thus comparable with the pharmacy students who identified altruism as their primary career motivator, closely followed by an interest in science[13] although the pharmacy students' appreciation of good employment prospects was not mentioned specifically by these Pacific students.

In other respects, the sample studied differed from the general health professional student population. Most (75%) of the New Zealand medical students surveyed in 2001, for example, had at least one parent who had a tertiary qualification, 17% of whom were practicing health professionals. More than 25% of these medical students came from homes in which the annual income exceeded $100,000.[11] Only a few of the Pacific students in the present survey, however, had these advantages which, given that parental education and employment play a major part in career choices,[11, 15] may be one of the explanations for the low number of Pacific students in these programmes.

Other external factors that influence students' choice of careers is access to good education at secondary school and the encouragement of appropriate role models. Although most respondents in this study had attended schools with a high decile (high socioeconomic community) rating, Pacific students in the population as a whole are disproportionately enrolled in low decile (low socioeconomic community) schools.[15] Moreover, the least popular subjects studied by Pacific school students are the biological and physical sciences, the essential prerequisites to a career in health sciences.[14, 16] Only a few respondents to this survey reported that they had been encouraged by high school teaching or guidance staff to consider a career in health; many had, however, been inspired by stories in the media, both factual and fictional.

Various strategies that might be employed to increase recruitment of Maori students into the health have been identified.[7] The information obtained in the present study – despite its limitations – indicates that the use of similar strategies might also increase the recruitment of Pacific students.

While the tertiary providers of health professional programmes can do little to reduce socioeconomic disparities between Pacific people and others in the population, they could perhaps do more within their existing systems to encourage such people into their health programmes. More focused targeting of younger school children, especially in areas of high concentration of Pacific people, such as parts of South Auckland, might encourage more to study the subjects they would need for entry into health science programmes. This would require even greater cooperation than currently occurs between university liaison personnel and school staff, perhaps aided by the presence of some actively practising and recognisable role models as well as articulate and enthusiastic tertiary Pacific students

Both the University of Otago and the University of Auckland currently offer programmes that bridge the gap between high school and health science studies at their institutions. These programmes have been designed to help those who may have been poorly prepared academically at secondary level and thus ease their transition into the even greater demands of tertiary study. Only a few study participants had taken one of these programmes. Similarly, the mentoring support offered by both Otago and Auckland, although identified as very valuable, was not taken up by all students, despite being freely offered and widely advertised. If more students, especially those whose families are overseas, could be encouraged to seek and accept this form of support, they might have fewer problems settling into both New Zealand and university life.

Most of the students who participated in this survey were ambitious, many wanting to pursue specialisation after graduation. Almost all, however, had as their focus the intention to work with their own people, to help improve health outcomes. As a result they could well become the role models for others to emulate in the future – provided that some of the barriers that hinder recruitment into the professions are lowered.

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New Zealand medical and dental students must be immunised against Hepatitis B, but how effective is the vaccine?

A systematic review of the efficacy of the Hepatitis B Vaccine among health care workers.

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ABSTRACT

A review of the relevant literature investigating the clinical use of hepatitis B vaccine. In the pre-vaccination era, transmission of hepatitis B in medical settings was a public health issue, especially in high-risk areas, such as haemodialysis units and oncology wards. All findings indicate that the vaccine is efficacious and safe to administer. Hepatitis B vaccination programmes can help reduce the incidence of hepatitis B infection in the population, irrespective of the individual's relative risk. With such a programme, the incidence of hospital-acquired hepatitis B infections could be profoundly reduced.

Keywords: Hepatitis B Vaccine, Chronic Hepatitis B, Health Care Workers, Medical Student, New Zealand.

Abbreviations: Chronic Hepatitis B (CHB), Health-Care Worker (HCW), Hepatitis B Virus (HBV), Hepatitis B Virus surface antigen (HBsAg), Hepatitis B Virus core antigen (HBcAg), Hepatitis B Virus early antigen (HBeAg).

INTRODUCTION

Hepatitis is inflammation of the liver. Hepatitis can be attributed to several infectious and non-infectious causes, hepatitis B virus (HBV), being one of the infectious causes. HBV can be transmitted via contact with bodily fluids; for example, transfusion of infected blood, sexual contact and mother-to-foetus transmission. Furthermore, HBV has a higher risk of being transmitted through needle-stick injuries (estimated 1.9-40%) than most of other blood borne pathogens.[1] For instance, hepatitis C virus has an estimated 2.7-10% risk of transmission through needle-stick injuries, whereas HIV has an estimated risk of 0.20-0.44%.1 Thus, health-care workers (HCW) can be considered as a high risk group of being infected with hepatitis B. It is estimated that the cumulative prevalence of past/present HBV infections among surgeons is10-18% worldwide.[2] Most cases of hepatitis B in adults are self-limiting, and patients do not require any medical intervention. However, a small percentage of people go on to develop chronic hepatitis B (CHB), particularly those with cellular immune impairment. CHB is a more serious condition, which may lead to liver cancer (also known as hepatocellular carcinoma), liver cirrhosis or liver failure. CHB is a particularly common outcome from HBV infection in newborn infants and it also has increased risk, although decreasing, after acute hepatitis B in early childhood. This is because the pattern of antigen appearance in the blood and the virus' incubation period is different in those patients than in adult patients.

Adult patients who contract HBV (fig. 1) have one or more virus-related proteins in their blood at any one time:

Hepatitis B Virus surface antigen (HBsAg): is expressed on the main surface protein of the virus. It starts to appear in patients' blood after the virus' incubation period (typically 6-20 weeks). It is a diagnostic marker of a current HBV infection. It starts disappearing from the blood as patients' symptoms fade away. HBsAg is the antigen that is able to stimulate protective serological immunity.

Hepatitis B Virus core antigen (HBcAg): does not appear in blood, since it is encapsulated by virus' main protein. However, HBcAg appears to stimulate protection, against subsequent HBV infections, at the T cell level. Antibodies to HBcAg (abbreviated HBcAb) appear in the blood after the incubation period. It lasts in patients' blood forever, and thus, it is a good marker of past Hepatitis B infection.

Hepatitis B Virus early antigen (HBeAg): appears to be derived from virus production in infected liver cells. It is a good indicator of patient's infectivity, since it typically correlates with high viral load in the blood (viraemia).

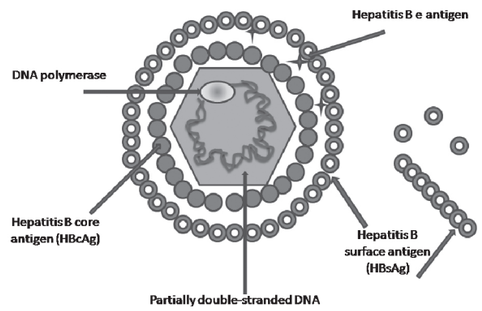

Figure 1. A simplified drawing of the HBV particle and antigens.[3]

Those antigens are used in detection of the disease and evaluation of the stage of the infection.[4] The Hepatitis B vaccine contains one of the HBV proteins (HBsAg) which, when administered, triggers the immune system to develop anti-HBsAg antibodies. Historically, this was derived from CHB patients' sera.[5] Now, more sophisticated recombinant vaccines are used. However, both vaccines are of equal effectiveness and are well-tolerated.[6]

HBV is estimated to chronically affect 350 people million people around the world, 75% of which are concentrated in Asian and Western Pacific regions.[4] New Zealand has been categorised in the lowest hepatitis B prevalence category by international comparative data[7]. However, a number of studies in New Zealand show disparity in the prevalence of CHB between various ethnicities, occupations, regions and age groups.[7] These studies have estimated that CHB during the 1980s, ranged from 5.4% in Maori police and customs workers, to as high as 16% in Maori children in the Eastern Bay of Plenty.[7] On the other hand, CHB prevalence has been somewhat steady in European populations, ranging from 1-3% only.[7] There are limited data on Pacific and Asian people in New Zealand.

METHODS

Types of studies

Observational studies and randomised controlled trails were included, irrespective of blinding or publication status. Such studies, however, may not capture rare adverse events due to their relatively small sample size, so previously published large cohort studies, meta-analyses and systematic reviews were also considered.

Types of intervention

The following comparisons were assessed:

- Intradermal versus intramuscular Hepatitis B vaccine.
- Deltoid intramuscular injection versus gluteal intramuscular injection of Hepatitis B vaccine
- Standard Hepatitis B vaccination schedule (at 0, 1 and 6 months) versus rapid Hepatitis B vaccination schedule (at 0, 1, and 2 months).
- Hepatitis B booster vaccination versus no booster vaccination.

Types of outcome measures:

The primary outcome measure was:

- Hepatitis B events at maximum follow-up.
- The number of HCW working without the minimum protective levels of anti-HBs (less than 10IU/L).
- Local adverse events, such as: pain, swelling and/or myalgia at the site of inoculation after each injection of the vaccine.

Search methods for identification of studies:

PUBMED and MIDLINE (from January 1966 to March 2008) were searched by combining the word "vaccine" with one of the following words: medical, doctor, health-care worker, health-care provider, student, hepatitis B, professional, physician, surgeon, and university. Results were limited to articles written in English and Arabic languages.

RESULTS

The efficacy of the Hepatitis B vaccine is best assessed and presented in the systematic review by Chen W. and Gluud C.5 This review includes 21 randomised trails, irrespective of blinding, publication status or language. It excludes quasi-randomised trails and observational studies. For rare and severe adverse events, it also includes large cohort studies, meta-analyses and previous systematic reviews. HCW were chosen as they are assumed to be healthy and in contact with blood or blood products, contaminated instruments, body fluids and tissues. A hepatitis B event would be considered to have occurred if a person had two or more consecutive blood specimens that were HBsAg and/or HBcAb positive.[5]

These studies reveal that intramuscular vaccinations cause more systemic adverse events, while intradermal vaccinations cause more local adverse events.[5] Furthermore, deltoid injections seem to be more effective in boosting antibodies than gluteal injections.[5] In addition, the standard vaccination schedule (at 0, 1 and 6 months) produces a better antibody response than a rapid vaccination schedule (at 0, 1 and 2 months).[5] A recent separate study by Fitzsimons D. et al showed that Hepatitis B vaccine was effective in nearly all recipients of the vaccine. And even though the antibody titres declined with time elapsed after the first vaccination, to below the accepted level of 10mIU/mL, vaccinated responders had persisting antibodies and/or cellular immunity that could respond powerfully to a vaccine challenge.[8] Table 1 displays findings on Hepatitis B vaccine efficacy from different studies on HCW and/or university medical students.

Table 1. Different studies examining efficacy of the Hepatitis B vaccination among HCW and University students.

Author, publication and year	Study group and method	Place	Main findings
Olubuyide IO et al.[9] QJM, 1997.	Cross-sectional survey of 75 physician, surgeons and dentists.	Departments of Medicine, Restorative Dentistry and Oral and Maxillofacial Surgery, University College Hospital, Ibadan, Nigeria.	Prevalence of HBV in vaccinated doctors and dentists (n=15): 15.3% Prevalence of HBV in non-vaccinated doctors and dentists (n=60): 43.5% OR 2.83 (95% CI 0.55-19.5, p<0.05).
Fisker N et al.[10] European Journal of Epidemiology, 2004.	Cross-sectional survey of 1439 hospital staff, 960 (67%) of which were HCW.	Odense University Hospital, Odense C, Denmark.	-Non-HCW (p<0.001): Prevalence of HBV in vaccinated staff (n=14): 0% Prevalence of HBV in non-vaccinated staff (n=458): 2% -HCW (p<0.001): Prevalence of HBV in vaccinated staff (n=215): 0.9% Prevalence of HBV in non-vaccinated staff (n=733): 1.6%
Shapiro CN et al.[11] The Journal of Bone and Joint Surgery, 1996.	Cross-sectional survey of 3411 conference attendees, 3239 (95%) of which underwent a hepatitis B infection blood-test.	The 1991 annual meeting of the American Academy of Orthopaedic Surgeons, Atlanta, USA.	Prevalence of HBV in vaccinated surgeons (n=2300): 5% OR 7.48 (95% CI 5.91-9.48).
Su FH.[12] Journal of Viral Hepatitis, 2008.	This study examined the status of HBV infection amongst 5875 students, 18 years after the implementation of a nation-wide mass hepatitis B vaccination programme in 1984.	At a private university in northern Taiwan in 2005.	Prevalence of HBV in 1987 birth-year cohort students (n=670): 5.2% Prevalence of HBV in 1976 birth-tier cohort students (n=76): 48.7% p<0.0001

DISCUSSION

Limitations

Although the current Hepatitis B vaccine has proven to be effective in reducing the incidence of hepatitis B infection, it does not cure already-existing disease. There are limitations to the vaccine programme adopted currently. These limitations can be grouped into 3 categories:

Limitations associated with administering the vaccine.

Limitations of the vaccine itself.

Practical limitations.

Firstly, any hepatitis B vaccination programme, whether national or international, faces some limitations associated with administration of the vaccine. For example, many studies have shown that intradermal and intramuscular vaccines are of similar efficacy.[5] On the other hand, one randomised controlled trail found that the intramuscular route may be preferable.[5] However, the intramuscular vaccine requires a larger quantity of the antigen (HBsAg) than the intradermal vaccine, hence increasing the cost of intramuscular administration.[5] In contrast, the intradermal route allows a progressive diffusion of the antigen and a longer action-time of the vaccine. Therefore, less antigen is used, and is a cost-effective route of administration. Unfortunately, the vaccine adjuvant (aluminium hydroxide) to enhance the anti-HBsAg action can cause a granuloma to form at the site of the injection.[5]

The Hepatitis B vaccine regimen has practical problems. Since the current Hepatitis B vaccine is of killed-virus type or recombinant/purified protein type, it requires administration of multiple doses of the vaccine to reach immunity. Thus, the current three-dose Hepatitis B vaccination regimen might deter people who do not like needle-injections. There is also a possibility, although slim (estimated 10-15%), of requiring a 4th (booster) vaccine especially in non-responders.[5] Non-responder incidence tends to increase with age: 1% at birth, 5% at age 20 years, and approximately 50% at age 60 years.[8] However, most of those non-responders tend to be obese, alcoholics with advanced liver disease, immunosuppressed, or on renal dialysis.[13] Recently, a new combined vaccine against both hepatitis A and hepatitis B (Twinirix) has been formulated. This combined vaccine may raise concerns surrounding the current separate vaccines, which are less cost-effective than the combined one.[14] Studies have shown that this combined vaccine is as efficacious against hepatitis A and hepatitis B as the separate vaccines.[14] Current research is aiming to find alternative administration routes, such as the oral route[15], as well as aiming to combine hepatitis B vaccine with other vaccines, such as the Human Papilloma Virus (HPV) vaccine.[16]

Finally, the Hepatitis B vaccine itself faces obstacles. Even though the current vaccine is efficacious, immunogenic and safe, certain groups of people cannot make use of it. Travelers and HCW may need a faster-acting vaccine. Non-responders to the current vaccine including immunosuppressed people may benefit from a more immunogenic vaccine.[17] This may also reduce the number of injections required and, hence, the cost of the vaccine.[17]

Ethical considerations

While the Hepatitis B vaccination has been shown to be efficacious and safe, mandatory immunisation raises some ethical and public controversy. It is known that HBV can be transmitted sexually, so abstinence or use of condoms could be part of the solution. However, one of the more sophisticated issues is the balance between the rights of the medical/dental student, the rights of the patient and society's expectations. The rights of medical/dental students lie in their interests in furthering their careers and patient care, as well as the right to privacy and freedom from discrimination.[2] On the other hand, patients' rights range from autonomy and the right to be protected from harm, to the freedom of choosing and consenting to the medical staff.[2] Society's interests revolve around providing a safe and affordable health care.[2] Table 2 shows the assessment used in Canadian universities of the suitability of a medical/dental student practicing clinical work should he/she become HBV-infected.[2]

Table 2. Assessment of HBV infectivity by serological marker status and suggested curriculum restrictions.[2]

HBsAg	HBeAg	HBV DNA	Suggested curriculum restrictions
Negative	Negative	Negative	No curriculum restrictions or modifications necessary. Offer immunisation.
Positive	Negative	Negative	No curriculum restrictions or modifications necessary. Offer yearly blood tests to confirm HBV DNA titers.
Positive	Positive	Positive	Cease performing exposure-prone procedures. Undergo antiviral therapy. Offer chance to rejoin programme after successful therapy.

CONCLUSION

Hepatitis B, in its chronic state, is a serious liver disease, and has been found to be a precursor to many liver complications. It is estimated that 350 million people around the world have CHB. Unlike other viruses such as HIV, HBV is more infective, yet is preventable by vaccinations. Many studies have shown hepatitis B vaccine's safety and efficacy, as has been alluded to in this review. However, vaccination programmes against hepatitis B face a number of practical limitations and ethical issues that need to be considered first. Nonetheless, these issues appear to be outweighed by the benefits this vaccine offers.

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MAAP

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MAAP Christchurch is up and running with several fundraising events planned for this year. We are looking for enthusiastic new members, fresh ideas and offers of support. We would love to get MAAP re-established in Auckland, Wellington and Dunedin so if you are interested, please contact Felicity Williamson or Alex Frankpitt at maap.christchurch@gmail.com