

**SEROEPIDEMIOLOGICAL PROFILE AND RISK FACTORS FOR  
HEPATITIS B INFECTION IN HEALTH CARE WORKERS IN DIALYSIS  
UNITS.**

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**ABSTRACT**

The objective of this study was to determine the prevalence of serological markers of hepatitis B and risk factors in health care workers of dialysis units. An analytical descriptive transversal study was performed with 138 health professionals from six dialysis units of Recife city, Brazil. Blood samples were collected between March and July, 2007 and tested for the HBsAg markers (HBsAg, anti-HBs and total anti-HBc) using ELISA method of third generation. Two softwares were used for statistical analysis: the Epi Info (v. 6.04) for the univariate analysis and the Statistical Package for the Social Sciences- SPSS (v. 8.0) for multiple logistical regression. The prevalence of hepatitis B infections, determined by presence of the HBsAg and/or total anti-HBc markers in dialysis staff was 13%. Positivity rate for anti-HBs was 75.4%. However, 11.6% of them were susceptible to infection. In the univariate analysis the variables: length of employment in hemodialysis, quantity of individual protective equipment (IPEs), surgery and/or dentary-surgery antecedents and incomplete vaccination against HBV presented statistically significant association with HBV seropositivity. But, according the multivariate analysis, only length of employment in hemodialysis, quantity of individual protective equipment (IPEs) used and incomplete vaccination against HBV presented statistically significant association with HBV seropositivity. These results showed that dialysis units have been focused on reducing the occurrence of exposure to blood and body fluids. These strategies include reevaluating the kind of material used, demanding strict compliance for protection in risky occupational procedures, the use of gloves and other barriers and a follow-up with serological tests whenever there is a case of work-related injury with biological material, as well as mandatory vaccination after exposure.

**INTRODUCTION**

The hepatitis B infection is considered one of the most prevalent occupational infections acquired in hospital environment (Aziz et al. 2002, Vardas et al. 2002). After percutaneous exposition to materials with contaminated blood by hepatitis B virus (HBV), the risk of transmission among susceptible professionals from a source carrying HBV surface antigen (HBsAg+) is between 6 and 30% or up to 60% in cases where viral replication marker (HBeAg+) is present (Fonseca 2004). The HBV is approximately 100 fold more infectious than the human immunodeficiency virus (HIV) and 10 fold more infectious than the hepatitis C virus (HCV) (CDC 2003).

Health professionals represent one of the most important risk groups for HBV infections, which include: nursing staff, hemotherapeutics medical, doctors, endoscopist, dentist surgeons, laboratorist and staff of hemodialysis units (Fernandes et al. 1999). The risks for health professionals from hemodialysis units are associated to puncture of the arteriovenous fistula (Rosa 2008).

Positivity rates between 2.4% and 5.1% for HBsAg were observed in hemodialysis professionals (Petrosillo et al. 1995, Shakhgil'dian et al. 1994, Bussaleu et al. 1991). In Brazil, studies performed in Santa Catarina, Tocantins and Goiás States showed that the prevalence of HBV infection in these professionals based on the presence of the HBsAg antigen and total anti-HBc was 15%, 22% and 24% respectively (Carrilho et al. 2004, Luz et al. 2004, Lopes et al. 2001).

Transmission of HBV from health care workers to patient can be prevented first of all by vaccination of the dialysis staff professionals and by implementation of s-called universal precautions for infection control. Quantitative evaluation of anti-HBs after one or two month's vaccination will determine the seroconversion state (Ministério da Saúde 2004).

Considering that there are few studies about the HBV infection in dialysis staff professionals in Brazil, this work has as objective to determine the prevalence of serological markers of hepatitis B, vaccination situation as well as the possible risk factors associated to infection in six dialysis clinics from Recife, State of Pernambuco, Brazil.

## **MATERIAL AND METHODS**

### **Study population.**

A prospective, analytical and transversal study was performed on 138 health professionals working in six hemodialysis units from Recife city, Brazil between March and July, 2007. The software Statcal from Epiinfo version 6.04 was used for calculating the sample size with  $p=0.05$  and power of 80% and estimated prevalence of 22% (Luz et al. 2004) in health professionals, thus the minimum sample size was 135 individuals. Medical and nursing categories from both sex who keep direct contact with patients were included in the study. The research was approved by the Ethics Committee from the Health Sciences Center of the Universidade Federal de Pernambuco –UFPE– under the registration N° 271/06.

### **Data and samples collection.**

Data from professionals were obtained by a questionnaire with: age, sex, professional category, duration of work in hemodialysis, occupational accident, if any use of individual protective equipment (IPE), frequency and quantity of blood transfusion or hemoderivates, surgery or dentary-surgery antecedents, sharing of personal use cutting objects, use of preservative, tattoo and/or *piercing*, injection of drugs and HBV vaccination. 10mL of blood were collected intravenously, using the

*Vacutainer*<sup>®</sup> System and processed in the Virology Laboratory in the Keizo-Asami Immunopathology Laboratory (LIKA)/ UFPE.

**Serological tests.**

Detection of HBV markers was carried by ELISA method of third generation: Monolisa<sup>®</sup> HBsAg Plus, Monolisa<sup>®</sup> anti-HBc Plus and Monolisa<sup>®</sup> anti-HBs qualitative (*Bio-Rad Laboratories*), according to manufacturer's instructions. Positive samples for anti-HBs were quantified using the Cobas<sup>®</sup> (*Roche Diagnostics*). HBV positivity was considered when at least HBsAg and/or total anti-HBc marker was present in the serum sample analyzed.

**Statistical analysis.**

To evaluate the association of each variable to the effect (positivity for HBsAg and/or total anti-HBc markers), the univariate analysis was performed using the Epi Info software (version 6.04d). Multiple logistical regression was performed in the SPSS software (version 8.0) using the Forward Stepwise model. The entry orders in the model occurred from the univariate analysis significance where all variables associated with  $p < 0.200$  were included.

**RESULTS**

From the 138 health professionals of the six dialysis units studied, 78.3% were female; average age was 36 years (ranging from 22 to 55) and 82.6% belonged to the nursing staff category.

Prevalence of hepatitis B considering positive serological markers HBsAg and/or total anti-HBc was 13.0%. It is emphasized that 11.6% professionals presented no marker being considered susceptible to HBV infection. The anti-HBs, marker of vaccination response, was observed as only marker in 75% of professionals studied

(Table 1). The anti-HBs quantitative analysis showed that all the 120 professionals which were positive for this marker presented titers >10UI/L.

**Table 1.** Prevalence of serological markers in health care workers of six hemodialysis units from Recife, State Pernambuco, Brazil, March to July, 2007.

<b>Status</b>	<b>Hepatitis B markers</b>	<b>Reactive</b>	
		<b>n</b>	<b>%</b>
<b>HBV Immune</b>	<b>Anti-HBS</b>	<b>104/138</b>	<b>75.4</b>
<b>HBV infection</b>	<b>HBsAg</b>	<b>1/138</b>	<b>0.7</b>
	<b>HBsAg/anti-HBc total</b>	<b>1/138</b>	<b>0.7</b>
	<b>Anti-HBs/anti-HBc total</b>	<b>16/138</b>	<b>11.6</b>
<b>Susceptible</b>	<b>No markers</b>	<b>16/138</b>	<b>11.6</b>

The table 2 shows the distribution of variables: length of employment in hemodialysis, IPE's quantity, surgery and/or dentary-surgery antecedents and incomplete vaccination against HBV, which after the univariate analysis presented statistically significant association to the prevalence markers.

In the table 3 is presented the results the final logistical multiple regression model with the variables that showed significantly associated to the markers HBsAg and/or total anti-HBc : length of employment in hemodialysis higher than 10 years (OR=7.47), use of less than three IPEs (OR=7.44) and incomplete vaccination (OR=8.22).

**Table 2.** Risk factors associated with hepatitis B virus infection in health care workers in six units from Recife, PE, March to July, 2007.

Risk factors	n	%	HBsAg and/or total anti-HBc				OR <sup>2</sup> (CI 95%) <sup>3</sup>	P
			Pos	%	Neg	%		
<b>Gender</b>								
Female <sup>1</sup>	108	78.3	14	13.0	94	87.0	1	
Male	30	21.7	04	13.3	26	86.7	1.03 (0.26-3.77)	0.800
<b>Professional category</b>								
doctors	09	6.5	00	00	09	100		
nurses	15	10.9	00	00	15	100	---	<sup>4</sup>
nursing staff	114	82.6	18	15.8	96	84.2		0.113
<b>Age</b>								
< 40 years <sup>1</sup>	96	69.6	09	9.4	87	90.6	1	
≥ 40 years	42	30.4	09	21.4	33	78.6	2.64 (0.87-8.05)	0.096
<b>Length of employment in hemodialysis</b>								
0-5 years <sup>1</sup>	38	27.5	02	5.3	36	94.7	1	
6-10 years	36	26.1	01	2.8	35	97.2	0.51 (0.02-7.75)	0.961
>10 years	64	46.4	15	23.4	49	76.6	5.51 (1.09-37.31)	0.035 <sup>5</sup>
<b>Occupational accident</b>								
yes	88	63.8	13	14.8	75	85.2	1.56 (0.47-5.41)	0.591
No <sup>1</sup>	50	36.2	05	10.0	45	90.0	1	
<b>IPE use</b>								
yes <sup>1</sup>	126	91.3	16	12.7	110	87.3	1	
No	12	8.7	02	16.7	10	83.3	0.73 (0.13-5.29)	0.953
<b>IPE's frequency of use</b>								
always	111	80.4	15	13.5	96	86.5	1.25 (0.30-5.93)	0.988
sometimes <sup>1</sup>	27	19.6	3	11.1	24	88.9	1	

<b>IPE's number</b>								
< 3 IPEs	12	8.7	04	33.3	08	66.7	4.00 (0.87-17.54)	0.029 <sup>5</sup>
≥ 3 IPEs <sup>1</sup>	126	91.3	14	11.1	112	88.9	1	
<b>HBV vaccination</b>								
< 3 doses	20	14.5	07	35.0	13	65.0	5.24 (1.51-18.16)	0.005 <sup>5</sup>
≥ 3 doses <sup>1</sup>	118	85.5	11	9.3	107	90.7	1	
<b>Preservative use</b>								
always <sup>1</sup>	37	26.8	04	10.8	33	89.2	1	
sometimes or never	101	73.2	14	13.9	87	86.1	1.33 (0.37-5.18)	0.852
<b>Tattoo and/or piercing</b>								
yes	10	7.2	00	0	10	100		
no	128	92.8	18	14.1	110	85.9	---	0.432
<b>Surgery or dental treatment</b>								
<b>surgery</b>								
yes	97	70.3	17	17.5	80	82.5	8.50 (1.12-177.3)	0.033 <sup>5</sup>
no <sup>1</sup>	41	29.7	01	2.4	40	97.6	1	
<b>Blood transfusion or hemoderivates</b>								
yes	06	4.3	01	16.7	05	83.3	1.29 (0.20-8.18)	0.726
no <sup>1</sup>	132	95.7	17	12.9	115	87.1	1	
<b>Sharing of personal use cutting objects</b>								
yes	79	57.2	12	15.2	67	84.8	1.58 (0.51-5.11)	0.541
no <sup>1</sup>	59	42.8	06	10.2	53	89.8	1	

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<sup>1</sup>Reference group, <sup>2</sup>OR: Odds Ratio, <sup>3</sup>CI: confidence interval, <sup>4</sup>--- undefined OR, <sup>5</sup> $p \leq 0.05$

**Table 3.** Multiple logistical regression model of the association risk factors for HBV infection in health professionals in six dialysis units from Recife – PE, March to July, 2007.

Variables	OR <sup>2</sup> (CI 95%) <sup>3</sup>	<i>p</i>
<b>Length of employment in hemodialysis</b>		
0 – 10 years <sup>1</sup>	1.0	
> 10 years	7.47 (1.31 – 42.4)	0.023
<b>IPEs' number</b>		
≥ 3 EPIs <sup>1</sup>	1.0	-
< 3 EPIs	7.44 (1.29 – 42.6)	0.024
<b>HBV vaccination</b>		
≥ 3 doses <sup>1</sup>	1.0	-
< 3 doses	8.22 (2.07 – 32.6)	0.003

<sup>1</sup>Reference group. <sup>2</sup>OR: Odds Ratio. <sup>3</sup>CI: Confidence Interval

## DISCUSSION

The prevalence obtained in the study was lower in relation to other studies performed in different States of Brazil, such as Tocantins, Santa Catarina, Goiás, which showed prevalence between 15% and 23.4% (Carrilho et al. 2004, Lopes et al. 2001, Luz et al. 2004).

Positivity for HBsAg and total anti-HBc markers was only observed in the nursing staff showing that this is a highest risk professional category due to direct contact with patients and constant exposition to body fluids potentially contaminated by this virus. In fact, among health the professionals studied, the nursing staff constituted the most representative category (82.6). It may be related to the Collegiate Directory Resolution (CDR) number 154 that regulates the functioning of the dialysis services (Anvisa 2008).

The infection by the HBV in occupational accident is often well demonstrated and according to Ciorlia & Zanetta (2005), the risk is of 4.2 times in the health professionals. However, in the studied population there was no statistical significant association, even so 63.8% of professionals have reported occupational accident.

The exposition to the HBV is a risk factor and that is directly proportional to the length of employment in hemodialysis (Bussaleu et al. 1991, Lopes et al. 2001, Machado et al. 1990). In our data, this relation was evidenced, once those professionals with more than 10 years in this activity had presented 7.4 times more risk for infection.

However, Petry & Kupek (2006) demonstrated that length of employment and positive for HBV can not depend exclusively on occupational accidents. These authors reported that the percentage of non-responders to the immunization considerably increases after the 50 years old and in such a way, more they are displayed the virus.

In fact, the age with highest HBV positive among the health professionals studied was superior to the 40 years old. This result corroborated for other authors (Ciorlia & Zanetta 2005, Fernandes et al. 1999, Kondili et al. 2007).

The use of IPEs in the dialysis unit is fundamental to protect the health professional. In the dialysis units studied, 91.3% of the professionals had affirmed to

use three or more IPEs during their activities and of these 80.4% made use of the IPEs frequently.

On the other hand, professionals whom referred to make use of less than three IPEs presented 7.4 times more risk for hepatitis B when compared to those that always were protected. This result is similar to the studies of Lopes et al. (2001) that identified 14.6 times more risk of exposition to the HBV in professionals who did not use IPEs.

The complete vaccination (three doses) is recommended for all the workers who in its activities enter in frequent contact with patients, blood or biological fluids (Bonani & Bonaccorsi 2001). The antibodies response derived from the vaccine normally decline with time, but remain for at least 15 years after a complete series of vaccination and are reactivated, when necessary, by the immunological memory. For this reason, reinforcement doses are recommended in special risk groups, among them, health professionals (Coates et al. 2001).

The present research showed that 85.5% of professionals made the complete vaccination and the all positive anti-HBs had presented titers > 10 UI/L, being therefore duly immunized. These data are corroborated by Coates et al. (2001), showing that 92.2% to 94.5% of health professionals when vaccinated present titers of anti-HBs equal or superior to 10 UI/L.

On the other hand, it was observed a significant statistical association between incomplete vaccination and HBV positivity, representing a risk factor for infection. Professionals who received less than three doses of the vaccine presented 8.2 times more risk of exposition to the virus when compared with those that made the complete vaccination.

An interesting aspect was to demonstrate that 11.6% of the professionals of the study presented no serological marker for the HBV, being then susceptible to the

infection. Therefore, recognizing the non-responders group is important for interrupting the hepatitis B transmission.

This study showed that the dialysis units had taken preventive measures of control and prevention of the illness, in view of low the prevalence of hepatitis B markers. However, it is emphasized the need of periodical monitoring of serological markers once there are professionals susceptible to the infection.

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