

Prevalence of HBV Sero-markers in two Different Socioeconomic Groups of Schoolchildren from Abidjan, Côte d'Ivoire

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Received: June 2, 2013

Revised: July 1, 2013

Accepted: July 3, 2013

Published online: September 21, 2013

ABSTRACT

AIM: To assess seroprevalence of hepatitis B markers according to the social condition, in schoolchildren born before newborns immunization in Abidjan.

METHODS: A total of 253 schoolchildren (6 to 15 years) were recruited in two randomly selected primary schools between April and June 2006. Schools A ($n=124$) and B ($n=129$) respectively were attended by schoolchildren from poorest and high social conditions. Serum samples were analyzed for serological markers of hepatitis B (ELISA method) to determine if they were infected, healed, vaccinated or seronegative. Logistic regression was performed to research the relationship between being infected or vaccinated and social condition, age and sex.

RESULTS: Overall, children infected, healed and vaccinated were 4.3% ($n=11$), 6.3% ($n=16$) and 45.9% ($n=116$). No Hepatitis B Virus seromarkers were found in 121 cases (47.8%). In univariate analysis infected status increasing (0.8% vs 8.1% $P=0.004$) and vaccinated status decreasing (80.8% vs 8.9% $P<0.00001$) in poor social condition. In logistic regression, infected status was associated with increasing age [Odds Ratio (OR): 4.3; $P=0.001$; 95% confidence interval: 1.7-10.5] and poorest social condition [Odds Ratio (OR): 12.6; $P=0.00$; 95% confidence interval (CI): 2.9-55.7]; and vaccinated status was only associated with high social condition [Odds Ratio 64 (25.2-162.5) $P<0.001$]. No relation was found between sex and vaccinated [Odds Ratio (OR): 1.9; $P=0.083$; 95% confidence interval (CI): 0.9-4.1] or infected [Odds Ratio (OR): 1.9; $P=0.168$;

95% confidence interval (CI): 0.8-4.5] status.

CONCLUSION: In Abidjan, poorest social class is associated with low immunization coverage and high infected status in schoolchildren born before hepatitis B universal vaccination. Catch-up immunization is necessary and must be free of charge to be effective.

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Key words: Hepatitis B seroprevalence; Vaccination; Schoolchildren; Socioeconomic level; Catch up immunization

Lohouès-Kouacou MJ, Assi C, Simen-Kapeu A, Badje AD, Koné S, Ouattara A, Soro D, Camara BM. Prevalence of HBV Sero-markers in two Different Socioeconomic Groups of Schoolchildren from Abidjan, Côte d'Ivoire. *Journal of Gastroenterology and Hepatology Research* 2013; 2(9): 798-802 Available from: URL: <http://www.ghrnet.org/index.php/joghr/article/view/486>

INTRODUCTION

Hepatitis B infection is globally a well-recognized public health problem. Nearly two billion people worldwide have serologic evidence of past or present HBV infection, while 350 million people are chronically infected^[1].

In sub-Saharan Africa, HBV is most commonly spread from mother to child at birth or from person to person in the early childhood. More than half of the population becomes infected during their lifetime and more than 8% of the inhabitants remain chronic carriers^[2]. In Côte d'Ivoire, the seroprevalence of HBV infection is estimated 18.2% of pregnant women and the perinatal transmission occurs in 33% of neonates of HBV infected mothers^[3].

Previous studies showed that socio-demographic characteristics are important risk factors for HBV infection^[4,5,6]. Acute hepatitis B occurs in approximately 1% of perinatal, 10% of early childhood (1-5 years old) and 30% of late (>5 years old) HBV infections. The development of chronic HBV infection is inversely related to age and occurs in approximately 90% of children infected prenatally, in 30% infected in early childhood and in 6% infected after 5 years of age^[1]. In addition, finding on HBV epidemiology showed a higher prevalence of chronic carriers of HBV among boys than girls^[7,8]. As

regards to socioeconomic influences, a higher risk of HBV infection was observed in economically disadvantaged populations^{15,61}.

To date, few findings are available on the HBV epidemiology among children born before implementation the HBV vaccine in EPI in sub saharian Africa . Hepatitis B vaccination was included in 2002 in the expanded program on immunization (EPI) for children aged 6 weeks to 11 months after a pilot study years 2000-2002 in Côte d'Ivoire⁹¹. Catch-up vaccination for adolescents was not introduced and there is no schools-based vaccination program. Children currently attending primary schools were not eligible to receive hepatitis B vaccine within the program. Some of them were certainly immunized at their own charge under their parents' initiative. Other children, however, have not been vaccinated and are highly susceptible to be infected.

Abidjan, the economic capital city of Côte d'Ivoire, is situated in the southern part of the country with a surface area of 261 square kilometers (sq.km). It comprised 35% of the total Ivorian population and the density population is 98 inhabitants per sq. km. The city is divided into 10 municipalities.

We there carried out a cross-sectional study in schoolchildren to assess the seroprevalence of HBV markers according to socioeconomic level in Abidjan in children born before the implementation HBV vaccine in the expanded program on immunization.

METHODS

Population and study design

The study was conducted in two municipalities with opposite human development indexes, standards of living, sanitation level, income distribution and socioeconomic status. One school was randomly selected in each municipality from a list obtained from the Ministry of Education. School A is a public school, free of charge, located at Adjamé, the low socioeconomic municipality (=Poorest socio economic level). School B is an expensive private school located at Cocody, the highest socio-economic municipality (=High socio economic level).

Children less than 16 years of age account for 50% of the Ivorian population. Around 65% of children aged 6-15 years are enrolled in schools. A sample size of 107 was estimated to evaluate the prevalence of HBV infection on the basis of an alpha error of 5% and with an expectation of the HBsAg seroprevalence of 7.5% ($\pm 1.5\%$ level of accuracy). All children enrolled were born before introduced the hepatitis B vaccination in Côte d'Ivoire expanded program on immunization (year 2002).

Ethics

The study protocol was approved by the Ministry of The Health and the National Ethical Review Committee "comité national d'éthique des sciences de la vie et de la santé (CNESVS)" in Côte d'Ivoire. Informed written consent was obtained from the parent of the study subject. The serological results were provided to the parents at the completion and kept strictly confidential. The parents of infected children were provided with appropriate information on the prevention of further spread of these infections and referred to public or private hepatologist accordance with the wishes of parents. All children seronegative for anti-HBc were all vaccinated against HBV.

Serological analyses

The blood sample were obtained from all participants and sera stored at -20°C until analysis in the Viral and Bacterial Serology Unit (USVB) of Institut Pasteur, Cocody, Abidjan. Institut Pasteur is a reference research institute recognized for its high quality standard. Sera were

screened for HBV surface antigen (HBsAg), HBV core antibody (anti-HBc), and HBV surface antibody (anti-HBs) by Enzyme Immunosorbent Assays (Monolisa[®] Aventis Pasteur, Paris, France). Samples that presented reactivity for HBsAg alone were retested with the same kit.

Serological status

Children found reactive for both HBsAg and anti-HBc were considered infected. Those with anti-HBc and anti-HBs positive were considered healed. When anti-HBs alone greater than 10 mUI/mL was found, children were said vaccinated. Children classified as seronegative were negative for all HBV markers.

Statistical analyses

The data were doubled-entered and validated in Epi Info 6.04 (CDC Atlanta, USA, 2001). Data analysis was carried out in SPSS version 17.0 (SPSS Inc, Chicago, USA).

Descriptive statistics of socio-demographic variables and other characteristics of the sampled population were computed. Means and standard deviations (SD) were calculated for quantitative variables and proportions for categorical variables. Age of children was divided into two tranches to reflect the characteristic of pre-adolescence (from 11 years)

The X^2 test was used in the bivariate analysis for the comparison of the seroprevalence of HBV markers in various subgroups. Logistic regression was performed to assess the association between binary outcome (infection, immunization status) and explanatory variables (sex, age and socioeconomic level). Two-sided P value of less than 0.05 was the level that indicated statistical significance.

RESULTS

A total of 253 schoolchildren were screened for HBV serological markers. The age range was 6-15 years. The characteristics of the sample are shown in table 1.

Table 1 Characteristics of the 253 schoolchildren.

Variables	Total N (%)	School A n (%)	School B n (%)
Mean age \pm standard deviation $P=0,02$	9.27 \pm 2.12	9.85 \pm 2.31	8.71 \pm 1.73
Age (years)			
6-10	177 (70%)	75 (60.5%)	102 (79.1%)
11-15	76 (30%)	49 (39.5%)	27 (20.9%)
$P=0,001$			
Sex			
Boys	109 (43%)	57 (46%)	52 (41%)
Girls	144 (57%)	67 (54%)	77 (59%)
$P=0,21$			

Seroprevalence of HBV markers

Overall (Table 2), children infected, healed and vaccinated were 4.3% ($n=11$), 6.3% ($n=16$) and 45.9% ($n=116$) respectively. No HBV markers were found in 121 cases (47.8%). None isolated case of HBsAg or anti-HBc antibody was observed.

Characteristic of hepatitis B serological status in the two socio economic level (Table 2).

Infected ($P=0.004$) or healed ($P=0.001$) status is significantly higher in schoolchildren with lower economic level (School A); vaccinated status ($P<0.00001$) is associated with high social condition (School B).

Effect of age, sex and socioeconomic level in schoolchildren infected status

After multivariate analysis, increasing age and poorest social condition were independent risk factors for infected status. There was no relationship between being vaccinated and sex. Table 3 presents relationship between infected status, sex, age and social condition.

Effect of age, sex and socioeconomic level in schoolchildren vaccinated status

The vaccination status of schoolchildren decreased with age and was associated with a higher social condition. There was no relationship between being vaccinated and sex in this study. Table 4 shows (logistic regression) relationship between vaccinated status of schoolchildren and sex, age and social condition.

Table 2 Seroprevalence of hepatitis B virus markers in schoolchildren stratified by sex and age, Abidjan 2006.

Variables	N	Infected n (%)	Healed n (%)	Vaccinated n (%)	seronegative n (%)
Sex					
Boys	109	7 (6.4)	9 (8.3)	38 (34.9)	55 (50.5)
Girls	144	4 (2.8)	7 (4.9)	67 (46.5)	66 (45.8)
P value		P=0.21	P=0.2	P=0.1	P=0.8
Age(years)					
6-10	177	5 (2.8)	4(2.3)	85 (48)	83 (46.9)
11-15	76	6 (7.9)	12(15.8)	20 (26.3)	38 (50)
P value		P=0.09	P<0.01	P=0.01	
Socio-economic level					
Poorest (school A)	124	10 (8.1)	15(12.1)	11 (8.9)	93 (75)
High (school B)	129	1 (0.8)	1(0.8)	105 (80.8)	28 (21.7)
P value		P=0.004	P=0.001	P<0.00001	P<0.00001
Total	253	11 (4.3)	16 (6.3)	116 (45.9)	121 (47.8)

Table 3 Relation between hepatitis B infected status and social demographic factors (sex, age and socioeconomic level) in schoolchildren (logistic regression), Abidjan 2006.

Variables	Odds Ratio
Sex	
Girls	1.0 (reference)
Boys	1.9 (0.8-4.5) ¹
Age	
6-10	1.0 (reference)
11-15	4.3 (1.7-10.5) ²
Socio-economic level	
High	1.0 (reference)
Poorest	12.6 (2.9-55.7) ³

¹ P=0.168; ² P=0.001; ³ P=0.001.

Table 4 Relation between hepatitis B vaccinated status and social demographic factors (age, sex and socioeconomic level) in schoolchildren (logistic regression), Abidjan 2006.

Variables	Odds Ratio
Sex¹	
Boys	1.0 (reference)
Girls	1.9 (0.9-4.1)
Age²	
11-15	1.0 (reference)
6-10	1.7 (0.8-4.7)
Socio-economic level³	
Poorest	1.0 (reference)
High	64 (25.2-162.5)

¹ P=0.083; ² P=0.185; ³ P=0.001.

DISCUSSION

We reported that 4.3%, 6.3% and 45.9% of schoolchildren were infected, healed and vaccinated respectively. Infected ($P=0.004$) or healed ($P=0.001$) status is significantly higher in schoolchildren with lower economic level; vaccinated status ($P<0.00001$) is associated with high social condition.

Our findings confirm the high frequency of HBV infection (4.3%

infected and 6.3% healed) in schoolchildren born before included hepatitis B vaccination in EPI. Similar results were previously found in a study conducted in Antananarivo, a city like Abidjan, the seroprevalence of HBsAg was 4% in children aged 4-15 years^[10]. In Mauritania, Rui *et al*^[11] reported that among children aged 6-16 years, 13.6% were HBsAg-positive. In Nigeria, an HVB endemic country, the prevalence of HBsAg was 11% in children aged 6-10-year-old in a hospital setting^[12].

Infected status increased with age in our study. In Ghana, authors reported a seroprevalence of 10% in children 6-9 years compared to 21% in children aged 13-18 years^[13]. Similar trends were previously observed in others studies in Africa (Cameroonian^[7] and Ethiopian children^[14]). Gandolfo *et al*^[6] also noted in Spanish that the incidence of HBc antibody increased with age.

In Côte d'Ivoire, the seroprevalence of HBsAg is estimated to 8-13%^[15] in the general population and to 8% in pregnant women^[16]. The prevalence of hepatitis B is higher in adults. Because adults are more exposed to sexual transmission. Indeed coverage against viral hepatitis B in adult in Abidjan does not exceed 3% by Assi *et al*^[15].

No data were previously collected in schoolchildren in Côte d'Ivoire before introduction hepatitis B in EPI. Although our study design did not permit determination of when the infection was acquired, the increasing age in HBV infection prevalence may reflect an increase of high risk behaviours such as sexual expose, use of infected instruments with HBV for scarification, fighting and other (games involving close physical contact). Our findings support the existence of frequent horizontal transmission of HBV in schoolchildren aged 11-15 years in high endemic areas^[8,14].

Although the seroprevalence of infected schoolchildren increased from 2.8% in 6-10-year-olds to 7.9% in the older age group, the seroprevalence of anti-HBs decreased from 48% in 6-10-year-olds to 26.3% in the older age group. This difference could be explained by a low coverage rate of hepatitis B vaccine in the older group. Many studies showed that lack of vaccination is associated with increasing of chronic infection with age^[17,18].

Our data showed that 47.8% of schoolchildren were seronegative. This rate is higher compared with that reported by Rui *et al*^[11] in Mauritania (36.2%). Children not infected and not immunized were potential candidates of HBV infection through parenteral or sexual route.

We evaluated the association between HBV infection (infected status) and socio-demographic risk factors. Collecting data from the parents or guardians of children such as annual income, social environment, educational level and living conditions was practically difficult. Alternatively, we considered the municipality in which the school was located and also used the information obtained from the teachers concerning the school fees, the profession of the parents and their place of habitation. Although limited, these data showed that infected status was significantly associated with a poorest social condition [odds ratio 12.6 (2.9-55.7)]. These socioeconomic differences could be explained by a high frequency of risk factors to HBV infection in poorest social condition areas such as promiscuity, frequent poor hygiene conditions, lack of child insurance and primary health care delivery, unfavourable living conditions, frequent residency change^[6,20,21].

We finally assessed the association between the coverage rate for hepatitis B vaccination and socio-demographic factors. The immunization card was not available for most of the children at the time of the study. We therefore considered anti-HBs positivity alone as a marker of immunity due to hepatitis B vaccination. Long term follow-up studies have demonstrated that the level of anti-

HBs antibody does wane overtime after vaccination, without this decline been associated with a loss of protection against HBV^[4]. The immunization card not required in school A compared to school B, before school entrance at 5 years of age, could be one cause of this low vaccination coverage rate. Other explanations might be the low educational level of parents and the high number of illiterate inhabitants which often limit accessibility to health information in less-developed areas. In Africa, Ategbo *et al*^[22] found that the principal reasons for non-immunization were lack of financial resources.

The introduction of hepatitis B vaccination in the national childhood immunization program in 2002 after a pilot study in 2000 is certainly an important step to reduce the incidence of HBV infection. For example, in Taiwan, mass hepatitis B vaccination campaigns were gradually introduced, every two years, starting from newborns to pre-schoolchildren, then primary and secondary schoolchildren and finally adults. The authors showed that 10 years after the national hepatitis B vaccination program was implemented in schools, HBsAg-positive rates dropped from 10.5% to 1.7% and the HBV infection rate dropped considerably in parallel from 25% to 4.3%. In addition, The incidence of HCC per 100000 children declined from 0.54 to 0.20 in those born before versus after the vaccination program^[23,24].

CONCLUSION

In Abidjan, low socioeconomic level reduced proportion of vaccinated and increasing seroprevalence of HVB infection in schoolchildren born before introduction HVB vaccination in the EPI. We advocate for the implementation of school-based catch-up hepatitis B immunizations, free of charge, as soon entrance of primary school.

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