Community prevalence of hepatitis B infection & modes of transmission in Tamil Nadu, India


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**Background & objectives**: There have been very few community based studies on prevalence of hepatitis B virus (HBV) infection in India. We undertook this study to determine the prevalence of HBV infection in a southern State of India, Tamil Nadu and to describe the important factors related to transmission of the virus in the community.

**Methods**: Analysis of stored blood samples from a representative population of Tamil Nadu from an earlier community cluster survey on sexually transmitted diseases (STD) prevalence using proportionate to population size (PPS) technique was done. Serum markers of HBV viz., hepatitis B surface antigen (HBsAg), hepatitis B e antigen (HBe Ag) and antibody to surface antigen (anti-HBs) were performed.

**Results**: 1981 subjects were screened in the study. HBsAg prevalence was 5.7 per cent (CI 4.6-6.8) with 23.5 per cent (25/106) of these having positive HBe-antigen. Community seroprevalence (HBsAg + anti-HBs) of hepatitis B infection was 27.4 per cent (CI: 25.3-29.5) with the highest prevalence of 32.7 per cent (CI: 30.2-35.2) noted in the 15-20 yr age group. Significant independent association (OR 1.4; \( P = 0.006 \)) was detected with family history of exposure to HBV infection by logistic modeling. Other risk factors noted to have significant association were use of disposable needles during injection (OR 0.5; \( P = 0.02 \)) in men, smoking (OR 3; \( P = 0.04 \)) and use of condom (OR 0.6; \( P = 0.08 \)) in women.

**Interpretation & conclusion**: This community based study shows a high prevalence of hepatitis B infection in the state of Tamil Nadu with the highest prevalence being in the younger (15-20 yr) age group. High prevalence rate in childhood with e-antigenemia seen in 23.5 per cent of HBsAg positive subjects suggest childhood transmission. Poor injection practices and high-risk sexual behavior were found to be additional risk factors for transmission of the disease in the community.

**Key words** Community - hepatitis B infection - mode of transmission - prevalence - Tamil Nadu, India

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Hepatitis B virus is known to be highly infective and associated with long-term morbidity and mortality due to complications like cirrhosis, portal hypertension and hepatocellular carcinoma. Prevalence of hepatitis B surface antigen (HBsAg) in India varies from 1 to 13 per cent, with an average of 4.7 per cent\textsuperscript{1-6}. High prevalence rates of HBsAg has been noted among the Indian tribal population\textsuperscript{7-11}. There are only a few community-based studies that have looked into the prevalence of hepatitis B infection (HbsAg + anti-HBc/anti-HBs)\textsuperscript{12,13}. However, these studies have been done in select groups such as children\textsuperscript{12} and rural population\textsuperscript{13}. Only one community-based study has looked into the prevalence of HBV infection in both rural and urban community in northern India\textsuperscript{14}. Hence, the present study was undertaken to estimate the prevalence of hepatitis B infection in a representative sample of population in Tamil Nadu and to throw more light on the dynamics of virus transmission in the community.

Material & Methods

In 1998, a community based study to measure the prevalence and risk factors of sexually transmitted diseases (STD) was conducted in Tamil Nadu\textsuperscript{15}. A representative sample from the State of Tamil Nadu (Population 12,542,6772, Census 1991) was chosen using the “Proportionate to Population” (PPS) cluster technique. One district was randomly selected from the three major regions of Tamil Nadu (Chennai, Coimbatore and Madurai). Thirty clusters were randomly selected from each of the three districts Thanjavur (Population 2,025,324, Census 1991), Dindugal (Population 1,760,601, Census 1991) and Ramanathapuram (Population 1,144,040, Census 1991) using the PPS method. These clusters were villages from rural areas and wards from urban areas based on the 1991 census of India. Households were the basic unit of a cluster. The first household of the cluster was chosen randomly. Fifteen consecutive households from the first house were included in the survey. If a locked house was encountered, the next household in the same direction replaced it. All adults aged 15-45 yr in the target households were registered and encouraged to participate in the medical camps as eligible population for the study. Blood, serum and urine samples from target individuals were stored at -70°C for future reference and formed the sample for the current evaluation.

Hepatitis B surface antigen (HBsAg), e antigen (HBeAg) and anti-HBs antibody were measured. Presence of either HBsAg or anti-HBs antibody was considered as indicating an overall exposure to hepatitis B virus.

Information on age, sex, education, occupation, area of residence, type of housing were extracted from the original database and linked to the results of the study along with positive HBsAg or anti-HBs antibody level to any other member of the family. Detection of HBsAg and anti HBs antibody were performed by ELISA as mentioned in Microbiological Methods Section in the project for members of the family in the age group 15-45 yr. Sexual and behavioural risk factors were analyzed separately for males and females. Sexual mode of transmission was ascertained by association with number of sexual partners, extramarital sex, premarital sex, visit to commercial sex workers, homosexuality, use of condoms and HBV-positive married couples.

Risk of horizontal transmission was ascertained by determining the association with blood transfusion, tattooing, ear pricking, dental extraction, number of injections in the last year, use of disposable needles, and smoking/alcohol intake.

Microbiological methods: The serum markers of HBV, viz., HBsAg, HBeAg and anti-HBs were tested using ELISA kits manufactured by Organon Technika, Holland. All the positive sera were reconfirmed using Wellcozyme-HBsAg kit of Murex Diagnostics. Presence of either HBsAg or anti HBs was considered as indicating overall exposure to HBV. Presence of HBeAg indicated the presence of replicative virus and thus the degree of HBV infectivity in the population.

Statistical methods: Chi Square analysis was performed on the measured factors and those factors with probability value of less than 0.1 were included in the model for multivariate logistic regression estimating independent association. Ninety five per cent confidence limits of values were calculated.
Results

In the three districts selected, viz., Thanjavur, Ramanathapuram and Dindigul, 20,975 people attended the medical camps. Data were obtained from 1114 (82.5%) of 1350 households studied. From these households 1981 individuals attended the medical camps and were screened for STDs and STD syndromes. There were 824 males and 1157 females (Table I). Seventy seven individuals (3.9%) refused to undergo either genital examination or provide blood or urine for tests. Results of the HBsAg serology was available for 1856 subjects, samples from 125 were insufficient to do the test. Anti-HBs antibody results were available in 1853 subjects with sample being insufficient in 128 subjects. The overall prevalence of HBsAg was (106/1856) 5.7 per cent (95% CI 4.7-6.8) and anti-HBs antibody was (387/1853) 20.9 per cent (95% CI 19.05-22.75). Both HBsAg and anti-HBs serology were available in only 1798 subjects and 493 were positive for either HBsAg or anti-HBs antibody; 1305 were negative for both. The overall exposure to HBV was calculated to be (493/1798) 27.4 per cent (95% CI 25.34-29.46). HBsAg was positive in 106 subjects, of which 25 HBeAg positive giving a prevalence of (25/106) 23.6 per cent (95% CI 16.4-32.6). Age specific prevalence for the overall exposure to HBV, HBsAg, HBeAg was not significantly different in different age groups, however, age-specific overall exposure to HBV was highest in younger age group (15-20 yr) (Table II).

Prevalence of hepatitis B infection was not found to be significantly associated with age group (N=1798; P=0.4), sex (female 1033, male; 765 P=0.3), residence (rural 1378, urban 420; P=0.8), type of house (katcha 608, semipacca 1030, pacca 160; P=0.8), education (illiterate 416, primary 580, high school 548, above high school 254; P=0.5), occupation (household work 744, manual labourer 895, semi skilled 93, skilled 39, professional 27; P=0.2) and district (P=0.05). However, it was strongly associated with positive family contact (positive family contact 684, no contact 1114; P=0.01).

Risk factors were analysed separately for men and women as sexual and risk behaviours are likely to be different in them. The total number respondents for the different risk factors (represented by N) were: alcoholism (N=679; P=0.15), smoking (N=687; P=0.06), blood transfusion (N=764; P=1.0), tattoo (N=765; P=0.4), injections in the last one year (N=765; P=0.4), use of disposable needle (N=520; P=0.03), use of condom (N=764; P=0.6), number of lifetime sexual partners (N=765; P=0.5), extra-marital sex (N=553; P=0.6), pre-marital sex (N=764; P=0.5), visit to commercial sex worker (CSW) (N=764; P=0.5) and homosexual contact (N=729; P=1.0). In women, the results of the univariate analysis were as follows: alcohol intake (N=1033; P=0.5), smoking (N=1033; P=0.06), blood transfusion (N=1029; P=0.7), tattoo (N=1033; P=0.4), injections in the last one year (N=1033; P=0.9), use of disposable needles (N=772; P=0.6), use of condom (N=1028; P=0.02), lifetime sexual partners (N=1033; P=0.5), extra-marital sex (N=97; P=0.6), pre-marital sex (N=1028; P=0.5) and homosexual contact (N=729; P=1.0).

Factors with less than 10 per cent level of probability in univariate analysis were entered into a logistic regression model. The logistic model with adjusted odds ratios (OR) and probability values are shown in Table III.
Of the 1856 individuals on whom HBsAg testing was performed, 701 (37.8%) reported at least one family member with exposure to HBV as compared to 1155 (62.2%) individuals whose family members never had exposure to HBV. Among the 701 subjects (reporting family contacts), 56 (8%) were HBsAg positive as compared to 645 (92%) who were HBsAg negative. Among the 1155 individuals (who reported no family contacts), 50 (4.3%) were HBsAg positive as compared to 1105 (95.7%) who were HBsAg negative (P=0.001)

### Discussion

About 130 countries of the world are now covered by routine hepatitis B immunization\(^6\). Asian subcontinent remains a region where the vaccine, though available on request, is recommended only to health care workers and other high risk groups. There are some data from the community which suggest that exposure to the virus occurs very early, perhaps even before the first year of life, and vertical transmission from infected mothers may play a major part in viral transmission\(^7\). In India where the majority of births occur outside the organized health sector, effective early neonatal immunization may be difficult to achieve. The effect of the vaccine if given later in life, may be less than that observed in other developed countries. The epidemiological data on the dynamics of transmission are scanty and inconclusive.

This study reports epidemiological data of hepatitis B prevalence in a large group of randomly selected urban and rural subjects in the state of Tamil Nadu. We observed an overall exposure to hepatitis B infection in 27.4 per cent population in Tamil Nadu. Among this, 5.7 per cent were HBsAg positive. This is consistent with earlier observations\(^6,18-20\). Among the HBsAg positive individuals, 23.6 per cent were positive for HBe antigen which is comparable to literature available from west and other developing countries\(^6,17,21,22\). The overall exposure to hepatitis B infection may be underestimated as we used anti-HBs test to measure previous hepatitis B infection, which may fail to detect people in the “core-window period”. Anti-HBs was chosen to understand the herd immunity status of the population in addition to estimate on prevalence in this survey.

There is no statistically significant difference in the age specific prevalence of overall exposure to HB virus, HBsAg or HBeAg. However, the best estimates of age specific overall exposure to HB virus was highest in the youngest age group (15-20 yr=32.7%). The best estimates of HBsAg (7.5%) and HBeAg (37.5% in those with HBsAg) were also noted to be highest in the same age group. Earlier studies on vertical transmission have noted higher HBeAg prevalence (30-40%) in children born to infected mothers\(^21\). Valid population data on HBeAg prevalence were not available in India. We have noted an HBeAg prevalence of 23.6 per cent in those who were HBsAg positive. The most significant risk factor noted was family contact with hepatitis B virus. Lack of statistically significant difference in prevalence between age groups and highest best estimates noted

### Table III. Logistic analysis summary findings

<table>
<thead>
<tr>
<th>Variable</th>
<th>Odds ratio</th>
<th>Significance (P value)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall 1237 subjects in the model:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Household contact</td>
<td>1.4</td>
<td>0.006</td>
</tr>
<tr>
<td>Always used disposable needles</td>
<td>0.9</td>
<td>0.5</td>
</tr>
<tr>
<td>Sometimes used disposable needles</td>
<td>0.9</td>
<td>0.7</td>
</tr>
<tr>
<td>Smoking</td>
<td>1.0</td>
<td>0.9</td>
</tr>
<tr>
<td>Gender (F)</td>
<td>0.8</td>
<td>0.2</td>
</tr>
<tr>
<td>Data restricted to women - 772 subjects in the model:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Household contact</td>
<td>1.1</td>
<td>0.4</td>
</tr>
<tr>
<td>Always used disposable needles</td>
<td>1.2</td>
<td>0.2</td>
</tr>
<tr>
<td>Sometimes used disposable needles</td>
<td>1.1</td>
<td>0.6</td>
</tr>
<tr>
<td>Smoking</td>
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<td>0.04</td>
</tr>
<tr>
<td>Condom</td>
<td>0.6</td>
<td>0.07</td>
</tr>
<tr>
<td>Data restricted to men - 465 subjects in the model:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Household contact</td>
<td>2.09</td>
<td>0.0005</td>
</tr>
<tr>
<td>Always used disposable needles</td>
<td>0.5</td>
<td>0.02</td>
</tr>
<tr>
<td>Sometimes used disposable needles</td>
<td>0.8</td>
<td>0.4</td>
</tr>
<tr>
<td>Smoking</td>
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<td>0.3</td>
</tr>
<tr>
<td>Condom</td>
<td>1.3</td>
<td>0.3</td>
</tr>
</tbody>
</table>
in the younger age group support the conclusion that predominant transmission of HBV occurs early in life among those who have positive family contact.

One of the limitations of the present study was that the information was limited to a population of 15-45 yr. Information regarding the prevalence of infection in the paediatric age group would have given better insights regarding the modes of transmission in the younger age groups. HBV is one of the most infective hepatits viruses. Known risk factors were studied to understand other causes of horizontal transmission in the population. These risk factors were estimated separately for men and women since sexual mode of transmission is one of the established methods of hepatitis B virus spread in the community. After hepatitis B virus infection, HBsAg clearance is noted to be about 2 per cent per year\textsuperscript{23,24}. The present study shows no significant drop in prevalence from 15 to 45 yr. This could be due to the continued horizontal transmission of the virus in the community.

Household contact with hepatitis B virus was associated with significantly higher risk of developing overall exposure (OR=1.4; \(P=0.006\)).

Preference for injections as treatment for even minor ailments has been recorded in earlier studies\textsuperscript{21}. Even licensed health providers do not use proper sterilization methods when giving these injections. The results of the logistic regression show that use of disposable needles for injections had a significant independent protective effect in men. This data is consistent with other studies\textsuperscript{21,25,26}. However, blood transfusion and tattooing did not have significant impact on influencing the prevalence of HBV infection in the population study; this in part may be related to improved methods of screening blood in donors. Protective effect of condom has been demonstrated in other studies\textsuperscript{26} but in the present study this was seen only in the subgroup of women.

The major spread of HBV infection in the community occurs during childhood and with familial contact. Horizontal transmission related to poor injection practices and sexual behaviour may be important factors for maintaining the spread and prevalence of HBV infection in the community. Further studies need to be done to assess vertical transmission of HBV in the community.

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References


