

RISK FACTORS FOR HEPATITIS B CARRIER STATUS AMONG BLOOD DONORS OF THE NATIONAL BLOOD CENTER, THAI RED CROSS SOCIETY

Thassanee Nuchprayoon and Termsri Chumnijarakij

Department of Preventive and Social Medicine, Faculty of Medicine, Chulalongkorn University, Bangkok 10330, Thailand.

Abstract. A study of risk factors for hepatitis B carriers among voluntary blood donors of the National Blood Center, Thai Red Cross Society was carried out in a case-control study design during January 1989 to June 1990. Cases were 876 blood donors whose blood identified HBsAg at time of recruitment and continued positive for more than 6 months. Controls were 1,750 blood donors whose blood was free from HBsAg who came for blood donation at the same period as the cases. The ratio of cases : controls = 1 : 2. Self-administered questionnaires were constructed and pretested before using with both cases and controls.

The study revealed that the risk factors for hepatitis B among voluntary blood donors were age of less than 30 years old; low socioeconomic status (family income of less than 8,000 Baht/month); single status, especially males; male occupations of students, monks, nongovernment workers compared with government officials; female occupations of laborers, students, nongovernment workers and government officials compared with housewives.

Sharing of nail clippers, used blades and tooth brushes among family members are proved to be risk factors, especially among males. In addition, sharing of used blades in barber shops proved to be a risk among males while sharing of nail clippers in beauty salons, history of ear-piercing at department stores or history of caesarian section among females could not be shown to be risk factors.

Among blood donors who donated blood more than once in whom HBsAg was discovered in the most recent blood donation but was not found in the previous one, regardless of the interval between the last two donations, a history of accidents, having dental care or a history of sexual contact with casual friends or prostitutes were all the risk factors, but a history of receiving medical treatment by injection or blood drawn for biochemical laboratory tests did not convey an increased risk.

INTRODUCTION

Viral hepatitis B infection is one of the major public health problems in Thailand. The infection is of particular interest because of its transmissibility, chronicity and progression, in a proportion of patients, to chronic liver disease, cirrhosis and hepatocellular carcinoma. While most HBV infections are resolved, about 10% of infected persons become chronic carriers (Sherlock, 1987) who may remain healthy but can spread infection to their family members, friends, and public by sharing used personal belongings such as nail-clippers, blades etc, or by sexual contact. In an endemic area, infection is also transmitted from the mother to neonate perinatally, and the chance of transmission is greater with acute than with chronic maternal carriers.

As the disease is known to spread via the blood route, the National Blood Center in 1972 started screening every unit of donated blood for HBsAg by immunoelectrophoresis. The method was changed to RPHA since 1984, with reconfirmation of this result by the more sensitive ELISA or RIA at the time the donors come to the clinic at the National Blood Center. In spite of using disposable blood collection sets for all blood donors, hearsay that it is possible to get infections by donating blood is still prevalent. At the same time other conditions that could serve as a means of infection are overlooked. However, an abundant quantity of blood is still needed for most operations and especially for severe accident cases which, according to the statistical report of Thailand in 1988, are the third cause of death (Ministry of Public Health, 1988). In this connection, the

HEPATITIS RISK IN BLOOD DONORS

National Blood Center has to collect more blood by persuading people from all parts of the country to be voluntary blood donors. As a result, newly diagnosed HBV carriers are disclosed. By using a case-control study design, the risk factors for HBV carriers can be demonstrated.

In order to control hepatitis B infection, all HBV carriers should be instructed how to avoid spreading infection to others around them and to the general public; HBV markers as well as VDRL should be checked before marriage and vaccination should be given to all HBsAg negative women. Identification of risk factors for HBV carriers will help to demonstrate the high risk groups requiring serological tests and health education. It also helps the Center to choose the low risk groups as voluntary blood donors.

MATERIALS AND METHODS

Populations studied were all blood donors who came for blood donation either at the National Blood Center or at mobile units, both in Bangkok and outside of Bangkok during January 1989 to July 1990.

Cases were all voluntary blood donors whose blood was first discovered to be HBsAg positive in routine blood screening by RPHA during the study period and came to the clinic at the National Blood Center with a letter of advice to have the diagnosis reconfirmed by ELISA immediately and again 6 months later to assess persistence of HBsAg. Controls were mostly voluntary blood donors at the National Blood Center, whose blood was shown to be free from HBsAg in routine blood screening. The selection of controls was done each week during the same study period by systematic random sampling, using double numbers of cases in each week as sampling fractions.

The sample size (Schesselmann, 1982) was calculated by assuming that the least relative risk of the related factors was 2, using the confidence level at $\alpha = 0.05$ and $\beta = 0.1$. The result of the calculation was 690 cases, with cases to controls = 1 : 2.

The criteria of being voluntary blood donors, set forth by the National Blood Center, Thai Red Cross Society, are as follows :

1. Age : 17-60 years old.
2. Weight : 45 kg and up.
3. No previous history of hepatitis/icteric skin or sclera.
4. No history of malarial illness within the past 3 years, asthma and other allergic conditions. Not having venereal diseases, yaws, chronic cough, hemoptysis, bleeding tendency, fainting spells, chronic skin disease, heart disease, kidney disease, diabetes mellitus.
5. Not in a condition of acute weight loss.
6. Not a homosexual.
7. No history of drug addiction by injection.
8. Not less than 6 months after operation or delivery (termination of pregnancy).
9. In a healthy condition, sound sleep at least 5 hours the night before.
10. The interval between blood donation should not less than 3 months.

A self-administered questionnaire was constructed and pretested before use. This required information on general characteristics of population, numbers of previous blood donations, place of blood donation on the last occasion, the interval between the last 2 donations among those who donated blood more than once, history of all probable risk factors, history of sharing nail-clippers, used blades and toothbrushes among family members, etc. These forms were distributed to all cases and controls, to be completed as well as possible before being returned to the research team. If important data were missing, they would be completed in the next visit.

The data were analysed by microcomputer using SPSS/PC⁺ program and by using descriptive statistics, RR and 95% CIRR to reveal all risk factors for HBV carriers.

The limitation of this study was that controls were mostly selected from blood donors at the Center. This group of donors are mostly regular blood donors whose mean age ($\bar{X} \pm SD = 32.7 \pm 9.2$) was higher than that of cases ($\bar{X} \pm SD = 28.2 \pm 9.7$) with statistical significance ($p < 0.01$).

RESULTS

A total number of 876 newly diagnosed hepatitis B carriers (cases) were recruited from blood donors who donated blood either at the Center or

at mobile units during January 1989 to June 1990, 1,750 controls were selected from blood donors whose blood was negative for HBsAg, mostly from the National Blood Center, by systematic random sampling.

Both cases and controls were quite similar in nationality (Thai), in religion (Buddhism), and being residents of Bangkok. More than 70% of both groups were male. Cases as well as controls were in active sexual life. The difference between cases and controls were marital status which showed that 63% and 49% of cases and controls, respectively, were single. In addition, most of the cases were blood donors giving their first donation (52.5%) while among controls this was only 14% (Table 1). It was also shown (Table 2) that most cases were from mobile units in Bangkok (48%) but most controls were from the Center (78.0%).

Table 3 shows that blood donated by donors at

mobile units in Bangkok had a much higher risk of being positive for HBsAg (RR 30.2) than blood donated at mobile units outside Bangkok (RR 19.3), compared to blood donated at the Center. Also blood from those who never donated before was shown to have a greater risk (RR 167.7) than those who donated once (RR = 11.4) in comparison to donors who donated more than twice before. An interval between the last two donations of more than 12 months carried a 20 times higher risk of detecting of HBsAg than where the interval was less than 12 months.

Biological and environmental risk factors for hepatitis B carrier status are shown in Table 4. Age 31-40 appeared to have a similar risk of HBV carrier status as did age > 40, but age of 20 or less had a higher risk (RR = 5.8) of developing HBV carrier status than did age 21-30 (RR = 1.56), compared to the age group over 40. Females appeared to have a risk of developing HBV carrier of 1.35

Table 1

Some selective descriptive characteristics of cases (hepatitis B carrier) and controls.

Characteristics	Cases (n = 876)	Controls (n = 1,750)
Age (years) : $\bar{X} \pm SD$	28.2 \pm 9.7	32.7 \pm 9.2
Sex (%) : Male	71.0	76.7
Nationality (%) : Thai	100.0	99.7
Religion (%) : Buddhism	97.7	95.9
Residence (%) : Bangkok	76.5	76.5
First blood donation (%)	52.5	14.1
Age of first donation : $\bar{X} \pm SD$	25.6 \pm 8.6	29.1 \pm 8.4
Marital status (%) : single	63.0	49.0

Table 2

Numbers (%) of blood donors by the place of the last blood donation.

Place	Cases	Controls	Total
The National Blood Center	44 (20.6)	1,279 (86.5)	1,323 (78)
Mobile, Bangkok	103 (48.1)	99 (6.7)	202 (12)
Out of Bangkok	67 (31.3)	101 (6.8)	168 (10)

HEPATITIS RISK IN BLOOD DONORS

Table 3

Numbers of blood donation, places and interval between the last 2 blood donations and the relative risks of being positive for HBsAg.

	Cases	Controls	RR	95 (%) CIRR
1. Numbers of blood donations :				
Never before	163	6	167.7	111.5 - 252.2*
Ever : 1	460	250	11.4	9.4 - 13.8*
> 2	218	1,346	1.0	-
2. Place of collection of the last blood donation :				
The National Blood Center	44	1,279	1.0	-
Mobile, Bangkok	103	99	30.2	22.1 - 41.27*
Out of Bangkok	67	101	19.3	13.7 - 27.2*
3. Interval between the last two blood donations :				
< 12 months	75	1,209	1.0	-
> 12 months	81	65	20.1	14.6 - 27.8*

* Statistical significance at $p = 0.05$

times greater than males. The lesser the family income per month, the greater the risk of developing HBV carrier status (Table 5, RR of 2.4, 2.3 and 1.7 in groups of no income, < 5,000, 5,001-8,000 Bahts per months, respectively). The risk of developing HBV carrier status for single persons (of both sexes) was 1.68 times that for those who were ever married. But when sex was considered, there was only an association between single males and the development of HBV carrier status. The occupations among males which showed a risk of being HBV carrier (Table 5) in order of the higher risk first, relative to 1.0 of government officials, were as follows : students (RR = 4.5), monks (RR = 4.1) and nongovernment workers (RR = 1.4), while among females, compared to housewives, the risk order was laborers (RR = 8.2), students (RR = 3.51), nongovernment workers (RR = 2.91) and government officials (RR = 2.85), respectively.

For personal behavior of sharing personal belongings (used blades, nail-clippers, tooth-brushes) among family members or closed friends, there was a statistically significant association between those who had a history of sharing per-

sonal belongings and the development of HBV carrier status (Table 6). The risk of developing HBV carrier status for those who had a history of sharing used blades in barber shops was 2.5 times that of those who never had that history. However, female blood donors who had a history of using sharp equipment in public places such as used nail-clippers in beauty salons, having caesarian sections or a history of ear-piercing at department stores did not show an increased risk with statistical significance of developing HBV carrier status, compared to those females with no history (Table 6).

Among blood donors whose blood in the last donation had showed HBsAg but had not been positive in the one prior to the last, a history of having sexual contacts with casual friends or prostitutes among males, accidents with laceration, and receiving treatment in dental clinics between the last 2 donations, regardless of the interval between them, conveyed 2.96, 2.80 and 2.02 the risk of developing HBV carrier status, respectively, compared to those without a history of those incidental events (Table 7). But a history of receiving medical treatment by injection or blood drawn

Table 4

Biological and environmental risk factors for hepatitis B carriers.

	Cases	Controls	RR	95 (%) CIRR
1. Age (years)				
< 20	231	124	5.89	4.37 - 7.9*
21 - 30	337	680	1.56	1.20 - 2.0*
31 - 40	190	602	0.99	0.98 - 1.0
41 - 60	109	344	1.00	—
2. Sex : Female	254	414	1.35	1.12 - 1.62*
Male	622	1,364	1.00	—
3. Family income (Baht per month)				
No income	37	67	2.44	1.55 - 3.84*
< 5,000	371	723	2.26	1.75 - 2.34*
5,001 - 8,000	114	294	1.71	1.23 - 2.34*
> 8,000	90	397	1.00	—
4. Marital status by sex				
a) Male : Single	398	618	2.10	1.72 - 2.57*
Ever married	213	684	1.00	—
b) Female : single	146	242	0.94	0.70 - 1.27
Ever married	107	166	1.00	—
c) Total : Single	544	860	1.68	1.42 - 1.94*
Ever married	320	850	1.00	—

* Statistical significance at $p = 0.05$

for biochemical laboratory test did not show any increased risk.

DISCUSSION

This study showed that among donors who donated blood for the first time, the risk of finding HBsAg in the routine blood screening for HBsAg was quite high and it also showed that more than half the donors whose blood contained HBsAg were new blood donors, and were from mobile units in Bangkok. Therefore the blood donated by new donors, particularly from mobile units, both in Bangkok and outside of Bangkok, should be carefully inspected by the most sensitive and the most reliable tests to rule out HBsAg, before being distributed for use. The reason for this difference might be because mobile units are more easily accessible to those who had in their

mind some suspicion of having become infected. This awareness might also be relevant to donors who donated blood more than twice where the interval between donations was more than 12 months which showed in this study a risk of detecting HBsAg 20 times that of those whose interval between the last two donations was less than one year.

Single status, particularly male, appeared to have higher risk due to an increased chance of getting infection from sexual exposure. On the contrary single females had an equal risk of detecting HBsAg in their blood compared to ever-married females which could be due to the Thai cultural characteristic that single females should not have sex before marriage. The chance of females getting infection by sexual contact mostly comes from their spouses.

In this study, females carried a risk of detecting

HEPATITIS RISK IN BLOOD DONORS

Table 5
Occupational risk factors for HBV carrier by sex.

	Cases	Controls	RR	95 (%) CIRR
Occupation by sex				
A) Male : government officials	131	446	1.00	—
nongovernment workers	173	429	1.40	1.06 - 1.85*
laborers	18	38	1.61	0.90 - 2.90
merchants	47	166	0.96	0.60 - 1.46
students	187	143	4.50	3.40 - 5.99*
monks	31	26	4.10	2.42 - 6.96*
B) Female : housewives	20	77	1.00	—
government officials	37	50	2.85	1.50 - 5.40*
nongovernment workers	80	106	2.91	1.66 - 5.09*
laborers	17	8	8.20	3.34 - 20.12*
merchants	21	60	1.35	0.67 - 2.73
students	61	67	3.51	1.90 - 6.32*

* Statistical significance at p = 0.05

HBsAg 1.4 times that of males and approximately only 30% of donors were females. From other studies (Nuchprayoon *et al*, 1990; Kiatsevi, 1989), the prevalence of HBV carriers was 3.4 times higher in males than in females. Therefore female blood donors in this study might belong to a higher risk group whose husbands were informed that they had HBV infection and this knowledge stimulated them to donate blood at the mobile units.

Regarding occupations at risk of leading to HBV carrier status, it was found that among male donors, students had the highest risk, followed by monks and nongovernment workers, compared to government officials as the reference group. Among female donors, compared to housewives, laborers came first, followed by students, nongovernment workers and government officials. This finding suggest that female laborers might change sexual partners quite often. People staying together in big groups such as laborers, monks, students, unaware of the route of HBV transmission, may tend to share used personal belongings (nail-clippers, used blades, toothbrushes) which can cause the spread of infection. It was also shown in this study that a history of sharing those

personal belongings among family members or close friends carried a higher risk of developing HBV than in those without such a history.

There is a statistically significant association between sharing of used blades in barber shops and being HBV carriers among males in this study, while it could not be demonstrated that sharing of nail-clippers in beauty salons among females was a risk factor. This might be due to the fact that the barber shop is a place where people come from all walks of life, different in age, socio-economic status, education, etc, to use its service. It was also shown in this study that the lesser the family income, the greater is the risk of being an HBV carrier. Thus the spread of HBV infection among those who shared used blades in barber shops is quite possible, whereas females who came to beauty salons for manicure might be tend to.

Receiving medical treatment by injection as well as caesarian section or having blood drawn for laboratory tests were not the risk factors for HBV carrier status, but a history of accident with laceration or receiving treatment in dental clinics showed a positive association with HBV carrier status which could be the same reasons which

Table 6
Personal behavior risk factors for HBV carriers.

	Cases	Controls	RR	95 (%) CIRR
A. Sharing of personal belongings among family's members or close friends				
1) Nail clippers : Never	40	238	1.00	—
Ever	634	1,342	2.80	2.00 - 3.9*
2) Used blades : Never	136	829	1.00	—
Ever	535	718	4.50	3.84 - 5.27*
3) Toothbrushes : Never	456	1,218	1.00	—
Ever	212	286	1.98	1.60 - 2.43*
B. Sharing of used sharp equipment in a public place				
a) Males in barber shop : Sharing of used blades				
Never	34	184	1.00	—
Ever	470	1,023	2.50	1.72 - 3.23*
b) Females				
1. Beauty salons-used nail clippers				
Never	91	181	1.00	—
Ever	71	171	0.83	0.58 - 5.07
2. History of caesarian section				
Never	41	219	1.00	—
Ever	9	22	2.20	0.95 - 1.19
3. History of having ear-piercing at department stores				
Never	84	196	1.00	—
Ever	70	166	0.98	0.96 - 0.99

* Statistical significance at $p = 0.05$

have been suggested to explain the risks in the case of sharing used blades in barber shops. All dentists should have vaccination against HBV infection and should be aware of possible means of transmission from patient to patient via the equipment they use.

It is proposed that the target population for blood donation should be aimed at government officials as well as merchants instead of aiming at students, monks or laborers. Health education should be emphasized to all high risk groups such as students, monks and laborers. HBV carriers themselves should report to doctors and dentists their HBV status to reduce transmission risks.

In conclusion, this study showed that new voluntary blood donors have a higher risk of detecting HBsAg in their blood than repeat donors. The former were mostly those who donated blood

at the mobile units. Blood donors whose the interval between the last 2 donations was more than 12 months also have higher risk regarding HBV carrier status.

The risk factors for HBV carrier among blood donors shown in this study are as follows :

1. Age of less than 30 years old.
2. Single status, especially males.
3. Low family income (< 8,000 Baht per month).
4. Certain occupation groups : among males these are students, monks, nongovernment workers, and among females they are laborers, students, nongovernment workers and government officials.
5. Intrafamilial sharing of used personal belongings, such as nail-clippers, blades, toothbrushes.

HEPATITIS RISK IN BLOOD DONORS

Table 7

Incidental events between the last 2 blood donations among donors who gave more than 1 donation.

History of	Cases	Controls	RR	95 (%) CI RR
1. Receiving medical treatment by injection :				
Never	176	1,198	1.00	—
Ever	22	121	1.24	0.76 - 2.01
2. Accidents with lacerations				
Never	170	1,236	1.00	—
Ever	29	76	2.80	1.79 - 4.37*
3. Blood drawn for biochemical lab tests				
Never	178	1,175	1.00	—
Ever	21	142	0.98	0.97 - 1.0
4. Treatment in dental clinics				
Never	121	1,025	1.00	—
Ever	80	334	2.03	1.5 - 2.75*
5. Sexual contacts with casual friends or prostitutes among males				
Never	120	1,065	1.00	—
Ever	82	246	2.96	2.19 - 4.0*

* Statistical significance at $p = 0.05$

6. Sharing of used blades in barber shops
7. History of sexual contacts with casual friends or prostitutes.
8. History of accidents with laceration.
9. History of receiving dental care.

Red Cross Society for laboratory work and assistance.

ACKNOWLEDGEMENTS

We are extremely grateful to Professor Dr Chaivej Nuchprayoon, Director of the National Blood Center, Thai Red Cross Society who permitted and gives administrative support to this study. We are also grateful to Associate Professor Dr Paiboon Loasoonthorn, Head, Department of Preventive and Social Medicine, Faculty of Medicine for giving us the opportunity to study this subject. Special thanks are also expressed to Dr Rachanee O'Charoen and the Staff of the Reference Laboratory in Cooperation with the WHO Section, the National Blood Center, Thai

REFERENCES

- Kiatsevi F. Prevalence of markers of hepatitis-B virus infection in hospital personnel. *Bull Dept Med Serv* 1989; 14 : 835-51.
- Ministry of Public Health. Public health statistics 1988. Division of Health Statistics, Office of the Permanent Secretary 1988; 81 pp.
- Nuchprayoon C, O'Charoen R, *et al*. Prevalence study for hepatitis-B in various groups of employees, Bangkok. *Chula Med J* 1990; 34 : 277-84.
- Schlesselman JJ. Case Control Studies : Design, Conduct, Analysis. New York : Oxford University Press 1982; pp. 145-6.
- Sherlock S. The natural history of hepatitis-B. *Postgrad Med J* 1987; 63 (suppl 2) : 7-11.