Vaccination and screening of medical students: results of a student health initiative

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ABSTRACT

Objective: To evaluate the immune status and vaccination needs of first-year medical students in relation to bloodborne viruses and common vaccine-preventable diseases.

Design, setting and participants: Survey of first-year medical students at the University of New South Wales, Sydney, NSW, attending a mandatory screening and vaccination clinic, 2002–2005.

Main outcome measures: Self-reported history of vaccination or natural infection; serological evidence of immunity to measles, mumps, rubella and varicella (presence of specific IgG) and hepatitis B (presence of hepatitis B virus surface antibodies) or infection with hepatitis B and C viruses and HIV; and Mantoux test results.

Results: 733 students attended the clinic (85% of those enrolled). Four students were positive for HBsAg and four had hepatitis C antibodies. None were HIV-positive. Twenty-nine per cent (216/733) were not immune to hepatitis B, 33% (238/724) to mumps, 26% (190/724) to measles, 13% (91/724) to rubella and 10% (75/724) to varicella. About 23% (91/237) needed further testing for tuberculosis. Immunity corresponded poorly with self-reported history of vaccination. More students reported vaccination against rubella (96%), measles (81%) and mumps (80%) than were immune, and fewer reported vaccination against hepatitis B (44%).

Conclusions: Many students were not immune to vaccine-preventable diseases, and a small number had a previously undiagnosed bloodborne virus infection (hepatitis B or C). The level of immunity to vaccine-preventable infections was unacceptable and justified the provision of an easily accessible program for screening and vaccination.

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Vaccination of medical students is important to protect them from acquiring and transmitting vaccine-preventable infections in clinical practice. Clinical institutions and universities generally have policies for the screening and vaccination of health care workers, but vary in how they manage medical students. Education of students about their vaccination needs, and compliance checks may also be lacking.[1] New South Wales Department of Health policy requires all health care workers, including health care students, to know their status in regard to the bloodborne viruses HIV and hepatitis B and C, and to be vaccinated against a range of vaccine-preventable infections — hepatitis B, pertussis, varicella, measles, mumps and rubella.[2]

This study examined self-reported vaccination status and serological results for a cohort of 733 first-year medical students who attended a medical-student vaccination and screening program over a 4-year period between January 2002 and December 2005. This information provides a basis for evaluating the predicted and actual level of immunity at entry to medical school and the vaccination needs of this group.

METHODS

In 2002, the University of New South Wales set up a mandatory screening and vaccination program for first-year medical students. Previously, vaccination and screening guidelines were available for medical students, but compliance was not uniformly monitored. From 2002, students were required to attend a vaccination clinic for screening (by questionnaire and standard serological tests) and vaccination according to NSW Department of Health guidelines.[2] This service was financially supported by the medical faculty and was free to the students.

Students were asked to answer a questitonnaire on demographic data, including country of birth, and previous vaccinations, and to bring any available documentation on vaccination to the clinic. They underwent serological tests for antibodies to HIV and hepatitis C virus (HCV) and hepatitis B surface antibodies (HBsAb) and, in some, for hepatitis B surface antigen (HBsAg), and measles, mumps, rubella, and varicella-specific IgG antibodies. Some students brought serology results to the clinic that had been organised by their own health care provider. These were accepted if performed in Australia within the previous 6 months.

Students who were not immune to hepatitis B, pertussis, varicella, measles, mumps or rubella were appropriately vaccinated. The need for vaccination with the combined acellular pertussis, tetanus and diphtheria vaccine was decided on the basis of history and documentation provided. All students with positive or equivocal serology results for bloodborne viruses were appropriately followed up.

Students also underwent standardised Mantoux testing and were referred for further investigation and treatment as required.[3,4]

RESULTS

Survey and serological data were available for 733 students (85% of enrolled students). Age range was 16–65 years, and over 90% of students were immediate secondary school leavers. Birth country was available for 396 students, of whom 45% were Australian-born; 75% (297/396) had undertaken at least part of their schooling in Australia. Country of birth is shown in Box 1.

Most students were aware of some childhood or school-based vaccinations, but only about one in three had any documentation, and many were unsure which vaccines they had received. Providing documentation was complicated by the fact that many students were from overseas. Self-reported vaccination rates are shown in Box 2. Most students believed they had previously been vaccinated against rubella (96%), tetanus (82%), measles (81%), mumps (80%), and polio (67%). Fewer believed they had been vaccinated against hepatitis B (44%) and varicella (5%). Previous BCG vaccination was reported by 32%.

Results of serological screening are shown in Box 3. Hepatitis B immunity was more common than expected from the survey (71%). This was due to previous infection in nine (2%) (positive for hepatitis B virus core antibodies as well as anti-HBs), and to vaccination in the remainder (positive for anti-HBs). Four students were found to have

1 Country of birth of surveyed medical students ($n = 396$)

Region	No. (%)
Australia or New Zealand	177 (45%)
Central Asia	105 (27%)
South-East Asia or Pacific	61 (15%)
Middle East	11 (3%)
North America	5 (1%)
South Africa	2 (0.5%)

2 Responses of 733 first-year medical students to survey of previous vaccination*

	Yes	No	Unsure
Rubella	704 (96.0%)	29 (4.0%)	0
Tetanus*	597 (81.5%)	97 (13.3%)	38 (5.2%)
Measles	596 (81.3%)	37 (5.0%)	100 (13.6%)
Mumps	587 (80.1%)	30 (4.1%)	116 (15.8%)
Polio†	490 (67.0%)	56 (7.7%)	185 (25.3%)
Hepatitis B	324 (44.2%)	37 (5.0%)	372 (50.8%)
BCG*	233 (31.8%)	209 (28.6%)	290 (39.6%)
Varicella	38 (5.2%)	79 (10.8%)	616 (84.0%)

* One student did not answer. † Two students did not answer. ◆

3 Serological status of 733 first-year medical students

	Detected	Equivocal	Not detected
Bloodborne viruses			
Anti-HBs ($n = 733$)	517 (70.5%)	28 (3.8%)	188 (25.7%)
Anti-HBc ($n = 480$)	9 (1.9%)	0	471 (98.1%)
HBsAg ($n = 631$)	4 (0.6%)	0	627 (99.4%)
Anti-HCV ($n = 733$)	4 (0.5%)	2 (0.3%)	727 (99.2%)
Anti-HIV ($n = 733$)	0	0	733 (100%)
Other infections			
Varicella zoster virus IgG ($n = 724$)	649 (89.6%)	6 (0.8%)	69 (9.6%)
Rubella virus IgG ($n = 724$)	633 (87.4%)	64 (8.8%)	27 (3.8%)
Measles virus IgG ($n = 724$)	534 (73.8%)	42 (5.8%)	148 (20.4%)
Mumps virus IgG ($n = 724$)	486 (67.1%)	42 (5.8%)	196 (27.1%)

Anti-HBs = hepatitis B virus surface antibodies. Anti-HBc = hepatitis B virus core antibodies. HBsAg = hepatitis B virus surface antigen. HCV = hepatitis C virus. ◆

chronic hepatitis B infection (positive for HBsAg), and three of these were also positive for hepatitis B e antigen.

Two students had initial equivocal serological results for hepatitis C, which subsequently proved to be false-positive results. Three students (0.4%) had definite evidence of hepatitis C infection, and another continued to have indeterminate serological results and was referred for specialist follow up. Two had HCV RNA detected using standard methods (COBAS Amplicor HCV test, version 2.0, Roche). No students were HIV-positive.

For other infections, the highest level of immunity was found against varicella, followed by rubella, measles and then mumps. Fewer students were screened for immunity to these diseases, as some were tested by their own health care providers, who did not always include infections other than the bloodborne viruses.

Compliance with attendance at this program was about 85% of first-year medical students. This increased only slightly over the 4 years reviewed.

Fewer students were compliant with Mantoux testing (397/733; 54%). Of these, about 76% (300) had negative results, 15% (61) had positive results, and 8% (30) had strong positive results. The 91 with positive results were referred for further testing and treatment.

DISCUSSION

Our study found that many medical students were not immune to vaccine-preventable infections, and that their self-reported history of previous vaccination was often inaccurate. Vaccination of medical students is important for many reasons — they have an occupational risk for acquiring these infections and they are a recognised source of outbreaks.[1,5-7]

Medical students sustain needlestick injuries at a rate comparable with other hospital personnel,[8] but, until recently, many policies for health care workers have not specifically included health care students.[9] Some argue that occupational health and safety guidelines cannot be applied to students as they are not employees,[10] but students are explicitly included in the definition of health care workers from the United States Centers for Disease Control and Prevention[11] and in local policies.[2]

The processes required for screening and vaccination of students are not always well established.[12,13] It is difficult to enforce compliance, and our study found that 15% of medical students were still non-compliant. Like ours, most studies have found unacceptable levels of immunity to vaccine-preventable diseases.[1,14-20] Several studies found that, for a vaccination program to be effective, it must be easily accessible, free (or at least subsidised), and well understood.[1,7] Some studies have found cost of vaccination to be an important barrier, as is perception of lack of risk.[5,21]

This study, like others, found that students had poor specific knowledge of their previous vaccinations.[22,23] A poor correlation between historical information and serological test results has been found previously, mandating serological testing.[16]

The proportion of students found to be immune to hepatitis B (71%) is higher than found in some previous studies,[17] and probably reflects childhood schedules that include hepatitis B vaccination in many countries. However, the 29% rate of non-immunity is of particular concern, given that clinical exposure occurs immediately on medical school entry in most current Australian medical curricula.

For measles, mumps and rubella, rates of immunity reflect the expected community rates, given the effectiveness of childhood vaccination programs. For varicella, the high rate of immunity reflects the high rate of natural infection.

The finding that 0.5% of students had chronic hepatitis B infection was very

important. None of these students were aware of their status before screening, and it had major implications for both their health and career choices.[24] The three students with chronic hepatitis B infection were considered infective. Similarly, two of the students with hepatitis C had hepatitis C RNA detected, and would also be considered infective.

One of the most difficult aspects of this program was Mantoux testing — both compliance with testing and interpretation of results. Only 54% of the cohort attended for testing, with particularly poor compliance with the requisite second visit, and there were also periods during which purified protein derivative was not available. Students also had concerns about the consequences of positive test results. There was also a high rate of positive Mantoux results, necessitating further investigations. Interpretation was further complicated by the high rate of previous BCG vaccination.

Many issues influence the success of a medical student screening and vaccination program, including the level of responsibility assumed by the universities and health care institutions, available funding, enforcement of the program, ramifications for non-compliant students, and the stage at which students begin clinical exposure. There is also the issue of student confidentiality, which potentially conflicts with the requirement of institutions to see serological evidence of immunity. Students infected with bloodborne viruses who have to exclude themselves from exposure-prone procedures may perceive potential and actual discrimination.

We encountered a number of problems with this program. There was debate about which institution should carry financial responsibility. Data collection was difficult and time-consuming, surveys were often returned incomplete, and students frequently lost documentation. Compliance with completing vaccinations (particularly for hepatitis B) was a problem. Although there were few false-positive serological results for bloodborne viruses, they were distressing for the students involved.

The recent move by many medical schools to early clinical exposure of students has increased the need for an easily accessible, subsidised and well understood vaccination and screening program. Since our program began, the NSW Department of Health has adopted even more rigorous vaccination and screening standards for all medical personnel working within the health care system, with all now being asked to show evidence of compliance. These make the establishment of an effective process to screen and vaccinate all medical students early in their career even more vital.

COMPETING INTERESTS

None identified.

AUTHOR DETAILS

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