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CONTRACT REPORT

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A STUDY OF HEPATITIS B IN THE CANADIAN FORCES

1985

by

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EXECUTIVE SUMMARY

1. This study was established to determine the incidence of Hepatitis B core antibody in CF recruits as well as the risk of acquiring Hepatitis B infection during recruit training.
2. The information obtained will serve as a guide for the Surgeon General in determining the extent to which Hepatitis B immunization should be offered within the Canadian Forces. In view of the high cost of the vaccine (more than \$100 per immunization schedule), universal immunization would be financially unacceptable.
3. In addition to causing debilitating disease featured by nausea, vomiting, fever and jaundice with a mortality rate of 2%, Hepatitis B has been associated with later development of cancer of the liver.
4. The disease is generally transmitted by blood transfusion, illegal intravenous use of drugs, by sexual contact, or contact with other secretions or blood from infected individuals. The latter route is recognized as placing medical, dental and laboratory staff at a sufficient risk to warrant immunization with the vaccine. Transmission from food handlers, although unusual, has also been suspected in some outbreaks.
5. The study concentrated on recruits undergoing training at CFB Cornwallis. The results indicated an incidence of previous exposure, as evidenced by antibodies to the Hepatitis B core antigen, of approximately 4.3% among the 1851 recruits tested.
6. Evidence was obtained for a total of 15 seroconversions from negative to positive among 1374 paired specimens. Such conversions may be related to the transmission of the disease at the recruit school but may also be a

reflection of pre-existing subclinical infections since antibodies to this virus are slow to develop.

7. The extremely low rate of seroconversion and the absence of clinical reports of Hepatitis-like illness among the population, indicate that universal immunization of recruits is not warranted.

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CONTRACT NUMBER: 97702-R-3-6791  
8SG83-00022

TITLE: A Study of Hepatitis B in the Canadian Forces

OBJECTIVE: To determine whether selected CF populations show high level prevalence of exposure (core antibody) to Hepatitis B.

REQUIREMENT: A new vaccine against Hepatitis B has recently become commercially available. In view of its high cost per immunizing dose, it is essential that only those personnel at high risk be immunized.

STATEMENT OF WORK: The contractor will examine the sera from approximately 2000 Canadian Forces personnel for the presence of Hepatitis B antibody. The ABBOTT CORZYME reagent will be used and will be supplied by DRES.

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ABSTRACT

Blood was drawn from 1851 recruits at CFB Cornwallis during basic training between July 1981 and February 1983. Paired specimens, the first being taken at the beginning of the training period and the second at the end, were received from a total of 861 male and 513 female recruits. There were 479 unpaired specimens.

Overall, 79 (4.3%) displayed antibodies to the Hepatitis B core antigen in the first sample. There was no significant difference between the 3.9% prevalence rate for males and the 5.0% rate for females.

There was evidence of a total of 15 seroconversions from negative to positive for core antibodies among the 1374 paired specimens. Thirteen of these were detected in courses with a duration of more than 8 weeks.

MATERIALS AND METHODS

Blood was drawn from 1851 recruits between the ages of 17 and 30 who were undergoing basic training at CFB Cornwallis between July 20, 1981 and February 2, 1983. A sample was taken as each recruit began the training period and another at the end of the course. At the termination of the project there were paired samples from 861 males and 513 females (total:1374) and 479 unpaired sera, two of which were taken at the end of the course indicating that these recruits had not been available for the initial sample taking.

The blood was allowed to clot and the serum removed at CFB Cornwallis, and then shipped immediately to Halifax. On its arrival at this laboratory, the serum was frozen at -20°C until the second specimen arrived. At that time, both samples were tested for antibodies to Hepatitis B core

antigen using the Abbott Corzyme system (enzyme immunoassay) and a Quantum II spectrophotometer. The tests which gave inconsistent results for the paired samples and those which gave equivocal results in any test were retested up to three times, until the validity of the test results was unquestionable. The accumulated results were tabulated, keypunched, and sent to the Department of Epidemiology and Community Health of Dalhousie University for statistical analysis, using the SPSS (Statistical Package for the Social Sciences) and Cyber 170-730 computer, with regard to age, sex, place of residence at enlistment, province of birth, change in province or country since birth, rural/urban home, length of course, and military occupation.

### RESULTS

Overall, the recruits at CFB Cornwallis showed a frequency of 4.3% for Hepatitis B core antibodies. The men stood at 3.9%, and the women at 5.0%. For the first sample received from 1849 subjects, there were 68 which were positive for antibodies to Hepatitis B core antigen and 11 which gave equivocal results, for a frequency of 4.3%. Of the 1374 second samples received, 52 were positive and 9 equivocal, for a frequency of 4.5% (see Table I). For reporting purposes, the equivocal samples are treated as positives, since they indicate probable exposure to the Hepatitis B virus followed by incomplete development of immunity. There were 15 cases in which the first sample was negative for antibodies and the second was either positive (12) or equivocal (3).

The ages of the subjects in this study ranged from 17 to 30 years, with 95% falling between 17 and 23. The average age of the males in this study was 19.2 years, and of the females, 19.4 years.

The initial requirements for the study did not include data on the home addresses of the subjects, but in the latter stages, as geographical

origins became a matter of interest in the Hepatitis A antibody study (1), this information was included. For those lacking the information, the first three digits of the Social Insurance Number were used as a guide to their general home area. Of the 1846 persons for whom the information gave some indication of area, 573 or 31.2% were from the Atlantic Provinces, 110 (5.9%) from Quebec, 751 (40.6%) from Ontario, 249 (13.6%) from the Prairie provinces and Northwest Territories, and 163 (8.8%) from British Columbia and Yukon.

Of the 875 recruits for whom the information was received, 201 (23%) had made a significant change in residence during their lifetime prior to enlistment. Some had come from as far away as the British Isles, France, Germany, Argentina, Uruguay, and Hong Kong. There were 583 for whom information was available on rural/urban living.

Military occupational categories were given for all but 27 of the recruits.

During the first months of the study, the training period at CFB Cornwallis was 10 weeks in length, and the time period between blood samples ranged from a normal of 9 weeks, to 11 weeks over the Christmas holiday season. However, as of March 1982, course time was shortened to 8 weeks, which decreased the time interval between samples to 7 to 8 weeks in the 1982-83 groups.

There was no correlation between the presence of antibodies to Hepatitis B core antigen (anti-HBc) and the following variables: age, sex, residence at enlistment, province of birth, change in province or country since birth, rural/urban home, or military occupation. (See Table II and Figure I). One possible area of interest, however, occurred in the 89 recruits known to have lived in Nova Scotia. Of the 44 males, none displayed anti-HBc, while 4 of the 45 females (8.9%) were positive for anti-HBc. The

only case in which statistically significant correlation ( $p=.006$ ) was found was in the instance of the 15 seroconverting subjects, where 13 of the cases were detected in groups which had an interval of more than 8 weeks between blood samples (see Tables III and IV).

### DISCUSSION

The study of the presence of antibodies to Hepatitis B core antigen in recruits undergoing basic training at CFB Cornwallis between 1981 and 1983 has raised more questions than it has answered. While it is gratifying to know that our young adults are within normal range for their age group in the areas north of the Mexican border, the question arises as to why the female subjects seem to have a slightly higher incidence (5%) than the males (3.9%). Then, in looking over the subjects who seroconverted, one sees that of the 15 cases, 11 (73.3%) were female. As the transmission mode of Hepatitis B has been seen differently as the years pass (from blood transfusions to intravenous drug use and currently to homosexual activity among males), the question is raised as to the source and mode of transmission in these cases. The seroconversions that we detected overlapped in their stay at Cornwallis, for the most part (see Figure 2 and Table V). As we have no epidemiological data available we can only conjecture as to the answers. Living conditions, daily routines, opportunities for intimate contact, the possibility of drug experimentation, and many other questions arise. Perhaps there is an infection source within the base.

The incidence of seroconversion dropped drastically when the course length was curtailed. Was that due to cleaner living, or was it merely because the time that elapsed between blood samples was too short to allow detection of developing antibodies?

The blood samples were not tested for Hepatitis B surface antigen.

Is it present in the seroconverting sera? There are several subjects who display a very high level of HBcAb, and it is known that carriers of Hepatitis B have that characteristic, so there may be HBsAg-positives among them.

Is anyone else in the group developing the disease and in the pre-antibody stage?

It could be of value to follow up the subjects insofar as is possible, given the mobility of this segment of society, as we now have a baseline on which to build. The comparisons which have been made between the Cornwallis recruits and the crew of HMCS Margaree (1) have been quite interesting. Together, these groups give a picture of very little difference in the incidence of Hepatitis B across Canada (See Figure 3).

A recent article in Canada Diseases Weekly Report (2) indicates that the occurrence of anti-HBs alone is much higher than that of anti-HBc alone in their study group of Canadian Forces health care personnel. This is at odds with the findings of other studies (see Table VI and references 3, 4, and 5). We are in an excellent position to throw more light on this question since the sera is already on hand and the testing partly done. If we were to test for Hepatitis B surface antigen and its antibody, we would have an excellent reference group for future studies across Canada.

#### REFERENCES

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3. James, LTC J.J., Cowan, LT D.N., Johnson, SSG W.L., Heath, SP D.G., Polk, Maj A.J., Stienmier, Col R.H. Serological markers for Hepatitis types A and B among United States army blood donors. *Military Medicine*, 146, 1981.
4. James, J.J. and Smith, L. Serological markers for Hepatitis types A and B among U.S. army soldiers, Germany. *American Journal of Public Health*, 69: 12, 1979.
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TABLE I Summary of results of specimens testing

| Specimen            | Number of Specimens | Positive Number (%) | Equivocal Number (%) |
|---------------------|---------------------|---------------------|----------------------|
| Beginning of course | 1849                | 68 (3.7)            | 11 (0.6)             |
| End of course       | 1374                | 52 (3.8)            | 9 (0.7)              |

TABLE II The correlation of various factors with the presence of hepatitis B core antibodies in Cornwallis recruits 1981-1982

| Factor                          | Correlation with Anti-HBc                               |
|---------------------------------|---|
| Age                             | none  |
| Sex                             | none  |
| Residence at enlistment         | none  |
| Province of birth               | none  |
| Significant change of residence | none  |
| Rural/urban background          | none  |
| Military occupation             | none  |
| Length of course                | p = .006 for seroconversions in course length > 8 weeks |

TABLE III Seroconversions detected as related to the time interval between serum samples

| Interval between sera (weeks) | Number of cases studied | Seroconversions |       |
|-------------------------------|-------------------------|-----------------|-------|
|                               |                         | Number          | (%)   |
| 7                             | 387                     | 2               | (0.5) |
| 8                             | 63                      | 0               | (0.0) |
| 9                             | 673                     | 10              | (1.5) |
| 10                            | 148                     | 2               | (1.4) |
| 11                            | 85                      | 1               | (1.2) |

TABLE IV CFB Cornwallis: Results by course of testing recruits for hepatitis antibodies 1981-1982

| Course # | Course Length | Single | Pairs | Total | Pos. A | Pos. B | ±   | Seroconversions                  |
|----------|---------------|--------|-------|-------|--------|--------|-----|----------------------------------|
| 8129     | 9 wks.        | 38     | 84    | 122   | 17     | 6      | 2   | 2 (B)                            |
| 8129W    |               | 12     | 48    | 60    | 7      | 4      | 0   | 4 (B)                            |
| 8133     | 10 wks.       | 35     | 47    | 82    | 17     | 4      | 1   | 0                                |
| 8133W    |               | 12     | 54    | 66    | 11     | 3      | 2   | 2 (B)                            |
| 8137     | 9 wks.        | 29     | 66    | 95    | 18     | 4      | 0   | 0                                |
| 8137W    |               | 16     | 73    | 89    | 22     | 6      | 0   | 2 (B)                            |
| 8141     | 8½ wks.       | 43     | 73    | 116   | 28     | 3      | 1   | 1 (B)                            |
| 8141W    |               | 24     | 79    | 103   | 21     | 4      | 1   | 1 (B)                            |
| 8145     | 11 wks.       | 25     | 50    | 75    | 20     | 4      | 0   | 0                                |
| 8145W    |               | 10     | 44    | 54    | 9      | 5      | 0   | 1(B)                             |
|          |               |        |       |       | 170    | 43     | 7   | Hep. A: 0(0.0%)                  |
|          |               |        |       |       | 244    | 618    | 862 | 19.8% 5.0% 0.8% Hep. B: 13(2.1%) |
| 8201     | 9 wks.        | 28     | 73    | 101   | 13     | 0      | 0   | 0                                |
| 8201W    |               | 20     | 69    | 89    | 14     | 3      | 0   | 0                                |
| 8213     | 7 wks.        | 18     | 42    | 60    | 13     | 0      | 0   | 1 (B)                            |
| 8213W    |               | 10     | 22    | 32    | 7      | 1      | 0   | 0                                |
| 8217     | 7 wks.        | 21     | 58    | 79    | 10     | 0      | 0   | 1 (A)                            |
| 8217W    |               | 2      | 50    | 52    | 8      | 0      | 0   | 1 (B)                            |
| 8220     | 7 wks.        | 4      | 26    | 30    | 6      | 1      | 0   | 0                                |
| 8220W    |               | 10     | 32    | 42    | 9      | 1      | 0   | 0                                |
| 8223     | 7 wks.        | 24     | 79    | 102   | 22     | 3      | 0   | 0                                |
| 8228     | 7 wks.        | 9      | 79    | 88    | 5      | 3      | 2   | 0                                |
| 8233     | 7½ wks.       | 24     | 63    | 87    | 13     | 1      | 0   | 0                                |
| 8244     | 9 wks.        | 26     | 52    | 78    | 11     | 1      | 0   | 0                                |
| 8245     | 9 wks.        | 16     | 46    | 62    | 15     | 5      | 1   | 0                                |
| 8245W    |               | 7      | 21    | 28    | 6      | 2      | 0   | 0                                |
| 8248     | 9 wks.        | 9      | 22    | 31    | 2      | 6      | 0   | 0                                |
| 8248W    |               | 5      | 23    | 28    | 2      | 0      | 0   | 0                                |
|          |               |        |       |       | 233    | 756    | 989 | 156 27 3 Hep. A: 1(0.1%)         |
|          |               |        |       |       |        |        |     | 15.8% 2.7% 0.3% Hep. B: 2(0.26%) |