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The prevalence of hepatitis B in Sweden; A statistical serosurvey of 3381 Swedish inhabitants

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SUMMARY

The prevalence of hepatitis B virus markers in the adult Swedish population was investigated according to age, sex, origin and demographic stratum. Sera were collected from 3382 persons in 1990–1. The sera were selected on a statistical basis considered to be representative of the Swedish population from adults aged ⩾ 18 years. Two of the sera (0·06%) were found to be hepatitis B surface antigen positive. The two hepatitis B carriers were of non-Scandinavian origin as were (8·9%) of those tested. A total of 90 persons had a marker of previous, hepatitis B virus infection, i.e. antibodies against hepatitis B core antigen. Of these, 66 (2·0%) were of Scandinavian origin and 24 (18·1%) from highly endemic areas. The overall hepatitis B virus marker prevalence was 2·7%. The highest age-specific prevalence of hepatitis B markers in those of Scandinavian origin was in those born in 1939 and earlier. In this age-group, women had a significantly higher prevalence (3·6%) than males (1·9%). The lowest prevalence was found in those born in 1970 and later. No significant, age-related differences between younger or older persons, or between men and women, could be found in persons of non-Scandinavian origin. The results showed significant differences in exposure to hepatitis B virus among the indigenous population, compared with those of non-Scandinavian extraction. The results do not support the proposal to include hepatitis B vaccination in the Swedish immunization schedule.

INTRODUCTION

Like the rest of the Scandinavian countries the prevalence of hepatitis B virus carriage is extremely low in the Swedish population [1–5]. Hepatitis B was introduced into Sweden by intravenous drug abusers after the Second World War. At the beginning of the 1950s, it was recognized that hospital personnel ran an increased risk and in the 1960s and early 1970s, hepatitis B became a great hazard to medical staff, particularly those working in haemodialysis and surgical units [6–9]. During the period 1957–63, 568 cases of serum hepatitis were reported among orienteers [10]. The outbreak ceased when protective clothing was introduced in order to prevent injuries during races. Cyclical outbreaks of hepatitis B, due to transmission among drug abusers, became a problem at the end of the 1960s [1]. The disease was first recognized in urban areas and later in all parts of Sweden. The peak incidence was reached in 1976 and the last outbreak of hepatitis B among drug abusers was observed in 1985, when a total of 516 acute cases of hepatitis B was reported. After 1987, fewer than 300 cases of acute hepatitis B have been reported yearly.

Previous studies of selected populations in Sweden have shown a carriage rate of 0·6% in volunteer blood

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donors [11] and 3·6% in orthopaedic patients [12]. A recent study of young adults in Sweden comprising 2000 pregnant women and 2000 conscripts indicated that 0·25% were hepatitis B carriers and 1·6% had markers of previous exposure [4]. As might be expected, the highest prevalence was found in those originating from countries where hepatitis B was highly endemic. The age-related prevalence has not previously been investigated in the general Swedish population, especially in those > 30 years. This is the first study of the age-specific prevalence of hepatitis B virus markers on material statistically selected as representative of the population in a country with a low endemicity for hepatitis B. The investigation was performed on 3390 adult individuals aged 18–90 years from different geographical areas in order to get cross-sectional samples of the Swedish population.

MATERIAL AND METHODS

For this study, a random sample of 4800 persons was selected. Parishes were randomly selected and the number of parishes was correlated to the population in the area. In each parish, 24 men and 24 women aged 18–90 years were selected. They were contacted and offered an investigation of their immunity to poliomyelitis, diphtheria and tetanus. Those who were not satisfactorily protected were offered appropriate vaccination. They also agreed that, after the investigations had been performed, their blood samples could be used for other investigations, except HIV tests. These further tests would be carried out anonymously. The main collection was done in 1991. Of the 4800 persons contacted, 3390 (71%) agreed to participate. For this present study, 3382 samples remained.

The number of persons tested per age-group in relation to the Swedish population is shown in Figure 1. Before names were removed, the present postal codes were registered for all subjects and whether the individuals had been born in a Scandinavian country or not was determined. Because large-scale immigration from remote countries did not commence until the 1980s, most of the adults from remote countries in this study had also grown up there. Origin was divided into two categories, Scandinavian or non-Scandinavian countries. The latter were highly endemic regions which included countries in eastern Europe, the Mediterranean area, Africa, Asia and Latin America. The study was approved of by the Ethics Committee of the Karolinska Institute.

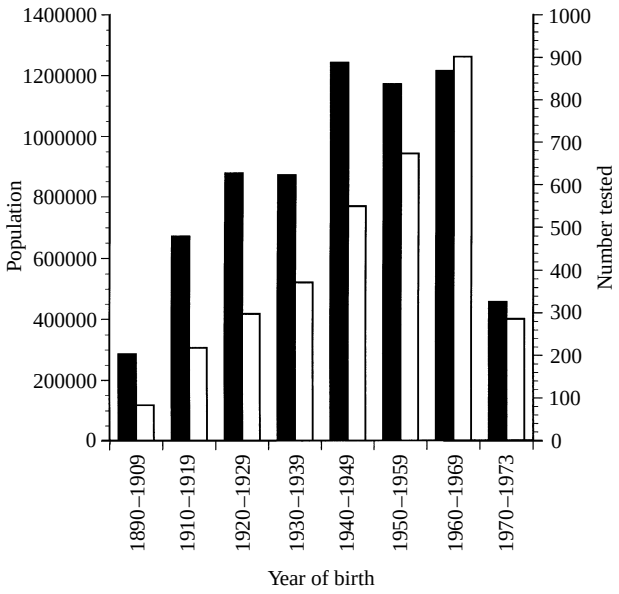

Fig. 1. The Swedish population (■) in relation to the number of persons tested (□).

Study parameters

The participants were first divided according to age, sex, origin and area of domicile. The participants were thereafter divided into 10-year groups and, for comparison and statistical analysis, they were also divided into three age groups, those aged ⩾ 50 years, those who were 30–49 and those < 30 years. The youngest group, comprised only a 3-year age group born in 1970–2. No person of foreign extraction was found in the oldest age group born before 1909, and there were only a few born before 1929. The area of domicile was divided into four strata, according to the average population density. The first comprised the metropolitan areas. This stratum included the big cities (Stockholm, Gothenburg and Malmö) and the neighbouring communities. The second stratum comprised towns having a more complete local government. The third stratum included villages and communities in a county district generally smaller than a town. Finally, the fourth stratum was drawn from rural parts of Sweden.

Hepatitis B serology

The prevalence of hepatitis B virus markers was determined by testing all serum samples for the presence of anti-HBc by Corzyme enzyme-immuno assay (EIA) (Abbott Laboratories, Chicago, Ill.). The manufacturer's instructions were followed. All anti-HBc positive sera were, in addition, tested for HBsAg and anti-HBs by Auszyme and AusAb EIA (Abbott),

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Table 1. *Prevalence of hepatitis B virus markers, distributed by age and origin among the Swedish population, 1990–1*

	Scandinavian origin			Non-Scandinavian origin		
Born	No. positive/ no. tested	Positive (%)	Predicted (%)*	No. positive/ no. tested	Positive (%)	Predicted (%)*
1900–9	6/84	7·1	4·8	–	–	4·8
1910–19	5/216	2·3	4·1	0/2	–	7·7
1920–9	9/293	3·1	3·5	1/5	20	10·5
1930–9	6/355	1·7	2·9	4/17	23·5	13·3
1940–9	11/527	2·1	2·2	3/22	3·6	16·1
1950–9	15/637	2·4	1·6	8/36	22·2	18·9
1960–9	12/860	1·4	1·0	6/42	14·3	21·7
1970–3	2/277	0·7	0·7	2/9	22·2	22·8

* The fit of the applied logistic regression model.

Table 2. *Distribution of hepatitis B virus markers in the Swedish population according to age and origin*

	Scandinavian origin					
	Males		Females		Total	
Age, years	No. tested	Positive (%)	No. tested	Positive (%)	No. tested	Positive (%)
> 50	472	1·9	476	3·6	948	2·7
30–49	531	2·8	633	1·7	1164	2·2
< 30	521	0·6	616	1·8	1137	1·2
Total	1524	1·8	1725	2·3	3249	2·0
	Non-Scandinavian origin					
	Males		Females		Total	
Age, years	No. tested	Positive (%)	No. tested	Positive (%)	No. tested	Positive (%)
> 50	12	16·7	12	25·0	24	20·8
30–49	28	28·6	30	10·0	58	19·0
< 30	27	14·8	24	16·6	51	15·7
Total	67	20·9	66	15·0	133	18·0

respectively. Forty of 90 anti-HBc positive sera were also positive to anti-HBs. HBsAg reactive sera were retested and also analysed for HBeAg and anti-HBe by Abbott Hbe (rDNA) EIA (Abbott Laboratories).

RESULTS

Ninety persons (2·6%) had markers of a previous hepatitis B virus exposure and two individuals (0·06%) were positive for HBsAg. These two persons were both of non-Scandinavian origin. Of the 90 persons who had markers of a previous hepatitis B virus infection, 24 were of non-Scandinavian origin, which means that the prevalence of hepatitis B virus markers was 18·1% in persons coming from highly endemic areas. There was a significantly greater risk of exposure to hepatitis B virus in the non-Scandinavian population than in people of Scandinavian origin with an overall odds ratio of 11 (95% confidence interval 6–18). For men, this figure was 14 (confidence interval 7–30) and for women 8 (confidence interval 3–16). Calculation of the age-specific prevalence of hepatitis B markers in the Scandinavian population showed that the highest

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Table 3. *Distribution of hepatitis B virus markers in the Swedish population according to origin in four strata*

Strata	Scandinavian		Non-Scandinavian	
	No. tested	Positive (%)	No. tested	Positive (%)
1. Metropolitan areas	660	2·7	51	21·6
2. Towns	1214	1·9	50	20·0
3. Villages and small communities	923	1·5	29	10·3
4. Countryside	452	2·4	3	–

prevalence (7·1%) was found in the oldest age-group, i.e. those born in 1900–9 (Table 1). Table 1 also includes the fit of the applied logistic regression model. The lowest prevalence was found in the youngest age group, those born in 1970–3. In this group, only 2/277 (0·7%) had markers of a previous exposure to hepatitis B. In the next youngest age-group, those born in 1960–9, the prevalence was 1·4% (12/860).

For comparison purposes and as the subjects from highly endemic areas were few, the material was divided into three groups: (1) $\geqslant 50$ years, (2) 30–49 years and (3) $\leqslant 30$ years (Table 2). For subjects of Scandinavian origin, the highest prevalence was found in > 50 years (2·7%), compared with individuals < 30 years (1·2%) ($P < 0{\cdot}02$). Of those > 50 years, women had a higher prevalence (3·6%) than men (1·9%) but this difference was not significant. The lowest prevalence was found in men aged 30 years and younger (0·6%), whereas the corresponding figure for women was 1·8% ($P < 0{\cdot}05$). There was no difference in the total prevalence between men (1·8%) and women (2·3%) of Scandinavian origin. Males of non-Scandinavian origin had a significantly higher prevalence (20·9%) than females (15·2%) ($P < 0{\cdot}05$), whereas no significant difference in prevalence between the age-groups for persons of non-Scandinavian origin was discovered. No difference in the prevalence of markers for hepatitis B in persons in the four strata was observed. The number of participants in each stratum and the distribution of hepatitis B markers among these will be seen in Table 3.

DISCUSSION

Hepatitis B virus infection is a minor problem for the general population in Sweden. Like the other Scandinavian countries, Sweden is a low-endemicity region. This is the first study of hepatitis B virus markers in Sweden using a representative sample of the population. Previous studies have been based on selected groups such as blood donors [3], health-care personnel [9, 11], pregnant women and conscripts [5].

A decrease in the number of cases of acute hepatitis B has been observed in the last 10 years in Sweden, because the cyclic outbreaks of hepatitis B among drug abusers ceased in the mid 1980s. During these outbreaks, an increase in the number of hepatitis B cases in the general population was also observed, probably due to sexual transmission. The incidence of hepatitis B has decreased from 6/100000 subjects in 1985 to 3/100000 in 1990–1, while the immigration of hepatitis B virus carriers from highly endemic areas exceeded the acute cases twice in 1985 and eight times in 1990. In spite of the increasing numbers of hepatitis B virus carriers, the number of acute hepatitis B cases decreased [13].

There is a higher age-specific prevalence of hepatitis B markers in the older Scandinavian population. There was a significant difference between people age > 50 years, compared with those < 30 years. The highest prevalence 3·6%, among Scandinavian people was found in women aged > 50 years. Males of Scandinavian origin < 30 years of age had a prevalence 0·6%, the lowest prevalence found.

This age-profile, with higher prevalence at older ages, is characteristic of a low-endemicity country. In countries of low endemicity it requires long exposure for the virus to hit the population. The population > 50 years of age most likely came into contact with the infectious agent before it was recognized, some probably through hospital care and blood transfusions. In the 1950s, epidemic outbreaks also occurred among orienteers; orienteering is a popular sport in Sweden [10].

In those ages 21–30 years, 10/471 women (2·1%) of

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Scandinavian origin had markers of previous hepatitis B infection, compared with 2/389 males (0·5%) ($P < 0·05$) whereas in those 31–40 years the opposite was found and males had a prevalence of 3·4%, compared with 1·4% for the females. This suggests infection by sexual exposure for the 21–30-year-old women and contacts with intravenous drug abuse for the 10-year-older males.

However, in total, there was no difference in the prevalence of hepatitis B virus markers between men and women of Scandinavian origin. Unlike to those of Scandinavian origin, there were significant differences in prevalence between men and women in those of non-Scandinavian origin. Males had a higher prevalence (20·9%) than females (15·2%). It was emphasized that those who had been exposed to hepatitis B in the Swedish population were mainly of non-Scandinavian origin. They had a significantly higher exposure risk with an overall odds ratio of 11 (95% confidence interval of 6–18) and, unlike those of Scandinavian origin, there was no significant difference in prevalence between different ages.

There was no difference in the prevalence of hepatitis B virus markers between the four strata. Subjects living in metropolitan areas did not differ from those living in rural areas (Table 3). The non-Scandinavian population was mainly living in metropolitan and urban areas, whereas only three persons were living in rural areas (stratum 4).

More than 80 countries have met the call by the Global Advisory Group of the WHO Expanded Programme on Immunization (EPI) to introduce hepatitis B vaccine into their national immunization programmes by 1997 [14]. However, the Scandinavian countries, Great Britain and Ireland are not convinced that this approach is justified despite favourable cost-effectiveness analyses from areas of low endemicity [15, 16]. Reduction of the incidence by vaccination in highly endemic areas should also reduce the risk of exposure in low endemic areas.

In conclusion, the risk of exposure of hepatitis B is low in Sweden. A low prevalence of hepatitis B virus markers was found in the Scandinavian population, whereas a relatively high prevalence was noticed in the non-Scandinavian population. In spite of the impact of immigrants coming from highly endemic areas, no indications of increasing exposure for hepatitis B virus markers were observed. Concerning Sweden, the WHO recommendation of global vaccination against hepatitis B could not be supported by the results in this paper.

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