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Hepatitis B virus infection in Northern Ireland 1970–1987

J H Connolly, W M McClelland, H J O'Neill, D Crowley

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SUMMARY

In the 18 years between 1970 and 1987, 504 patients were found to have hepatitis B surface antigen (HBsAg) in their blood. Acute hepatitis was present in 184 patients and six died (3·3%). The annual incidence of acute hepatitis B virus infection in Northern Ireland was about one-quarter that of England and Wales. A decrease in acute infection occurred in 1986–87, while in England and Wales acute infection has fallen by more than half since the peak in 1984. Hepatitis B virus infection in health care staff and patients in high risk groups were reviewed: 32% were in those of foreign origin or who had known foreign contacts. In blood donors there was a marked fall in incidence of hepatitis B surface antigen carriage from 1982 onwards: the incidence in antenatal patients and those screened for rubella antibody (mainly females) was half that of new blood donors in 1972–81. Carrier rates in blood donors and antenatal patients were less than those from other parts of the United Kingdom. All indices show that Northern Ireland has a lower incidence of hepatitis B virus infection than the rest of the United Kingdom.

INTRODUCTION

Hepatitis B virus infection is a large problem in the world. It has been estimated that there are in excess of 200 million human carriers, but the distribution of these carriers is uneven. The prevalence of carriers in northern Europe, North America and Australia is 0·1% or less, but rises to 20% or more in some parts of Africa, Asia and in the Pacific region. Hepatitis B vaccine is now available but it is expensive. A knowledge of local epidemiology is important to assess whether vaccine is required.

PATIENTS, MATERIALS & METHODS

Testing for hepatitis B surface antigen began in the Regional Virus Laboratory in 1970 in blood donors required for the Renal Unit, Belfast City Hospital. The immunodiffusion test was used initially; in 1974 this was replaced by the more sensitive reverse passive haemagglutination test (RPHA) (Hepatest-Wellcome) and from 1984 onwards the very sensitive enzyme-linked immunosorbent assay (ELISA) (Hepanostika-Organon Teknika) was used. The Regional Virus

Regional Virus Laboratory, Royal Victoria Hospital, Belfast, BT12 6BN.
J H Connolly, MD, FRCPI, FRCPath, Consultant Virologist.
H J O'Neill, BA, PhD, FIMLS, Principal Scientific Officer.
Northern Ireland Blood Transfusion Service, 89 Durham Street, Belfast, BT12 4GB.
W M McClelland, MB, MRCPath, Director, Northern Ireland Blood Transfusion Service.
D Crowley, FIMLS, Chief Medical Laboratory Scientific Officer.
Correspondence to Dr Connolly.

Laboratory receives specimens from patients with clinical or suspected hepatitis from hospitals and general practitioners throughout Northern Ireland.

Over 5,000 patients are screened for HBsAg each year. Patients and staff in the Renal Unit, Belfast City Hospital, are screened, as are all donors of organs and sperm, and certain population group surveys. In certain cases other markers of hepatitis B virus infection are tested.

The Northern Ireland Blood Transfusion Service began routine screening of all blood donors in 1972 using the immunoelectro-osmophoresis test. The RPHA test was introduced in 1975 and the radioimmunoassay test (Blood Products Laboratory, Elstree) in 1982. An ELISA test (Wellcozyme) has been used from July 1987. Screening of antenatal patients began in 1973 and of blood samples sent for rubella screening in 1982. Positive blood samples were referred to the Regional Virus Laboratory for confirmation. All hepatitis B surface antigen positive patients were reported confidentially to the Public Health Laboratory Service, Communicable Disease Surveillance Centre, in London.

RESULTS

HEPATITIS B SURFACE ANTIGEN IN PATIENTS AND CARRIERS

There were 504 patients and carriers identified in the 18 years from 1970 to 1987; 282 (56%) were detected by the Regional Virus Laboratory and 222 (44%) by the N I Blood Transfusion Service.

The annual incidence for each laboratory is shown in the Figure. Both showed a variable pattern; the peak years were 1983 and 1985. The age of blood donors is not usually recorded; however, the age distribution of 350 patients and carriers ranged from newborn to 74 years old. The highest incidence was in the age group 20–29 years and 60% of all patients were male.

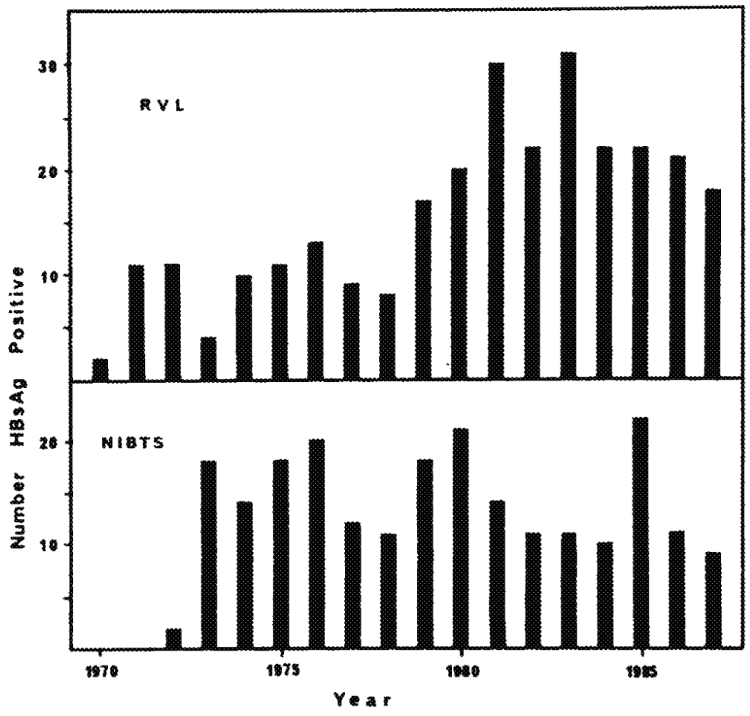

Figure.
Number of hepatitis B surface antigen (HBsAg) positive patients identified at the Regional Virus Laboratory (RVL) and the Northern Ireland Blood Transfusion Service (NIBTS) from 1970 to 1987.

The categories of patients who were HBsAg-positive and the number of patients who had acute hepatitis B virus infections are shown in Table I. There were 184 patients with symptoms or signs of acute hepatitis, accounting for 65% of the total diagnosed by the Regional Virus Laboratory (131 males and 53 females). The average annual incidence of acute infection per 100,000 population was 0·95 for males and 0·37 for females. There were six deaths, a mortality rate of 3·3%. In the age group 15–64 years there were 125 males and 50 females, an average annual incidence per 100,000 population of 1·48 for males and 0·58 for females. Three hundred and twenty patients were carriers in high risk groups or were detected on screening.

TABLE I

Categories of patients infected with hepatitis B virus

	Number with acute hepatitis (deaths in brackets)	*Total including carriers*	*%*
Regional Virus Laboratory			
Health care workers and spouses	18 (1)	25	5·0
Haemophiliacs	11 (1)	11	2·2
Received multiple transfusions	8	8	1·6
Recently tattooed	8	8	1·6
Post-surgery	20	24	4·8
Intravenous drug abusers	17	22	4·4
Renal unit patients	4	4	0·8
Mentally handicapped patient	0	1	0·2
Homosexual/bisexual contacts	8	17	3·3
Heterosexual contacts	12 (1)	16	3·2
Babies and children of known carrier mothers	1	16	3·2
Foreign-born children	0	18	3·5
Foreign-born adults or foreign contact	25	44	8·7
Donors of organs and tissues	0	3	0·6
Others	52 (3)	65	12·9
N I Blood Transfusion Service			
Blood donors	—	117	23·2
Antenatal patients	—	90	17·8
Patients screened for rubella antibody	—	15	3·0
Totals	184 (6)	504	100·0

HEALTH CARE WORKERS AND SPOUSES

Medical and dental: There were five surgeons or trainee surgeons with hepatitis B virus infection but none had been infected in Northern Ireland — India (one acute), Republic of Ireland (one acute), Africa (two carriers), and the Far East (one carrier). Two wives were infected: one had acute hepatitis and the other was a carrier. Three other doctors had been infected, one acutely in a Dublin neonatal unit, one in a London liver unit (carrier) and one in Africa (carrier). Only one

dentist was infected and died of acute hepatitis aged 63 years, but there had also been a history of receiving recent treatment from an unlicensed electrolysis parlour.

Nurses: Four nurses had acute hepatitis B virus infection while working in Northern Ireland. These were a midwife, a nurse who was vomited over by a known carrier, a nurse who received a needlestick injury from an acutely infected patient in the Renal Unit, and a male nurse who gave a history of needlestick injury. None had received prophylaxis with anti-hepatitis B immunoglobulin. In addition, a nurse with acute hepatitis had been infected in Saudi Arabia, and another nurse, a carrier, had been infected in Hong Kong. The average number of nurses in Northern Ireland per year between 1970 and 1987 was 14,980, giving an average annual incidence of acute hepatitis B virus infection of 1·48 per 100,000.

Laboratory staff: Four laboratory staff had acute infections: three worked in clinical chemistry and one in a haematology laboratory. Three became infected between 1971 and 1974 and the fourth in 1985. In addition, a laboratory worker in a Jamaican laboratory had acute hepatitis B virus infection. The mean number of laboratory staff in Northern Ireland between 1970 and 1987 was 542 per year, giving an average annual incidence of acute infection of 41 per 100,000.

Others: A hospital cleaner with a history of needlestick injuries developed acute hepatitis B virus infection. A hospital administrator in Oman and a hospital worker in Papua New Guinea also had acute infections while in Northern Ireland.

BLOOD AND BLOOD PRODUCTS TRANSMISSION

These high risk groups include those who within the previous six months had received blood or blood products, multiple transfusions, had been tattooed or had surgery, or were intravenous drug abusers.

Haemophiliacs: Acute infections occurred in 11 patients between 1972 and 1982 after receiving blood transfusions, cryoprecipitate or factor VIII, and one patient died aged 51 years.

Multiple transfusions: Acute infections took place between 1970 and 1980 in eight patients who had received multiple transfusions after surgery.

Tattoos: Seven males and one female had acute infections following tattooing. Two had been tattooed in Singapore and one in Hong Kong.

Post-surgery: There were two clusters of five patients each, and a third cluster of three patients who were associated with the use of an inadequately sterilised reusable piece of equipment. Five other patients had received dental treatment only but there was no evidence of clustering.

Intravenous drug abusers: Four patients had known contacts in London and one in Dublin.

RENAL UNIT

In July 1971 hepatitis B surface antigen was first discovered in a patient with chronic renal failure on haemodialysis. Two further patients were detected in September and a fourth patient in October. All patients carried the 'd' subtype of HBsAg. The first three patients were jaundiced. These patients did not share any equipment, but the first had received blood transfusions in a peripheral hospital and two others received blood transfusions in the Renal Unit before becoming

HBsAg positive. The first patient refused further haemodialysis and died, and the other three patients remained carriers for short periods (6–15 weeks) before becoming negative. While they were positive the four patients were isolated and dialysed in a separate Portakabin until they became negative. During the outbreak, staff and patients were screened weekly. A nurse received a needlestick injury from the fourth patient in October 1971 and became positive for 11 days only, two months later; she felt ill at the time, but liver function tests remained normal.

HOSPITAL FOR THE MENTALLY HANDICAPPED

Hepatitis B virus markers of infection were investigated in 720 patients in the largest hospital for the mentally handicapped in Northern Ireland during 1987. Only one HBsAg carrier was found (0·14%) who was hepatitis B 'e' antigen (HBeAg) negative and antibody to hepatitis B 'e' antigen (anti-HBe) positive which indicated low infectivity.

SEXUAL AND PERINATAL SPREAD

Of the 33 homosexual/bisexual and heterosexual contacts with hepatitis B virus infection, one heterosexual man died aged 32 years. Twelve infants and four young children were positive for HBsAg whose mothers were also known carriers. Twelve of the mothers were local, two Chinese, one African and one Afghan.

FOREIGN-BORN OR FOREIGN CONTACTS

There were 161 people (32%) infected with hepatitis B virus who were foreign-born or had foreign contacts. The two main foreign groups were Chinese (73) and Vietnamese (32). Some of these patients were classified in other high risk groups. Since 1982, about half of all hepatitis B virus infected persons diagnosed have been of foreign origin. Ninety were diagnosed by the Regional Virus Laboratory. The main groups were 21 Chinese and 23 Vietnamese, including 18 children under 18 years of age of whom 15 were Vietnamese and three were Chinese. These were additional to the 16 babies and young children infected perinatally. The NI Blood Transfusion Service detected 71 foreign-born people who were carriers. Twelve were blood donors, 48 antenatal patients and 11 were being screened for rubella antibody; 52 were Chinese and nine Vietnamese. In addition there were 37 HBsAg positive blood donors who were not indigenous Northern Ireland inhabitants.

DONORS OF ORGANS AND TISSUES

All organ and sperm donors are screened for hepatitis B surface antigen and antibody to human immunodeficiency virus. Two potential donors of ear ossicles and one potential kidney donor were HBsAg carriers.

OTHERS

There remained 65 (12·9%) patients investigated by the Regional Virus Laboratory who were infected with hepatitis B virus where a risk factor was not identified. There were three deaths in this group (two males aged 50 and a female aged 70 years).

BLOOD DONORS

The number of blood donors tested each year ranged from 50,006 in 1974 to 66,614 in 1986. The number of 'new' donors (previously untested for HBsAg) ranged from 9,302 in 1973 to 17,266 in 1987. Potential donors with a history of

hepatitis or jaundice during the previous 12 months were excluded, as were those with other risk factors for hepatitis B virus infection during the previous six months. Exclusion of those belonging to high risk groups for AIDS was introduced in 1983. The results of screening for hepatitis B surface antigen are shown in Table II.

TABLE II

Incidence of hepatitis B surface antigen (HBsAg) carriage in blood donors, antenatal patients and patients screened for rubella antibody

Category screened	*Years*	*Number tested*	*Number HBsAg positive*	*Incidence*
New blood donors	1972–81	130,459	82 (41)	1:1,591 (1:3,182)
	1982–87	79,195	16 (8)	1:4,950 (1:9,899)
Prior blood donors	1972–81	419,779	(17)	(1:24,693)
	1982–87	305,220	(2)	(1:152,610)
Antenatal patients and Patients screened for rubella antibody	1973–87 1979–87	375,760	105 (46)	1:3,759 (1:8,169)

Figures in brackets refer to indigenous Northern Ireland inhabitants.

One hundred and seventeen donors were carriers. In the new donors there was a threefold drop in incidence from 1972–81 to 1982–87. For the same two periods the incidence of HBsAg in donors found HBsAg negative on previous donations (prior donors) showed a sixfold drop.

Included in the new donors screening positive were 12 people of foreign origin and 37 transient residents from other parts of the United Kingdom. The number of these non-indigenous people tested was small in relation to the total number of new donors and, if these 49 positives are removed from the total, it halves the incidence, which corresponds more closely to the incidence in the indigenous population.

ANTENATAL PATIENTS AND PATIENTS SCREENED FOR RUBELLA ANTIBODY

All the positive antenatal patients were first-time positives and did not include those positive in a previous pregnancy. Ninety antenatal patients and 15 patients screened for rubella antibody were carriers. The incidence of hepatitis B surface antigen in this predominantly female group is less than half that of the new blood donors in the period 1972–81, and there was no drop in incidence between 1973–81 and 1982–87. Fifty-nine were of foreign origin; if these are excluded from the total the incidence again corresponds more closely to the incidence in the indigenous population.

PASSIVE AND ACTIVE IMMUNISATION

Human anti-HBs globulin was used in a Medical Research Council trial after inoculation accidents from 1973. It was available in limited amounts for clinical trial from the Blood Products Laboratory, Elstree, for accidental exposure from 1978. From 1983 it was obtained from the Scottish National Blood Transfusion

Service. To date, no one in Northern Ireland has developed hepatitis B virus infection who had received anti-HBs globulin following accidental exposure to infected patients. Plasma-derived hepatitis B vaccine (Merck, Sharp & Dohme Ltd) was available in 1982 but was expensive at £63.50 per course. Genetically engineered hepatitis B vaccine (Smith, Kline & French Ltd) became available in 1987 and was less expensive (£31.50 per course). At about this time the cost of plasma-derived vaccine was reduced to £36.22 per course. Very little vaccine was used in Northern Ireland up until 1987.

DISCUSSION

The main methods of hepatitis B virus spread are inoculation of infected blood and blood products, and sexual intercourse. During the period under study, there has been a continuous improvement in work practices to prevent infection in health care facilities, and more sensitive tests have been developed for the detection of hepatitis B surface antigen. Both these factors have contributed to greater safety. There was a steady increase in the number of positive patients in Northern Ireland until about 1985 since when the numbers have fallen by about 40%. There was an increase of acute cases in England and Wales which reached a peak of 2,000 cases in 1984 but then dropped sharply to about 800 cases in 1987.[1] Warnings about the risk of acquiring AIDS may have led to a decrease in drug abuse by injection and a modification of behaviour by homosexual men. The peak incidence in Northern Ireland was in the 20–29-year-old age group and males were more commonly infected than females. Other studies have shown similar results.[2]

Clinically only 184 patients (36%) had symptoms and signs of acute hepatitis B virus infection, the rest being carriers, which highlights the necessity of being aware of infection in high risk groups who are otherwise well. The average annual rate of acute infection in the 15–64-year-old age group per 100,000 population was 1·48 for males and 0·58 for females which is about one-quarter the incidence found in England and Wales in the same age group.[2]

The risk to health care staff was small. No surgeon or doctor was first infected while working in Northern Ireland. One dentist became infected and died, but there was strong epidemiological evidence that this infection was by means other than practising dentistry, which emphasises the danger of procedures which puncture the skin with instruments which may be inadequately sterilised. However, there was an increased risk when surgeons operated in areas of the world where the carrier rate was high, and patients who come from such countries to Northern Ireland for surgery present a greater hazard than the local population. Surgeons as a group in England had an annual incidence of 25/100,000 during 1980–84 which had doubled since 1975–79, while dentists had an annual rate of 17/100,000.[2]

Four nurses developed acute infection, two of them after needlestick injuries. Approximately 40% of self-inoculation accidents occur while resheathing needles using both hands and this should not be done unless there is a safe means available.[3] Needles may be resheathed safely using a one-handed method and the needle should remain safe once it has been disposed of into a 'sharps' container in the ward and thereafter until final disposal outside the hospital. Education plays a very important part in the safe disposal of contaminated 'sharps' and all members of the health care professions must be taught how to do it correctly. Anti-HBs globulin should be given to the person suffering the

needlestick injury if the source of the needle is known to be a hepatitis B positive person. The annual incidence of 1·48 nurses per 100,000 in Northern Ireland is less than that found in the female population aged 15–64 years in England and Wales, and is three to five times less than that found in nurses in England (7/100,000 in 1975–79 and 4/100,000 in 1980–84).[2] The fall in incidence in England was probably due to the adoption of safer working practices.

The case of a hospital cleaner who developed hepatitis after a needlestick injury emphasises that resheathing needles safely should prevent such injuries in people 'downstream' in the disposal chain from those who used the needles. The risk of acquiring hepatitis B virus infection following an accidental needlestick injury from a carrier ranges from 6% to 30%, which is far in excess of the risk of human immunodeficiency virus infection following a similar injury with an infected patient where the risk is $<1\%$.[4] Four laboratory staff became infected with hepatitis B virus. Statistics from England indicate that the annual rate in laboratory staff doubled from 18 to 37/100,000 between 1975–79 and 1980–84,[2] while in Northern Ireland three of the four cases occurred between 1971 and 1974. Nevertheless the overall incidence for Northern Ireland is similar to that of England in 1980–84.

Transmission of hepatitis B virus by blood and blood products such as cryoprecipitate and factor VIII has almost ceased following the screening of blood donors and the development of more sensitive and specific tests. There was no evidence that haemophilia patients became infected after 1982 and patients who received multiple transfusions after 1980 did not have acute hepatitis B virus infections. Tattooing is a high risk procedure, particularly if carried out abroad in a country where the incidence of hepatitis B virus infection is increased. Any procedure which uses unsterilised instruments such as ear-piercing, acupuncture, electrolysis, unregistered chiropody and accidental skin piercing in hairdressing and barbers carries a risk. The association of infection with previous surgical procedures is difficult to prove. There was probably only a chance association in those patients who gave a history of dental treatment in the previous six months, since dental treatment is common and there was no obvious 'clustering' of patients. There were three 'clusters' of cases identified involving a total of 13 patients. Advice was given to the staff involved, measures to preserve asepsis were instituted, and no further cases were indentified. It has been estimated that in England and Wales the average annual risk of a patient developing acute hepatitis B virus infection as part of a cluster caused by staff during surgical procedures was one in a million operations.[5]

Intravenous drug abuse is a small problem in Northern Ireland. The number of addicts notified was 13 in 1985 and 11 in 1986.[6] However, there are large numbers of intravenous drug abusers in Dublin, Edinburgh, Glasgow and London, and it is not known how many contacts are made with these cities. Drug abuse was the commonest high risk group in England and Wales and accounted for 23·9% of all cases of acute hepatitis B virus infection reported to the Public Health Laboratory Service in 1980–84.[2] Renal units are often cited as having a high risk of transmission to patients and staff, but while this may be true of other countries it does not now apply to the United Kingdom. Following a prevention and control programme instituted in 1971, the Renal Unit at the Belfast City Hospital has been free of hepatitis B virus infection since 1972. This programme included screening of blood donors, screening of patients monthly and staff every three months, and the isolation of infected patients in 1971 until they became

HBsAg-negative. Similar programmes were carried out throughout the United Kingdom which resulted in the almost complete elimination of hepatitis B from dialysis units.[7,8]

Psychiatric hospitals are also regarded as having an increased risk of hepatitis B virus infection for patients and staff. In the largest hospital for the mentally handicapped in Northern Ireland only one out of 720 patients (0·14%) screened was found to be an HBsAg carrier of low infectivity. This contrasts markedly with 9% of patients found to be chronic carriers in a hospital for the mentally handicapped in the Republic of Ireland[9] and 7·6% in a hospital for the mentally subnormal in Wessex, Southern England.[10]

Hepatitis B can be spread sexually; male homosexual/bisexuals and heterosexual contacts with cases or carriers accounted for 6·5% of the total. In a study by the Public Health Laboratory Service male homosexuals alone were 7·8% of the total.[2]

Sixteen babies positive for HBsAg had mothers who were also positive antenatally. These children usually become lifelong carriers.[11] Transmission is mainly perinatal and intrauterine infection is rare. Transmission is likely if the mother has an acute infection in the last trimester of pregnancy or early in the puerperium. Mothers who are HBsAg carriers and are HBeAg-positive or who are both HBeAg- and anti-HBe-negative have an increased risk of transmitting hepatitis B virus infection to their babies. Transmission from mother to child is lower in Europe and North America than in the Chinese race. However, transmission has occurred from white women to their babies in Northern Ireland.[12]

One hundred and sixty-one (32%) of those found to be HBsAg-positive were foreign-born or had foreign contacts and 105 (78%) of these were of Chinese or Vietnamese origin. While both groups constitute a very small minority in the Northern Ireland population, they have contributed substantially to the total number of cases. Only three potential organ donors were found to be HBsAg-positive but it is essential to maintain an emergency laboratory service for testing organ donors for both HBsAg and anti-HIV. Since a hepatitis B virus infected donor could donate at least both corneas and both kidneys, four recipients could be infected.

All patients should be treated as if they were carriers of both the hepatitis B and the human immunodeficiency viruses and suitable precautionary measures taken when dealing with blood or other body fluids — wearing gloves, gowns or aprons and eye protection as well as avoiding skin puncture from contaminated 'sharps'.

Although blood donors are self-selected and not quite typical of the general population, new donors of the indigenous population in the early years of testing (1972–81) may be as close as one can get to the HBsAg carrier incidence in the population. The threefold fall in incidence between 1972–81 and 1982–87 may be caused by further self-selection of males due to publicity about AIDS, which started about that time. A similar drop in incidence was seen in the prior donors between the same two periods. The local incidence of HBsAg positive tests in new donors (1:1,590 or 1:3,180 for the indigenous population) is less than the 1:562 found by North London Blood Transfusion Centre, Edgeware,[13] or the 1:800 found by the Glasgow and West of Scotland Blood Transfusion Service,[14] but is similar to the 1:1,670 found in the Oxford region in 1973–84.[15] The 1:24,690 incidence in prior donors is, however, a measure of the very low incidence of HBsAg infection occurring in previously HBsAg-negative individuals

and is lower than the 1:16,000 found in the Glasgow and West of Scotland Blood Transfusion Service.[14]

A fall in number of positive HBsAg tests did not occur during 1982–87 in the antenatal patients or in the predominantly female patients screened for rubella antibody. This again suggests that the fall observed in the blood donors during this period was due to self-exclusion of male donors. The Northern Ireland incidence of positive tests in the antenatal patients and the patients screened for rubella antibody was less than half that found in new donors during 1972–81 and again confirms the two–threefold lower incidence of hepatitis B virus infection in females. The incidence is five times lower than that detected in Oxfordshire and Northamptonshire,[15] eight times lower than in the West Midlands,[16] and 20 times lower than in London.[13] In the indigenous Northern Ireland population the incidence is still lower.

The use of vaccine should be based on local epidemiology. The small groups who really are at increased risk might be offered vaccine, rather than the blanket coverage at present recommended. This strategy is logical and cheaper, but it is more important that safe working practices should be taught since good technique protects against all microbiological hazards.[17]

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