PREVALENCE OF HEPATITIS B MARKERS AMONG YOUTH AGED 13-18 YEARS IN PUBLIC HIGH SCHOOLS WITHIN NAIROBI AND VIACHAKOS.

SUBMITTED FOR THE PARTIAL FULFILMENT OF THE DEGREE OF MASTER OF MEDICINE PAEDIATRICS AND CHILD HEALTH UNIVERSITY OF NAIROBI.

BY DR. WACEKE NG'ANG'A.

FEBRUARY 2010.

DECLARATION

I declare that this dissertation is my original work and has not been published elsewhere or presented for a degree programme in any other university.

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APPROVAL

I certify that this dissertation has been presented to the University of Nairobi with the approval of my supervisors.

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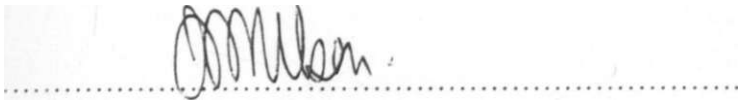

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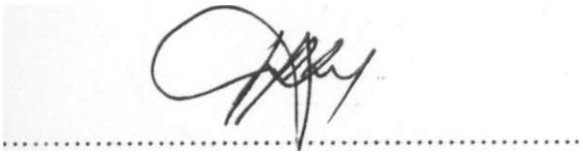

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DEDICATION

I dedicate this work to my husband. Mr David Kombe. for his unconditional support during the research and the entire VlVled program.

I also dedicate this work to the many young adults I met in the course of carrying out research. They are full of life and are the leaders of tomorrow. They too require prevention against hepatitis B.

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ABBREVIATIONS

HBV Hepatitis B virus

HBsAg Hepatitis B surface antigen

J. KEMRI Kenya Medical Research Institute

4. HBeAg Hepatitis B envelope antigen

5. HBcIgG Hepatitis B IgG core antibodies

6. anti HBs Hepatitis B surface antibodies

7. KEPI Kenya Expanded Programme for Immunization

8. KDHS Kenya Demographic Health Survey

9. ELISA Enzyme linked immunosorbent assay

10. KEMRI-HEPCELL KEMRI HBsAg test kit

11. KEMRI-HEPSAB KEMRI anti HBs test kit

12. UNICEF United Nations Children Fund

13. UNESCO United Nations Educational, Scientific and Cultural Organisation

ABBREVIATIONS

1. HBV Hepatitis B virus
2. HBsAg Hepatitis B surface antigen
3. KEMRI Kenya Medical Research Institute
4. HBeAg Hepatitis B envelope antigen
5. HBcIgG Hepatitis B IgG core antibodies
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S U M M A R Y

Background

Hepatitis B is a worldwide public health concern with one third of the world hav ing been infected. Transmission can occur vertically or horizontally. Horizontal transmission occurs through contact of body secretions with non intact skin or mucous membranes. In the developing countries it is mainly transmitted during childhood. No local studies have assessed the prevalence of hepatitis B among adolescents. The study aimed at getting a prevalence of hepatitis B among the ages of 13-18 years.

Methods

A cross-sectional study carried out in public high schools within Nairobi and Vlachakos among students aged 13-18 years. Clustering of schools and stratification of students was used to sample the population. Data was obtained using questionnaires and lab tests and analyzed using SPSS version 13. Prevalence was presented in the form of frequencies. Mean, median, and standard deviation were obtained. Analysis of risk factors was done using chi squared test and Fishers exact test.

Results

The prevalence of HBsAg among youth aged 13-18 years in Machakos and Nairobi public day high schools was found to be 1.8% and 3.5% respectively. Overall prevalence was 3.0%. The prevalence of antiHBs, Ig G among youth aged 13-18years in Machokos and Nairobi public day high schools was found to be 6.4% and 10.7% respectively. Overall prevalence was 9.3%

Conclusions

Although the prevalence of hepatitis B obtained was low at 3.0%, the prevalence of the hepatitis B surface antibody IgG was also low at 9.3%.

Recommendation

Targeted adolescent vaccination would be recommended for this age group.

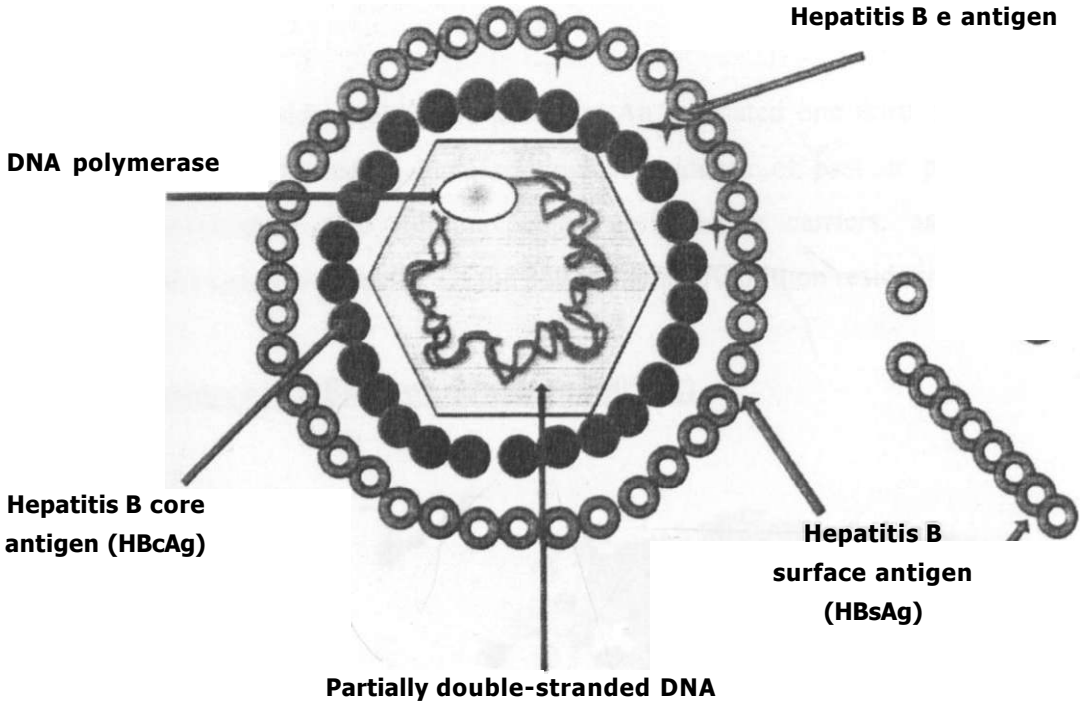
INTRODUCTION AND LITERATURE REVIEW

HEPATITIS B VIRUS

Hepatitis B virus (HBV) is a member of the Hepadnavirus family. The virus particle, (virion) consists of an outer lipid envelope and an icosahedral nucleocapsid core composed of protein. The nucleocapsid encloses the viral DNA and a DNA polymerase that has reverse transcriptase activity. The outer envelope contains embedded proteins which are involved in viral binding of, and entry into, susceptible cells. The virus is one of the smallest enveloped animal viruses with a virion diameter of 42nm. but pleomorphic forms exist, including filamentous and spherical bodies lacking a core. These particles are not infectious and are composed of the lipid and protein that forms part of the surface of the virion, which is called the surface antigen (HBsAg), and is produced in excess during the life cycle of the virus.

The surface of the virus includes particles designated *hepatitis B surface antigen (HBsAg),* which is a 22 nm diameter spherical particle and a 22 nm wide tubular particle with a variable length of up to 200 nm. The inner portion of the virion contains hepatitis **B** core antigen (HBcAg), the nucleocapsid that encodes the viral DNA, and a nonstructural antigen called hepatitis B e antigen (HBeAg), a nonparticulate soluble antigen derived from HBcAg by proteolytic self-cleavage. Replication of HBV occurs predominantly in the liver but also occurs in the lymphocytes, spleen, kidney, and pancreas

Fiourc 1: Schematic diagram of the hepaiitis B virus.



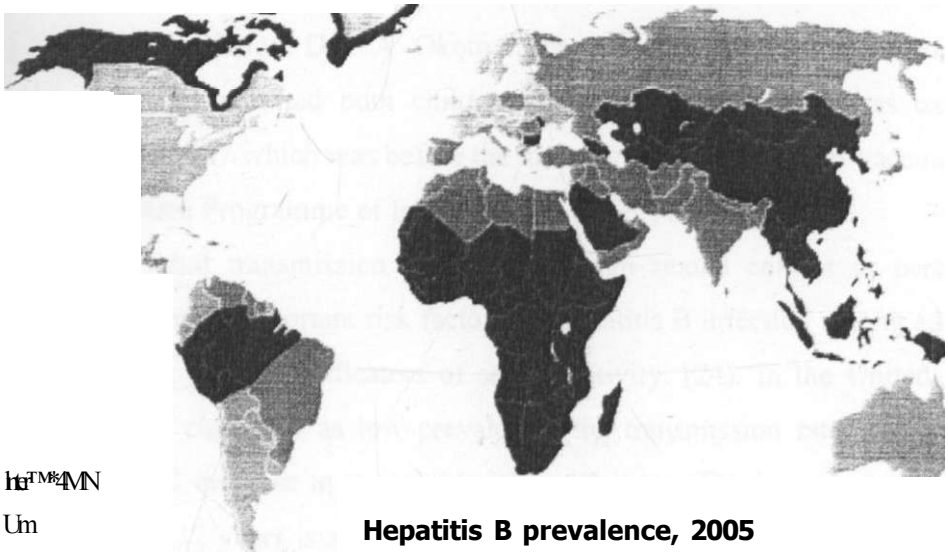
The acute response of the liver to hepatitis B virus is predominantly non cytopathogenic and mainly immune mediated. The initial process of acute hepatitis is infection of hepatocvtes by HBV, resulting in expression of viral antigens on the cell surface. The most important of these viral antigens may be the nucleocapsid antigens HBcAg and HBeAg. These antigens, combine with class I major histocompatibility (MHC) proteins to make the cell a target for cytotoxic T-cell lysis. The mechanism for development of chronic hepatitis is less well understood. The infected hepatocvtes avoid destruction by an unknown mechanism. Either the core protein or MHC class 1 protein is not recognized, the cytotoxic lymphocytes are not activated or there is an unknown mechanism which interferes with the destruction of hepatocvtes. This tolerance

phenomenon predominates in the cases acquired perinatallv. resulting in a high incidence of chronic carrier state in those children with no or little inflammation in the liver.

gPlDEMIOLOGY

Hepatitis B is a worldwide health care problem. An estimated one third of the global **population** has been reported to have serological evidence of past or present HBV **infection.** Approximately 350 million people are lifelong carriers, and only 2% **spontaneously** seroconvert **annually.** Of the 350 **million.** 170 million reside in Africa (3).

Figure 2. Prevalence of HBsAg worldwide in 2005. (2)



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Hepatitis B prevalence, 2005

The world is divided into three endemicity zones:

- Low endemicity with a carrier rate of less than 2%. This is seen in Western Europe. North America. Australia, and South America.
- Intermediate endemicity with a carrier rate of 2-7%. This is seen in the Mediterranean, Eastern Europe, former USSR, Middle East. Central and South America and Saharan Africa.

- High endemicity with a carrier rate above 7%. This is observed in China. Southern Asia. su!»-Saharan Africa. Amazon basin and Oceania.

In sub Saharan Africa, the carrier rate of HBV is given as between 2 and 30 %(3). In Kenva a number of seroepidemioiogical studies have shown high HBV carrier rates of between 3 and 15% with a high prevalence of hepatocellular carcinoma. Okoth et al (4) found a national average prevalence of HbsAg of 9.3% in 2005. An earlier study that he had done in a rural community in Maragua obtained a carrier rate of 3% (5). Wankva (6) also carried out a rural community study in Machakos and found a carrier rate of 11%. Bowry et al (7) found a carrier rate of about 10% in an urban population in Nairobi. The highest carrier rate. 30%, was found among the Turkanas in Northwest Kenya in 1985 by Greenfield (8).

With the exception of one study, Okoth et al (5), all the other studies were carried out among the adult population. Dr F.A. Okoth carried out a community based longitudinal study and therefore recruited both children and adults. This study was carried out between 1986 and 1987 which was before the introduction of hepatitis B vaccination into the Kenya Expanded Programme of Immunisation (KEPI) schedule.

Adolescent and adult transmission is mainly through sexual contact or percutaneous transmission. The most important risk factors for hepatitis B infection among adolescents are injectable drug use and indicators of sexual activity. (24). In the United States of America, a region classified as low prevalence, the transmission rates are low below 12years of age and increase in those older than 12 years. The increased prevalence in persons older than 12 years is associated with the initiation of sexual contact (the major mode of transmission), the number of sexual partners, and an early age of first intercourse. In Spain, an increase in Hepatitis B infection was noted between the ages of 15-24 years and 25-44 years (22). In Germany, an increase was noted between the ages of 15-19 years and 20-24 years (23). Adolescent transmission may become important in the developing countries as the youth try to imitate the Western culture.

Other practices such a* community circumcision, scarification and other surgical procedures carried out away from a hospital in Somalia were found to be significant risk factors for anti HBc positivity (15)

TRANSMISSION

Transmission results from exposure to infectious blood or body fluids containing blood. Possible forms of transmission include (but are not limited to) unprotected sexual contact, blood transfusions, re-use of contaminated needles & syringes, and vertical transmission from mother to child during childbirth. HBV can be transmitted between family members within households, possibly by contact of non intact skin or mucous membrane with secretions or saliva containing HBV. Without intervention, a mother who is positive for the hepatitis B surface antigen confers a 20% risk of passing the infection to her offspring at the time of birth. This risk is as high as 90% if the mother is also positive for the hepatitis B e antigen. At least 30% of reported hepatitis B among adults cannot be associated with an identifiable risk factor.

The primary method of transmission reflects the prevalence of chronic HBV infection in a given area. In low prevalence areas injection drug abuse and unprotected sex are the primary methods, although other factors may be important. In moderate prevalence areas the disease is predominantly spread among children. In high prevalence areas such as China and South East Asia, transmission during childbirth is most common, although in other areas of high endemicity such as Africa, transmission during childhood is a significant factor. Okoth et al (2) found low levels of HbeAg suggesting questionable low rate of perinatal transmission but high rate of horizontal transmission. Studies have suggested that HBV transmission in Africa occurs predominantly in childhood by the horizontal rather than the vertical route. Compared with adult HbsAg carriers in the Far East, those in Africa have a low rate of HbeAg positivity, which may account for the relatively low rates of perinatal infection (2).

SYMPTOMS

Hepatitis B virus infection may either be acute or chronic. Persons with self-limiting infection clear the infection spontaneously within weeks to months.

Children are less likely than adults to clear the infection. More than 95% of people who **become** infected as adults or older children will stage a full recovery and develop **protective** immunity to the virus. However, only 5% of newborns that acquire the infection from their mother at birth will clear the infection. Of those infected between the aues of one to six. 70% will clear the infection (9).

Acute infection with hepatitis B virus presents with general ill-health, loss of appetite, **nausea,** vomiting, body aches, mild fever, dark urine, and then progresses to development **of** jaundice. It has been noted that itchy skin has been an indication as a possible **symptom** of all hepatitis virus types. The illness lasts for a few weeks and then gradually **improves** in most affected people. A few patients may develop fulminant hepatic failure which may be fatal. The infection may **be** entirely asymptomatic and may go unrecognized.

Chronic infection with Hepatitis B virus may be either asymptomatic or may be associated with a chronic inflammation of the liver (chronic hepatitis), leading to cirrhosis over a period of several years. This type of infection dramatically increases the incidence of hepatocellular carcinoma. Co-infection with hepatitis D increases the risk of liver cirrhosis and liver cancer.

DIAGNOSIS

The hepatitis B surface antigen (*HBsAg*) is most frequently used to screen for the presence of this infection. It is the first detectable viral antigen to appear during infection. However, early in an infection, this antigen may not be present and it may be undetectable later in the infection as it is being cleared by the host. The infectious virion contains an inner "core particle" enclosing viral genome. During this 'window period' in

which the host remains infected but is successfully clearing the virus, IgM antibodies to the hepatitis B core antigen (*anti-HBc IgM)* may be the only serological evidence of disease.

Shortly after the appearance of the HBsAg, another antigen named as the hepatitis B e antigen *[HBeAg)* is detected. Traditionally, the presence of HBeAg in a host's serum is associated with much higher rates of viral replication and enhanced infectivitv; however, variants of the hepatitis B virus do not produce the 'e' antigen, so this rule does not always hold true. During the natural course of an infection, the HBeAg may be cleared, and antibodies to the 'e' antigen *(anti-HBe)* will arise immediately afterwards. This conversion is usually associated with a dramatic decline in viral replication.

If the host is able to clear the infection, eventually the HBsAg will become undetectable and will be followed by IgG antibodies to the hepatitis B surface antigen and core antigen. (*anti-HBs* and *anti HBc IgG).* A person negative for HBsAg but positive for anti-HBs will have either cleared an infection or has been vaccinated previously.

Individuals who remain HBsAg positive for at least six months are considered to be hepatitis B carriers. Carriers of the virus may have chronic hepatitis B, which would be reflected by elevated serum alanine aminotransferase levels and inflammation of the liver, as revealed by biopsy. Carriers who have seroconverted to HBeAg negative status, particularly those who acquired the infection as adults, have very little viral multiplication and hence may be at little risk of long-term complications or of transmitting infection to others.

TREATMENT

Antiviral treatment may be effective in approximately one third of the patients who receive it, and for selected candidates, liver transplantation currently seems to be the only viable treatment for the latest stages of this disease

Patients in the immune clearance or reactivation phases are candidates for therapy. At the present time, lamivudine and a combination of interferon and lamivudine seem to be the

best options for HB infection treatment in the pediatric population (10). Treatment is **expensive** and doesn't guarantee cure and so prevention remains our safest way of combating hepatitis B.

HEPATITIS B VACCINATION.

In May 1992. the World Health Organisation endorsed recommendations stating that countries with an HBV carrier prevalence of > 8% should have hepatitis B vaccine integrated into their national immunization programmes by 1995 and the vaccine should be integrated into all national immunization programmes by 1997. In Kenya routine infant immunization was started in November 2001. In addition to the routine vaccination, measures have also been instituted for high risk group's vaccinations such as medical personnel. We do not have in place an adolescent vaccination program for persons born prior to the introduction of the vaccine in the KEPI schedule.

WHY ADOLESCENTS?

According to the Kenya Demographic Health Survey done in 2003, 18% of women aged 25-49 had sex before age 15, while >50% had their first sexual encounter by their 18th birthday. 25% of men aged 20-54 had sex before the age of l 5 years. The median age for the first sexual encounter in men is at 17years. (11). This shows that men and women are sexually active in their teenage years. Adolescents are also involved in high risk sexual activities. In our community cultural rites of passage including circumcision usually occur by the 13th birthday. These are factors that are associated with the transmission of hepatitis B making the adolescent period a possible period of transmission of the disease.

cTrpV JUSTIFICATION

Hepatitis B is a highly infectious disease with severe and at times fatal complications. **Vet** an efficacious and safe vaccine is available. If the study does show significant **transmission** within this age group, then administration of the vaccine would save many lives and reduce on enormous health costs for individuals, families and countries.

Adolescents are known to be involved in high risk sexual behaviour and to experiment with intravenous drug use. factors known to be associated with the spread of hepatitis B. This **age**-group was not vaccinated as infants and as yet there is no targeted vaccination program in place in Kenya. The study would assist in determining the value of introducing adolescent vaccination programmes.

The study would give a reflection of the disease burden in this age group and comment on the prevalence among particular high risk groups within this age group.

To date there have been no studies on prevalence of Hepatitis B on adolescents as a group in Kenya.

OBJECTIVES

pnjMARY OBJECTIVE

To determine the seroprevalence of hepatitis B markers among persons aged 13-18 years in public high schools within Nairobi and Machakos.

SFCONDARY OBJECTIVES

To determine some of the risk factors associated with hepatitis B sero-positivity among adolescents aged 13-18 years. The risk factors studied included:

1. adolescents involved in unprotected sex,
2. those who have had blood or blood product transfusions.
3. those who have undergone cultural scarification,
4. those involved in intravenous drug use,
5. those who have undergone traditional circumcision.

STUDY METHODOLOGY

SITE:

Students were selected from mixed day high schools in Nairobi and Machakos. The population included day schools for ease of obtaining consent from the parents and high schools because of the age being studied. Students selected were from forms 1 to 4.

STUDY POPULATION:

Adolescents aged 13-18 years who signed the assent form and whose parents signed the consent form.

gTTJPV DESIGN:

High school based cross-sectional study.

SAMPLING TECHNIQUE:

Public day high schools within Nairobi and Machakos were listed and randomly selected usinu Microsoft Excel. The classes from the selected schools were stratified according to forms and an equal number of students selected from each form. This assisted in getting equal representation across the age group being studied. In different forms the students were invited to participate in the study. Students voluntarily took parental forms following an introductory talk on the study and its objectives. Those who returned completed parental consent forms then filled adolescent assent forms.

The study approximated an acceptance rate among the students of 30% (12) and therefore aimed at getting about 12 students from every 50 invited to participate in the study. Estimating a school to have about 100 students per form, 3 schools were selected from Nairobi and 3 from Machakos.

SAMPLE SIZE CALCULATION

The sample size calculation was done using the average prevalence of HBsAg as 9.3% F.A.Okoth et al (2). Fisher's formula

Prevalence study calculation: $N = \frac{Z^2 p (1 - p)}{D^2}$

WHERE

N = minimum sample size

Z = standard normal deviate for 95% confidence interval (= 1.96)

P = estimated prevalence of hepatitis B among the general public (9.3%)

D = degree of precision (4%)

N = 202

rx SF DEFINITION:

Inclusion criteria:

- Students aged 13-18 years at the time of the study
- Signed written consent from the parents/guardians

Exclusion criteria:

- Refusal to be involved in the study

DATA COLLECTION:

QUESTIONNAIRE:

The consent forms were given to the students to take home to their parents to fill in. Students who returned signed consent forms were given the assent forms. Those who signed the assent forms were given the questionnaires. If a student's parent or guardian found to be illiterate, we requested the student to explain to the parent the content of the study and consent form as explained to the student by the investigator. The consent/assent forms were completed in duplicate and a copy given to the student or parent/guardian. After receiving parental consent and student assent forms, the student were given a questionnaire to fill in individually. The questionnaires would only be identifiable by a study number. Students who wanted their results communicated to them were asked to write their names on the questionnaires.

LABORATORY METHODS:

3ml of venous blood were drawn from the students after receiving the consent of the parent and assent of the student. Samples were transported using cool boxes, and delivered to the Kenya Medical Research Institute (KEMRI) laboratory on the same day. The serum from the samples was separated and stored in a fridge at temperatures of 2°-4°C at the same laboratory.

Analysis was done using reverse passive haemagglutination method- KEMRI-HEPCELL kit for HBsAg

If positive the serum was also tested for Hepatitis B e Ag using the Elisa method.

All samples collected were also screened for HBsAb using KEMRI-HEPSAB. A hemagglutination method.

DATA ANALYSIS

Data was analyzed using SPSS version 13 and Epi Info.

Prevalences were presented in the form of frequencies.

Mean, median, and standard deviation were obtained for continuous data.

Analysis of risk factors was done using student t-test for continuous data and chi squared test for non-continuous data.

Continuous data included age, number of sexual partners and number of family members.

Non-continuous data included whether or not they have had cultural scarification, blood transfusion or family member with jaundice.

pi.OW CHART.

Research approval from KNH and Ministry of Science and Technology. Approval from **the head** teachers of the schools.

1

Parental consent signed

i

Adolescent assent form signed

1

Fill **in questionnaire**

1

Blood samples taken and tested for HBsAg, anti HBs, LFTs

1

If HBsAg positive, then test for HBeAg

1

Data analysis and feedback.

ETHICAL CONSIDERATIONS:

- Ethical approval was sought from the Kenvatta National Hospital Research and Ethics Committee, the Ministry of Education and the National Council of Science and Technology.
- Written consent was sought from the student's parent or legal guardian and assent from the student. The consent/ assent form was filled in duplicate and one copy given to the student/ parent or guardian.
- The results of the study are in the process of being forwarded to the Division of child health as adolescent vaccination has been deemed necessary.
- Students found to be HBsAg positive and HBeAg positive were referred to Kenvatta National Hospital Gastroenterology clinic for follow-up.
- Students found to be HBsAg negative were advised to seek vaccination against hepatitis B.
- There were no costs-incurred by the students who participated.
- Provision was made to communicate the results to the students individually and confidentially.

RESULTS

3 schools in Nairobi were visited. These were Ruaraka High School. Ruthimitu High School and Kamiti High School in that order. Consent forms distributed ranged from 200-500 per school. The acceptance rate ranged from 28%-69%.

2 schools were visited in Machakos. These were Ngomeni Secondary School and Kvanda Secondary School in that order. Consent forms distributed ranged from 150-200. The acceptance rate ranged from 28-76% (Table 1). The third school was omitted as the sample size required had already been reached and surpassed after tested participants from the second school.

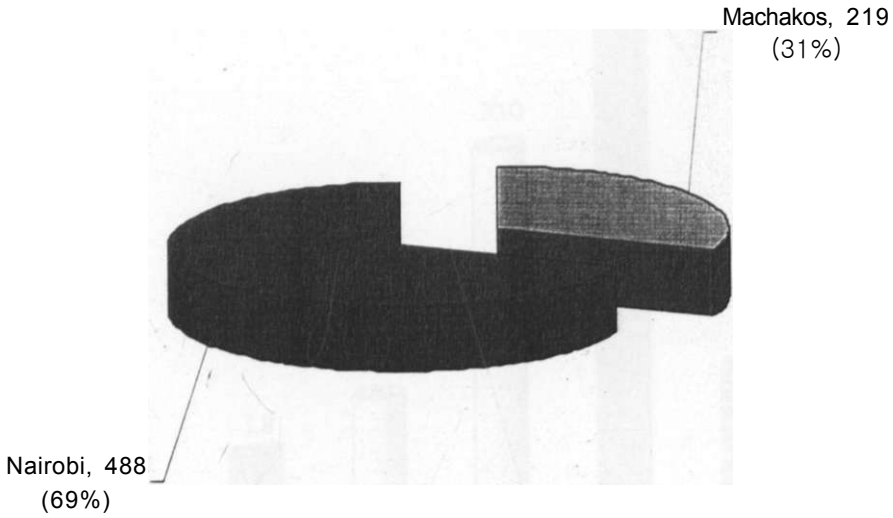
Table 1: Acceptance rates among the schools visited.

School	No given consent forms	No tested	Acceptance rate (%)
Ruaraka	200	78	39
Ruthimitu	300	84	28
Kamiti	500	347	69
Ngomeni	200	151	76
Kyanda	150	68	45
TOTAL	1350	728	54

Participants as categorized according to residence.

ij9 participants were from Machakos and 488 were from Nairobi. This was determined **by** the number of students who consented to being involved in the study.

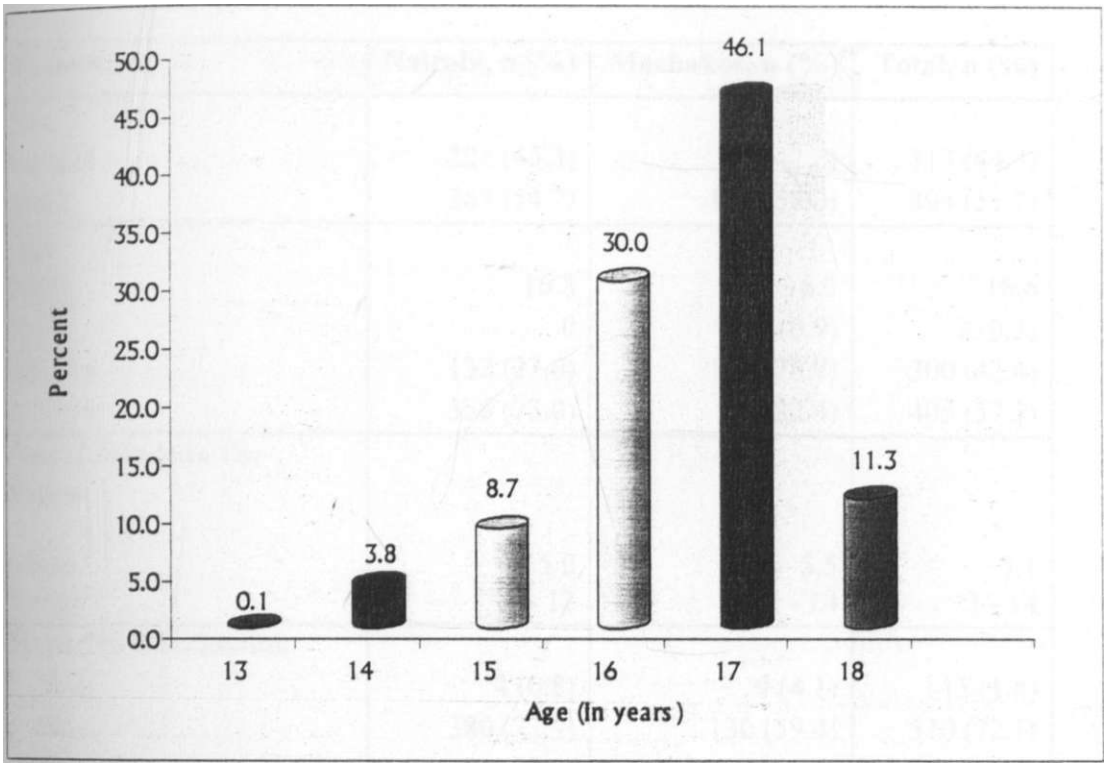
Figure 3: Participants as categorized according to residence (n = 707)



\ae **distribution of participants**

The participants' ages ranged from 13-23 years. 97.2% of the participants were between **the ages of** 15-18 years. 21 (2.8%) participants were excluded from the study as they **were above** 18 years.

Figure 4: Participants as categorized according to age



Socio- **Demographic Factors.**

The median age of participants in Machakos was 16 years (14-18). In Nairobi the median **age** was 15.5 years(13-18). The percentage of participants who were male was 56% while 44% were female. The mean of number of people in the house was 5.0 in Nairobi **and** 5.5 in Machakos. (Table 2)

Table 2: Socio-Demographic Factors of study participants.(n = 707)

Factors	Nairobi, n (%)	Machakos, n (%)	Total, n (%)
Sex			
Female	221 (45.3)	92 (42.0)	313(44.3)
Male	267 (54.7)	127 (58.0)	394 (55.7)
Age			
Mean	16.8	16.3	16.6
< 14	0	2(0.9)	2(0.3)
14- 16	132 (27.0)	168 (76.7)	300 (42.4)
17-18	356 (73.0)	49(22.4)	405 (57.3)
No. of People in the House			
Mean	5.0	5.5	5.1
Range	I - 12	1 - 14	1 - 14
Hepatitis Vaccination			
Yes	4(0.8)	9(4.1)	13 (1.8)
No	380 (77.9)	130 (59.4)	510(72.1)
Don't know	104 (21.3)	80 (36.5)	184 (26.1)
Yellowness in the Eyes			
Yes	23 (4.7)	9(4.1)	32 (4.5)
No	360 (73.8)	165 (75.3)	525 (74.3)
Don't know	105 (21.5)	45 (20.5)	150(21.1)
Liver Disease			
Yes	14(2.9)	4(1.8)	18(2)
No	370 (75.8)	183 (83.6)	553 (78.2)
Don't know	104 (28.8)	32(14.6)	136(19.2)
STD			
Yes	4(0.8)	10(4.6)	14(2.0)
No	484 (99.2)	209 (95.4)	693 (98.0)

Clinical History

Of the group studied, only 1.8% reported to have received any hepatitis B vaccination. This included those who had received one. two or three injections. A large proportion did not know suggesting that this question would probably have been better answered by the parents of the students and not the students themselves. (Table 2)

4.5% reported history of either having yellowness of eyes or having a family member with yellowness of eyes.

2% reported having a liver disease or having a family member with a liver disease.

2% of the participants reported having suffered from a sexually transmitted disease.

The clinical patterns were not significantly different between participants in Nairobi or Machakos.

Table 3: Sexual History of the Study Participants (n = 707)

	Nairobi, n (%)		Total, n (%)
Sexually Active			
Yes	126 (25.8)	70 (32.0)	196 (27.7)
No	362 (74.2)	149 (68.0)	511(72.3)
Unprotected Sex(n=196)			
Yes	59 (46.8)	32 (45.7)	91 (46.4)
No	67 (53.2)	38 (54.3)	105 (53.6)
Drug Injected			
Yes	3 (0.6)	3(1.4)	6 (0.8)
No	485 (99.4)	216(98.6)	701 (99.2)
Blood Transfusion			
Yes	33 (6.8)	5 (2.3)	38 (5.4)
No	445 (93.2)	214(97.7)	669 (94.4)
Circumcision or scarification			
Yes	83 (17.0)	35 (16.0)	118(16.7)
No	405 (83.0)	184 (84.0)	589 (83.3)

27.7% of the participants are sexually active and of these 46.4% engage in unprotected sex. The percentage of those who are sexually active is higher in Machakos (32%) than in

Nairobi (26%). About liaif of those who are sexually active engage in unprotected sex. Unprotected sex was taken as having sex without the use of a condom in this study.

Only 0.8% of the participants had **history** of injectable drug use. 5.4% had history of a prev ious blood transfusion and 16.7% had history of traditional circumcision or scarification. Of note is that the number of people requiring blood transfusion is more than 3 times in Nairobi compared to Vlachakos. (Table 3)

Prevalence of Hepatitis B markers (HBsAg .AntiHBs and HBeAg)

The overall prevalence of hepatitis B surface antigen was 3.0%. The prevalence in Vlachakos was 1.8% and in Nairobi was 3.5%.

The overall prevalence of antibodies to hepatitis B surface antigen was 9.3%. The prevalence in Vlachakos and Nairobi was 6.4% and 10.7% respectively. This is shown below in Table 4.

The prevalence of a positive hepatitis **B** e antigen was studied among the 23 students who were hepatitis **B** s antigen positive. The prevalence was found to be 0.09% with only 2 students testing positive.

Table 4: Prevalence of Hepatitis B markers (HBsAg and AntiHBs)

	Nairobi, n (%)	Machakos, n (%)	Total, n (%)
Prevalence of HBsAg			
• +ve	19(3.5)	4(1.8)	23(3.0)
• -ve	461 (94.7)	190 (87.2)	651 (92.4)
• No Sample	9(1.8)	24(11.0)	33 (4.7)
Prevalence of AntiHBs			
• +ve	52(10.7)	14(6.4)	66 (9.3)
• -ve	427 (87.5)	181 (82.6)	608 (86.0)
• No Sample	9(1.8)	24(11.0)	33 (4.7)
Prevalence of HBeAg			
• +ve	2(0.12)	0(0)	2(0.09)
• -ve	17(99.88)	4(100)	21(99.91)

pattern of Hepatitis B markers among various age groups.

Of the 23 students who tested positive for HBsAg, the mode. 9. were I6years of age. About 83% of those positive were 16 years and above.

Of the 66 students who tested positive for AntiHBs. 85% were 15 years and above.

There were only two students who were positive for HBeAg. One was 14 years and the **other** was 15 years. Of note is that they were from the same class and may possibly have **infected** one another.

Risk factors for Hepatitis B.

Risk factors studied included history of blood transfusion, injectable drug use. traditional circumcision or scarification and sexual activity. Only 358(51%) of the students reported **any** of these risk factors. None of these factors were found to be significantly associated with positive Hepatitis B serology. However the study was not powered to adequately evaluate the role of individual risk factors. (Table 6)

Table 5: correlates of risk factors for Hepatitis B.

Factors	HbsAg			
	+ve. n (%)	-ve. n (%)	OR (95% CI)	P-value
Blood transfusion				
• Yes	1 (4.3)	37(5.4)		
• **No**	22 (95.7)	647 (94.6)	0.9(0.1 -6.6)	0.735
Injectable drug use				
• Yes	0	6(0.9)		
• **No**	23 (100.0)	678 (99.1)		0.460
Traditional circumcision or scarification.				
• Yes	4(19.0)	105(15.3)		
• **No**	19(81.0)	579 (84.7)	1.2(0.4-3.7)	0.950
Sexually Active				
• Yes	5(23.8)	175 (25.5)		
• **No**	18(76.2)	509 (74.5)	0.9(0.3-2.4)	0.761

For cases where the cell-count was less than 5. Yates Corrected statistic was used to adjust for the small count.

DISCUSSION

The objective of the study was to determine the prevalence of hepatitis B markers among the youth aged 13-18 years in public day high schools in Nairobi and Vlachakos. The prevalence of hepatitis B surface antigen was found to be 3.0% and the prevalence of the antibody to the hepatitis **B** surface antigen, anti HBs was found to be 9.3%. The prevalence of hepatitis B envelope antigen among those positive for hepatitis B surface antigen was 0.1%.

The study also aimed at determining the correlates of hepatitis B sero-positivity among adolescents aged 13-18 years. The correlates studied included adolescents who are sexually active, those who have undergone a blood or blood product transfusions, those with a history of having undergone cultural scarification, or intravenous drug use. None of the correlates studied were found to be significant. However, the study was not adequately powered to comment on association between the risk factors and the prevalence of hepatitis **B.**

The participants in the two study areas were comparable in terms of social demographic factors. They had a similar age distribution and household population density (the number of people living in a house). Likewise the sex distribution was similar with the number of males enrolled being 54% and 58% in Machakos and Nairobi respectively. This is in keeping with studies on secondary school enrolment that have shown 52% of males and 49% of females in that specific age bracket are enrolled in school (17).

The prevalence obtained fit into the range of hepatitis B prevalence in sub Saharan Africa which was given as 2-30% (3). It also fits into the range obtained in various studies in Kenya which was given as 3-15%. It is however lower than what was found by Okoth et al in 2006. He obtained a national average of 9 3%. Wankva had also obtained a

prevalence in Machakos of 1!% which is much lower than 1.8% which was the prevalence of HBsAg in Machakos. This lower prevalence may be partly due to the use of the rapid passive hemagglutination assay method for testing for hepatitis B surface antigen. This method is less sensitive than the enzyme linked immunosorbent assay method used in the other studies (18). It may also be explained by the different population studied. Wankya studied the community and therefore looked at the entire age spectrum, while Okoth studied pregnant women. In another study carried out in Eastern Kenya (19), prevalence of seropositivitv for hepatitis B markers was positively correlated with age. This may explain higher prevalence figures when an older population is studied.

The prevalence of hepatitis B surface antigen was not found to be influenced by sex unlike in the study carried out by Hyams et al(l 9) which found an association between the male gender and hepatitis B positivity.

The prevalence of anti HBs, at 9.3%, was also surprisingly low as it has been assumed that most infections occur in childhood. One would have expected much higher values. Okoth et al(4) found anti HBs prevalence of 30.2% while Hyams et al found a prevalence of 44.9% when he tested for both anti HBs and anti HBc (19). As both studies had older participants, this may point to significant infection occurring outside the childhood age group.

Of the 23 students who tested positive for HBsAg, majority were 16 years and above w ith the peak occurring at 16 years. The distribution follows the age distribution of the sample size studied though in the sample size the mode was 17 years. Of the 66 students who tested positive for AntiHBs 86% students were 15 years and above. 22% of those who were positive were 18 years though this age group was only 11% of the sample size. These results are in keeping with trends in the United States were positivity for hepatitis B markers increased with age from 12 years(25).

The low prevalence of hepatitis B envelope antigen suggests that those infected are not currently infective. This may occur when one is in the process of acquiring immunity against hepatitis B or if one is a chronic carrier. Low hepatitis B envelope antigen markers are a sign of low transmission among the students. However, assays for core antigens would be recommended.

Vaccination rates were very low. In Nairobi the rate was 0.8% and in Machakos the rate was 4.1%. The low rates were expected as the vaccine had not been introduced into the KEPI schedule by the time the students were born. However it is surprising that the rate was higher in Vlachakos than in Nairobi. One would have expected a higher rate in the urban towns. According to the KDHS (2003) children in the urban settings are more likely to be vaccinated than those in the rural settings. However, Eastern Province, of which Vlachakos is a part of, had a higher percentage of children between 12-23 months who had been fully vaccinated than Nairobi (11). The questionnaire filled by the students was also limited in its ability to capture this information as the parents would have been better placed to answer this question. As such this information may not be a true representation of the vaccination status.

There were very small numbers involved in injectable drug use to be able to comment on its correlation with hepatitis B though this has been shown to be a risk factor (14). In a study carried out among short term injection drug users, 65.7% of those who had been exposed for more than one year were hepatitis B surface antigen positive while 49.8% of those who were exposed for less than a year were hepatitis B surface antigen positive.

History of blood transfusion and history of traditional circumcision or scarification (15) are also known risk factors though they too could not be adequately analysed as the study was not powered enough for this analysis. Interestingly, Bwogi et al (16) in Uganda found out that circumcised men were less likely to have had hepatitis B virus infection than uncircumcised men. A larger study done among the Somali community living in

Liverpool found out that community circumcision or other surgical procedure carried out away from a hospital in Somalia were significant risk factors for anti- HBc positivity.

The number of participants who reported to being sexually active was 25.8% in Nairobi and 32% in Machakos. About 46.4% of those who are sexually active are engaging in unprotected sex. These numbers are probably higher because they may have been underreporting on the questionnaire given the sensitive nature of the questions. Sexual activity was not shown to be a significant risk factor in this study though it has been proven in others. Sexual transmission has been estimated to account for 50% of new infections among adults in industrialized countries (20). In Tanzania. Jacobs B. et al. found the attributable fraction for sexual acquisition of hepatitis B to be estimated at 7.2% in men and 3.0% in women (21). The large number of participants engaging in unprotected sex is worrying as the students are exposed to all the sexually transmitted diseases including human immunodeficiency virus.

Strengths of the study.

The strengths of the study included the large number studied. The minimum sample size required was 202 and the study was able to study 709 students. This was partly because a larger acceptance rate of 54% was observed compared to other studies carried out previously which had acceptance rates of about 30% (12).This may be explained by the adequate time taken to establish rapport with the head teachers and students and therefore gain their confidence. Each school had a separate day set apart for this prior to commencing the data collection. In Machakos. the desired sample size was obtained from the first two schools and therefore a third school was not involved as had been planned earlier.

The involvement of both Nairobi and Machakos gave the study the benefit of having an area of high prevalence and one of low prevalence as well as urban and rural areas . In earlier studies, Wankya (6) had obtained a prevalence of 11% in Machakos. This was a

community based study carried out in 1989. Okoth et ai (4) had obtained a prevalence of 5% in Nairobi in a study carried out in 2006 on pregnant women.

Limitations of the study.

The study was limited by a design involving only youth registered in schools. The risk factors associated with hepatitis B infection, sexual activity and injectable drug use (13). are also associated with absenteeism from school or school drop out. This then introduces a bias that would theoretically give a lower prevalence in this age group than if the study was able to include those in this age group who are not in school.

In addition, the study only involved students in day schools and left out students in boarding schools. Information about the effect of this bias on the results was scanty but it is possible that this limitation did introduce a bias.

The students may also not have answered the questions truthfully. This is especially so given the sensitive nature of some of the questions. This bias would underestimate the exposure to certain risk factors and bias the data. The study attempted to reduce this limitation by using self administered questionnaire. Some of the questions were also difficult for the student to answer such as " history of hepatitis vaccination'' and "history of liver disease in the family".

CONCLUSIONS

1. The prevalence of HBsAg among the youth aged 13-18 years in public day high schools within Nairobi and Machakos is 3.0%.

2. The prevalence of HBsAb among the youth aged 13-18 years in public day high schools within Nairobi and Machakos is 9.3%.

3. The prevalence of HBeAg among those who were HBsAg positive was 0.1 %.

RECOMMENDATIONS

1. The low HBsAb points to a low acquired immunity rate in this age group. This means that this group is at risk of infection and would therefore benefit from vaccination

2. The prevalence of HBsAg was lower than what has been observed in the adult population. This means that there is transmission in adolescent and adulthood years. Awareness of transmission in this age group needs to be highlighted..

3. Further research is required on the risk factors affecting transmission of hepatitis B among adolescents within our community.

APPENDIX C.

PARENTAL CONSENT FORM

We are carrying out a study to assess the prevalence of Hepatitis B among youth aged 13-18 vrs old. I, Dr Waceke Ng'ang'a (TEL 0722846302), under the University of Nairobi. Department of Pediatrics will be the principal investigator. We would like to include your child as one of the participants in the study.

Hepatitis B is a viral infection affecting the liver that can go unnoticed for a long period of time and then begin to cause illness in adulthood. It can be passed on through contact with infected person's body fluids, blood transfusion, sharing of contaminated needles and needle prick injuries in hospitals. It may also be passed on through sex with an infected person.

Once someone is infected with the virus, they may be yellowness of the eyes or they may remain normal with no noticeable changes. The body then fights the virus and the patient may be able to overcome the infection and therefore become immune. Unfortunately, not everyone becomes immune. Some people remain infected and go on to develop liver disease and liver cancer later on in life.

Given the seriousness of the disease, the ministry of Health in November 2001 started immunizing all children against hepatitis **B.** Unfortunately anyone born before that date did not benefit from the vaccination program. Adolescents have been seen as a group that may benefit from vaccination and indeed some countries have vaccination programs for them, but not Kenya.

This study will heip us to see the magnitude of the problem among our adolescent population and whether such a vaccination program would be beneficial.

We shall be asking your son/daughter to sign an assent form, after which they will fill in a questionnaire. We shall then draw a blood sample of 3ml from them to test for hepatitis B markers. The questionnaire and the results of the tests shall remain confidential. We shall not be testing for anv other diseases.

The blood sample shall be taken by trained staff and with sterile single-use equipments. The risks of the procedure include bleeding from the site, pain of the needle prick and swelling at the site. These shall be controlled with proper compression to avoid bleeding and correct site location for the prick to avoid unnecessary bruising.

Students and their parents/guardian will be informed if a student is found to be hepatitis B infected and advised on further follow up at the Kenvatta National Hospital liver clinic. Those enlisted for the study and found to be negative will be advised to seek vaccination against hepatitis B.

The students are free to withdraw from the study at any time and to call the investigator for any further clarification. If you are agreeable, please sign the attached page and return it to the investigator. A copy of the consent will remain with you.

In case of any ethical concerns regarding the study and the procedures, please contact Prof A.N. Guantai. Secretary Kenvatta National Hospital/ University of Nairobi- Ethics committee. P.O. BOX 20723, NAIROBI, Tel 020 726300-9. You may contact me on 0722846302 for any further clarifications. Thank you for your cooperation.

Dr Waceke Ng'ang'a.

Principal Investigator.

PARENTAL CONSENT FORM

I (name)_____the parent/ guardian of_
having read the above information do hereby give consent for him/her to be involved in the study.

Signature

Address

Telephone no.

APPENDIX C.

ADOLESCENT ASSENT FORM

I Dr Waceke Ng'ang'a (TEL 0722846302), under the University of Nairobi. Department of Pediatrics will be carrying out a study to assess the prevalence of Hepatitis B among adolescents aged 13-18 yrs old.

Hepatitis B is a viral infection affecting the liver that can go unnoticed for a long period of time and then begin to cause illness in adulthood. It can be passed on through contact with infected person's body fluids, blood transfusion, sharing of contaminated needles and needle prick injuries in hospitals. It may also be passed on through sex with an infected person.

Once someone is infected with the virus, they may be yellowness of the eyes or they may remain normal with no noticeable changes. The body then fights the virus and the patient may be able to overcome the infection and therefore become immune. Unfortunately, not everyone becomes immune. Some people remain infected and go on to develop liver disease and liver cancer later on in life.

Given the seriousness of the disease, the ministry of Health in November 2001 started a nationwide campaign to immunize all newborns against hepatitis **B.** Unfortunately anyone born before that date did not benefit from the vaccination program. Adolescents have been seen as a group that may benefit from vaccination and indeed some countries have vaccination programs for them, but not Kenya.

This study will help us to see the magnitude of the problem among our adolescent population and whether such a vaccination program would be beneficial.

We shall be asking you to sign this assent form. After that we shall give you a questionnaire to fill and then take a blood sample from you of 1ml. The questionnaire

and the results of the tests shall remain confidential. We shall not be testing for anv other diseases.

The blood sample shall be taken by trained staff and with sterile single-use equipments. The risks of the procedure include bleeding from the site, pain of the needle prick and swelling at the site. These shall be controlled with proper compression to avoid bleeding and correct site location for the prick to avoid unnecessary bruising.

Students found to be infected will be followed up at the Kenyatta National Hospital liver clinic, while those enlisted for the study and found to be negative will be advised to seek vaccination against hepatitis B.

You are free to withdraw from the study at any time and to call the investigator for any further clarification. If you are agreeable, please sign the attached page and return it to the investigator. You will remain with a copy of the signed assent form.

In case of any ethical concerns regarding the study and the procedures, please contact Prof A.N. Guantai, Secretary KNH/UON-ERC, P.O. BOX 20723, NAIROBI, Tel 020 726300-9. You may contact me on 0722846302 for any further clarifications. Thank you for your cooperation.

Dr Waceke Ng'ang'a.

Principal Investigator.

ADOLESCENT ABSENT FORM

I (name)_____aged (insert age in years)

having read the above information do hereby give assent to be involved in the study.

Signature

Address

Telephone no.

APPENDIX C.

QUESTIONAIRE

We, under the University of Nairobi, are undertaking a study to determine the prevalence of Hepatitis B among adolescents aged 13 yrs to 18 vrs. Hepatitis B is an infection of the liver with a virus. This can be avoided by vaccination. In Kenya, vaccination is currently offered at 6 weeks, 10 weeks and 14 weeks of age since 2002. Part of the objectives of this study is to explore the need for such a vaccination later on in life for those born before 2002.

Any information gathered from this questionnaire is confidential and will be treated as such. Do not write your name on any part of the questionnaire.

STUDY SUBJECT NUMBER:.....(leave this blank. To be filled by investigator)

QUESTIONAIRE

1. **Where were you born? (tick one)**

   (a) Coast province
   (b) Eastern province
   (c) N. Eastern province
   (d) Nairobi province
   (e) Central province
   (f) Rift Valley province
   (g) Western Province

   (h) Nyanza province

2. **Area of residence**

(O)Nairobi (l)Machakos

3. **Date of Birth (date/month/year) (...../...../.....)**

4. **Sex**

(0)Male (l)Female

5. How many people live in the house where you live?.....(give a number)

6. Have you ever received vaccination for hepatitis B?

(0) Yes (1) No (2) Do not know

7. If yes to question 7, how many times were you injected?

(1) One (2) Two (3) Three (4) Do not know

8. Have you had a family member develop yellowness of eyes?

(0) Yes (1) No (2) Do not know

9. Have you ever had a family member diagnosed with a liver disease?

(0) Yes (1) No (2) Don't know

10. Have you ever suffered from a sexually transmitted disease? •

(0) Yes (1) No

11. Would you consider yourself sexually active?

(0) Yes (1) No

12. Have you ever had unprotected sex?

(0) Yes (1) No

13. How many sexual partners have you had?

(please insert a number)

14. Have you ever injected yourself as a method of using a drug of abuse?

(0) Yes (I) No

15. Have you ever had a blood transfusion or transfusion of any blood product?

to

(0) Yes (1) No

16. Have you had a cultural circumcision or any procedure that involved a cut carried out away from a hospital?

(0) Yes (1) No

APPENDIX D:

BUDGET

- Laboratory costs

TEST	METHOD OF TEST	COST PER TEST	NO OF TESTS	TOTAL COSTS
HBsAg	Hep Cell	50	204	10,200
HBeAg	Elisa	1000	20	20,000
AntiHBs	Elisa	1000	204	204,000
AST&ALT		600	204	122,400
			TOTAL	356,600

- Transport costs Kshs 5.000
- Operating expenses Kshs 5.000
- Miscellaneous and contingency costs Kshsj 10,000

TOTAL COSTS Kshs 376,000

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Email: KNHplan@Ken.Healthnet.org

Ref: KNH/UON-ERC/A/224

18th May 2009

Dr. Waceke Ng'ang'a
Dept. of Paediatrics & Child Health
School of Medicine
University of Nairobi

Dear Dr. Ng ang'a

Research proposal "To study the Prevalence of Hepatitis B Markers among the Youth aged 13-18 years in Public schools in Nairobi and Machakos" (P54/2/2Q09)

This is to inform you that the Kenyatta National Hospital Ethics and Research Committee has reviewed and **approved** your above revised research proposal for the period 18th May 2009 -17* May 2010.

You will be required to request for a renewal of the approval if you intend to continue with the study beyond the deadline given. Clearance for export of biological specimen must also be obtained from KNH-ERC for each batch.

On behalf of the Committee, I wish you fruitful research and look forward to receiving a summary of the research findings upon completion of the study.

This information will form part of database that will be consulted in future when processing related research study so as to minimize chances of study duplication.

Yours sincerely

DR. L. MUCHIRI
AG. SECRETARY, KNH/UON-ERC

c.c. The Chairperson, KNH/UON-ERC
The Deputy Director CS, KNH
The Dean, School of Medicine, UON
The Chairman, Dept. of Paediatrics & Child Health, UON
Supervisors: Dr. A. Laving, Dept. of Paediatrics & Child Health, UON
Prof. Mbori-Ngacha. Dept.of Paediatrics & Child Health, UON
Dr. F. A. Okoth, KEMRI

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When

p. 0. Box 30623-00100
NAIROBI-KENYA

0UR REF:

D *J^June 2009*

Dr. Waceke Nga'nga
University of Nairobi
P.O. Box 30197
NAIROBI

RE: RESEARCH AUTHORIZATION

Following your application for authority to carry out research on, *To Study the Prevalence of HepattesLB Markers among the Youth Aged 13-18 Years in Public Schools in Nairobi ?nd Machakos'*

I am pleased to inform you that you have t/een authorized to carry out research in Nairobi and Machakos Districts for a period ending 30m June 2010.

You are advised to report to the Provincial Commissioner Nairobi, the Provincial Medical Officer of Health Nairobi, the District Commissioner and the Medical Officer of Health Machakos District before embarking on your research.

On completion of your research, you are expected to submit two copies of your research report/thesis to this office.

P R O F ^ ^ ^ ^ ^ f ^ ^ A K Ph.D. MBS
SECRETARY

Copy to:

A h e Provincial Ccmmissioner
Nairobi

The Provincial Medical Officer of Health
Nairobi

MINISTRY OF EDUCATION

Telegrams: "Education", Nairobi
Telephone: 318581
When replying please quote

JOGOO HOUSE "B"
HARAMBEE AVENUE,
P.O. Box 30040
NAIROBI

REF: MOE/S&TE/ADM/09

DATE: 17th JUNE, 2009

The District Education Officer
Machakos District
MACHAKOS

RE; REASEARCH AUTHORIZATION

This is to inform you that Dr Wacheke Ng'ang'a from University of Nairobi has been authorized by the National Council for Science and Technology to conduct research in Public Day Secondary schools as per the attached letter.

The purpose of this letter is to authorise you to allow her access to any relevant research material in your office and learning institutions under your jurisdiction.

Please accord her any necessary assistance to enable her complete the work successfully.

ORWA M. J. ONDEGO
FOR: PERMANENT SECRETARY

MINISTRY OF PUBLIC HEALTH AND SANITATION

Telephone:- (0145) 20594. 2084'/,
20234,21685
Fax:-0145-20594

OFFICE OF THE
DISTRICT MEDICAL OFFICER OF HEALTH.
P.O. BOX 646.
MACHAKOS.

Ref.No.MOH/MKS/C.4 VOL.VI/34

June 19, 2009.

To Whom It May Concern:

RE: RESEARCH AUTHORIZATION

This is to confirm that Dr. Waceke Ngang'a has been authorized to carry out a research in schools in Central Division of Machakos District. The tittle of the research is the prevalence of Hepatitis B Marker's among the Youth aged-13-18 years in Public Schools in Nairobi and Machakos.

Please assist her.

Thanks in advance.

Yours faithfully.

Dr. J. Rogena
District Medical Officer of Health
MACHAKOS.

MINISTRY OF EDUCATION

Telegrams: "SCHOOLING", Nairobi

Tel. 0202453699 Fax 2244831 Nairobi

When replying please quote

PROVINCIAL DIRECTOR OF EDUCATION
NAIROBI PROVINCE
NYAYO HOUSE
P.O.BOX 74629- 00200
NAIROBI

Ref: NP/GA/1/7

Date: 1st July 2009

To:
All Principals
Public Day Secondary Schools
NAIROBI PROVINCE

RE: RESEARCH AUTHORIZATION

The bearer, Dr. Penina Waceke Ng'ang'a, who is a post-graduate student at the University of Nairobi, School of medicine, has been granted authority by the Permanent Secretary, Ministry of Education **to undertake research on the Prevalence of Hepatitis B markers among the Youth aged 13 - 18 years in Public Day Secondary Schools in Nairobi Province.**

The purpose of this letter is to introduce her to you and ask you to accord her all the necessan^assistance she may require from you.

CA- w \

JAMIN
FOR: PROVINCIAL DIRECTOR OF EDUCATION
NAIROBI

t/^c: The Permanent Secretary
Ministry of Education

Telegrams: PRO-MINHEALTH", Nairobi
Telephone: Nairobi 217131/313481
Fax:217148
E-mail: pmonairobi@yahoo.com

When replying please quote

Ministry of Health

PROVINCIAL MEDICAL HEADQUARTER
NAIROBI PROVINCE
NYAYO HOUSE
P.O Box 34349,GPO
NAIROBI

Ref: No. PMO/NRB/RI/VOL.1/21

25th June 2009

TO WHOM IT MAY CONCERN

RE: RESEARCH AUTHORIZATION

Authority is granted to Dr. Waceke Nga'nga of University of Nairobi to carry out research on, the Prevalence of Hepatitis B Markers among the Youth Aged 13-18 Years in Public Schools in Nairobi Province.

Please accord her any necessary assistance.

DR. S. OCHOLA
PROVINCIAL DIRECTOR OF PUBLIC HEALTH & SANITATION

/C.C. **Dr.** Waceke Nga'nga

MINISTRY OF EDUCATION

Telegrams: ^Education", Nairobi
Telephone: 318581
When replying please quote

JOGOO HOUSE "B[M]
HARAMBEE AVENUE,
P.O. Box 30040
NAIROBI

REF: MOE/S&TE/ADM/09

DATE: 17th JUNE, 2009

/The Provincial Director Education
Nairobi province
NAIROBI

RE: REASEARCH AUTHORIZATION

This is to inform you that Dr Wacheke Ng'ang'a from University of Nairobi has been authorized by the National Council for Science and Technology to conduct research in Public Day Secondary schools as per the attached letter.

The purpose of this letter is to authorise you to allow her access to any relevant research material in your office and learning institutions under your jurisdiction.

Please accord her any necessary assistance to enable her complete the work successfully.

ORWA M. J. ONDEGO
FOR: PERMANENT SECRETARY