



## Hepatitis B virus infection among health care workers in Public Teaching Hospitals in Khartoum State, Sudan

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### ABSTRACT

**Background:** Hepatitis B virus (HBV) infection is a global public health problem. It is estimated that there are more than 300 million HBV carriers in the world.

**Aim:** The study aimed to examine the sero-prevalence of hepatitis B virus (HBV) markers among health care workers (HCWs) in Public Teaching Hospitals in Khartoum State, in the year 2004.

**Methods:** The study is an observational, cross sectional, facility-based study. It was conducted on stratified two-stage cluster random sample of 843 subjects. The study followed non-parametric statistical methods, using Z-test for single proportion.

**Results:** Among the 843 subjects tested for all HBV markers (Anti-HBc, HBsAg, HBsAb, and HBeAg), the prevalence of Anti-HBc, HBsAg, HBsAb, and HBeAg was found to be 57% (CI 95%:53–60%), 6% (CI 95%:4.0–8.0%), 37% (CI 95%:34–40%) and 9% (CI 95%:7–11%) respectively.  $P < 0.05$ .

**Conclusion:** Seroprevalence of all HBV markers ( $P < 0.05$ ) was found to be significantly high, while the rate of immunity against HBV infection was low among health care workers in Public Teaching Hospitals in Khartoum State, Sudan.

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## 1. Introduction

### 1.1. Background information

There are estimated 4 million new cases of acute HBV infections world-wide each year. Approximately 30% of world's population or about 2 billion persons have serologic evidence of HBV infection. Out of these, about 350 millions have chronic HBV infection and at least one million chronically infected persons die each year from liver cancer and cirrhosis. HBV is second to tobacco as a known human carcinogen. It is the 10th leading cause of death worldwide (WHO/204, 2000; The Massachusetts Department of Public Health, 2002; WHO, 2002; Lavanchy, 2004). In Sudan there are no records for HBV as a cause of death, but it is included in the general term (jaundice) as a cause of death.

Serologic markers for HBV were detected in 68% of sexually active heterosexuals in Port Sudan and Suakin (McCarthy et al., 1989).

In Khartoum, Sudan, HBsAg was found to be positive in 4% of control-hospitalized patients and 67% in patients with hepatocellular carcinoma (Itoshima et al., 1989).

In Khalwat and Salem (two villages in Gezira State), HBsAg was found in 18.7% and seropositivity for any HB markers (HBsAg, Anti-HBs, or anti-HBc) was found in 63.9% (Hyams et al., 1989).

In the South of Sudan (Juba), prevalence of HBsAg was found to be 26% and that of Anti-HBcore was 67% (McCarthy et al., 1994).

This study describes the situation of HBV infection among the Health Care Workers (HCWs) in Public Teaching Hospitals in Khartoum State. Healthy HCWs provide safe health services thereby blocking an important way of spread of viruses and maximizing benefits from the available health services in both directions (i.e. HCWs and the rest of the community). No proper published data regarding HBV among HCWs are available in Sudan.

## 2. Methods

This study was an observational, cross sectional, facility-based study. It was conducted at Public Teaching Hospitals in Khartoum State. It was carried on stratified two-stage cluster random sample of 843 subjects.

### 2.1. Study population

According to the annual health statistical report of 2003, the total number of Federal Teaching Hospitals were seventeen

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(6753 HCWs) while the State Teaching Hospitals were thirteen (1680 HCWs) in Khartoum State.

## 2.2. Sample selection

The sample type is stratified, two stage cluster, random sample.

## 2.3. First

The hospitals were divided according to the type of the hospitals into two groups:

- Federal Teaching Hospitals with a total number of 6753 HCWs.
- State Teaching Hospitals with a total number of 1680 HCWs.

Thus, the ratio of HCWs in the Federal Teaching Hospitals to those in the State Teaching Hospitals approximately was 4:1. So, the sample size taken from the Federal Teaching Hospitals was 640 HCWs and that from the State Teaching Hospitals was 160 HCWs.

## 2.4. Second

The hospitals were divided into groups according to the different departments in each.

Using probability proportional to size (PPS); the number of selected hospitals was as follows:

- Ten Federal Teaching Hospitals.
- Seven State Teaching Hospitals.

## 2.5. Updating the records of the HCWs in the selected hospitals

The calculated sample size (800) was divided proportionately among the selected hospitals according to the number of the HCWs in each. This sample size was calculated after approximation of the fraction for each hospital, and was found to be equal to (600 + 208 = 808), as shown in the tables below. This sample was further divided among the different departments of each hospital with approximation of the fraction for one decimal point. So the final sample size (actual sample size) was found to be equal to (639 + 231) 870 HCWs as shown in the tables below.

- Group of Federal Teaching Hospitals (updating the number of the HCWs in the selected hospitals as shown in Table 1).
- Group of State Teaching Hospitals (updating the number of the HCWs in the selected hospitals as shown in Table 2).

**Table 1**  
Federal Teaching Hospitals.

No.	Name of the hospital	HCWs load	Proposed sample size	Actual sample size
1	KCTH	1935	238	245
2	Bahri	1006	124	135
3	Chinese	0276	034	041
4	Elshaab	0386	048	051
5	Dental	0167	021	023
6	Maternity	0216	027	029
7	Eye	0297	038	040
8	Pediatrics-Kh.	0246	031	033
9	Tropical	0200	025	025
10	Abu Anga	0111	014	017
	Total	4840	600	639

**Table 2**  
State Teaching Hospitals.

No.	Name of the hospital	HCWs load	Proposed sample size	Actual sample size
1	Ibrahim Malik	0386	048	053
2	Elacadimi	0091	012	016
3	Elnow	0232	029	033
4	Elsaudi	0222	028	031
5	Paediatric-Omd.	0337	042	044
6	Hajj Elsafi	0168	021	023
7	Elbuluk	0221	028	031
	Total	1657	208	231

Finally, the updated number of the HCWs of selected hospitals was found to be as follow:

A. Updated number of the HCWs in the selected Federal Teaching Hospitals = 4840

B. Updated number of the HCWs in the selected State Teaching Hospitals = 1657

Total of the updated number of the HCWs in the selected hospitals = 6497

Informed consent from the selected HCWs was obtained. A pre-tested questionnaire was applied to collect socio-demographic characteristics data. To measure HBV markers (i.e. Anti-HBc, HBs Ag, Anti-HBs and HBe Ag) in the blood of HCWs. Five mills of venous blood were collected using 10 ml vacucontainer. Sera was separated and stored at – 20 centigrade, until testing. ELISA was used to screen for anti HB core total. Reactive specimens for anti HB core were tested for HBs Ag. Reactive specimens for HBs Ag were tested for HBe Ag. Vaccinated HCWs and part of the reactive specimens for anti-HB core but non-reactive for HBs Ag were tested for Anti-HBs.

## 2.6. Statistics

Data was entered and analyzed using SPSS program.  $P < 0.05$  was considered statistically significant. The Z-test for single proportion was used to assess the prevalence of HBV markers.

## 3. Results and discussion

A total blood samples from 843 HCWs (628 HCWs from Federal Teaching Hospitals representing 74.5%; while 215 HCWs from State Hospitals representing 25.5%) were collected.

The mostly represented age group in the study was the age group 30–49 with a percentage of 58.4% followed by less than 30 years (30.7%), and the least one is the age group of 50 + years (10.9%).

The gender representation in the study was 366 males HCWs (43.4%) and 477 females HCWs (56.6%). University education was the most common represented by 269 HCWs (31.9%), followed by high secondary education with 214 HCWs (25.4%). The least representation is Khalwa education (Quranic school), with 5 HCWs (0.6%).

Concerning the original residency, it has been found that 288 HCWs come from the Central Region (34.2%) followed by Western Region (27.9%), Northern Region (25.1%), Southern Region (10.20%), while the Eastern Region of the Sudan represented the least one with a percentage of 2.6%. Regarding the marital status, 460 HCWs (54.6%) were married, 381 (45.2%) were not married and 2 (0.2%) refused to identify themselves.

Table 3 shows, out of the 843 HCWs tested, 477 (57%) showed positive Anti-HBc marker, while 366 (43%) was negative Anti-HBc

**Table 3**  
Z-test for single proportion testing prevalence of HBV markers among HCWs.

Markers	Group	Category	N	Observed prop.	Test prop.	Confidence interval (CI)	P-value	Bayesian analysis
Anti-HBc	Group 1	+ve	477	0.57	0.5	0.57 ± 0.033	0.000*	
	Group 2	–ve	366	0.43				
	Total		843	1.00				
HBsAg	Group 1	+ve	27	0.06	0.5	0.06 ± 0.016	0.000*	+ve Anti-HBcore → 0.057
	Group 2	–ve	461	0.94				
	Total		488	1.00				
Anti-HBs	Group 1	+ve	46	0.37	0.5	0.37 ± 0.032	0.007*	
	Group 2	–ve	77	0.63				
	Total		123	1.00				
HBeAg	Group 1	+ve	3	0.09	0.5	0.09 ± 0.019	0.000*	+ve HBsAg → 0.0063
	Group 2	–ve	29	0.91				
	Total		32	1.00				

\* P-value <0.05 indicating significant results.

marker. The *P*-value of the Z-test for single proportion was 0.000, which means that there was a significant difference between the prevalence of 57% and the tested rate of 50% (i.e. 0.5). This concludes that HBV was highly prevalent among HCWs in Public Teaching Hospitals in Khartoum State. The findings of the test were as follows:

### 3.1. Anti-HBc

The percentage of individuals who have evidence of past or ongoing HBV infection was 57%. The confidence level was 95% that the prevalence of Anti-HBc being 54% as a lower bound and 60% as an upper bound. The *P*-value of the Z-test for single proportion was 0.000.

### 3.2. HBsAg

The prevalence of currently infected individuals in the study population was 6% and they represent the HBV carriers with a low infectivity profile. The *P*-value of the Z-test for single proportion was 0.000.

### 3.3. Anti-HBs

Those who were vaccinated against HBV infection or infected with HBV and developed immunity counted for 37%. The *P*-value of the Z-test for single proportion was 0.007.

### 3.4. HBeAg

Out of the 27 currently infected individuals, three of them (9%) were considered as a high profile infected people. The *P*-value of the Z-test for single proportion was 0.000.

In conclusion, HBV was highly prevalent among HCWs in Public Teaching Hospitals in Khartoum State. The Z-test for single proportion showed that there was a significant difference between the actual prevalence and the expected rate. The obtained results were consistent with reported international statistics as recorded by WHO; Hamidi et al. in Iran; Teo and Lok in USA. and College of Physicians and Surgeons of Alberta, Bo-Moon Shin, Hyeon Mi Yoo, Ae Sook Lee, Sang Keun Park. Seroprevalence of Hepatitis B

Virus among Health Care Workers in Korea, Mahgoub, Candotti, El Ekiaby, Allain. Hepatitis B virus (HBV) infection and recombination between HBV genotypes D and E in Asymptomatic blood donors from Khartoum, Sudan (WHO/204, 2000; Hamidi et al., 2002; Teo and Lok, 2004; CPSA, 1994; Shin et al., 2006; Candotti et al., 2011).

Completion of vaccination during training in schools of medicine, dentistry, nursing, laboratory technology, and other allied health professions, before trainees have their first contact with patient's blood and body fluids is needed.

## References

- Mahgoub, Candotti, El Ekiaby, Allain, 2011. Hepatitis B virus (HBV) infection and recombination between HBV genotypes D and E in Asymptomatic blood donors from Khartoum, Sudan. *Journal of Clinical Microbiology* 49 (1), 298–306, Epub 2010 November 3.
- College of Physicians and Surgeons of Alberta (CPSA). Hepatitis B Virus Infection in Health Care Workers, CPSA Guideline, 1994. <<http://www.cpsa.ab.ca>>.
- Hamidi, B. et al., 2002. Sero-Epidemiological Survey of Hepatitis B Markers in National Iran Oil Company (Nioc) Health Care Workers in Tehran Prior To Mass Vaccination. <<http://www.sums.ac.ir/AIM/0031/hamidi0031.html>>.
- Hyams, K.C. et al., 1989. Epidemiology of hepatitis B in the Gezira region of Sudan. *American Journal of Tropical Medicine and Hygiene* 40 (2), 200–206, <<http://www.ncbi.nlm.nih.gov>>.
- Itoshima, T. et al., 1989. Hepatitis B virus markers in patients with schistosomiasis, liver cirrhosis and hepatocellular carcinoma in Khartoum, Sudan. *Acta Med Okayama* 43 (4), 241–244.
- Lavanchy, D., 2004. Hepatitis B virus epidemiology, disease burden, treatment, and current and emerging prevention and control measures. *Journal of Viral Hepatitis* 11 (2), 97–107, <<http://www.medscape.com/viewarticle/471470>>.
- McCarthy, M.C. et al., 1989. Hepatitis B and HIV in Sudan: a serosurvey for hepatitis B and human immunodeficiency virus antibodies among sexually active heterosexuals. *American Journal of Tropical Medicine and Hygiene* 41 (6), 726–731.
- McCarthy, M.C. et al., 1994. Hepatitis B and C in Juba, southern Sudan: results of a serosurvey. *Transactions Royal Society of Tropical Medicine and Hygiene* 88 (5), 534–536, <<http://www.ncbi.nlm.nih.gov>>.
- Shin, Bo-Moon, Yoo, Hyeon Mi, Lee, Ae Sook, Park, Sang Keun, 2006. Seroprevalence of hepatitis B virus among health care workers in Korea. *Journal of Korean Medical Science* 21, 58–6213.
- Teo, E.K., Lok, A. 2004. S Epidemiology, Transmission and Prevention of Hepatitis B Virus Infection. <<http://www.uptodate.com>>.
- The Massachusetts Department of Public Health, 2002. Facts about Hepatitis B Disease and Hepatitis B Vaccine. <<http://www.state.ma.us/dph/cdc/epiimm2.htm>>.
- WHO, 2002. Introducing Hepatitis B Vaccine Into National Immunization Services. <<http://www.who.int>>.
- WHO/204, 2000. Hepatitis B fact sheet. <<http://www.who.int>>.