

IMMUNISATION:

Does Practice Reflect Preaching?

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ABSTRACT

The issue of childhood immunisation is never too far from the minds of paediatricians and paediatric allied health professionals. The recent implementation by the Australian Government of the establishment of a National Immunisation Register appropriately signifies its recognition of the importance of immunising children for vaccine preventable diseases, and with the requirement by schools for proof of immunisation on enrolment will serve to remind parents and health professionals of the need to vaccinate the children in their care.

"The issue of childhood immunisation is never too far from the minds of paediatricians and paediatric allied health professionals".

But do the carers maintain their own immunisation? A number of studies, including a very large serological survey in the United States¹, have indicated that the proportion of the population which has protective levels of antibody to vaccine preventable diseases

diminishes rapidly after the age of the last scheduled childhood immunisation²⁻¹¹. Average serological immunity to tetanus in populations of developed countries is in the 50-70% range, but when age is included in the analysis, the rates vary from about 96% at age 6, to as low as 40% for those over seventy years old, with the latter being the age group at highest risk of tetanus infection. Slightly better results are found in studies of healthcare workers^{4,8}, which confirmed declining levels of immunity with increasing age.

We recently completed a study¹² of a Sydney population of ages over 40 years which has confirmed that local rates of immunity are similar to those published in studies conducted overseas. In a separate study, we examined the tetanus, diphtheria¹³, Haemophilus influenza type b (Hib) and pneumococcal antibody levels of 51 staff of the Childrens Hospital. At the time of this serosurvey, neither Hib nor pneumococcal immunisation were routinely available, but immunisation of adults for tetanus and diphtheria could easily be obtained by vaccinating with ADT.

We report here that the levels of immunity to tetanus and diphtheria in a group of Childrens Hospital staff, who are occupationally exposed to both vaccine-preventable diseases and to copious immunisation literature, were in agreement with published findings.

These findings demonstrate the vulnerability of a health-orientated professional group to certain vaccine-preventable diseases, and the failure of health care staff to demonstrate increased awareness of the value of

vaccination for adults at risk, compared to the lay population. We conclude that existing proimmunisation literature, which targets children for immunisation, fails to suggest the importance of up to date immunisation for adults, and indicates the need for a specific educational campaign in support of adult immunisation, also observed overseas¹³⁻¹⁶.

Introduction

Numerous studies published in the last decade have examined immunisation practices in developed countries, with the emphasis of these studies being on coverage of populations thought to be at greatest risk of the vaccine preventable diseases: children. A number of studies have examined rates of immunity in older children and adults, and a consistent finding in the United States, European countries and New Zealand, is for reasonably high level of immunity to be found in children and young adults, with this level declining with the increasing age of the population group studied. No large study of rates of immunity has been published for Australian populations.

In this project, which is part of a study of broader scope, we examined the rates of immunity of staff of a children's hospital to certain vaccine preventable diseases: tetanus, diphtheria, Haemophilus influenza type b (Hib), and pneumococcus. At the time of this study, vaccination for Hib and pneumococcus was not performed routinely. This childrens hospital has a good record of being proactive in the promotion of childhood immunisation, during the

period of the study conducting "on the spot" immunisation to its Accident and Emergency Department. Staff of the hospital are well aware of the importance of childhood immunisation, but we reveal here that the levels of immunity in those staff are no higher than those published for the general population.

Our results indicate that campaigns for immunisation of children do not necessarily promote awareness of the need for vaccination of adults, even in a population highly motivated towards immunisation.

Materials and Methods

We recruited 51 staff members of the Children's Hospital Camperdown, from Nursing, Allied and Technical, Clerical and Medical staff groups, who gave informed consent for serology to be performed on a sample of blood collected for this research. Total staff numbers of the hospital were approximately 2000. No attempt was made at randomisation, nor was there any effort made to include or exclude volunteers who had actively participated in childhood immunisation programs conducted by the Hospital.

There were 18 Nursing staff (18 female, 0 male), 6 Allied & Technical staff (3 female, 3 male), 6 Clerical staff (4 female, 2 male) and 21 Medical staff (8 female, 13 male). The group studied are not representative of Hospital staff generally, and management is particularly under represented in this group.

Serum prepared from a single blood sample collected by venepuncture from the volunteers was included in routine assays for IgG antibody specific for tetanus toxoid, diphtheria toxoid, Hib capsular antigen, and the capsular antigens of three serotypes of pneumococcus which are included in the Pneumovax vaccine. Serology was performed by well established "in-house" ELISA assays which are used for routine diagnostic purposes in a laboratory registered by the National Association of Testing Authorities.

For immunity to Hib, the levels of specific antibody accepted as being protective are 1.0 ug/ml for long term protection, with levels of 0.15 ug/ml or higher indicating immunity at the time of testing. There are no universally accepted levels of specific antibody which are considered protective for tetanus or diphtheria, but in a normal healthy patient we would report immunity as uncertain when antibody levels are below 0.2 EU/ml. For pneumococcal serology,

protective levels of antibody are not known, and we compare patient levels to a reference standard pool of post immunisation, normal adult human sera, which has an arbitrary 1000 units of specific IgG antibody.

Volunteers were advised of the results of serological tests on their blood samples, and were offered advice about their need for vaccination. A follow-up study will examine the number of staff with low or absent immunity, who sought immunisation after their results were made known.

Results

Tetanus serology

Overall 3/51 (6%) had no serological immunity to tetanus, and a further 2/51 (4%) had borderline positive titres. Thus, we considered 90% of staff to be adequately protected from tetanus. The remaining 10% were all female, and were medical or nursing staff.

Diphtheria serology

Overall 28/51 (56%) had no serological immunity to diphtheria. 8/18 (44%) males were not immune, evenly distributed in the professional groups. 20/33 (61%) females were not immune, with significantly greater numbers of non-immunes in the medical and clerical groups.

Haemophilus influenzae type b serology

Overall 28/51 (56%) had no serological immunity to *Haemophilus influenzae* type b (Hib). These were evenly distributed among gender and professional groups.

Pneumococcal serology

Overall 41% of staff had high levels of antibody to at least one of the pneumococcal serotypes tested. Nursing and medical staff were more likely to be immune. More male medical staff were immune than female medical staff (80% of males, 14% of females), and 62% of nursing staff were immune to at least one serotype of *Streptococcus pneumoniae*, with 25% of the immunes tested having high levels of antibody to all three serotypes tested.

Discussion

Healthcare staff are subjected to a significant amount of exposure to information about immunisation, and at a children's hospital are, in particular, informed of the importance of vaccinating children. Many medical, nursing, and technical staff are selectively immunised during training, or preemployment, for at least tetanus and hepatitis B.

At a paediatric treatment centre, one can expect to routinely encounter patients infected with diphtheria, *Haemophilus*, or *S. pneumoniae* (pneumococcus). Results not shown here indicate that the highest levels of serological immunity to diphtheria were found in medical staff of the Infectious Diseases and Casualty departments of this children's hospital, which may reflect increased exposure.

The results of our tetanus antibody serosurvey, surprisingly, place the non-immune individuals in the medical and nursing staff. Even so, the proportion of staff who are immune is well above that reported for the general population. Therefore, staff should be aware of the need for immunisation.

Our staff also had a higher proportion of individuals immune to diphtheria than the general population (where levels of serological immunity may be extremely low, particularly in adults). This cannot be accepted as indication of immunisation, because of the high likelihood of exposure of some of the staff to the disease organism. The fact that such a large proportion of the staff have no serological immunity to diphtheria more likely indicates that few have been recently immunised for diphtheria.

In the case of *Haemophilus influenzae* type b (Hib) immunity, a history of immunisation of these adults is unlikely, and positive titres probably reflect recent infection with this organism. Nearly half of the staff therefore have results suggestive of fairly recent infection with Hib.

Similarly, vaccination of healthy staff with Pneumovax is unlikely, and the fact that only 25% of "immunes" had high levels of antibody to each of the three serotypes tested, suggests that these antibodies are the result of natural exposure.

In this context, therefore, the presence of antibodies is likely to be the result of natural infection, and this is seen in about half of the staff, for each organism tested.

Approximately 2.5% of the Hospital staff were tested, with an emphasis on staff at the frontline of exposure to infectious diseases: the nursing and medical staff. For all agents tested, other than tetanus (which is not a common infection in children) less than half of the staff are immune to these vaccine preventable diseases.

Our results are consistent with the recently published findings of studies conducted overseas on general populations, revealing a significant proportion of the adult population to

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be lacking protective levels of antibodies to certain vaccine-preventable diseases.

Vaccines for tetanus and diphtheria are well established, and have been used for many years to protect children and military personnel. Vaccines are successful, suitable, inexpensive, and easily accessible. Hib vaccines are now also easily accessible and shown to be effective, though, like the pneumococcal vaccine (Pneumovax 23) are not routinely prescribed for adults.

The Childrens Hospital Camperdown (now at Westmead) is proactive in the field of childhood immunisation, participating in educational campaigns, and performing "on-the-spot" immunisation of children visiting the Accident & Emergency Department who had an incomplete vaccination history. Generally, the staff of this Hospital are quite aware of the importance of vaccination.

In such a climate of vaccine-awareness, one might assume that our volunteers would have considered their own immune status, particularly with the increased possibility of occupational exposure to some of these vaccine-preventable diseases. Our results show that the proportion of this group with protective levels of antibody was little higher than that of the general population, based on results of other published studies. Protection for diphtheria, for which there is a routinely available vaccine, was no higher than protection for Hib and pneumococcus.

Conclusions

Our results indicate that, for any organism tested (other than tetanus), about half of the staff have had a natural exposure. This study was not capable of evaluating morbidity data, and the consequent cost of sick leave, and was not designed with the intention of performing a cost-benefit analysis of immunising hospital staff for these vaccine-preventable diseases. Nonetheless, if we attribute two days' sick leave for each infection with each organism (excluding tetanus), the total amounts to about 2.5 thousand sick-days, with a resulting cost far in excess

of the cost of the vaccinations.

We conclude that the campaigns which promote childhood immunisation, although they are targeted at those who care for children, are not successful in promoting awareness of the need for immunisation by adults, even in a group of paediatric healthcare staff. These results indicate the need for an adult immunisation awareness program.

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Sharps Container Alert

A recent incident in NSW highlights the need to ensure the safe placement of sharps containers.

A child visiting a general practitioners surgery received a needlestick injury following the insertion of a hand into a sharps container placed on the floor.

The Royal Australian College of General Practitioners document *Sterilisation/Disinfection Guidelines for General Practice*, 1994, when referring to sharps containers states that "Care

should be taken in the placement of such containers so that children cannot reach them under any circumstances. Specifically sharps containers must not be located on the floor, as children have been observed to place their hands inside containers."

The NSW Health Department's *Infection Control Policy* also requires placement of containers such that they are not easily accessible to children.

All practitioners are requested to assist in the wide dissemination of this information and undertake preventative measures.

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