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Hepatitis B Virus Infection Rate among Koreans†

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= Abstract =**To explore the overall infection state of Hepatitis B virus(HBV) in Korea during the 1980's, the standard values(weighted mean values) of infection rate(IR), the acute infection rate(AIR), and the chronic carrier rate(CCR) of HBV were estimated through summerizing the serological data from previous articles. The data used in this analysis include some cross sectional and a few follow-up studies, and were limited to those tested by the methods of radio immunoassay(RIA), reverse passive hemagglutiuation(RPHA), passive hemagglutination(PHA), or enzyme immunoassay(EIA) in order to maximize the validity. Using the sensitivity and specificity of each test method, we corrected the serological positivities from all data as if they were tested by RIA only. The age and sex specific IRs, AIRs, and CCRs of HBV were estimated, and the age adjusted rate for each sex was also estimated on the basis of the age structure of the 1985 population census. The IRs for men and women are 61.3% and 52.8%, the AIRs are 3.3% and 2.9%, and the CCRs are 4.7% and 3.3%, respectively.**

Key Words: *Hepatitis B Virus, Infection rate, Chronic carrier rate, HBsAg positive rate, Korean*

INTRODUCTION

Hepatitis B forms over 60% of acute hepatitis in Korea (Kim 1988; Lee *et al.* 1990), and slightly over 85% of chronic liver diseases such as chronic hepatitis and liver cirrhosis, are associated with the hepatitis B virus (HBV) (Kim 1988; Lee *et al.* 1992). The population attributable risk of HBV for primary liver cancer is reported to be as high as 70% (Ahn *et al.* 1990). Therefore, the scale and importance of Hepatis B cannot be over-emphasized, especially in Korea.

As for now, HBsAg positive rate has usually been estimated (to figure out the infection state of hepatitis B), but two other rates are also to be clarified. One of them is the infection rate(IR), i. e. the proportion of persons who have been infected by HBV,or on the contrary, the susceptible rate(SR) which is the proportion of people who have never been infected by HBV. The other one is the acute infection rate(AIR), that is, the frequency or velocity of infection by HBV. HBsAg positives are consisted of HBsAg chronic carriers and recently infected persons, and HBV infected persons, the numerator of IR, include not only HBsAg positives but anti-HBs positives and anti-HBc positives. Therefore, HBsAg positive rate(PR) can not give any idea in terms of of the dynamics in HBV infection.

If we want to know the rates mentioned

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above, we need to have summary estimates of anti-HBs and anti-HBc positive rates which can be obtained either from a cross sectional or a longitudinal study, and the CCR and AIR which can only be obtained from a longitudinal follow-up study. Most of the domestic research, however, is done in cross sectional scheme measuring only HBsAg positivity at a certain point of time.

What is the age specific and gender specific infection rate? How many chronic carriers of HBsAg are there? Or how often are new infections happening? Is there any chronological variation in the infection state? These are the most essential questions for people who want to control this disease.

In this paper, we review several articles dealing with serological data for HBV infection published after 1980. Among them, articles with data measured by so-called third generation test methods are selected for the estimation of the mean values of IR, AIR, and CCR to figure out the state and the force of HBV infection.

MATERIALS AND METHODS

1. Terminology

We defined some key words as follows;

1) *HBV infected person* is someone who has showed a positive response to HBsAg, anti-HBs or anti-HBc at a certain point of time. The proportion of HBV infected persons among the general population is defined as the IR which can be interpreted as the cumulative incidence of HBV infection in the population.

2) *HBsAg chronic carrier* is someone who has carried HBsAg for more than six months (i. e. marker positive to two or more consecutive serological tests which were done more than six months apart), and has had no liver diseases clinically or serologically. In that sense, we do not know their number unless we have had a result from a longitudinal study followed up for at least six months. We estimate the CCR of HBsAg using the chronic carrier proportion among HBsAg positives calculated from some longitudinal studies. (Park 1989; Choi *et al.* 1990; Koo *et al.* 1984; Yoon *et al.* 1987; Lee *et al.* 1984; Lee *et al.* 1987; Lee *et al.* 1988)

3) *HBV acutely infected person* is someone who has had HBsAg for less than six months. The number can be easily identified by subtracting chronic carriers from HBsAg positives. AIR is defined as the proportion of HBV acutely infected persons among the general population. AIR implies the frequency of the HBV infection (or propagation) occurring within six months.

4) *HBV susceptibles* are people who were negative for all three serological markers of HBsAg, anti-HBs and anti-HBc, or who had never been infected by HBV until the time of the test. They are the target population of new HBV infection, which forms the numerator of the SR. It is possible that an HBV infected person can also be re-infected or super-infected by HBV, but we assume people who had never been infected can only be susceptible to HBV because we can only barely know if new infections happened among already infected persons, by serological marker tests.

2. Materials and Methods

1) *Selection of articles to be used for estimation of age-specific, sex-specific mean values*

Among the articles on the subject of HBV infection reported after 1980, we excluded papers in which serological markers were tested by the methods except RPHA or PHA, EIA, or RIA. The data in the selected articles must have been collected in age and sex specific way and the age groups should have been devided on the basis of WHO age classification with ten years interval at most (0-9, 10-19, 20-29, etc.). Exceptions were the articles which were selected to give the general rates among neonates and their mothers (Koo *et al.* 1984; Lee *et al.* 1984; Lee *et al.* 1987; Yoon *et al.* 1987; Lee 1988). If the test population in an article obviously did not represent the general population (for example, orphans, prostitutes, patients having specific diseases, etc), the article was also excluded. Table 1

Table 1. Serological studies on HBV used in this analysis

No	First Author	Year reported	Subject size (male/female)	Range of age (years)	Observation type	Study area	Test method
1	Jun GH	1983	474/1,152	8-44	cross-sectional	Kyung-buk	RPHA
2	Ro SK	1983	403/ -	20-59	"	Kangwon	"
3	Kim JJ	1984b	4,805/ -	20 and over	"	Whole country	"
4	Koo JJ	1984	380/380@		longitudinal	Seoul	"
5	Lee SG	1984	1,506/ 74@		"	"	RIA
6	Kiel BD	1985	4,175/ 369	"	"	?	"
7	Kim YS	1985	502/ 513	whole range	both	"	"
8	Lee SH	1985	1,671/ 808	20 and over	cross-sectional	"	RPHA
9	Oh HC	1985	1,287/1,343	19 and over	"	Seoul	"
10	Choi BY	1986	219/ 196	6-17	longitudinal	Kyunggi	"
11	Kim DJ	1986a	256/ 218	6-17	"	Chun-buk	"
12	Nam JW	1986	3,461/ 664	18-20	"	Seoul	"
13	Sohn SJ	1986	2,127/ 722	9-78	"	Chung-nam	"
14	Park JH	1986	0/ 604	whole range	cross-sectional	Taegu	RIA
15	Kim IS	1987	415/ 817	whole range	"	Kyunggi	EIA
16	Lee BW	1987	1,486/ 67@		cross-sectional	Chun-buk	RPHA
17	Park JH	1987b	312/ 73	20-24	"	Kyung-buk	RIA
18	Yoon K	1987	763/ 22@		"	Seoul	RIA
19	Lee SY	1988	4,952/ 168@		"	Chun-nam	"
20	Yoo KY	1988	626/ 116	20 and over	"	Seoul	"
21	Park BJ	1989	380/ -	20 and over	"	Seoul	RIA
22	Shin HC	1989	4,347/ -	30 and over	longitudinal	Whole C	EIA
23	Choi BY	1990	335/ 406	2-85	cross-sectional	Kyunggi	"
24	Choi BY	1991	135/ 179	2-85	longitudinal	"	"

@ : measured in mothers and their new born babies

shows the list and methodological characteristics of the papers used in the estimation of mean values.

2) *Correction of test results according to the test methods*

Different test methods have different validity. Therefore, to summarize the values of all data from different articles, we have to correct the different test results as if they were tested by the same method. As RIA is considered to be the most acurate technique, results from RPHA, PHA, and EIA were converted to those of RIA. The correction formula was derived from the sensitivity and specificity of PHA and RPHA relative to RIA(Table 2).

From the Table 2.

(1) r (HBsAg positive rate by RPHA) can be converted into r'(HBsAg positive rate by RIA) by

Table 2. The sensitivities and specificities of test methods

Test Method	Relative sensitivity to RIA	Relative specificity to RIA	References (1st author)
RPHA (HBsAg detection)	97.7%	99.8%	Kim 1984a
PHA(anti-HBs detection)	84.6%	88.8%	Park 1987a
EIA(HBsAg and anti-HBsAg)	100.0%	88.9%	Bom 1984

the following calculation:

$$r' = \frac{[.998\ r - .002\ (1-r)]}{(.997 + .998 - 1.0)}$$

(2) p (anti-HBs positive rate by PHA) can be converted into p'(anti-HBs positive by RIA) by

$$p' = \frac{[.888\ p - .112\ (1-p)]}{(.888 + .846 - 1.0)}$$

(3) the EIA method has 100% sensitivity, so using positive predictability of 94. 1% (Bom and Kim 1984), p or r can be easily converted into p' or r' by following formula:

$$p'\ (\text{or } r') = .941\ p\ (\text{or } r)$$

3) *Estimation of the mean value of age-specific, sex-specific infection rates and susceptible rates*

In order to calculate the summary estimates of IR and SR, we need to know the number of people who have any of the three markers(HBsAg, anti-HBc, anti-HBs) at a certain potint of time. Since they had not often been tested simultaneously in most of the articles, we could find only three articles in which all the three markers were tested (Kim *et al.* 1985; Yoo *et al.* 1986; Choi *et al.* 1990. The weighted average of age-specific, sex-specific IRs and SRs were estimated using the data from these three articles. (Table 3)

4) *Estimation of HBsAg chronic carrier rates and acute infection rates*

As we have mentioned in the previous section, HBsAg positives can be divided into chronic carriers and acutely infected persons. Data for HBsAg PRs are abundent. So, if we have the numbers of chronic carrier fraction

Table 3. Estimation of mean value of the HBV infection rate among Koreans

Reference+		7		20		23		Weighted Mean	
	Age	N#	IR(%)@	N##	IR(%)	N###	IR(%)	N++	IR(%)
	0- 9	44	29.5					44	29.5
M	10-19	91	45.1					91	45.1
A	20-29	49	63.3	129	77.5	31	67	209	72.6
L	30-39	39	64.1	255	82.4	34	57	328	77.5
E	40-49	47	80.9	159	88.7	44	80	250	85.7
	50-59	23	82.6	81	95.1	54	80	158	88.1
	60-	2	100.0			54	76	56	76.9
total									61.3*
F	0- 9	23	21.7					23	21.7
E	10-19	87	42.5					87	42.5
M	20-29	51	60.8	64	59.4	23	55	138	59.2
A	30-39	65	63.1	27	63.0	45	52	137	59.4
L	40-49	64	82.8	8	100.0	41	60	113	75.7
E	50-59	11	72.7	3	66.7	73	73	87	72.7
	60-	3	33.3			47	75	50	72.5
total									52.8**

+: References are represented in numbers assigned in Table 1.

#, ##, ###: Subject numbers in each articles. In the article 23(Choi et al. 1990), IRs were reported by the authors without decimal points.

++: Combined subject numbers from all three articles

@ : Infection Rate

*, **: the summary estimate in reference to the age structure of 1985 population census

Table 4. Estimation of the mean value of the HBsAg positive rates among Koreans

	Male			Female		
Age	N**	PR#	contributing articles*	N	PR	ontributing articles
at birth	9087	1.10	4, 5, 16, 18, 19	9087	1.1	4, 5, 16, 18, 19
0- 9	199	7.50	1, 7, 11	163	6.73	1, 7, 11
10-19	4220	7.14	1, 7, 11, 12	1332	5.80	1, 7, 11, 12
20-29	5078	9.11	2, 6, 7, 8, 13, 14, 20	920	5.11	6, 7, 8, 13, 14, 20
30-39	7635	9.13	2, 3, 6, 7, 8, 13, 20, 2	528	7.05	6, 7, 8, 13, 20
40-49	3667	7.96	2, 6, 7, 8, 13, 20, 22	510	8.04	6, 7, 8, 13
50-59	742	7.81	2, 6, 7, 8, 13, 20	237	7.62	6, 7, 8, 13, 20
60-	221	6.25	7, 8, 13, 15	134	3.44	7, 8, 13, 15
Total@		7.98			6.19	

**: Combined Subject numbers from all contributing articles

#: HBsAg Positive Rate in %. These are to be used to calculate CCRs by multiplying PRs by chronic carrier fractions of them in each age-sex group.

*: Articles are represented in numbers assigned in Table 1.

@: The summary estimate in referent to the age structure of 1985 population census

among HBsAg positives, we can easily calculate the CCR by multiplying chronic carrier fraction by HBsAg PRs in each age group (Table 4). We assumed that the chronic carrier fraction was influenced by age and sex, so estimated the CCR in each age and sex specific stratum. The specific calculations are as follows :

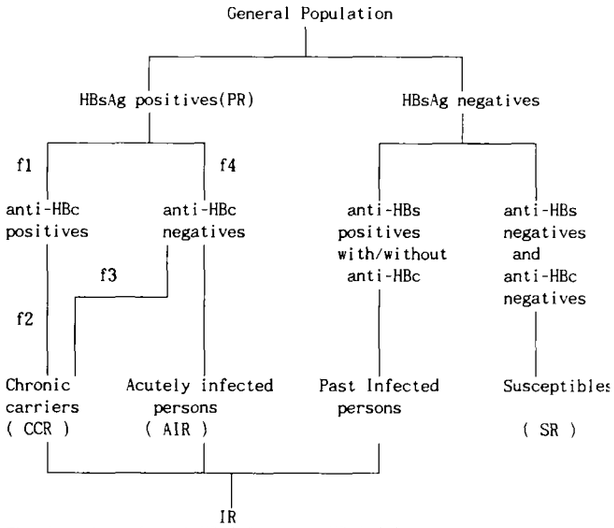
(1) Chronic carrier fraction in men aged 20 or more

Park (1989) followed healthy men of age 20 or more for 24months and found that 65.7% of HBsAg positives who did not had have any clinical symptoms became chronic carriers at the end of the study. This number did not significantly vary among different age groups. Based on this report, we can say that 65.7% of HBsAg positives are chronic carriers who will carry their antigenecity for more than six months, and the rest of them(34.3%) are acutely infected persons whose antigenecity will be transient.

(2) Chronic carrier fraction in women aged 20 or more

There is no longitudinal follow-up study for CCR in adult women as of yet. So we have had to borrow some information from a study which was done on men. At least, we can say that people who carry both HBsAg and anti HBc will have different rate of becoming chronic carriers from people who carry HBsAg only (Fig. 1). Park (1989) reported that 72% of healthy men who had both HBsAg and anti-HBc became chronic carriers(f2), whereas 25% of the men who had only HBsAg did(f3). According to Choi *et al.* (1990) and Yoo *et al* (1988), 66.5% (This number is the weighted average of the two papers) of HBsAg positive adult women had concomittent anti-HBc(f1). These numbers inferred that .563 (= .665 × .72 + .335 × .25) can be the chronic carrier fraction in anti-Hbs positive women if we ignore the rate variation among age groups.

(3) Chronic carrier fraction in children aged 19 or less



f1 : The fraction of anti-HBc(+)s among HBsAg(+)
f2 : The fraction of anti-HBc(-)s among HBsAg(+)
f3 : The fraction of chronic carriers among HBsAg(+) with anti-HBc
f4 : The fraction of chronic carriers among HBsAg(+) without anti-HBc
PR : HBsAg Positive Rate
CCR : Chronic Carrier Rate
CCR = PR x chronic carrier fractions among HBsAg positives
= PR x (f1 x f2 + f4 x f3)
AIR : Acute Infection Rate
SR : Susceptible Rate
IR : Infection Rate

Fig. 1. Diagram of HBV infection.

The serological characteristics of children were far from the adult rates but they showed little difference between male and female. (Choi *et al.* 1991). The proportion of anti-HBc positives among HBsAg positive children was 46.8%(f1) which was lower than in adult women (66.5%). Thereby the fraction of chronic carriers among HBsAg positives in children (male and female) can be .47 (=.468×.72+.532×.25), and the fraction of acutely infected persons can be 53%.

(4) The perinatal infection rate among neonates and chronic carrier fraction in HBsAg(+) neonates

Iatrogenic infection of HBV is quite possible during labor (for example, via medical equipment, or medical personnel). But we supposed that the chances were extremely rare of being a HBV infected baby unless the mother had HBsAg. In that sense, we neglected all the infection routes other than mother-child vertical transmission and assumed only HBsAg positive mothers to be capable of infecting their children. Five articles that investigated HBsAg PRs among mothers and their new born babies simultaneously were collected to estimate the HBV infection status among neonates. The weighted average of HBsAg PRs is 6.5% among mothers, and 16.4% among neonates given birth by HBsAg positive mothers. (Koo *et al.* 1984; Yoon *et al.* 1987; Lee *et al.* 1984; Lee *et al.* 1987; Lee *et al.* 1988). So, we conclude that the perinatal HBV infection rate among all newborn babies is around 1.1%(=.065×.164). Koo *et al.* (1984) and Lee *et al.* (1984) reported that 61.1% of HBsAg positive neonates kept their antigenecity until three months after birth. There was no follow-up report on HBs antigenecity for six months or more.

5) *Rates in the general population*

We fitted the age-specific, sex-specific mean values of the rates to the age distribution as taken by the 1985 population census, so that we could estimate age adjusted sex-specific population rates.

RESULTS AND DISCUSSION

1. Acute infection rate of HBV

Most of the studies on the perinatal HBV infection state presented their results in terms of HBsAg positivity of the newborn babies from HBsAg positive mothers and no study was done on HBs positivity among newborn babies regardless of mothers' HBsAg positivity. Paik *et al.* (1984) reported the highest rate, 62.5%, and Koo *et al.* (1984) presented 44% which was the number including babies who were negative of HBsAg at birth but became positive three months after birth. Other papers have HBsAg PRs ranged from 10-33% (Lee *et al.* 1984; Lee *et al.* 1987; Yoon *et al.* 1987; Lee *et al.* 1988). The summary estimation (i. e. weighted mean value) of the perinatal infection rates among neonates from HBsAg positive mothers was about 16.4%. The result from Paik *et al.* (1984) was excluded here because its value was so extreme that it tended to lead the mean value toward erroneously high level. Together with the HBsAg PR of mothers (weighted mean; 6.5%), we can say that 1.1% of Korean newborn babies were infected by HBV from their mothers during the perinatal period, in other words, one

out of a hundred neonates are born infected by HBV. Since no study was done on sex-specific rates in neonates, 1.1% is an overall rate among all neonates

Table 5 shows the AIRs at a certain point of time among different age groups. In general, 3.3% of men and 2.9% of women are acutely infected with the highest rate in the 0-9 years old group (male 4.0%, female 3.6%), and the rates have a slightly decreasing tendency with age. In their 60's, both men and women have much similar AIRs at around 2.0%, which are not very different from the rates in young age groups though. Therefore, we conclude that it is less likely the infection force(i, e, AIR) of HBV at a specific point of time which is responsible for the variation in age and sex specific IRs, but the frequency of exposure or contact to HBV.

Table 5. Infection rate and acute infection rate of hepatitis B virus among Koreans by sex and age group

Age group (years)	Male		Female	
	IR*	AIR**	IR	AIR
at birth	-	1.1	-	1.1
0- 9	29.5	4.0	21.7	3.6
10-19	45.1	3.8	42.5	3.1
20-29	72.6	3.1	59.2	2.3
30-39	77.5	3.1	59.4	3.1
40-49	85.7	2.7	75.7	3.5
50-59	88.1	2.7	72.7	3.3
〉= 60	76.9	2.1	72.5	2.0
Total@	61.3	3.3	52.8	2.9

* Infection rate(%) and Acute infection rate(%)** at a point of time estimated with the serological test results by RIA.

@ Crude rate with reference to the total population of 1985 census

2. Infection rate of HBV

At birth, about 1% of babies are infected, and the number of infected persons accumulates in proportion to age (Table 5). 29.5% of males and 21.7% of females have been infected by HBV up to 9 years old. In the group of 10-19 years old, 45.1% of males and 42.5% of females have experienced HBV infection, which implies quite an increment as compared with the younger age group. Until the age of 29, the IRs of men and women become 72.6% and 59.2% respectively, with a bigger increment among men. The IR keeps rising with age among men, and nine out of ten have had HBV infection at least once by the time they become 60 years old. Women also have more chance to be infected in their 40's than at younger ages, and seven out of ten have experienced HBV infection by their 60's. Based on the age distribution of the 1985 Korean population census, 61.3% of men and 52.8% of women can be considered to have been infected by HBV sometime in their lifetime.

Young age groups, say aged 20 or younger, show a rapid increase in IR with age up to 43-45%. That is true for both men and women because they might have a very similar living environment, i. e. , mainly consisting of home and school. Therefore, we can say that childhood hepatitis B is very prevalent in Korea, and that in-family propagation plays an important role in that age period (Kim *et al.* 1992).

After 20 years of age, men and women have different IRs especially in their 20's. The amount of increment is 27.5% (45.1 to 72.6%) in men and 17.6% (42.5 to 59.2%) in women, so the frequency of infection increases much more rapidly in men than in women. In their 30's, the IRs are similar to the rates of their 20's in both men and women, but in their 40's they increase again, especially in women. Therefore our conclusion is that there is no sex difference in a IRs until 20 years old, but from then on men have definitely more chance to be exposed to or contacted by HBV especially in their 20's, and that might result in the higher IR in men than in women in the general population. The age adjusted IR before 20 years of age are 37.8%, 32.9%, for men and women respectively, which are quite similar to each other, but 78.3%, 65.6% after 20 years of age.

Table 6. Positive rate and chronic carrier rate of hepatitis B virus surface antigen among Koreans by age and sex

(unit : %)

Age group (years)	Male		Female	
	PR*	CCR**	PR	CCR
at birth	1.1	-	1.1	-
0- 9	7.5	3.5	6.7	3.2
10-19	7.1	3.4	5.8	2.7
20-29	9.1	6.0	5.1	2.9
30-39	9.1	6.0	7.1	4.0
40-49	8.0	5.2	8.0	4.5
50-59	7.8	5.1	7.6	4.3
〉 = 60	6.3	4.1	3.4	1.9
Total@	8.0	4.7	6.1	3.3

*: Positive rate(%) and Chronic carrier rate(%)** at a point of time estimated with the serological test results by RIA.

@: Crude rate with reference to the total population of 1985 census

Note: The chronic carrier was defined as a person who has HBsAg(by serological, RIA, test) lasting more than 6 months without any signs of liver diseases

3. HBsAg positive rates(PRs) and chronic carrier rates(CCRs)

Table 6 shows age and sex specific HBsAg PRs and CCRs. In the total population, HBsAg PRs are slightly lower in women(6.2%) than men(8.0%), but in the age group of 0-9 and 40-59, the rates are not quite different between the sexes. When we consider age-specific HBsAg PRs, male groups have rates ranged from 7% before the age of 20, upto 9% among 20-30 year-olds, and then the rates have a decreasing tendency after the 40's. In female groups, PR is 6.7% before 10 years old, which is not very different from that of male group, and 5.8% among 10-19 year-olds, which is lower than in males , increases slowly in the 30's, and becomes similar to the male rate again in the 40's and 50's (8%). Most of the papers reported that HBsAg PR in males was about 1.3 times higher than that of females through out all age groups (Kim and Kim 1974; Kwon and Suh 1977; Ahn *et al.* 1983; Kim *et al.* 1983; Kim *et al.* 1985; Oh and Kim 1985; Shon 1986; Kim 1986b). In special populations, such as poor urban people (Kim *et al.* 1981) or medical personnel (Hah and Rha 1977), women had higher rates than men. Together with the previous results that men and women have different IRs only after 20 years of age, it can be inferred that men and women have no difference in biological susceptibility and it is the chance of exposure to the sources of infection which make the rates different. PRs in men or in people who have odd jobs (like nurses) are higher than those among others. Moreover, men might have a different immune mechanism toward HBV than women, especially during reproductive ages, which can result in the variation of CCRs between men and women (Blumberg *et al.* 1972).

According to the follow-up studies of HBsAg for six or more months, the chronic carrier fractions among HBsAg positives were estimated at about 53-65.7%. By multiplying these numbers by HBsAg PRs in each age-sex stratumm and summarizing them in reference to 1985 population age structure, we had the general CCR in men as 4.7% and in women as 3.3%. Generally, women have a lower CCR than men. Age specific CCRs are similar to the age specific HBsAg positive rates. The CCR of men shows a rapid increase after the age of 20, that is, 3.4% before 20 years of age, 6.0% in the 30's, and then a decrease after 40. In contrast with that, women show a stable CCR of 2.9% before 30 years of age. Then the rate starts to increase after 30 years of age with its peak (4.5%) in the 40's.

To have some idea on the chronological trend of the HBsAg PR, Ahn *et al.* (1983) analyzed 290,000 blood donor data collected from 1975 to 1981. They reported that the HBsAg PR increased as the years went by both in men and women, with more rapid increment in men. In this study, we observed The chronological trend of the HBsAg PR from 1982 to 1986. We restricted the age of the study

Table 7. Chronological variation of HBsAg positive rates among 20-39 years old group, 1982-1986

Year@	Male			Female		
	N**	PR#	contributing articles*	N	PR	contributing articles
1982	250	8.41	2	982	6.19	1, 4
1983	7698	9.07	3, 6, 7	2569	4.71	5, 6, 7, 17
1984	847	9.81	9, 15	1455	7.38	9, 15
1985	2039	10.24	8, 13, 14	8099	6.81	8, 13, 14, 16, 18, 19
1986	2726	8.53	20, 22	91	9.88	20

@: The year the study was done.This is usually one or more years earlier than the year the article was published.
**: Combined subject numbers from all contributing articles.
#: HBsAg Positive rates in %.
*: The articles are represented in numbers assigned in Table 1.

population within 20-39, because in that age group there was not excessive variation in HBsAg positivity. The results are in Table 7. Women do not have any regular trend, whereas men show a steady increment until 1985. The rate in men keeps increasing until the mid 1980's, and in women until the early 1980's. After then both of them have decreasing trends in rates. The reasons for this phenomenon are not so clear, but the improvement in medical services (e. g. disposable syringes and needles, strict screening tests for donated blood, etc.) and the new introduction of vaccine for HBV after 1982 could be partly responsible.

REFERENCES

Ahn YO, Kim CY, Lee JB, Park BJ, Kwon EH, Lee JH, Kim NK. An epidemilolgic observation on HBs antigenemia in Korean voluntary blood donors for the 6 and 1/3 years period, 1975-1981. J Korean Med Assoc 1983; 26:425-37

Ahn YO, Kim CY, Hiyama T, Tsukuma H, Shigematsu T, Kono S. Liver cancer among Koreans in Japan and Korea. Epidemiology & Prevention of Cancer, The Proceedings of MONBUSHO 1989 International Symposium on Comparative Study of Etiology & Prevention of Cancer, The University of Nagoya Press, Nagoya, Japan, pp. 177-84. 1990

Blumberg BS, Sutnick AI, London WT, Melartin L. Sex distribution of Australia antigen. Arch Intern Med 1972; 130:227-31

Bom HS, Kim SJ. Comparison of enzyme immunoassay (EIA) with radio immunoassay (RIA) method in dectection of Hepatitis B Virus (HBV) markers. Korean J Gastroenterol 1984; 16:413-6

Choi BY. Incidence of Hepatitis B Virus infection of the school children in a rural area of Korea. Korean J Prev Med 1986; 19:281-91

Choi BY, Song JC, Park HB, Ko UR. A seroepidemiological study on the aspects of Hepatitis B Virus infection in a rural community - its prevalence, familial aggregation and effects of vaccination. J Hanyang Medical College 1990; 10:245-65

Choi BY, Kim YT, Ko UR, Oh SJ, Park HB. A follow-up study on the chronological changes of HBV serologic markers in a rural community, Korea. Korean J Epidemiol 1991; 13:6-22

Hah JY, Rha HY. Studies on the occurrence of HBsAg in medical personnel including medical students, and the finding of liver function test in HBsAg positive person. Korean J Intern Med 1977; 20:326-34

Jun GH, Kim JJ, Shin DH, Yoon SD. A survey of HBs antigenemia among healthy primary and middle school children, pregnant women in Kyungpook province. J Korean Pediatric Assoc 1983; 26:1188-95

Kiel BD. An observation on serological pattern of hepatitis B markers in Korean industrial wokers. Human Science 1985; 9:231-43

Kim CK, Kim JS. Prevalence of Australia antigen among some Koreans. Korean J Public Health 1974; 11:58-68

Kim CY, Lee HS, Yu PC, Baik HO, Song YO, Jung HC, Choi SW. Comparison of radioimmunoassay (RIA) and passive hemagglutination assay (RPHA) in reverse the detection of Hepatitis B surface antigen

(HBsAG). J Korean Med Assoc 1984a; 27:49-53

Kim CY. Hepatitis B virus infection as an etiologic factor in acute and chronic liver diseases among Koreans. Proceedings of the Memorial Symposium of 10th aniversary of Seoul National University Hospital, Seoul National University Press, Seoul, pp. 57-78, 1988

Kim DJ, Choi BY, Park HB. A study of Hepatitis B infection rates of the school children in a rural area of Korea. J Hanyang Medical College 1986a; 6:99-107

Kim IS, Oh HC, Lee Y. Prevalence and changes of HBsAg and Anti-HBs for one year period in natural status and after Hepatitis B vaccination. Korean J Epidemiol 1987; 9:40-8

Kim JJ, Han GW, Nam TS. An epidemiologic study on related factors to HBsAg and Anti-HBs. Korean J Prev Med 1984b; 19:91-9

Kim JS. A study on the prevalence of Hepatitis B surface antigen among slum population. Korean J Public Health 1981; 31:30-40

Kim JS, Chung MH, Suh SC. HBsAg positive rate among Korean urban and rural middle school children. Korean J Epidemiol 1986b; 8:115-26

Kim YC, Kim JS, Kim SH, Lee SM, Shim WB, Moon HK. Chemical liver function text and epidemiologic studies of HBsAg positive blood donors. Korean J Intern Med 1983; 27:1-6

Kim YS, Kim JS, Huh BY. A study on Hepatitis B virus markers and formation of anti-HBs after Hepatitis-B-vaccination in healthy Korean population. Korean J Epidemiol 1985; 7:8-15

Koo JJ, Hwang DH, Kim WJ, Kim YM. Status of vertical transmission of HBs antigen and HBs antibody in Korean term pregnant women. Korean J Obst & Gyn 1984; 27:168-74

Kwon HH, Suh DJ. The Changing Pattern of Occurrence of HBsAg in Korean Patients during the period of 5 years. Korean J Intern Med 1977; 20:423-30

Lee BW, Lee MY, Kuk SM, Kim KS. A clinical study of the effect of Hepatitis B virus Infection on pregnancy. Korean J Obst & Gyn 1987; 30:494-8

Lee HS, Byun JH, Kim CY. Etiology and outcome of acute viral Hepatitis in Korean adults. J Korean Med Sci 1990; 5:149-54

Lee HS, Yoon JH, Kim W, Kim CY. Relative etiologic role of Hepatitis B virus and Hepatitis C virus in HBsAg-negative patients with chronic liver disease in Korea: determination of serum HBV DNA using polymerase chain reaction and of serum anti-HCV Using ELISA. Korean J Intern Med 1992; 42:8-15

Lee SG, Kim ZY, Lee YJ, Cho TH. A study of transmission of Hepatitis B virus in the HBsAg positive mothers and their newborns. Korean J Obst & Gyn 1984; 27:2121-8

Lee SH, Cho CY, Meng KH. A study on the positive rate of HBsAg and anti-HBs and the relationship between HBsAg positive and some liver function tests among the multiphasic health screening examinees. Korean J Epidemiol 1985; 17:265-73

Lee SY, Choi DY, Choi HJ, Shin SK. A survey of hepatitis B antigens and infectious sources in the HBsAg(+) mothers. Korean J Obst & Gyn 1988; 31:370-4

Nam JW, Yum YT, Hong DRM. An epicimiological investigation on Hepatitis B infection in some college students. Korea University Medical J 1986; 23:95-107

Oh HC, Kim IS. A study on the anti-HBs prevalence between occupationally risk and non-risk groups in terms of Hepatitis B virus exposure. Korean J Epidemiol 1985; 7:259-64

Paik SJ, Lee SI, Lee HS Kim KS, Ryu KZ, Choi HJ. Study on vertical transmission Hepatitis B virus in Korea. J Korean Med Assoc 1984; 27:331-8

Park BJ. A study on the validity of passive Hemagglutination (PHA) test for HBsAb. Korean J Prev Med 1987a; 20:114-20

Park BJ. Longitudinal study on the negative conversion rate of HBsAg among male adults in Korea. Seoul J Med 1989; 30:243-8

Park JH, Kim CY, Kim TH, Sohn KY. Risk of sexual transmission of Hepatitis B Virus. J Korean Med Assoc 1986; 29:397-408

Park JH, Youn TH, Chun BY, Song JH. Hepatitis B virus infection rate of medical school students in Taegu. Korean J Prev Med 1987b; 20:129-36

Ro SK, Kim JJ, Shin KC, Choi KH, Roh JK, Shim YH. Occurrence of HBsAg and anti-HBs in coal miners. Korean J Intern Med 1984; 27:1466-70

Shin HC, Kim JS. A study on the HBsAg positive rate among Korean adults and the immunogenicity of Hepatitis B vaccine. Korean J Epidemiol 1989; 11:98-106

Sohn SJ. A study on the positivity of HBsAg in urban, rural and coastal area. Korean J Prev Med 1986; 19:45-55

Yoo KY, Park BJ, Ahn YO. Seroepidemiology of Hepatitis B virus infection in healthy Korean adults in Seoul. Korean J Prev Med 1988; 21:89-98

Yoon K, Tsao AY, Shim SJ, Ahn JY. Hepatitis B markers expressed in term pregnant women and umbilical cord sera of their babies. Korean J Obst & Gyn 1987; 30:315-26