GMT among seroconverters of 210 IU/ml (N = 311); an additional dose at month 12 produced a GMT among seroconverters of 2,941 IU/ml at month 13 (N = 126).<sup>45</sup>

As Immunogenicity in Pediatric Patients is concerned; clinical trials in 242 children aged 6 months to, and including, 10 years given 10 mcg at months 0, 1, and 6, the seroprotection rate was 98% 1 to 2 months after the third dose; the GMT of seroconverters was 4,023 IU/ml. In a separate clinical trial including both children and adolescents aged 5 to 16 years, 10 mcg of ENGERIX-B was administered at 0, 1, and 6 months (N = 181) or 0, 12, and 24 months (N = 161). Immediately before the third dose of vaccine, seroprotection was achieved in 92.3% of subjects vaccinated on the 0-, 1-, and 6-month schedule and 88.8% of subjects on the 0, 12, and 24 month schedule (117.9 IU/ml versus 162.1 IU/ml, respectively,  $p = 0.18$ ).<sup>46</sup> One month following the third dose, seroprotection was achieved in 99.5% of children vaccinated on the 0-, 1-, and 6-month schedule compared to 98.1% of those on the 0-, 12-, and 24-month schedule. GMTs were higher ( $p = 0.02$ ) for children receiving vaccine on the 0-, 1-, and 6-month schedule compared to those on the 0-, 12-, and 24-month schedule (5,687.4 IU/ml versus 3,158.7 IU/ml, respectively). The clinical relevance of this finding is unknown.<sup>47</sup> The recommended series of three intramuscular doses of hepatitis B vaccine induces a protective antibody response (anti-HBsAg  $\geq 10$  IU/ml) in  $>90\%$  of healthy adults and in  $>95\%$  of infants, children, and adolescents. Hepatitis B vaccine should be administered

only in the deltoid muscle of adults and children or in the antero-lateral thigh muscle of neonates and infants; the immunogenicity of the vaccine for adults is substantially lower when injections are administered in the buttock.<sup>34</sup> When hepatitis B vaccine is administered to infants at the same time as other vaccines, separate sites in the anterolateral thigh may be used for the multiple injections. This method is preferable to administering vaccine at sites such as the buttock or deltoid.<sup>46</sup>

A total of 110 high-risk infants born to women who were carriers of HBsAg positive for HBeAg were randomized into two groups. The first group (54 infants) received a 20-[microgram] dose of surface antigen at birth and at one month, two months and 12 months of age. The second group (56 infants) received a 10-[microgram] dose of surface antigen at the same time periods. Another group of 60 high-risk infants who were recruited later received a 20-[microgram] dose of vaccine at birth and at one month and six months of age. All of the infants received a dose of hepatitis B immunoglobulin intramuscularly within 24 hours of birth.<sup>47</sup> No statistically significant differences were found among the infants in the three groups. The vaccine was more than 90 percent effective in each of the three dosage regimens and in combination with hepatitis B immunoglobulin. The infants who received the 20-[microgram] doses had higher antibody titer than the infants who received the 10-[microgram] doses, but the clinical significance of this phenomenon is not known. Adverse reactions were rare and mild.<sup>47</sup>

Hepatitis B vaccination has been shown to reduce the prevalence of chronic HBV infection and the incidence of HCC dramatically. In The Gambia, the prevalence of chronic infection among children declined from 10.0% to 0.6% after implementation of

universal infant hepatitis B vaccination. Similar declines in prevalence of chronic infection associated with infant and childhood hepatitis B vaccination have been demonstrated in China, Indonesia, Senegal, and Thailand, and among Alaska Natives. After implementation of universal infant hepatitis B vaccination in Taiwan, the incidence of HCC among children declined from 0.7 to 0.36 per 100,000.<sup>46</sup>

A major barrier to the introduction of hepatitis B vaccination has been the high cost of hepatitis B vaccines. Although the price of monovalent hepatitis B vaccine for developing countries has decreased from approximately U.S.\$3.00 per dose in 1990 to U.S.\$0.30 per dose in 2001, the cost remains higher than that of the older vaccines (e.g., DTP, oral polio, and measles), which cost U.S.\$0.06--\$0.10 per dose. Since 1999, support from the Global Alliance for Vaccines and Immunization (GAVI) and the Vaccine Fund (VF) has accelerated introduction of hepatitis B vaccine in the world's poorest countries. As of May 2003, of 75 countries eligible for GAVI/VF support, 48 (64%) had received funding for hepatitis B vaccination introduction.<sup>47</sup>

Administration of a birth dose of vaccine presents a challenge. Worldwide, approximately 50% of infants are born at home and do not have immediate access to health care. However, because hepatitis B vaccine has been shown to be heat stable, it could be administered by trained birth attendants to infants born at home. The feasibility of such a strategy has been demonstrated in Indonesia, where trained birth attendants were taught to administer the birth dose of vaccine to infants born at home by using a single-use, pre-filled injection device.<sup>48</sup>

## Chapter 2

**Study design:**

Descriptive cross-sectional - health facility based study.

**Study area:**

Khartoum state is one of the 26 states of Sudan. It is the capital of Sudan. It has political and commercial importance. Not only because it is the capital but also because of its location. It is situated in the centre of Sudan. Area is 2, 0140 Km<sup>2</sup>. The state has been divided into seven localities. Number of health centers in Khartoum State is 143, distributed all over the localities.<sup>49</sup>

About 44% of the population of the state is lifetime migrants. A study conducted by the National Population Council showed that approximately 1,000 persons enter and settle in the state daily.<sup>49</sup>

Sex ratio in the state was found to be 410 males per 1000 population. Average size of the households is 6.1 persons per house. Children under five accounts for 15.1 % (higher in the rural areas), while those under 14 years of age constitute 37.6%. The working age (15-59) accounts for 57.9% of the total population.

Religions: Muslim 70%, indigenous beliefs 25%, Christians 5%.<sup>49</sup>

**Study population:**

All pregnant women attending ANC unit in Khartoum State.

**Inclusion criteria:**

- 1/ Pregnant women attending ANC units for antenatal care visits.
- 2/ Women accept to be involved in the study.
- 3/ Any age.
- 4/ Any gestational age.

## **Sampling**

### **Sample design:**

Two stage cluster sample with stratification technique was followed. All 7 localities in Khartoum State (Khartoum, Jabal Awlia, Bahry, Sharq Alniel, Omdurman, Karary, and Umbada) were taken in the sample. Annex IV

In stage 1, a total of 20 ANC centers were selected by stratification from governmental, NGOs centers, Federal and State hospitals proportional to the number of health facilities that provide ANC services among different types. This resulted in selection of 6, 10, 2, and 2 centers from each stratum respectively, and then the number of ANC centers selected from each locality is taken according to the frequency of women attending the ANC centers (Annex IV).<sup>50</sup> The nearest true number was taken in Proportions with fractions. ANC units were selected randomly from the list in each locality using random digit table.

In stage 2 the calculated sample size of women, 314, was divided proportional to size among the selected ANC centers. In the selected centers women were chosen randomly from the registration book using the random digit table. Where the sample size was exceeding the registered number, all women registered in the day of visit, were selected and the sample was completed in the next days.

### **Sample size:**

A/sample of 20antenatal care unit was taken.

B/ sample of 314 pregnant woman was taken using the following formula:

$$n = \frac{z^2 (pq)}{d^2} * \text{design effect}$$

d2

$z = \text{Confidence level} = 1.96$  corresponds to 95 % in Z table

$p = \text{prevalence} = 0.08$  ,  $q = 1 - p = 0.92$  ,  $d_2 = \text{desired margin of error} = 0.03$

Design effect (design will be over weight by stratification) = 1.8

$n = 314$

### **Data collectors:**

Twelve data collectors had participated in the process of data collection, divided equally among 3 teams, each one composed of 2 data collectors, lab technician and field supervisor. They had received 2 days training on the filling of the questionnaire and collection of blood samples. This was followed by pre testing of the questionnaire in the unselected centers.

### **Tools for data collection:**

A pre designed questionnaire was used (annex I), which showed the following variables; age, tribe, marital status, number of children, type and place of delivery, level of education for the woman and husband, occupation of the woman and husband, history of blood transfusion for the woman and husband, history of unsafe injection to the woman and husband, past history of jaundice and renal dialysis for both woman and husband, number of other wives, vaccination history with HBV vaccine and previous testing for HBV.

Blood samples were taken from each woman before filling the questionnaire. Each woman was given a code, which was the same for the questionnaire and the blood sample container. 5 ml of intravenous blood was taken using a tourniquet and alcohol for local disinfection. The blood containers were taken by the end of the day to the lab, in sample

carriers, where they were centrifuged and kept in fridges at  $-8\text{ C}^0$ . Laboratory tests were performed at Khartoum State - ministry of health's lab. Blood samples were screened for hepatitis B virus's s and e antigens using the ELISA Test. Results were considered as positive for HBsAg after being reexamined with the ELISA test.

**Ethical considerations:**

- Ethical clearance certificate has been obtained from the ethical committee of the Federal Ministry of Health (annex III).
- Women had given a written consent before taking the blood samples following explanation of the procedure and its purpose.(Annex II)
- Women with positive results were informed through phone to take safety precautions and to ask for the vaccine and immunoglobulin for her child immediately after birth.
- Blood was collected by lab technician who were trained on safety of injection practices and using safety precautions (disposable syringes, safety boxes and gloves).

**Data analysis:**

Data were analyzed using Spss-13 soft ware program. Prevalence of HBsAg and HBeAg was calculated with 95% confidence interval and the risk of perinatal HBV transmission was measured by the frequency of HBsAg /HBeAg positive women .<sup>10</sup>Then HBsAg prevalence by age and other risk factors was calculated using odds ratio and logistic regression.

## Chapter 3

Three hundred and twenty pregnant women were tested for hepatitis B surface antigen. The main results obtained for this study are shown in (table 1), where (12/320) 3.75% (95% CI: 3.77-3.73) women were tested positive for HBsAg and only one woman out of the 12 {8.33% (95% CI:8.49-8.17)} was hepatitis B e antigen positive. Prevalence of HBsAg & HBeAg positive mothers is 0.31%, Frequency of HBV carriers in population due to perinatal infection is 0.25%.

Fifty two percent (166/320) of these women were from Omdurman locality and 11%(35/320) women were from Jabal Awlia ,10%(32/320) were from Khartoum locality, 8%(26/320) from Khartoum North (Bahry), 8%(26/320) woman were from Umbada locality, 8%(26/320) were from Sharg Alnil and 3%(10/320) were from Kararry locality .(Figure 1 ).

Fifty two percent (166/320) women were from hospitals, 23% (74/320) were from governmental health facilities ,and 24%(77/320) women were selected from non governmental organization health facilities.(figure No.2)

Fifty eight percent (185/320) of the study population were from southern Sudan and 42% (134/320) women were from northern Sudan. (Figure No.3) Six foreigner women were included in the study, two from Syria, one from Chad, one from Ethiopia, one from turkey and one woman is from Cameron.

The number of women aged less than 20 years of age were 10 %( 32/320), women aged between 20 to 29 years were 52 %( 164/320) and those who age 30 and above were (120/320) with median age of 27 years (figure No.4).

Figure No. 5 shows that 48 %( 154/320) women involved in the study received less than 9 years of education, and 52% (166/320) get more than 9 years of education.

Forty five percent (144/320) of the husbands received less than 9 years of education, and 55 % ( 176/320) get more than 9 years of education (figure No, 6).

Ninety seven percent (310/320) of the study population had non risky occupation, 3 % (9 /320) were health workers (risky occupation (figure No.7).

Twenty percent (64/320) of the husbands had a risky occupation (militaries, truck drivers and health workers), and 80 % ( 256/320) of the husbands were having a non risky jobs (Figure No.8).

Twenty eight percent (90/320) of the study population having a more than 3 children, and 72% (230/320) have less than 3 children (figure No.9).

Three hundred and nineteen women included in the study were married (99.7%).and the one woman is divorced (0.3%).

Seventy seven percent (170/220) of the study population having children were delivered vaginally, 13% (28/220) by caesarean section and 10% (22/220) by both vaginal and caesarean section (figure No. 10).

Twenty five percent (81/220) of those who delivered before were delivered at home, and 63% (139/220) women delivered at hospital (figure No.11).

Sixteen percent (52/320) of the husbands have other wives and 83.7 % (268/320) didn't have (Figure No. 12)

Fifty six percent (29/52) of those husbands who have other wives have one more wife, 35 % ( 18/52) have two more wives and 9 % ( 5/52) husbands have three more wives (figure No.13).

Three hundred and eighteen (99.4%) of the pregnant women in Khartoum state didn't vaccinate before, and 2 (0.6%) vaccinated.

Table 2 shows that There was insignificant relation ( $p>0.05$ ) between HBsAg prevalence and risk factors (age, African racial roots, education, husband's education, Risky occupations, Family size, Husbands having other wives, Blood transfusion, Blood transfusion for husbands, Unsafe injection, History of jaundice, Husband's history of jaundice).

The odds ratio for age was 0.644(95%CI:0.164-2.527), The odds ratio for African racial roots was 0.514(95%CI:0.139-1.905), The odds ratio for education less than 9 years was 1.139 (95%CI:0.272-4.774), The odds ratio for husbands education less than 9 years was 1.159(95%CI:0.29-4.63), The odds ratio for Risky occupations was 1.91 (95%CI:0.000-2.24), The odds ratio for Husband's risky occupation was 0.461(95%CI:0.166-1.82), The odds ratio for Family size was 2.20(95%CI:0.356-13.61), The odds ratio for Husbands having other wives was 2.06(95%CI:0.356-13.61), The odds ratio for history of Blood transfusion was 1.85(95%CI:0.0180-18.96), The odds ratio for husband history of Blood transfusion was 0.360(95%CI:0.034-3.77), The odds ratio for Unsafe injection was 0.592(95%CI: 0.046-7.70), The odds ratio for History of jaundice was 0.735 (95%CI:0.175-3.095), The odds ratio for Husband's History of jaundice was 2.014 (95%CI: 0.240-16.870). No relation was detected between hepatitis B infection and husband's history of unsafe injection, and history of renal dialysis for both women and husbands with odds ratio equals zero.

**Table No. 1 Prevalence of hepatitis Bs and e among pregnant women and estimates of frequency of perinatal HBV transmission Khartoum State 2005-2006**

Measures	Calculation(No.)	%
HBsAg prevalence	12/320	3.75% (95% CI:3.77-3.73)
HBeAg prevalence	1/12	8.33% (95% CI:8.49-8.17)
prevalence of HBsAg & HBeAg positive mothers	0.0375X 0.0833	0.31%
Frequency of HBV carriers in population due to perinatal infection	0.311% X 0.8**	0.25%***

\*Moderate endemicity.

\*\*Efficiency of perinatal transmission<sup>10</sup>

\*\*\*Low perinatal transmission.

Figure :1 distribution of study population among localities

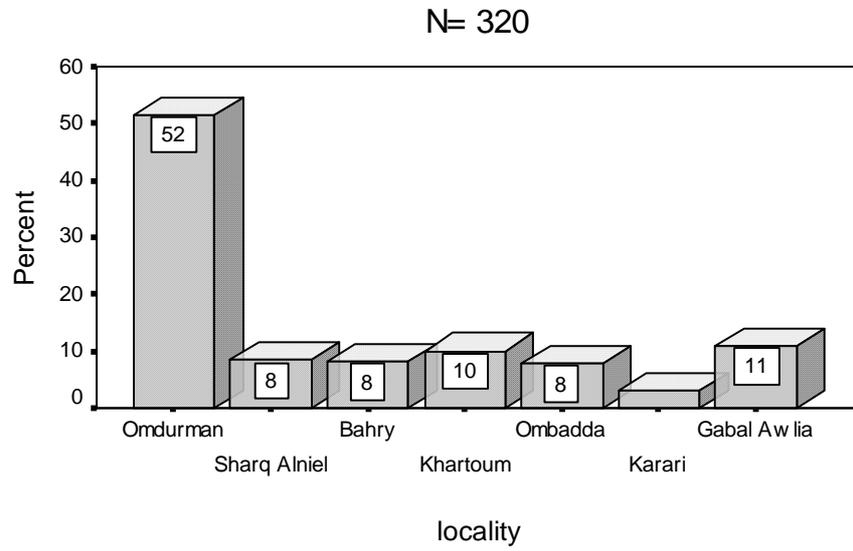
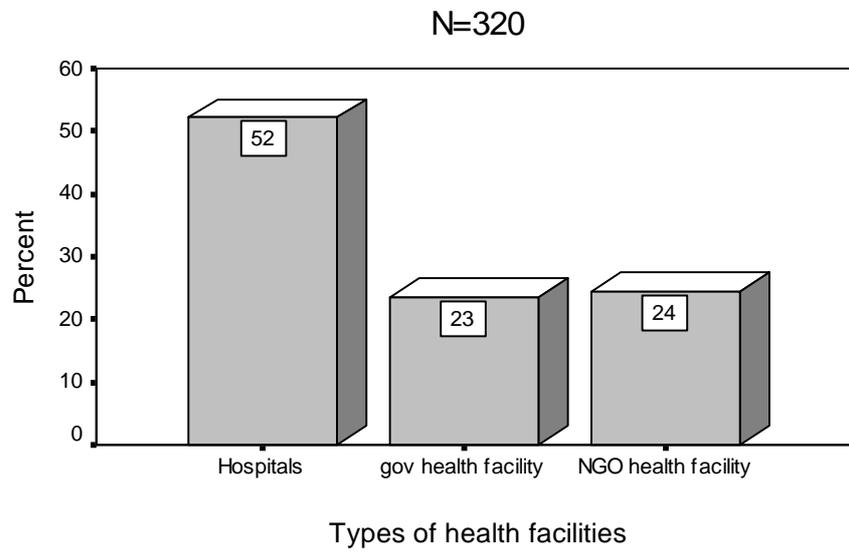


Figure :2 distribution of study population among different types of health facilities



**Figure 3 : distribution of the study population according to their origin N=320**

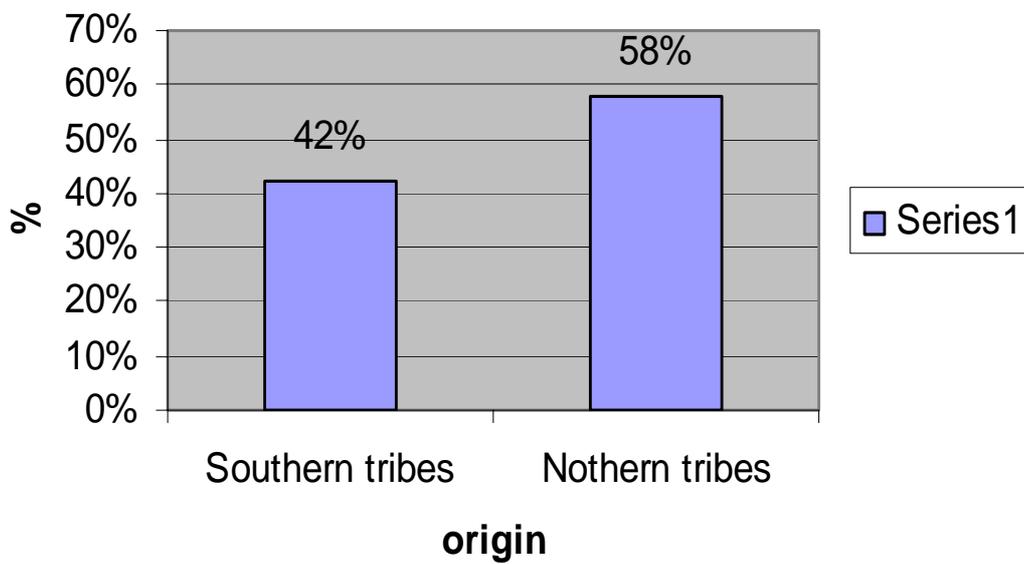
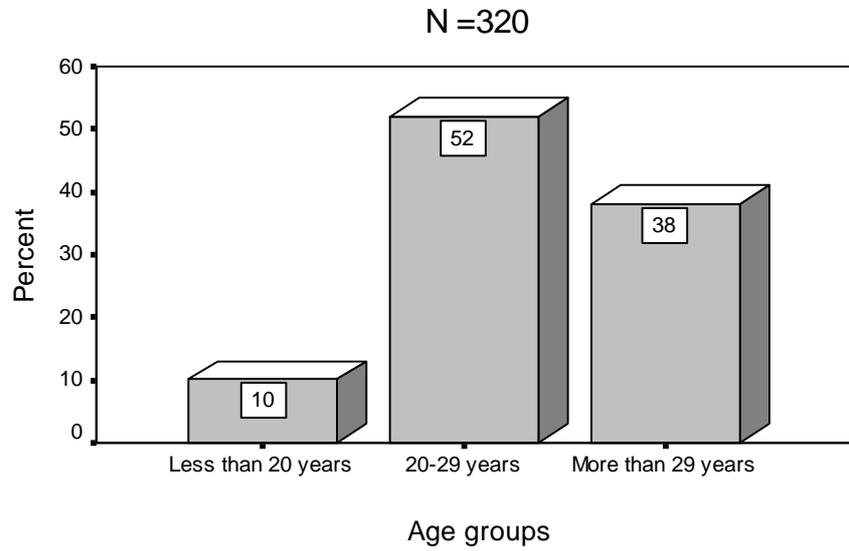


Figure :4 Distribution of study population according to the age groups



Median = 27.00

Std. Deviation= 6.35

Figure :5 Distribution of study population according to the years of systematic education

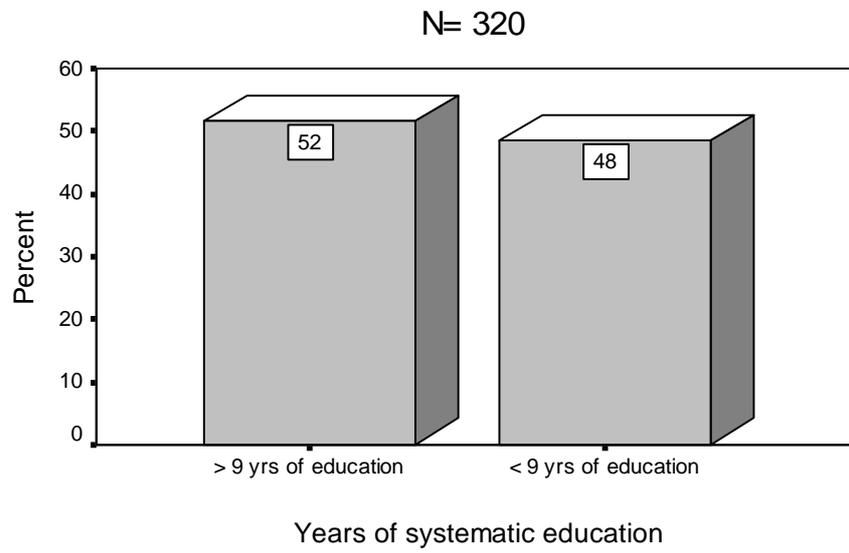


Figure 6 distribution of study population according to the years of husband systematic education

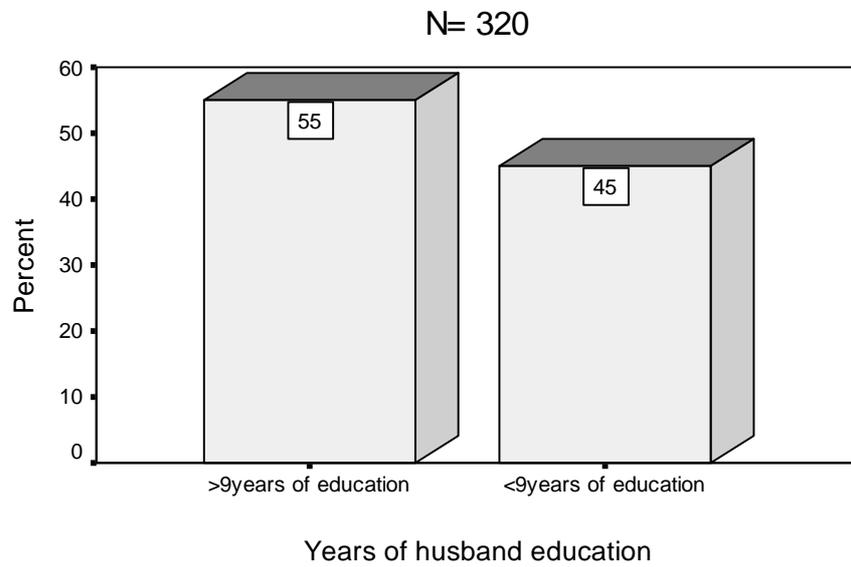
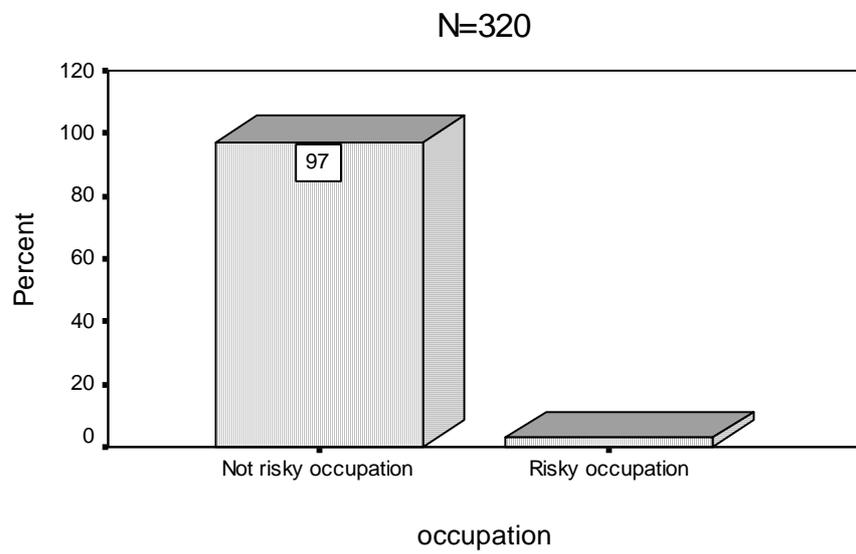


Figure :7 distribution of study population according to occupation



\*Risky occupation:

1. Health worker.
2. Truck driver.
3. Military service worker.

Figure :8 distribution of study population according to husbands occupation

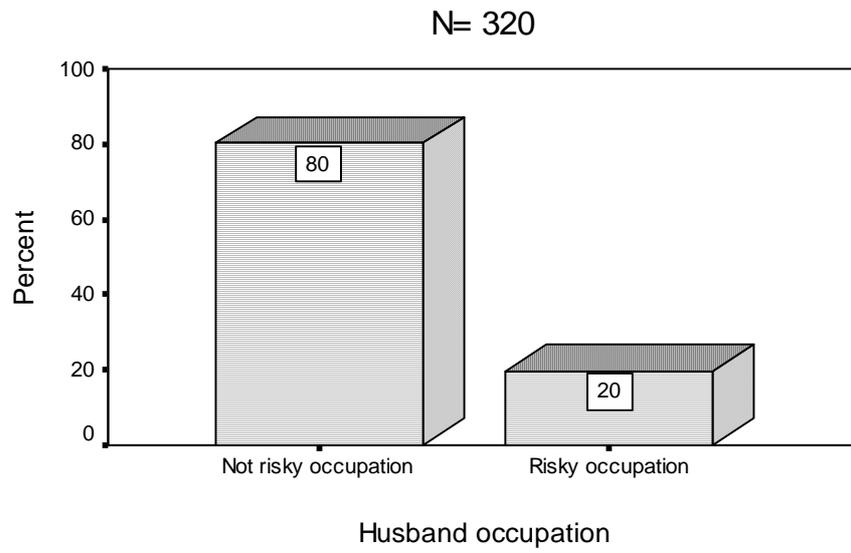


Figure 1 :9 Classification of study population according to the number of children

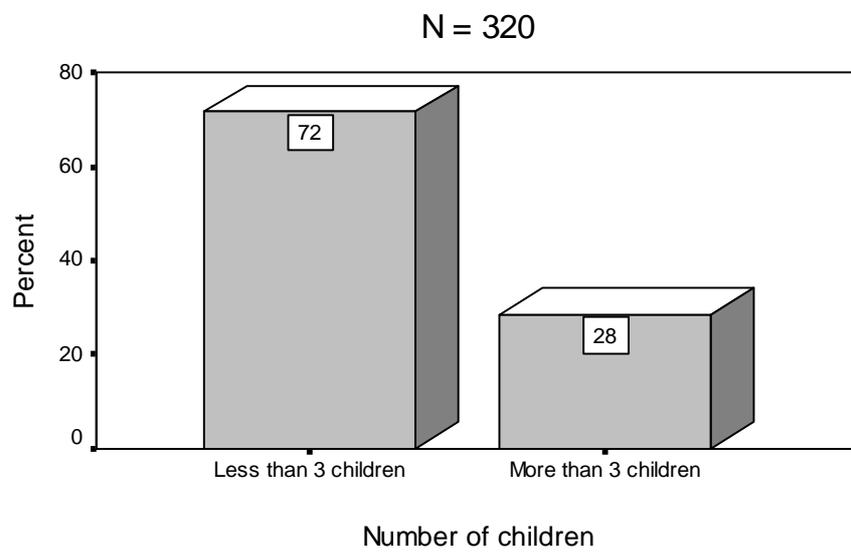


Figure :10 Classification of study population according to the mode of previous deliveries



Figure :11 classification of study population according to the place of delivery

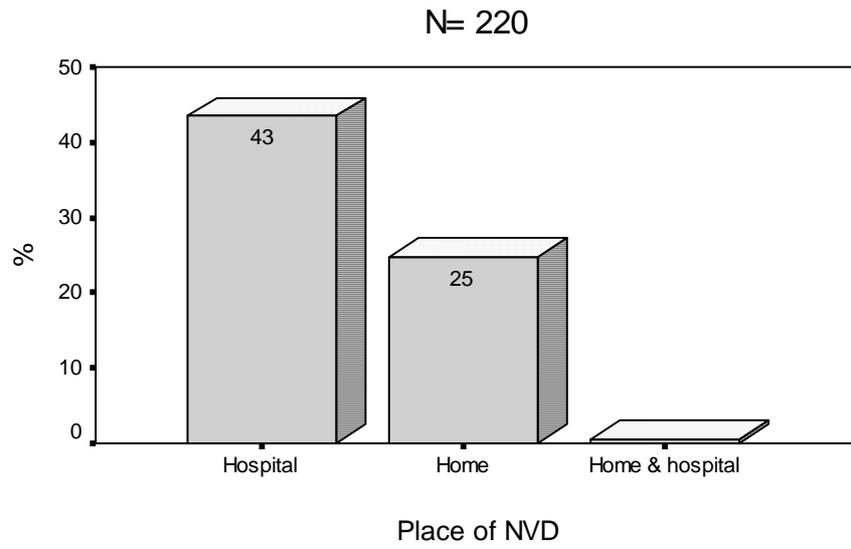


Figure 12 distribution of study population according to husband being married to other wives



Figure 13 distribution of study population according to the number of other wives

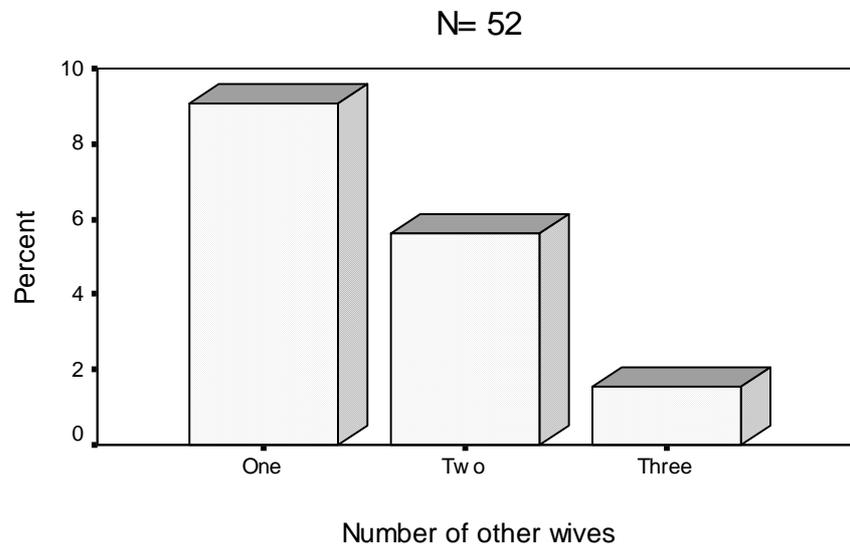


Table No. 2:

Relation of HBV risk factors with HBsAg positive study population using logistic regression

Risk factor	Frequency	Percentage	Odds ratio	95.0% Confidence interval for Odds ratio		P value
				Lower	Upper	
Age less than 27 years	162	50.62 %	0.644	0.164	2.527	0.528
African racial roots	133	41.56 %	0.514	0.139	1.905	0.319
Less than 9 years of education	155	48.44 %	1.139	0.272	4.774	0.859
Less than 9 years of husband's education	144	45.00 %	1.159	0.290	4.638	0.835
Risky occupation	9	02.81 %	1.080	0.419	2.786	0.873
Husband's Risky occupation	63	19.69 %	0.461	0.116	1.829	0.271
Family size	91	28.44 %	2.202	0.356	13.610	0.396
Husbands having other wives	52	16.25 %	2.066	0.230	18.556	0.517
Blood transfusion	30	10.00 %	1.850	0.180	18.962	0.604
Blood transfusion for husbands	11	03.44 %	0.360	0.034	3.772	0.394
Unsafe injection	13	04.06 %	0.592	0.046	7.700	0.689
History of jaundice	78	24.38 %	0.735	0.175	3.095	0.675
Husband's history of jaundice	54	16.88 %	2.014	0.240	16.870	0.518

- All factors are statistically insignificant

## Chapter 4

The aim of this study was to estimate the prevalence of HBV among pregnant women in Khartoum State. The results of this study revealed that, the number of pregnant women with hepatitis B surface antigen positive was found to be 3.75% (95% CI:3.7- 3.8). Although Sudan is considered as one of the countries with high prevalence rate (>8%)<sup>4</sup>, like sub-Saharan Africa, China, Indonesia, , the Pacific islands, and Southeast Asia, this study shows moderate disease endemicity in Khartoum State. A study which was conducted in Omdurman Maternity Hospital among women during labor and cord blood from their newborns was screened; it was found that the prevalence of HBsAg was 4.1% among the women and 1.52% among the neonates .<sup>37</sup> The same finding was noticed in eastern and northern Europe, Japan, the Mediterranean basin, the Middle East, Latin and South America, and central Asia<sup>4</sup>. This is can be attributed to the diverse ethnic groups in the Sudan, that may have markedly different HBV prevalence.<sup>10</sup> Similar phenomenon was obtained in a study that conducted to measure the prevalence of hepatitis B 'e' antigen (HBeAg) and hepatitis B surface antigen (HBsAg) in pregnant women in the Gulf States, where results have shown that hepatitis B virus (HBV) prevalence in pregnant women is of intermediate endemicity in Oman and of low endemicity in Qatar and UAE,<sup>34</sup> despite the fact that they are categorized as intermediate prevalence areas<sup>14</sup>. On the other hand this moderate disease endemicity necessitates further studies in young children to assess the relative importance of perinatal versus childhood transmission<sup>10</sup>.

Out of these 12 women who were HBsAg positive, only one woman found to be hepatitis B e antigen positive (8.3%). Distribution of HBV carriers in population due to perinatal infection was calculated using the efficacy of perinatal transmission<sup>10</sup>, which was measured as 80%, where the incidence of perinatal infection is around 70-90%, when the

mother is both HBsAg-positive and HBeAg-positive, this indicates that the likely importance of perinatal transmission is 0.25% (the result of multiplying the prevalence of HBsAg, HBeAg and the efficacy of transmission), which is low. This reflects that perinatal transmission is unlikely to play an important role in the mode of transmission of HBV in Khartoum State. This result is similar to some cases in the Middle East as in Jizan of Saudi Arabia, where perinatal transmission was unlikely to play an important role in HBV hyperendemicity in Jizan area <sup>24</sup>. Two studies conducted on mother-to-child transmission of HBV also in Saudi Arabia found the perinatal transmission to be 0.26% and 0.36% <sup>24</sup>, respectively, which is similar to that in Khartoum State. In Kuwait the perinatal transmission was calculated as 0.16% which is low. In contrast many studies support the likely important role of perinatal transmission of HBV as the studies carried out in the Republic of Yemen and Egypt, where the calculated perinatal transmission was found to be 0.43% and 0.50% respectively<sup>24</sup>.

Although Khartoum State appears to have low perinatal transmission, other areas in Sudan were shown to have high perinatal transmission rates as in Gazeera and Juba with more than 0.5% rates <sup>35</sup>.

Regarding the Socio-demographic factors of study population, most of them reside in Omdurman locality. All women were in the age group 15-49 years with a median age of 27 years. Most of the study population was originally from the North and West Sudan which can explain the intermediate prevalence of hepatitis B because most studies in Sudan suggested that, there is a higher prevalence of HBV infection among residents of the South compared with those of the North .<sup>27</sup>

All women involved in the study were married, but one and most of them have more than

three children forming large families. The majority of them were delivered vaginally at hospital. Nearly all were house wives and not involved in risky occupations like health workers, which indicates the importance of transmission during childhood . More than half of the study population has spent more than 9 years in systematic education. The investigator has observed that most of the women were not aware about the risk of hepatitis B disease and its mode of transmission.

When relating risk factors which are; the age, education, race, risky occupation, history of jaundice, blood transfusion, and unsafe injection, to the prevalence of HBV, the relation was found to be statistically insignificant. The same results were obtained from a study conducted among pregnant women in Omdurman maternity hospitals, where history of jaundice, contact with jaundiced patient, blood transfusion past history of operation, tattooing contact with blood were found statistically insignificant<sup>37</sup>.

This may be due to the fact that in most high and intermediate prevalence areas transmission, including that to the future mothers is predominantly due to perinatal transmission and during early childhood, this may weaken the relation of the studied risk factors to disease transmission<sup>12</sup>. Another point to be mentioned is that some of the risk factors involved in the study were sensitive to be told, and some are related to the husband's history with expected recall bias or inaccurate information. In some low prevalence areas like in Canada Western Europe, New Zealand, sexual and percutaneous transmission during adulthood are the main routes of transmission but they were difficult to be identified<sup>12</sup>. Many studies in countries with low endemicity, such as Britain and North America, have looked at selective versus universal antenatal screening. When a

direct comparison has been made, selective screening failed to identify about half of the women whose babies were at risk. Among the reasons for the failure of selective systems is the difficulty of discussing risk behaviors in a busy antenatal clinic, the possibility that women with no risk factors might have been infected by a partner with a "risk history," and many infected women have no recognized risk factors. As a result of a study in the Netherlands the Dutch national health authority has adopted as a policy the non-selective screening for hepatitis B infection with tests for blood group and syphilis early in pregnancy<sup>38</sup>. In spite of the fact that most HBV infections in developed countries result from sexual activity, injection-drug use, or occupational exposure, household contact, renal dialysis, transmission from a surgeon, and receipt of organs or blood products, no clear risk factors are found in 20 to 30 percent of patients, perhaps because of reluctance to report high-risk<sup>12</sup>.

The most common factors found to be associated with HBV infection and carrier status in the Middle East, other than the risk of perinatal transmission associated with HBsAg/HBeAg status of the mother, are family size, socioeconomic status, age, educational status and a history of previous blood transfusion, surgery or contact with a jaundiced person.<sup>24</sup>

This study showed statistically insignificant relation between age and HBV positive status OR= 0.64; (95% CI. 0.164-2.527) this in part may be due to the similarity in age groups of the study population. Some studies suggested higher chances of HBsAg positivity in those who are between 20 and 29 years of age<sup>39</sup>.

This study in African rooted race showed insignificant relation to HBsAg positive status with OR= 0.514 (95% CI. 0.139- 1.905). In comparison, a study in the United States of

America to estimate race/ethnicity-specific prevalence of hepatitis B surface antigen (HBsAg) in pregnant urban women and to evaluate factors associated with maternal HBsAg testing, showed that HBsAg prevalence among white non-Hispanics was 0.60% (95% confidence interval [CI]: 0.22–0.98), black non-Hispanics 0.97% (95% CI: 0.48–1.47), Hispanics 0.14% (95% CI: 0.01–0.26), and Asians 5.79% (95% CI: 4.42–7.16)<sup>40</sup>.

Large family size is a recognized risk factor for HBV transmission. This study showed that 28% of the study population have more than 3 children (large size families) and when related to HBsAg positivity, this read 2.202 OR (95% CI. 0.356- 13.610). Evidence supporting the role of large family size in increasing the risk of HBV infection came from the observation of pronounced familial clustering of HBV infection in Jordan. A significant correlation was found between family size and the proportion of HBsAg-positive family members<sup>24</sup>.

No significant relation is detected between the level of education and HBV transmission in Khartoum state, but higher rates found in mothers with low educational status in Egypt and a negative correlation between prevalence of HBV infection and educational levels has been observed in the Islamic Republic of Iran<sup>24</sup>.

Only 2.8% of the study population was employed in risky occupations mainly as health workers. Healthcare workers, have the highest risks of HBV infection<sup>32</sup>. The prevalence of hepatitis B virus infection was estimated to be 6 % among health workers at Khartoum state<sup>29</sup>.

History of jaundice, blood transfusion, and unsafe injection, and renal dialysis were weakly related to HBV transmission in this study, and this differs from the situation in Middle East where they were found to be associated with HBV infection and carrier

status<sup>24</sup>. Recently blood transfusion is hardly a factor in transmitting HBV due to pre transfusion screening.

The same can be said when discussing the risk factors associated to the husband where weak relation with HBsAg positivity was observed. This can be due to the inaccuracy of stating information related to husbands, beside, some points were unlikely to be talked about openly.

Conclusion:

Khartoum state was found to be of intermediate endemicity for hepatitis B virus infection. Frequency of HBV carriers in population due to perinatal infection was low which reflects that perinatal transmission is unlikely to play an important role in the mode of transmission of HBV in Khartoum State. Most of the study population resides in Omdurman locality.

All women were in the age group 15-49 years with a median age of 27 years. Most of the study population was originally from the North and West Sudan which can explain the intermediate prevalence of hepatitis B because most studies in Sudan suggested that there is a higher prevalence of HBV infection among residents of the South compared with those of the North .<sup>4</sup>

All women involved in the study were married; most of them have more than 3 children. The majority of them were delivered vaginally at hospital. Nearly all were house wives and not involved in risky occupations like health workers, which indicates the importance of transmission during childhood. More than half of the study population has spent more than 9 years in systematic education.

All risk factors found to be statistically insignificant with the prevalence of hepatitis B virus infection ,which may be due to the fact that in most high and intermediate prevalence areas transmission is predominantly due to perinatal transmission and during early childhood.

Recommendations:

- \* To continue giving the HBV vaccine with the DPT as scheduled in Khartoum State.
- \* To conduct other studies for young children to define the relative importance of perinatal versus childhood transmission Khartoum State.
- \* To screen all pregnant women for HBV during antenatal care visits, and giving appropriate management for neonates of positive mothers.
- \* To health educate pregnant women about hepatitis B infection (risk factors and mode of transmission) at antenatal care visits.
- \* To conduct another community based studies to estimate the prevalence.
- \* To study the prevalence in other states.
- \* To vaccinate female adolescents (child bearing age) before pregnancy to minimize vertical and horizontal transmission.

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بسم الله الرحمن الرحيم  
وزارة الصحة ولاية الخرطوم  
الإدارة العامة للرعاية الصحية الأولية - قسم البحوث

### إقرار موافقة

الموضوع / بحث نسبة انتشار مرض التهاب الكبد الفيروسي (ب) وسط النساء الحوامل بولاية  
الخرطوم 2004

أقر أنا..... بالموافقة علي مشاركتي في الدراسة بعد فهم اهداف الدراسة كما وافق  
علي أخذ عينة دم (5 س س ) مني ،كما وافق علي اخطاري في حالة كان النتيجة إيجابية و معرفة كيفية اخذ  
الاحتياطات اللازمة .

• الاسم:.....

• الإمضاء:.....

• التاريخ / / 2005

بسم الله الرحمن الرحيم

وزارة الصحة ولاية الخرطوم - الإدارة العامة للرعاية الصحية الأولية - قسم البحوث

## استمارة بحث نسبة انتشار مرض التهاب الكبد الفيروسي (ب) وسط النساء الحوامل بولاية

### الخرطوم 2005

#### • الجزء الأول:

المحلية:

اسم المركز : .....

نوع المركز : .....

رقم المتسلسل : .....

#### الجزء الثاني : العوامل الاجتماعية:

العمر : .....

تود معرفة النتيجة :

1-نعم 2-لا

السكن : .....

نمرة التلفون : .....

القبيلة: .....

الوطن الأصلي:

1-داخل السودان حدد الولاية : .....

2-خارجالسودانحدد البلد: .....

#### • الحالة الاجتماعية .

1-متزوجة 2-مطلقة 3-أرملة 4-غير متزوجة

• عندك كم طفل ؟

1- ولا واحد 2- 1-3 3- أكثر من 3

• اذا كان عندك طفل او اكثر ، كيف كانت ولاداتك السابقة ؟

• 1-طبيعي وقيصري 2-كلها طبيعي 3- كلها قيصري 4- لا ينطبق

• اذا كنت ولدت طبيعي من قبل ، اين تمت الولادة ؟

1- البين 2- المستشفى 3- لا ينطبق

• التعليم :

1-غير متعلمة 2-خلوة 3-ابتدائي 4-متوسط 5-ثانوي 6-جامعي

7-فوق الجامعي

#### • تعليم الزوج:

1-غير متعلم 2-خلوة 3-ابتدائي 4-متوسط 5-ثانوي 6-جامعي

7-فوق الجامعي

#### • المهنة :

1- ربة منزل 2- عاملة في المجال الصحي\*

2- اخري ، حددي .....

#### • مهنة الزوج :

1- عامل صحي\* 2- يعمل بالجيش او الشرطة 3- سائق مسافات طويلة

2- لا يعمل .

3- أخري ، حددي .....

الجزء الثالث: عوامل الخطورة :

- هل تم لك نقل دم من قبل ؟  
1-نعم  
2-لا  
3-لا اعرف

- هل تم لزوجك نقل دم من قبل ؟  
1-نعم  
2-لا  
3-لا اعرف

هل تعرضت لأي نوع من الحقن الملوثة (الطعن بابريرة مستعملة . سكين ملوث ، موس مستعمل ، حادث عربية) من قبل؟؟

- 1-نعم  
2-لا  
3-لا اعرف

هل تعرض زوجك لأي نوع من الحقن الملوثة (الطعن بابريرة مستعملة . سكين ملوث ، موس مستعمل ، حادث عربية) من قبل؟؟

- نعم  
2-لا  
3-لا اعرف

هل أصبت بمرض اليرقان من قبل ؟

- 1-نعم  
2-لا  
3-لا اعرف

هل أصيب زوجك بمرض اليرقان من قبل ؟

- 1-نعم  
2-لا  
3-لا اعرف

هل أنت مصابة بأي مرض مزمن يستوجب الحقن الدوري (غسيل كلي )

- 1-نعم  
2-لا  
3-لا اعرف

إذا كانت الإجابة بنعم حدد نوع المرض

- 1- فشل كلوي  
2- أمراض الدم المزمنة  
3- سكري  
4- السل  
2- أخرى حدد.....  
3- لا ينطبق

هل زوجك مصاب بأي مرض مزمن يستوجب الحقن الدوري

- 1-نعم  
2-لا  
3-لا اعرف

إذا كانت الإجابة بنعم حدد نوع المرض

- 3- 1 فشل كلوي  
2- أمراض الدم المزمنة  
3- سكري  
4- السل  
4- أخرى حدد.....  
5- لا ينطبق

هل زوجك مقزوج غيرك ؟

- 1-نعم  
2-لا  
3-لا اعرف

في حالة الإجابة بنعم كم زوجة لديه غيرك ؟

- 1- واحدة  
2- اثنتان  
3- ثلاثة  
4- أكثر من ثلاثة  
5- لا ينطبق

هل تطعمتي من التهاب الكبد الوبائي من قبل ؟

- 1-نعم  
2-لا  
3-لا اعرف

إذا كانت الإجابة نعم كم جرعة اخذت ؟

- 1-واحدة  
2- اثنين  
3- ثلاثة  
4- لا ينطبق

- هل تم لك فحص لالتهاب الكبد البائي من قبل ؟  
1- نعم  
2- لا  
3- لا اعرف
- اذا كانت الاجابة نعم ، ماذا كانت النتيجة ؟  
1- ايجابية  
2- سلبية  
3- لا ينطبق
- نتيجة فحص الدم : ( HbsAg )

- 1- ايجابية
- 2- سلبية

- نتيجة فحص الدم : ( HbeAg )

- 1- ايجابية
- 2- سلبية

\* عامل او عاملة في المجال الصحي : طبيب ، مساعد طبي – ممرض – سستر – داية – زائرة صحية – فني معمل

\*\* الحقن الملوث : عملية جراحية ابرة ملوثة – موس ملوث – مشرط ملوث – مقص ملوث – حادث عربية

**The centers were divided as follow:**

<b>Number</b>	<b>Type of antenatal care Unit</b>	<b>Number of ANC/locality</b>	<b>Number selected</b>	<b>Sample of women/ antenatal care Unit</b>
1	Governmental Health centre		6	94
2	NGOS Health centre		10	157
3	hospitals		4	64
Total			20	314

**Centers per locality were divided as follow:**

<b>No</b>	<b>Locality</b>	<b>Number of Governmental Health centre</b>	<b>Number of NGOS Health centre</b>	<b>Number of hospitals</b>	<b>Total</b>
1	Khartoum	2	-	1	3
2	Jabal awlia	-	2	1	3
3	Bahry	2	1	1	4
4	Sharg Alnil	1	2	-	3
5	Omdurman	1	1	1	3
6	Karray	-	1	-	1
7	Umbada	-	3	-	3
8	Total	6	10	4	20