MASTER OF APPLIED EPIDEMIOLOGY

BOUND VOLUME

Submitted for the degree of Master of Applied Epidemiology

by

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ACKNOWLEDGMENTS

I submit this volume for examination for the degree of Master of Applied Epidemiology, in accordance with the requirements of the Degree of Master of Applied Epidemiology, Australian National University.

I undertook the fieldwork while attached to the Western Sector Public Health Unit, in New South Wales, between April 1992 and February 1994.

Except where stated to the contrary, the contents are the results of my own original epidemiological field investigations, data collection, analysis and interpretation.

Jane Caroline Bell
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I have been most fortunate to have been enrolled in the Master of Applied Epidemiology (MAE) program conducted by the National Centre for Epidemiology and Population Health (NCEPH), Australian National University.

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My field placement in the Western Sector Public Health Unit (WSPHU) in North Parramatta was extremely rewarding. Thank you to all members of the WSPHU. They ensured my time was happy and productive, and provided me with professional fellowship, assistance, and encouragement. Particular thanks to Tony Capon and Louisa Jorm. They were both extraordinarily tolerant of my inabilities to understand the obvious, and enthusiastically supported my fieldwork. I also thank Christine Roberts. When I started my field placement she was a major source of advice and information about the New South Wales Infectious Diseases Surveillance Scheme.

I am looking forward to extending my public health and epidemiological education and experience. I have had wide exposure to a variety of public health experiences. These and the training I have received while enrolled in the MAE program will be invaluable. Thank you to everyone who has contributed.
Summary of requirements for Master of Applied Epidemiology

1. Field Investigations

1.1 Gastroenteritis at a church camp

1.2 Human parvovirus B19 in a public school and a preschool

1.3 Hepatitis A in a community of disabled people

1.4 Legionnaires’ disease in western Sydney

2. Surveillance

Child Dental Health Survey, NSW 1992

3. Publications in peer reviewed journals


Letters


4. Reports published in CDI


5. Presentations at scientific meetings

Immunisation status of children at school entry in the Wentworth Health Area, 1992.
Public Health Association of Australia, Annual Conference, Canberra, 1992

5.2 J.C. Bell, A.G. Capon.
Why investigate minor outbreaks of gastrointestinal illness?
New South Wales Public Health Network Conference, Sydney, 1992

Which children are not fully immunised?
Public Health Association of Australia, National Immunisation Conference, Melbourne, 1993

5.4 J Bell, L Jorm, M Williamson, N Shaw, D Kazandjian.
Follow up of 184 people exposed to Legionella bacteria at a seminar for retired people.

5.5 J Bell, E Crewe, A Capon.
Hepatitis A in a community of people with developmental disabilities in western Sydney, Australia.
Field Epidemiology Training Program’s (FETP) Annual International Conference, Chiang Mai, 1994

5.6 J Bell, L Jorm, M Williamson, N Shaw, D Kazandjian, A Capon.
A seminar for 184 retired people: were they exposed to Legionella?
Field Epidemiology Training Program’s (FETP) Annual International Conference, Chiang Mai, 1994
## ABBREVIATIONS

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
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<tbody>
<tr>
<td>AHS</td>
<td>Area Health Service</td>
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<tr>
<td>AIHW</td>
<td>Australian Institute of Health and Welfare</td>
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<tr>
<td>CDHS</td>
<td>Child Dental Health Survey</td>
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<tr>
<td>DCC</td>
<td>Child Day Care Centre</td>
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<tr>
<td>DHU</td>
<td>Dental Health Unit</td>
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<tr>
<td>DSRU</td>
<td>Dental Statistics and Research Unit</td>
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<tr>
<td>EHO</td>
<td>Environmental Health Officer</td>
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<tr>
<td>ICPMR</td>
<td>Institute of Clinical Pathology and Medical Research, Westmead Hospital</td>
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<tr>
<td>NSW</td>
<td>New South Wales</td>
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<tr>
<td>PHN</td>
<td>Public Health Nurse</td>
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<td>PHO</td>
<td>Public Health Officer</td>
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<td>PHUs</td>
<td>Public Health Units</td>
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<td>SDS</td>
<td>School Dental Service</td>
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<td>WSPHU</td>
<td>Western Sector Public Health Unit</td>
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1. BACKGROUND

The Western Sector Public Health Unit

The Western Sector Public Health Unit (WSPHU) is located in a demountable building in the grounds of Cumberland Hospital in the shadow of the sandstone wall of the Parramatta Correctional Services Centre. The hospital and surrounds were established on the banks of the Parramatta River. The sandstone buildings, extensive grounds and mature trees reflect its original purpose of caring for people with mental disabilities.

WSPHU is one of 14 Public Health Units (PHU) in metropolitan and rural New South Wales. It was established in 1990 to service two health areas, Western Sydney and Wentworth. The map on the following page shows the location of the two health areas. WSPHU is responsible to, and funded by both Western Sydney and Wentworth Area Health Services. It also has liaising and reporting responsibilities to Epidemiology and Health Services Evaluation Branch of the New South Wales Health Department.

WSPHU has three main focuses; infectious diseases surveillance and response, environmental and food health, and general epidemiological support to the Area Health Services. In 1993 there were 22 people working in the PHU. Fifteen were employed by the Area Health Service, three were research officers involved in asthma research and four were Public Health Officers, undergoing public health training.
WSPHU is also part of the conglomerate known as the Western Sydney Public Health Consortium. The consortium comprises the Department of Community Medicine at Westmead Hospital, the Centre for Health Economics Research and Evaluation, the Western Sydney Health Promotion Unit and WSPHU.

The Western Sector Population

The western sector includes the Western Sydney and Wentworth Health Areas. Western Sydney Health Area covers the five local government areas (LGAs) of Auburn, Baulkham Hills, Blacktown, Holroyd, and Parramatta, an area of 753 km². Wentworth Health Area comprises the Blue Mountains, Hawkesbury and Penrith LGAs, an area of 4,600 km².

Approximately 851,000 people live in the western sector; 590,000 in the Western Sydney Health Area and 270,000 in the Wentworth Health Area. When compared to the age structure of the NSW population as a whole, both Western Sydney and Wentworth populations are relatively young.

Western Sydney

Large variations in socioeconomic attributes exist across Western Sydney. Using the Australian Bureau of Statistics’ index of relative socioeconomic advantage (based on income, tertiary education and occupations) Auburn LGA is in the lowest 25% of state, and Baulkham Hills LGA in the top 10%. Overall, in Western Sydney there are fewer people with degrees and relatively more unqualified people then the rest of Sydney. In 1986, 24% of Sydney’s Aboriginal population lived in Western Sydney, and 70% of these lived in Blacktown LGA. One quarter of the
Western Sydney population were born overseas. Auburn LGA, has the highest proportion of overseas-born (40.5%), and most of these have a non-English speaking background. Arabic, Italian, Maltese, Greek and Chinese are the main non-English languages spoken at home in the Western Sydney Area.

**Wentworth**

When compared with other Health Areas, Wentworth has the third highest median score of relative socioeconomic advantage. However, variations exist between LGAs. Hawkesbury LGA lies in the second quartile of the state, Penrith is close to the state average, and the Blue Mountains lies in the third quartile of NSW. At the 1986 census, about 21% of Wentworth’s population were born overseas, and nearly half of these from non-English speaking backgrounds. Italian, Maltese, German and Greek were the most common non-English speaking languages.

**The New South Wales Infectious Diseases Notification System**

Previous public health legislation was framed in 1902. Doctors were required to notify 52 medical conditions, and were paid one dollar for each notification. Notifications were low, responses were poorly coordinated and there was little or no feedback to notifiers.

In November 1991, the new infectious diseases control system in NSW was introduced under the NSW Public Health Act 1991. Hospitals and laboratories, as well as doctors, are required to notify their local PHU by mail or telephone when a notifiable disease occurs. PHUs also receive informal notifications from other sources such as child day care centres, schools and concerned members of the
PHUs respond to notifications according to NSW Health Department guidelines, provide feedback to notifiers, collate data at a local level, and forward data to Epidemiology and Health Services Evaluation Branch of the NSW Health Department. From here, data are transferred to the Communicable Diseases Network of Australia and New Zealand.

In addition to notifying medical conditions, the Public Health Act 1991 also provides powers to deal with situations posing significant risks to public health, and provides guidelines for skin penetration procedures (such as tattooing, ear-piercing and acupuncture), and disinfecting swimming pools and spas, regulations for disposing of bodies, microbial control of building water systems and tobacco sales controls.4

References
2. FIELD INVESTIGATIONS

I was involved in the following field investigations; a gastroenteritis outbreak at a church camp, human parvovirus B19 in a preschool and public school, hepatitis A in a community of people with developmental disabilities, and Legionnaires’ disease.

2.1 Gastroenteritis outbreak at a church camp

I presented a summary of this investigation with results at the New South Wales Public Health network conference in November 1992. (see Appendix 7)

On Monday 8th June 1992, (the Monday of the long weekend), Hawkesbury Hospital notified the Western Sector Public Health Unit of twelve people who had presented to the hospital that day with gastroenteritis. The ill people had all attended a church camp during the long weekend at Londonderry, near Windsor.

On Wednesday 10th June, I telephoned the hospital for more information. Twelve people had attended with diarrhoea and vomiting, but no specimens had been taken.

I also contacted the administrators of the Church and the caretakers of the campsite. The Church had conducted a camp for their youth groups during the long weekend in June this year. Approximately 230 people attended from around NSW. The majority of people arrived on Friday 5th June in the evening and left on Monday 9th June about lunchtime.
Church officials reported that a number of people had become ill, and suggested that the cause was pre-existing viral illness among the campers. People with recent illness had attended the camp, and conditions may have been ideal for illness to spread, because a large number of people were gathered together. New gas heaters had just been installed in the chapel, and people were crowded together in this close warm atmosphere. Reports of the number who became ill varied from 25 to 40 or more.

We decided to investigate because a large number of people had become ill with gastro-enteritis in a short period of time. It was important to ensure that the source of the illness was not continuing, and that others were not exposed to the same source. If the illness were food or water borne, there would be wider public health implications.

The Church required a lot of persuading, and grudgingly gave us permission to distribute a questionnaire to those who attended the camp. Initially I was unable to obtain a list of campers, but later Church administration provided the names of those who attended from each church. I sent questionnaires to each of these churches, and the pastors distributed the questionnaires to those who had attended the camp. We obtained a list from the wife of one of the pastors, of the food and meals provided. I could not contact the main caterer.

I telephoned the pastors of the churches to ask them to distribute the questionnaires to the campers. They were all happy to assist, and I included a supporting letter in the parcel of questionnaires. Responses were to be posted back to WSPHU in the pre-paid envelopes. Talking to pastors suggested that illness was more widespread
than Church administration believed.

A total of 232 questionnaires were distributed. I included an explanatory letter with each questionnaire, asking people to complete the questionnaire and post it to the Public Health Unit in the reply paid envelope. I stressed that all who had attended the camp should complete the questionnaire, whether they had been ill or not.

I posted questionnaires to the churches on Friday 12th June. The questionnaire asked for general demographic information, and information about gastrointestinal illness prior to, and during the camp, as well as a food history. On Thursday 2nd July, I contacted the pastors again, to ask them to remind those who had not completed questionnaires to do so and to return them to WSPHU.

Of the 232 questionnaires sent to the churches, 111 (47.8%) were returned. Eighty-four were returned by 12 July, and another 27 arrived on 7th August.

The Church owns and runs the campsite, and uses it almost exclusively. The Church uses the campsite approximately eight to ten times each year. Other groups such as Brownies and Scouts have used it on a few occasions. Outbreaks of illness have never been reported before. The June long weekend camp is an annual event. People stayed in huts in dormitory style accommodation. Separate accommodation was provided for single males and females, and for married couples with children. Separate showering and toilet facilities were provided for males and females.

The sudden onset of gastro-intestinal illness in a group of people suggested a
common or point source. Some people became ill about one week later which suggested secondary spread.

After analysing the data, I wrote to all pastors with the results, thanked them for their help, and asked them to let the campers know the results.

This investigation illustrates some of the problems associated with this type of inquiry:

1. Cooperation from some of the pastors was doubtful. The senior pastor was not at all helpful, and always difficult to contact. He often changed plans at the last minute. As soon as he heard the "Health Department" was on to him, the senior pastor visited the site to ensure that it was as clean as possible. By Wednesday 10th June, the campsite had been completely cleaned and all accommodation blocks were open and being aired. No food remained, so we couldn’t collect any samples. Initially, he had said he would send out the questionnaires to reach campers at the Sunday church service. When it came to the crunch, we posted them. The pastor whose wife was involved in the catering was also suspicious of the "Health Department", and had trouble remembering the menu.

2. I was only permitted to have a list of names, and no addresses. I therefore had only indirect contact with the campers. I relied on the cooperation of the pastors. This made follow up, and reminders very difficult, and possibly less effective than a personal approach.
3. Bias: Response rates are likely to be higher from those who were ill. Our response rate was low (48%), and some of these questionnaires were incomplete. About two-thirds of respondents were ill.

4. Even though a group of twelve people from one campsite, with similar symptoms, attended a hospital accident and emergency department, at the same time, no specimens were taken. Four respondents reported that their doctor had taken specimens. I didn’t follow them up because I didn’t ask their permission to do so.

5. The time delay before I started investigating did not help. We were notified on Monday 8th June, and I started investigating on 10th June, after I returned from leave. Also, at the time, Food Inspectors were not part of the WSPHU. Had they been, an earlier start to the investigation may have been possible.

6. Response from those who participated in the survey was not timely. The last 27 questionnaires arrived at WSPHU as a batch on 7 August. This suggests that one pastor may have been hoarding them to send back together. It raises the question of confidentiality of the responses.

A copy of the questionnaire and letters follows. It was a one page, double-sided questionnaire. It could have been improved by better layout. I was concerned about keeping the questionnaire to one page, but extra pages, which were clearer to look at, may have increased response rates. Using double sided paper was also a risk. It may be easy for people not to see the reverse side. However, only one respondent did not complete the food history. The food history page is very cramped. The "circle the
food" idea worked well. It may have been easier though for respondents if they were asked if they ate that meal, and then going through the list if appropriate. If we had asked how many people live in the household, in addition to the number of household members who were sick after the camp, we would have been able to determine a household secondary attack rate. Had we thought about trying to perform an economic cost of the outbreak when we decide to investigate, we could have included additional questions. We also didn’t ask whether we could contact the doctors who campers consulted, especially those who had specimens collected.
Questionnaire for ALL people who attended the Four Square Youth Camp at Londonderry during the June long weekend.

Please answer all three sections, by writing in the space provided, or by circling the correct answer.

Section A

Last name ___________________________ First name ___________________________
Postcode ______ Date of birth ______ Sex: male/female
Did you had any stomach or bowel upsets during the week before the camp? yes/no
If yes, please describe briefly ____________________________________________

Did you become ill during, or after the Four Square Youth Camp held during the long weekend at Londonderry? yes/no
If no, please go to Section B.
If yes, when did you first become ill? day and date: _______ time: ______

What were your symptoms?
- nausea yes/no
- fever yes/no
- diarrhoea yes/no
- headache yes/no
- vomiting yes/no
- sore throat yes/no
- abdominal pains yes/no
- aching muscles/joints yes/no
- blood in stools/faeces yes/no

Did you consult a doctor/hospital? yes/no
If so, doctor’s/hospital’s name ___________________________

Did the doctor take any throat swabs, blood or stool specimens? yes/no

Did you have any days away from school or work as a result of the illness? yes/no
If yes, how many days? _______ days

Section B

Other than attending church services, in what other activities at the camp did you participate? (Please list)

What was the number of your dormitory? ________
OR What was the number of your married quarter? ________

Since your return from the camp, have other members of your household who were not at the camp become ill with symptoms similar to those listed above? yes/no
If yes, please give their name and date of becoming ill.
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Section C
It is important for all people who attended the camp to complete this part of the questionnaire, whether they were ill or not.

Please circle the foods which you consumed.

**Friday evening:**
- soup
- egg sandwiches
- meat sandwiches
- coffee/tea/milo/fruit juice with milk

**Saturday breakfast:**
- cereal
- corn flakes/rice bubbles/weet-bix with milk
- honey
- canned fruit: peaches/pears
- sultanas
- cooked tomatoes
- steamed potatoes with sour cream grated cheese
- boiled egg/s toast
- butter/margarine
- jam/peanut paste/vegemite
- coffee/tea/milo/fruit juice with milk

**Saturday lunch:**
- chicken mornay
- chicken mexican
- curry chicken
- salad: lettuce/tomatoes/cucumber/capsicum/onion
- corn on the cob
- beetroot
- bread rolls
- butter/margarine
- fresh fruit
- coffee/tea/milo/fruit juice with milk

**Saturday dinner:**
- soup
- spaghetti bolognese
- salad: lettuce/tomatoes/cucumber/capsicum/onion
- jacket potatoes
- canned fruit with cream
- coffee/tea/milo/fruit juice with milk

**Sunday breakfast:**
- cereal
- corn flakes/rice bubbles/weet-bix with milk
- fried tomatoes
- boiled egg/s
- sausages
- baked beans
- toast
  - butter/margarine
  - jam/peanut paste/vegemite toast
- fresh fruit

**Sunday breakfast cont’d:**
- coffee/tea/milo/fruit juice with milk

**Sunday lunch:**
- soup
- roast meat
- potatoes
- pumpkin
- peas
- corn
- gravy
- canned fruit
- ice cream
- bread/butter
- coffee/tea/milo/fruit juice with milk

**Sunday dinner:**
- soup
- braised steak
- steamed rice
- salad: lettuce/tomatoes/cucumber/capsicum/onion
- canned fruit
- cream
- coffee/tea/milo/fruit juice with milk

**Monday breakfast:**
- cereal
- corn flakes/rice bubbles/weet-bix with milk
- canned fruit
- toast
  - butter/margarine
  - jam/peanut paste/vegemite toast

**Monday lunch:**
- frankfurts
- bread roll
- fruit

Please list any food provided at the camp, which you ate, and which is not listed above.

Please list any food you ate which was not provided by the camp.

Thank you for completing this questionnaire. Please place it in the envelope provided and return it to the Public Health Unit.
Copy of letters sent to pastors of individual churches:

WESTERN SECTOR PUBLIC HEALTH UNIT
A joint Unit of Wentworth and Western Sydney Area Health Services

13 New Street
North Parramatta NSW 2151

Telephone: (02) 890 6060
Facsimile: (02) 630 8187

Clinical Sciences Building
Nepean Hospital
Kingswood NSW 2747

Telephone: (047) 32 0574
Facsimile: (047) 32 0567

12 June 1992

Dear Pastor,

Some of the people attending the Youth Camp over the June long weekend became ill. It is unclear whether the cause of the illness was related to the spread of pre-existing illness among the campers or to food consumed at the camp. The Public Health Unit needs to determine whether the cause was food related or not. If it was food borne, it may be related to the source of the food, and other members of the public may also be at risk of contracting the illness.

I need all people who attended the camp to complete a questionnaire and return it to the Public Health Unit. Pastor X has given permission for the questionnaires to be sent to the various churches for distribution to those who attended the camp. I would be grateful if you would be able to oversee the distribution of the questionnaires in your church.

All people who attended the camp should complete a questionnaire and return it to the Public Health Unit in the envelope provided, as soon as possible.

Results of the survey will be provided to you through the Four Square Church when they are available.

Thankyou for your assistance. If you have any queries, please contact me at the North Parramatta address above. (telephone 02 890 6060)

Yours sincerely

Dr Jane Bell
Public Health Officer
Dear Pastor

We have completed the investigation of the outbreak of gastro-intestinal illness which occurred at the youth camp held during the long weekend in June.

I am very grateful for your support and would like to thank you and your Church community for participating in the investigation. In particular, I would like to thank the pastors for distributing the questionnaires, and for reminding the forgetful people for me.

One hundred and eleven people helped by completing the questionnaires and we were able to reach some important conclusions.

Seventy-one people reported becoming ill. The illness was serious enough to cause 31 of them to visit a doctor or hospital, and 45 missed an average of 2.5 days each of work or school.

The dates of onset, and symptoms of the illness, suggested a food or water borne agent, or person-to-person transmission of an infectious agent.

We were able to rule out food and water as sources of the outbreak. This conclusion was important because of the possibility that other members of the public may have been exposed to a continuing source of infection.

We could not rule out the possibility that the outbreak was caused by person-to-person transmission of an infectious agent. Several campers were ill before the camp and the crowded conditions of camps are ideal for the spread of illness.

If you or any members of your church would like more information, please ring me at the Public Health Unit, telephone (02) 890 6060.

Please feel free to give copies of this letter to any of your Church members who might be interested. I am sending a similar letter with the investigation results to the pastors of the Churches which were involved in the camp. Thankyou again for all your help.

Yours sincerely

Jane Bell
Public Health Officer
2.2 Human parvovirus B19 in a public school and preschool

This investigation was reported in *Communicable Diseases Intelligence* (Appendix 4). Copies of the questionnaire, letters and other effects are found at the end of this section.

**Diary:**

Wednesday 17th June 1992: A general practitioner in Windsor, rang WSPHU to find out the NSW Health Department policy on Slapped face disease (or Erythema infectiosum, Fifth disease). She had diagnosed the infection in her daughter. The doctor had anecdotal reports of similar illness in other children at same school. There is no Health Department policy on human parvovirus infections. The doctor agreed to notify us if there were further cases.

Friday 19th June: I rang the doctor, who said that there were other cases in the school. She had sent some information on human parvovirus B19 (B19) to the school’s principal. She also gave me principal’s name. There was one child with leukaemia at the school. I panicked, mildly. No Tony, no Aileen and no Mike immediately available. After speaking to Aileen, I telephoned Tony Cunningham and Yvonne Cossart. Tony Cunningham said that his children, who attended a primary school in the northern Sydney area also had Erythema infectiosum. He also suggested I ring Yvonne Cossart.

I telephoned the principal of the public school. He had been away and was not sure how many children were affected. I explained the disease, and offered to send an information sheet to distribute to parents and staff. I called later and the principal had
learned that there had been cases of fever and rashlike illness in the infant classes. He also mentioned that the preschool next door may also have had cases. Many of the children at the public school had younger siblings at the preschool. I also asked about investigating further, and explained that Professor Cossart from the University of Sydney was keen to gather more information about the disease. The principal was happy to be involved. I also asked the principal to notify the parents of the child with leukaemia. I contacted the preschool adjacent to the public school, and the director reported similar cases of illness. We decided to investigate. We had received several reports, and although B19 usually causes only a mild illness, it may have serious consequences for some groups of people.

I telephoned the two local medical practices to tell them about EI, and that we planned to investigate further. They were keen to help if necessary, and I sent information about B19 to them. These practices have the same postcode as the schools and were selected from our "contacts list", and their names were also supplied by the principal and preschool director.

I also spoke to our WSPHU vet, Louisa, who said that parvoviruses were a common and serious infection of dogs, pigs and cats. The resulting illness varied between animals. (For example, in dogs - haemorrhagic enteritis, in pigs - abortion and neonatal deaths.) Parvoviruses are very host specific and are not known as zoonoses. Louisa also suggested another vet to contact.

I faxed information sheets to the schools to copy and distribute.
**Monday 22nd June:** I contacted Professor Yvonne Cossart, from the Infectious Diseases Department at the University of Sydney. And I was astonished that the discoverer of the virus lived in Sydney. Yvonne was keen to investigate further.

**In between times:** We prepared a questionnaire for parents of all children at the schools to complete. To determine the extent of the outbreak, we asked parents of all children at the school to complete questionnaires about recent illness.

Due to the difficulty diagnosing recent B19 infection because symptoms are fairly non-specific, and because infections may be asymptomatic, we asked for blood samples. To encourage as many people as possible to participate, we asked for finger-prick specimens from children, and 10ml venous blood samples from adults. B19 infections are most common in young children. And as most cases were reported in the infant classes, we asked for blood samples from the kindergarten and year one classes, and children at the preschool. We also asked for blood samples from staff at both schools. To alleviate fears, we offered to take blood samples from pregnant women also. We arranged for community health nurses to help collect blood samples. Yvonne Cossart had agreed to test the specimens.

Preschool enrolment totalled 60 children. Twenty attended Mondays and Tuesdays, 19 on Wednesdays, and 21 on Thursdays and Fridays. These three groups were independent of each other. Children were cared for by three staff. Approximately 300 children were enrolled in the public school: 83 in kindergarten and year 1, and 216 from years 2 to 6. The public school employed 25 staff (teaching, administrative, cleaning and ground staff).
Wednesday 24th June: Questionnaires, covering letters, and consent forms were delivered to both schools. They were to be given to all children and staff in the preschool. On the Wednesday they were given to parents with children who attended on Wednesdays. On Thursday 25th, they were given to parents whose children attended on Thursdays and Fridays. The following Monday they were given to the Monday/Tuesday group. At the public school, they were distributed with the weekly newsletter on Thursday 25th. In the newsletter, the principal encouraged parents to participate. Questionnaires, covering letters, and consent forms were given to all children in kindergarten and year one, and all staff at the public school. Questionnaires only, with covering letters were given to all other children at the public school.

Tuesday morning 30th June: Attended the public school to collect blood samples from children and staff. Senior students helped herd and direct students, and to entertain them. We used glucolets to collect finger prick blood samples on Guthrie cards, and vacutainers for collecting blood specimens from staff and other adults. The principal provided complete class lists for the school.

Tuesday afternoon 30th June, Wednesday 1st July and Friday 3rd July: Attended the preschool, to collect questionnaires and blood samples from staff and children. Obtained a list of all children enrolled, and the days they attended. We also collected a few more blood specimens from those at the public school who had missed out earlier in the week.

We collected completed questionnaires from both schools during our visits during the
week. The principal and staff were happy to remind students to return questionnaires if they had not done so.

Wednesday **1st July**: Delivered thank you letter to the principal of public school, thanking staff, parents, and senior students for all their help.

Friday, **3rd July**: The last day of school term. 148 questionnaires returned, out of possible 387 (38.2%). As this was the last day of term, it presented a problem for reminders and sending out extra questionnaires. We decided to follow-up on the first day of third term with a questionnaire asking about illness from 10th June to end of second term (3rd July).

Monday **20th July**: First day of third term. We contacted schools and asked whether we could send a reminder letter and another questionnaire to those who had not returned questionnaires. It was to be given to staff, and children in preschool and kindergarten and year 1 at the public school. We particularly encouraged parents of children who gave blood samples to complete a questionnaire.

To ascribe the illness to B19, we depended on laboratory results.

**July 1992 to July 1993**: Waited for testing to be available. A very embarrassing time. In July 1992, we had told participants that although testing kits were not yet available, we would obtain them soon.

**May 1993**: We received a letter from the principal of the public school. He was keen
to hear results. I rang and offered to come to talk to staff and parents. The principal
didn’t think that was a good idea. Yvonne Cossart also wrote to the principal.

July 1993: Human parvovirus B19 testing kits became available (from USA). As kits
were expensive, and kit numbers were limited, we decided to confirm the B19
diagnosis first. I selected six children with symptoms most compatible with B19
ilness. This included the child of the doctor who first notified us of the outbreak.
These six were tested for B19 IgM and IgG. All were negative for IgM, and four
were IgG positive.

August 1993: Letter with results posted to the principal and preschool director.
Comments

The second line of the information sheet on the next page is a superior example of what not to write. "It is not intended to alarm you, but..." This gem is no longer part of my repertoire. The third-to-last paragraph is also alarmist. I hope now that I would include more information, and explain better the risks to the foetus.

The questionnaire includes a column about duration of symptoms. We did not use this information. It was of doubtful quality anyway, because for many of the cases, symptoms had not ceased, and we had not intended to follow up cases to complete this information. We also did not ask how many people lived in the household, and so could not determine a household attack rate.

After the delay obtaining laboratory results, I was surprised that I did not receive any telephone calls from any parents. Perhaps, they thought it was just another example of bureaucracy at work. I was not happy about the delay between collecting blood samples and testing, but could do little about it. It was not at all comforting, especially for pregnant women. The next time I collect blood specimens, I would ensure that the appropriate test was available, and that results would be available in an acceptable time.
22 June 1992

Dear Parents and Teachers,

**Erythema Infectiosum (or Slapped Face Disease or Fifth Disease)**

This letter is being given to all staff and parents of children who attend the Primary School and the Pre-School. It is not intended to alarm you, but to make you aware of the following:

In the past week a number of children have been diagnosed as having Erythema Infectiosum (EI). EI is a viral illness, that can be transmitted by droplets or secretions from the nose and throat.

EI is a generally a mild illness and no specific treatment is necessary. EI is caused by a virus, the human parvovirus B19. It is most common in children, usually resulting in a rash on the cheeks (slapped-cheek appearance) followed one to four days later by a mottled/lace-like rash on the trunk and limbs. The rash may come and go for up to three weeks, and is often more obvious after a bath. The illness may include a fever, cough, sore throat or runny nose. It may be confused with German Measles or Scarlet Fever but is a less serious disease.

In adults, the rash may be different or may not occur at all. It may be accompanied by painful or inflamed joints.

The infectious period is usually over by the time the rash appears, so people with the illness need not be excluded from school or work.

In order to prevent further transmission of the virus, it is important that people cover their mouth when coughing, wipe their noses as necessary, avoid sharing cooking and eating utensils and wash their hands regularly.

Complications of the illness are rare but people with chronic blood diseases, people who are immunosuppressed and pregnant women should consult their doctor with this letter. Pregnant women with sick children at home should wash their hands frequently and avoid sharing eating utensils. There are some reports of miscarriages associated with this infection.

Little is known about EI in Australia, and Professor Yvonne Cossart of the University of Sydney is keen to investigate this illness further. To gain further knowledge we plan to distribute a questionnaire to all staff and to the parents of all children, whether they have been ill or not. We will also need to collect a small sample of blood from some children and adults, and we will contact some people about this.

If you would like further information please contact Dr Jane Bell at the Western Sector Public Health Unit at Parramatta, telephone (02) 8906060.

Yours sincerely

Dr Tony Capon
Director
Erythema Infectiosum (or Slapped Face Disease or Fifth Disease)

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If you would like further information please contact Dr Jane Bell at the Western Sector Public Health Unit at Parramatta, telephone (02) 8906060.
CONFIDENTIAL

Questionnaire to be completed for ALL children at the Public School and Preschool.

Please answer all questions on both sides of this paper by writing in the space provided, or by circling the correct answer.

PART A

Family name ___________________________ Given name ___________________________

Date of birth ___________________________ Telephone number ___________________________

Sex  male/female

Has your child been ill during the last two weeks? yes/no
(If no, please go to PART B on page 2.)

If yes, what date did your child first become ill? ________________

What was the first symptom? ________________

Please say whether your child has had any of the following symptoms, whether the symptoms are still present or not, and how long the symptoms lasted.

<table>
<thead>
<tr>
<th>Symptom</th>
<th>Please circle yes or no if your child had this symptom</th>
<th>If yes, is the symptom still present?</th>
<th>How long did the symptom last? (days)</th>
</tr>
</thead>
<tbody>
<tr>
<td>rash on face</td>
<td>yes/no</td>
<td>yes/no</td>
<td></td>
</tr>
<tr>
<td>rash on body</td>
<td>yes/no</td>
<td>yes/no</td>
<td></td>
</tr>
<tr>
<td>fever</td>
<td>yes/no</td>
<td>yes/no</td>
<td></td>
</tr>
<tr>
<td>cough</td>
<td>yes/no</td>
<td>yes/no</td>
<td></td>
</tr>
<tr>
<td>runny nose</td>
<td>yes/no</td>
<td>yes/no</td>
<td></td>
</tr>
<tr>
<td>sore throat</td>
<td>yes/no</td>
<td>yes/no</td>
<td></td>
</tr>
<tr>
<td>nausea</td>
<td>yes/no</td>
<td>yes/no</td>
<td></td>
</tr>
<tr>
<td>vomiting</td>
<td>yes/no</td>
<td>yes/no</td>
<td></td>
</tr>
<tr>
<td>diarrhoea</td>
<td>yes/no</td>
<td>yes/no</td>
<td></td>
</tr>
<tr>
<td>fatigue</td>
<td>yes/no</td>
<td>yes/no</td>
<td></td>
</tr>
<tr>
<td>any unusual bruising or bleeding</td>
<td>yes/no</td>
<td>yes/no</td>
<td></td>
</tr>
<tr>
<td>enlarged lymph nodes/glands</td>
<td>yes/no</td>
<td>yes/no</td>
<td></td>
</tr>
<tr>
<td>sore or aching muscles</td>
<td>yes/no</td>
<td>yes/no</td>
<td></td>
</tr>
<tr>
<td>sore or aching joints</td>
<td>yes/no</td>
<td>yes/no</td>
<td></td>
</tr>
</tbody>
</table>

if yes, please specify which joints were affected: ........................................

31
Did your child have any other symptoms? yes/no

If yes, please list __________________________________________________________

PART B

Does your child have an underlying blood disorder? (such as thalassaemia or spherocytosis) yes/no

If yes, please specify ______________________________________________________

In the last two weeks, have any other members of your household had an illness with rash and fever or runny nose or diarrhoea? yes/no

If yes, please give their name, date of birth, sex and date of becoming ill.

<table>
<thead>
<tr>
<th>name</th>
<th>date of birth</th>
<th>sex</th>
<th>date illness started</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
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<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Today’s date ____________________

If your child becomes ill during the next two weeks, please contact the Dr Jane Bell at the Public Health Unit (02 8906060). We would like to follow up any children who become ill to get information on their symptoms and if possible to take a small sample of blood by finger prick.

Thankyou very much for completing this questionnaire. Please place it in the envelope provided and post it to the Public Health Unit. The school will be kept informed about the results of the investigation but will not be given information about individuals.
Questionnaire to be completed by ALL staff at the Public School and Preschool.

Please answer all questions on both sides of this paper by writing in the space provided, or by circling the correct answer.

**PART A**

<table>
<thead>
<tr>
<th>Question</th>
<th>Answer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Family name</td>
<td></td>
</tr>
<tr>
<td>Given name</td>
<td></td>
</tr>
<tr>
<td>Date of birth</td>
<td></td>
</tr>
<tr>
<td>Telephone number</td>
<td></td>
</tr>
<tr>
<td>Sex male/female</td>
<td></td>
</tr>
<tr>
<td>Have you been ill during the last two weeks? yes/no</td>
<td></td>
</tr>
<tr>
<td>If yes, what date did you first become ill?</td>
<td></td>
</tr>
<tr>
<td>What was the first symptom?</td>
<td></td>
</tr>
</tbody>
</table>

Please say whether you have had any of the following symptoms, whether the symptoms are still present or not, and how long the symptoms lasted.

<table>
<thead>
<tr>
<th>Symptom</th>
<th>Please circle yes or no if you had this symptom</th>
<th>If yes, is the symptom still present?</th>
<th>How long did the symptom last? (days)</th>
</tr>
</thead>
<tbody>
<tr>
<td>rash on face</td>
<td>yes/no</td>
<td>yes/no</td>
<td></td>
</tr>
<tr>
<td>rash on body</td>
<td>yes/no</td>
<td>yes/no</td>
<td></td>
</tr>
<tr>
<td>fever</td>
<td>yes/no</td>
<td>yes/no</td>
<td></td>
</tr>
<tr>
<td>cough</td>
<td>yes/no</td>
<td>yes/no</td>
<td></td>
</tr>
<tr>
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<td>yes/no</td>
<td>yes/no</td>
<td></td>
</tr>
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<td>sore throat</td>
<td>yes/no</td>
<td>yes/no</td>
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<td></td>
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<tr>
<td>fatigue</td>
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<td>sore or aching muscles</td>
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<td>yes/no</td>
<td></td>
</tr>
<tr>
<td>sore or aching joints</td>
<td>yes/no</td>
<td>yes/no</td>
<td></td>
</tr>
<tr>
<td>if yes, please specify which joints were affected: ..................................</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Did you have any other symptoms? yes/no

If yes, please list __________________________

PART B

Do you work in the classroom when children are present? yes/no

If yes, have any children in your class been away from school in the last two weeks with an illness characterised by rash, fever, runny nose or diarrhoea? yes/no

Do you work in the school canteen? yes/no

Do you have an underlying blood disorder? (such as thalassaemia or spherocytosis) yes/no

If yes, please specify __________________________

Are you pregnant? yes/no If yes, when is your baby due? ________________

In the last two weeks, have any other members of your household had an illness with rash and fever or runny nose or diarrhoea? yes/no

If yes, please give their name, date of birth, sex and date of becoming ill.

name    date of birth    sex    date illness started

__________________________________________  __________________________  ___________  __________________

__________________________________________  __________________________  ___________  __________________

__________________________________________  __________________________  ___________  __________________

Today’s date ____________________________

If you become ill during the next two weeks, please contact Dr Jane Bell at the Public Health Unit (telephone 02 8906060). We would like to follow up anyone who becomes ill to get information on their symptoms and if possible to take a small sample of blood.

Thankyou very much for completing this questionnaire. Please place it in the envelope provided and post it to the Public Health Unit. The school will be kept informed about the results of the investigation but will not be given information about individuals.
To parents of children in the kindergarten classes at the Public School.

As part of the investigation into Erythema infectiosum, we need to take a small sample of blood from each child in the kindergarten classes.

It will involve using a sterile lancet to prick one of your child’s fingers. The blood will be collected on absorbent paper.

Public Health Officers and Public Health Nurses from the Public Health Unit and Community Health Nurses from the Community Health Centre at Richmond will be taking the blood samples.

The samples will be taken on Tuesday 30th June 1992, in the morning, between 9.30am and 11.30am. We will be using the Staff Room at the school.

Results of all blood tests will be confidential. You will be notified of your child’s results.

Participation in the study is voluntary. If you are willing for your child to participate in this study, please complete and sign the accompanying consent form and return it to the school by Monday 29th June 1992.

For your reference, the reverse of this sheet is a copy of the consent form.

Yours sincerely,

Dr Jane Bell
Public Health Officer
Investigation of Erythema Infectiosum at the Public School and Preschool

Consent Form

I consent to my child participating in a study of Erythema Infectiosum being conducted by Dr Jane Bell of the Western Sector Public Health Unit.

The investigation will involve a small sample of blood being taken from my child, by pricking a finger and collecting the blood on a piece of absorbent paper.

An information sheet about the investigation has been given to me. I have read it and understand its contents. I have been informed that participation is voluntary. Information collected will be confidential. My child’s personal results will only be reported to me.

Child’s name ___________________________ Class ____________

Parent’s signature ___________________________ Date ____________

Parent’s name ___________________________
To all staff of the Preschool.

As part of the investigation into Erythema infectiosum, we need to take small samples of blood from all adults who are employed in the school.

This will involve taking a blood sample from the arm. Public Health Officers and Public Health Nurses from the Public Health Unit and Community Health Nurses from the Community Health Centre at Richmond will be taking the blood samples.

The samples will be taken on Tuesday 30th June in the afternoon, or Wednesday 1st July in the morning. We will be using a room in the Preschool.

Results of all blood tests will be confidential. You will be notified of your personal results.

Participation in the study is voluntary. If you are willing to participate in this study, please complete and sign the accompanying consent form and return it to the school by Tuesday 30th June 1992.

For your reference, the reverse of this sheet is a copy of the consent form.

Yours sincerely,

Dr Jane Bell
Public Health Officer
Investigation of Erythema Infectiosum at the Public School and Preschool

Consent Form

I consent to participate in a study of Erythema Infectiosum being conducted by Dr Jane Bell of the Western Sector Public Health Unit.

The investigation will involve a small sample of blood being taken from the arm.

An information sheet about the investigation has been given to me. I have read it and understand its contents. I have been informed that participation is voluntary. Information collected will be confidential and personal results will only be disclosed to me.

Name ______________________________

Signature __________________________ Date ___________
1 July 1992

Mr Tony
Principal
The Public School

Dear Tony,

Thank you very much for agreeing to involve your school community in the study of human parvovirus. The response from parents, students and staff has been wonderful.

I would particularly like to thank the senior students who helped us while we were collecting samples. They made our task very much easier.

I will inform the school of the overall results of the study when they are available. Individual results will not be disclosed to the school.

Please convey my thanks to everyone who helped by completing the questionnaires and agreeing to have a blood sample taken.

I am very grateful for your personal assistance in the distribution of questionnaires and in the collection of the samples. Best wishes for a happy holiday in Queensland.

Yours sincerely

Dr Jane Bell
Public Health Officer
20 July 1992

Dear Parent/Guardian,

I am very grateful for the help that the school community has given me during the investigation of Erythema infectiosum or Fifth disease. Results of the investigation rely on the support of those who participate.

I realise that school holidays are over and that the outbreak of Erythema infectiosum occurred last term, but I would appreciate it if you would be able to complete the questionnaire and return it to the Public Health Unit in the envelope provided. Postage has been pre-paid.

I would like the questionnaire to be completed for all children, even if your child was not ill. I can then determine how many of the children were affected and find out more about the symptoms.

The questionnaire asks about symptoms and general information such as age, sex etc which help to determine characteristics which might predispose to infection. I have asked for names, addresses and telephone numbers so that I can contact you again if necessary.

The information collected will be confidential. Personal results will only be available to the parent concerned. Individuals will not be identifiable in analysed data or publication. Results will be combined and presented as group results. The schools will be kept informed about progress and results.

If you would like further information, please contact me at the Western Sector Public Health Unit, telephone (02) 890 6060.

Yours sincerely

Dr Jane Bell
Public Health Officer
14 August 1992

Mr Tony
Principal
The Public School

Dear Tony,

Thankyou very much for your help with the investigation of the parvovirus outbreak. I am delighted with the response from members of your school - Questionnaires have been received from all children who gave blood samples and from many others as well. This will provide invaluable information.

I am sure everyone is keen to get the results of their blood tests, but unfortunately there has been a delay in obtaining the kits required to perform the tests. They are only available from overseas, and the usual supplier has been difficult to contact. I apologise for the delay. When I have more information I will let everyone know.

Thankyou again for all your help.

Sincerely,

Jane Bell
Public Health Officer
Mr. T. Fogarty

Dr. Tony Capen,
Director,
Western Sector Public Health Unit,
Department of Health,
13 New Street,
NORTH PARRAMATTA. 2151.

Dear Sir,


Last year in June, we had an occurrence of “slapped-face” disease affecting a number of children in our school. Following an approach from your department, a significant number of parents, teachers and students participated in a testing program to facilitate further research into this disease. Although we were advised that some delays were being experienced with analysis of blood samples we were led to believe that results would be notified to the people involved in the testing program. It is now some considerable time since this testing was undertaken and we have still not been advised of the results. We have had a number of enquiries as to why participants have still not been notified. Would you please arrange for notification of results to the people concerned at the earliest possible opportunity.

Yours faithfully,

Tony Fogarty
Principal.
Dear Parents, children and staff,

Thank you for helping with the investigation of the outbreak of illness among children and staff in the school last year. We thought at the time that it was slapped face disease (caused by human parvovirus). All tests have been negative. We do not know what caused the illness.

I apologise that it has taken so long for you to receive any results. Laboratory testing kits for human parvovirus were extraordinarily difficult to get and only arrived from the USA last month. All tests were negative. The blood samples showed that the children had not had slapped face disease recently. We have also tested for rubella (German measles). These tests were also negative.

There are a number of other illnesses which are very similar to slapped face disease. These include measles, roseola and scarlet fever. Unfortunately, we were not able to test for any other illnesses because we only had a very small sample of blood.

Again, thank you for your interest and help. I'm sorry that I can't give you more definite results. Please ring me at the Public Health Unit (phone 02 840 3603) if you have any questions.

Yours sincerely

Jane Bell
Public Health Officer

10 August 1993
2.3 Hepatitis A in a community of people with developmental disabilities.

In early February 1993, WSPHU was notified of some cases of hepatitis A in residents of a centre for people with developmental disabilities. A summary of events, and the questionnaires follow.

The outbreak was reported in CDI 1994;18(1) (Appendix 5) and seroprevalence results have been prepared for publication (Appendix 2). I also presented a summary of the outbreak at the FETP conference in Chiang Mai in January 1993 (Appendix 10).

Diary:

2 Feb 1993, Tuesday

Virology department, ICPMR notified WSPHU of at least one, and possibly more cases of hepatitis A at the centre.

3 Feb

We contacted the full time medical officer at the centre. He reported that after the first case, the other 12 residents in the same residential unit (RU-H) had blood collected for serological testing, and were given normal immunoglobulin. Laboratory results showed five cases of hepatitis A, all from RU-H. Two residents had evidence of past HAV infection (IgM negative and IgG positive). None of the cases were very ill. All were wandering about. About three had yellow sclera and darkish urine. (Subsequently the remaining 6 susceptible clients in RU-H became ill and HAV IgM was detected.) Staff members in RU-H were encouraged to have immunoglobulin, and serological testing first if they wanted. Some senior staff were reported to be immune.
The PHN took hepatitis A fact sheets to the centre and asked for them to be widely distributed.

I asked about RU-H residents. They were reported to be a young, wild, hyperactive group and a very difficult group to manage. No-one else can manage them. None could talk, they smeared faeces, and ate faeces. Many were epileptic.

I asked about the possibility of serological testing of all clients and the consent required. Under the Guardianship Act, the centre is responsible for children younger than 16 years and can give consent. When necessary, the centre obtains permission from parents by telephoning them. It would be possible for ward staff to contact parents if necessary.

The centre has two medical officers, and nursing staff care for residents. Food and meals were supplied from a central kitchen and distributed to all units. The water supply was common to all units.

I also contacted the Virology department, ICPMR about the possibility of serological testing for all 270 residents. We arranged that WSPHU would pay for the test kits, and that ICPMR would do the testing.

4 Feb

I organised a meeting at the centre with centre staff on afternoon Thursday 4/2/93. The Chief Executive Officer, Director of Nursing (DON), two Assistant Directors of Nursing, the clinic nurse, the two medical officers and our Public Health Nurse attended.
We discussed:

- Strategy for investigating and controlling the outbreak. We were unsure of the extent of the outbreak - hygiene, immunoglobulin for residents and staff in RU-H.
- Allaying fears among the staff - We suggested that the outbreak should be widely publicised in the centre, and information about hepatitis A and good hygiene practices should be widely distributed. Hepatitis A letters and fact sheets were to be extensively distributed. We advised that staff and others in very close contact of cases should receive normal immunoglobulin. Any concerned staff were also welcome to contact me.
- Staff were also concerned about contact outside the centre. Some contact occurred between clients from the nearby centre for people with less severe developmental disabilities. During the Christmas/January period, residents from the two centres intermingled more than usual. I offered to go to the nearby centre to meet staff there, to discuss the outbreak with them.
- Strategy for active case finding:

  Case definition: serological presence of anti-HAV IgM

1. All permanent clients to have sera tested for anti-HAV IgM and IgG
2. Obtain a list of all staff ill with hepatitis-like illness since 1/12/92. If cases found in residents of other units, consider serological testing of these staff.
3. We asked for any ill staff to have blood samples tested for anti-HAV. Any ill staff to contact the medical officers at the centre.
4. Follow up contacts of known cases
5. Check any places suggested by staff where residents (especially RU-H) might have been
6. We would telephone hepatitis A notifications (or their doctor) on our database,
to see if any connection with people with developmental disabilities.

- Strategy for identifying source of infection: possible sources of infection discussed - for example, food or water. Sources to be investigated as more information about extent of outbreak became available.

- I requested information about the centre and staff:

1. List of names, dates of birth, sex, date admission to the centre, and residential unit
2. List of all temporary residents who have stayed at the centre since 25/12/92
3. Risk factors for hepatitis A infection were to be collected - before blood results were known (to avoid bias)

After the meeting, one of the medical officers showed the PHN and me around the centre. The Centre cares for approximately 270 permanent residents in 11 residential units. It also cares for some clients on a temporary basis. Residents are allocated to residential units according to their disability.

Profile of residents: All have moderate to severe intellectual disability, and most have associated physical disabilities. Some have severe medical problems, and some have disturbed behaviours (eg Unit F). Disability ranges from those who are totally dependent with multiple disabilities, to those who with appropriate training, would be able to live in a community group home.

4-8 Feb

Consent forms, information sheet for staff, questionnaires designed: risk factor questionnaire, illness questionnaire for those ill (about onset, and symptoms,
questionnaires for staff to complete themselves, and for staff to complete for residents with hepatitis A). Risk factor questionnaire compiled after consulting medical staff about risk factor behaviours in the centre, and about staff’s names for these behaviours. Questionnaires were reviewed by centre staff before being distributed.

Collected information about staff numbers, and about staff who had been ill since 1st December 1992. Fourteen domestic staff, five staff from the sheltered workshop and very few nursing and program staff had been away from work due to illness. Engineering staff reported 31 days absent. None reported hepatitis-like illness.

4 Feb

Cancelled the bug breakfast I was supposed to address on 5 Feb.

5 Feb

I delivered consent forms with information sheets for parents/guardians to the centre.

Collected information about residents’ date of birth, sex, duration of stay, date of admission to the centre, residential unit, from central records.

6 and 7 Feb (weekend)

Centre staff contacted parents and guardians of residents and asked for consent for blood samples to be collected and for records to be reviewed.

8-10 February, Monday - Wednesday

Centre staff collected risk factor data. Two clinic staff collected blood samples from about 260 people in 2.5 days.
8 Feb, Monday

I delivered the risk factor questionnaires to the DON to distribute to Nursing Unit Managers (NUMs) in each residential unit.

I addressed NUMs at their weekly meeting. I gave them information about hepatitis A, searching for cases, stressed hygiene, asked them to complete questionnaires about residents’ behavioural risk factors, and to report any illness in residents or staff.

9 Feb

I visited the nearby centre, and attended their executive meeting with their Medical Officer, Program Director, and DON. I brought hepatitis A fact sheets, to be distributed widely, and emphasised the importance of educating staff about hepatitis A, and searching for cases. I asked them to contact me if they have any cases, or any concerns.

9, 10 Feb

I visited the medical officers at the centre to see how things were going.

10 Feb

contacted Virology department about results

11 Feb

Delivered illness questionnaires to RU-H staff (to be completed for cases). Collected completed risk factor questionnaires from ADN.

We contacted all other PHUs in NSW (11/2/93) to let them know of outbreak and to ask if they were aware of any hepatitis A cases associated with developmentally disabled people. During the summer holidays there was possibly more movement in and out of
respite care and more intermingling than usual.

12 Feb

Visited the centre and collected more completed questionnaires from ADN.

15 Feb

Gave staff at the centre the names and phone numbers of contacts at WSPHU if they needed them, and the NCEPH number to contact me also.

16 Feb, and afterwards

I went to Canberra for MAE course. The PHN contacted parents of temporary care clients who had stayed in RU-H during January, told them about the hepatitis A and asked whether they would have their child tested for anti-HAV. One temporary care client lived outside our area, so we contacted Central and Southern Sydney PHU and asked them to follow up the temporary care client from their area. WSPHU staff (mainly the PHN) regularly contacted the centre and ICPMR for updates and kept me informed. I contacted the centre a few times while I was in Canberra. While I was away, much of the follow up of community cases occurred.

After I returned from Canberra

We continued to follow up community cases and contacts. I wrote to the centre’s CEO, and thanked her and centre staff for their cooperation, and I continued to contact and visit the centre. Interim report sent to Epidemiology Branch. I prepared the CDI and serological results papers. I also sent a copy of the serological results paper to the Department of Community Services. Copies of all were sent to the medical staff and Chief Executive
At some time

I contacted the Therapeutic Goods Authority in Canberra about hepatitis A vaccine (HAVRIX, Smith Kline and Beecham, Melbourne). Hepatitis A vaccine was available only on an individual basis, and by individual application. To use it in the centre, we would have required consent to use a drug not yet approved, and could not therefore guarantee its efficacy or safety. Three doses were also required. I also contacted Smith, Kline & Beecham, who did not have large amounts of vaccine. We felt that it would be unlikely that parents or guardians would consent to using a "trial" drug. We did not pursue the HAV immunisation further.

The following pages contain copies of the consent form, information sheets and questionnaires. A similar questionnaire for staff diagnosed with hepatitis A was prepared, but was only required for one staff member.
HEPATITIS A

Information sheet for staff

Over the last week, seven clients at Marsden have been diagnosed with hepatitis A. Marsden Centre staff, and staff from the Public Health Unit at Parramatta are investigating, and we would like your help.

Hepatitis A is often a very mild disease, and may not be noticed.

To minimise the chance of you becoming infected, good hygiene is very important. Thorough handwashing, after going contact with faeces, and before eating is essential. You should also avoid sharing food and drinks with other people.

If you become unwell, you should see one of the centre’s doctors (names given) or your personal doctor. They will arrange for you to be tested for hepatitis A. Symptoms to watch out for are abdominal pain, nausea, loss of appetite, fever, yellow eyes, yellow skin and dark urine.

All efforts are being made to contain the outbreak. If you do become ill with hepatitis A, please let the centre’s doctors know (names given), so that we can prevent it spreading further.

If you notice that any of the clients are unwell, please contact one of the centre’s doctors (names given) as soon as possible, so that the client can be assessed.

If we find more cases of hepatitis A, we will offer immunoglobulin to staff, clients and others in close contact with them. Immunoglobulin helps to prevent the disease spreading, and reduces the severity of the illness.

Thank you for your help.

Tony Capon
Director, Public Health Unit

The back of this sheet contains information about hepatitis A.
HEPATITIS A

Hepatitis A is usually a mild illness which may last several weeks. It is caused by the hepatitis A virus and mainly affects the liver. In some people, the infection is so mild that it may not be noticed. After the illness, people recover fully.

People with hepatitis A are infectious for only a short period of time. Hepatitis A is spread when faeces from an infected person is transferred to another person’s mouth.

Good hygiene, especially thorough handwashing, after going to the toilet, and before eating is essential. Avoid sharing food and drinks with infected people.

Notes

1. Please refer to the hepatitis A fact sheet also. They are available in the centre clinic or from residential units.

2. If parents ask questions etc you can not answer, or if they have a lot of questions, please ask if you can send out a fact sheet about hepatitis A.

3. Or, if parents are still concerned, they can contact Dr Jane Bell or Dr Tony Capon at the Public Health Unit at Parramatta, phone 890 6060. After hours they can be contacted by phoning 9253911 and asking for pager number 33114 for Dr Bell or pager number 69824 for Dr Capon.
CONSENT FORM

To be completed by Unit staff. Please collect all consent forms for your Unit.

Client’s name .................................................... Residential Unit .........

Parent/guardian’s name .........................................................

date ....../....../93 Staff member’s name ..................................................

Over the last week, seven clients here at Marsden have been diagnosed with hepatitis A.

Hepatitis A is often a very mild infection which might not be noticed.

To help determine the origin of the infection, and to see whether there are any other hepatitis infections we need to test a blood sample from (client’s name) for antibodies to hepatitis A. We also need to review the client’s records.

If we find any other clients with hepatitis A, or if any staff develop hepatitis A, we will offer an injection of immunoglobulin to other clients and staff in close contact with them. The immunoglobulin will help prevent further spread, and reduce the severity of the illness.

We need your consent to take a blood sample. The blood sample will be taken next week. You will be advised of the results. Results will only be known to medical staff at Marsden and the Western Sydney Public Health Unit, who are helping to coordinate the investigation.

Do you give permission for us to take blood from (client’s name) to be tested for hepatitis A?

yes / no
Questionnaire for clients of the centre who have been diagnosed with hepatitis A.

Please complete this form for any client who has been diagnosed with hepatitis A since 1st December 1992. Please give the completed questionnaire to the Director of Nursing.

Client’s first name .................................. Client’s last name ........................................

Residential unit ____ (1-11)

What school/workshop/ area does this client attend? ..........................................................

Does the client feed him/herself? yes / no

What date did this client first become ill? ......./......./....... 

Did the client have any symptoms of being unwell? yes / no

If yes, what clinical signs or symptoms did this client have?

    Circle yes or no

    general feeling of not being well yes / no
    dark urine yes / no
    whitish or clay coloured faeces yes / no
    fever yes / no
    abdominal pain yes / no
    yellow eyes yes / no
Since December 1st 1992, has the client been out of Marsden Centre?  yes / no
If yes, please list where, and what dates (include any other homes, hostels or community houses for the developmentally disabled)

Please continue on the back of the sheet if there is not enough space here.

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Has the client had any contact with any known hepatitis A cases?  yes / no

Thank you for completing this questionnaire. Please give it to the Director of Nursing.
To be completed by Unit staff. Please keep all questionnaires from your Unit together.

Information about clients who have blood samples taken.

Client’s first name ..................................... Client’s last name ..................................

Residential unit ____ (1-11) Sex ..............

Please circle Y (yes) or N (no) or U (unknown) to the following:

Has this client had hepatitis A in the past? Y N U

Is the client toilet trained? Y N

Does this client have any of the following habits or behaviours?

smearer (smears faeces) Y N
coprophagia (eats faeces) Y N
faecal incontinence Y N
manual evacuator Y N
feeds him/herself Y N

Please list any other risk behaviours this person has, which you think may contribute to transmission of hepatitis A.

............................................................................................................................................
............................................................................................................................................
............................................................................................................................................

Thankyou for completing these questions for us.

............................................................................................................................................

...
2.4 Legionnaires’ disease


Legionnaires’ disease outbreak, April 1992, South Western Sydney

The outbreak occurred soon after I arrived at my field placement. It was my first experience of the NSW Public Health Network in action. I played a very small part in this outbreak. Below is a summary of events.

On Wednesday, 22nd April, WSPHU was advised of an outbreak of Legionnaire’s Disease in the South Western Sydney Area. We commenced active surveillance for cases in the western sector. WSPHU staff and I visited hospital Accident and Emergency departments in our health areas to review admissions for atypical pneumonia. Throughout the outbreak, we continued active surveillance in the Western Sydney and Wentworth Health Areas.

Data were forwarded to the Health Department.

The South Western Sydney Public Health Unit held a meeting on Friday 24th April. Council employees, Environmental Health Officers, Public Health Officers (including me), and senior staff from Epidemiology Branch attended. Senior public health staff and hospital and laboratory infectious diseases staff, specified case definitions for definite and
probable cases. They planned a case-control study, and defined control selection.

Environmental Health Officers (EHOs) and the council representatives started a program of sampling possible sites (for example, air cooling towers) in the Fairfield Business District, and advising businesses with premises with air cooling towers to shut them off until cleaned.

Other Public Health Officers and I were despatched to hospitals to interview definite cases and probable cases about their movements in the ten days prior to the onset of symptoms. According to the specified definitions, we also selected controls for definite cases and probable cases from hospital admission records. We interviewed them about their movements during the corresponding incubation period for their case. Three others and I worked from Fairfield Hospital for two days, where 15 of the cases were admitted. We recorded information on interview sheets which were returned to South Western Sydney PHU in the evening.

Summary of results:
There were 25 confirmed epidemic related cases of Legionnaire’s disease (including six who died). Legionella pneumophila serogroup 1 was bacteriologically or serologically confirmed. Cases were significantly more likely to have visited the Fairfield Business District during the incubation period than controls (OR = 15; 95%CI 3.6 - 67).

Legionella pneumophila serogroup 1 was isolated from sputum cultures from 16 of the cases. Chromosomal fingerprints of 14 of were very similar to fingerprints of bacteria cultured from the McDonalds Family Restaurant at Fairfield. No control visited
McDonalds and so an odds ratio could not be determined.

Comments:

1. The case definition was not defined until the Friday 24th April. Without a case definition, it was difficult to search for cases or probable cases.

2. Most cases were admitted to Fairfield Hospital. We found it difficult to select the number of matched controls per case, according to the control definition. If a "prospective" control could not be identified, controls were chosen retrospectively from the date of admission. The prescribed age range was also extended.

3. Different people and departments in the Health Department continually harassed us in WSPHU for information updates. Requests for information were not coordinated.

After the Fairfield outbreak in 1992, the NSW Health Department developed a Legionnaires' Disease Management Plan for these situations. The plan is a subplan of the NSW Multiple Casualty, Emergency and Disaster Response Plan (MEDPLAN). A computer diskette containing the plan and a database was distributed to all Public Health Units. The senior Environmental Health Officer at WSPHU developed a local plan, in parallel to the State plan.

Public Health Units were required to rehearse the plan prior to the "Opening of Legionnaires' disease outbreak season". The "season opening" in 1993 was announced on April 1st, when Public Health Unit members attended a one day seminar at the Health Department. A media release informed the public that most cases of Legionnaires' disease occur in April and that public health officials had done everything to minimise the risk to
the public. A bomb threat that day disrupted proceedings.

Cooling towers and NSW legislation:

Under the Public Health Act in NSW, all cooling towers are required to be registered with the council in their local government area. Council EHOs maintain the register. Owners are required to carry out, and record regular maintenance. Regular testing is not required, although some owners have organised this through private laboratories.

Health Public Affairs can use a 008 number for the public to ring which gives information about Legionnaires’ disease, including signs and symptoms and who to ask and where to go for medical advice. They have compiled fact sheets for medical practitioners and the public. They also have a press kit which contains a history of Legionnaires’ disease in NSW, and edited pieces of television footage. They can provide instant media releases through the AAP media service to lists of media.
Legionnaires' disease outbreak, April 1993, Western Sydney

Between Thursday 22nd April and Tuesday 27th April, (while I was in Melbourne at the PHA immunisation conference), the Public Health Unit was notified of four cases of Legionnaires’ disease. All were confirmed by culture and were *Legionella pneumophila* serogroup 1. The investigation involved all WSPHU staff. A summary of events follows.

All cases became ill on either the 13th or 14th of April. Three of the cases were admitted to Westmead Hospital, and one to Fairfield Hospital. One patient was admitted to an Intensive Care Unit (ICU).

WSPHU staff questioned cases about their movements during the incubation period (two to ten days prior to the onset of illness). Three cases were interviewed personally. Relatives of the case in Intensive Care (ICU) obtained his diary or us. Two cases had attended one hotel on the 7th April for a retirement seminar. One case walked past this hotel every day to buy her lunch from a Take-Away shop three shops from the hotel. It seemed that the fourth case did not visit an area in common with the other three.

All cooling towers within 150 metres of the hotel, registered with the Parramatta council were sampled. Environmental Health Officers supervised the cleaning and decontamination of these cooling towers.

The second priority was to sample other sites with known cooling towers which had been visited by the cases during the incubation period. Environmental samples were sent to the Department of Analytical Laboratories (DAL).
During the outbreak period, we actively searched for cases by contacting all hospitals in the Western Sydney and Wentworth Health Areas. WSPHU staff faxed copies of the case definition for confirmed and probable cases to them. We spoke daily to a contact at each hospital to determine any new cases and to determine the clinical status of cases. We contacted daily the two laboratories in our area which test for Legionnaires’ disease and followed up requests for Legionnaires’ disease testing. We also contacted Public Health Units in adjoining areas and asked them to search for possible cases. This method of active surveillance was not very efficient. We had difficulty contacting staff in hospitals and gaining their support.

Environmental sampling and testing of all known evaporative condensers and cooling towers in the area, and DNA fingerprinting, implicated the two evaporative condensors at the hotel as the most likely source of infection. *Legionella pneumophila* serogroup 1 was isolated from the hotel’s first floor and rooftop evaporative condensers on 26 April. Counts of 28,000 and 3,400 colony forming units (cfu)/ml, respectively, were detected. DNA fingerprinting of these environmental cultures and from all cases’ specimens matched.

On Wednesday 28th April we suggested that a media release would be appropriate. We thought it was a chance for the Health Department to improve its Legionnaires’ disease image. We suggested a joint release from the Area Health Service, the Health Department and the Parramatta Council. We intended to include information about the cluster of cases in our area, and to say that three of them had visited a defined area in Parramatta central business district. All cooling towers in the vicinity had been sampled and cleaned. We also intended informing the public that there had been no other cases and that we considered
that there was no health risk to the public. In case of mass public response, Health Public Affairs in the NSW Health Department were approached. They were able to set up a 008 number with a tape recording giving information about Legionnaires’ disease, signs and symptoms, where to go for medical attention. Our suggested release follows:

**MEDIA RELEASE**

**LEGIONNAIRES’ DISEASE IN WESTERN SYDNEY**

28 April 1993

Between Thursday 22nd April and Tuesday 27th April, the Health Department was notified of four patients with Legionnaires’ disease, in Western Sydney. An investigation was launched and is continuing.

These patients all became ill between the 13th and 14th of April and were admitted to hospitals in the western Sydney area. Two have already gone home, one is recovering in hospital, and one patient is seriously ill. No other patients with Legionnaires’ disease have been reported.

Three of the patients visited the Parramatta Central Business District north of the Parramatta River. All cooling towers in this area were tested and cleaned. No specific source has been found as yet.

Patient ages range from 42 to 71 years. Two are male and two are female. The type of Legionnaires’ disease in these patients is that associated with air conditioning systems, rather than use of potting mix.

Symptoms of Legionnaires’ disease are fever, chills, aches and pains, a dry cough, diarrhoea and abdominal pain. It tends to occur in people who are especially susceptible to infection, such as those with chronic illnesses or heavy smokers.

The Health Department suggests that people who are concerned - particularly those with fever, cough, and abdominal pain - consult their doctors and that doctors who suspect the diagnosis refer patients as soon as possible to a hospital casualty department.

There have been three Legionnaires’ disease outbreaks in NSW in recent years - one in April 1987 associated with a Wollongong shopping centre, one in April 1989 related to a Western Sydney bowling club, and one in April 1992 associated with the Fairfield shopping centre.

The Health Department decided not to proceed with the media release.
The following day (Thursday 29th April) radio station 2WS and Channel Seven contacted Westmead Hospital about cases of Legionnaires’ disease. The Area Health Service and the Health Department then released information for the media. It did not mention a cluster of cases, but that there were two cases of Legionnaires disease in Westmead Hospital at the time. They then compared this with the number of cases in NSW in 1992, including the number of cases in April. The 1992 figures were considerably higher than 1993 figures due to the Fairfield outbreak. The release dispelled any media attention. A copy of the release is found on the next page.

Investigating and monitoring this outbreak severely disrupted normal Public Health Unit operation. Two epidemiologists, four Public Health Officers, two Environmental Health Officers and a Public Health Nurse spent between four to seven days investigating and monitoring the outbreak. In addition, council Environmental Health Officers spent days sampling cooling towers.

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Media release
29 April 1993

NO PUBLIC HEALTH RISK FROM LEGIONNAIRES’ CASES

The Western Sydney Area Health Service today confirmed that two people with Legionnaires’ disease are currently in Westmead Hospital.

Mr Tindale, Acting Chief Executive Officer, Western Sydney Area Health Service assured the local community that there is no public health risk associated with these two cases.

"The symptoms of the most recent of the two patients commenced on 14 April. Since the incubation period is between two and twelve days, there is no risk to the public," said Mr Tindale.

"As with every report of Legionnaires’ disease the local Public Health Unit acts promptly to establish, where possible, the origin of the infection. To date there are no test results which confirm that there was a common source of infection for the two patients," Mr Tindale said.

This year 23 cases of Legionnaires’ disease have been notified in NSW. This compares with 62 cases for the same period last year.

NSW Health Department figures show that in April there is a higher incidence of Legionnaires’ disease, with more admissions to hospitals expected at this time compared with other times of the year.

In April 1992 there were 46 Legionnaires’ disease notifications, compared with nine so far this month.

Mr Tindale said on average there are seven or eight people per month admitted to NSW hospitals with Legionnaires’ disease.

Public Health experts from throughout the state met earlier this month to ensure everything possible had been done to minimise outbreaks of the disease this year.

FOR FURTHER INFORMATION CONTACT:

MR R. E. TINDALE
The Legionnaires’ disease management plan (developed after the Fairfield outbreak) may be invoked in consultation with the Health Department, “if two or more notifications are linked in time or space”. Although our outbreak fitted the criteria, the plan was not invoked. We feel it was not, because it would grab media attention. Under the plan, EHOs have powers to enforce sampling and cleaning of cooling towers. This was not required in our outbreak. We had no difficulty encouraging businesses with cooling towers to sample and clean them.
Legionellosis Cross-sectional study

A summary of this cross-sectional study was presented at a late-breaker session at IEA conference in Sydney in 1993, and at the FETP conference in Chiang Mai in January 1994 (Appendices 9 and 11). In my talk to the medical microbiologists, I presented preliminary results as an example of WSPHU in action. Copies of letters, questionnaires and other effects are found at the end of this section.

At the end of April, when the hotel in Parramatta was implicated as a likely source of infection, we considered following up all those who attended the seminar at the hotel. We decided against it. We felt that the Health Department was unlikely to regard the enterprise favourably. We also thought that it would probably bring media attention. The cool response to our original suggestion of highlighting the Health Department’s expertise in the fight against Legionnaires’ disease had not been well received.

Towards the end of May, we decided to follow up the people who attended the investment seminar for retired people at the hotel that day (7th April 1993). Two of the four cases had attended the seminar on that afternoon. Another case had walked past the hotel to buy her lunch. And we found that the fourth case, although he had not been near the hotel, had visited the area within 300 metres of the hotel.

I contacted the company who had conducted the seminar and explained what we intended to do. I asked for a list of names, addresses and phone numbers of clients who had attended the seminar. They were not enthusiastic, and required "a letter". The company held two seminars at the hotel that day (at 1.15pm and 5.45pm). We followed up those
who attended the first seminar, which all cases had attended. This time was also the lunch 
break for the third case.

Dr Capon contacted the hotel. They were not enthusiastic about an investigation.

I prepared a letter to attendees, advising them that some people who attended the seminar 
had become ill with Legionnaires' disease, and that we intended to investigate to try to 

determine the source of their infection. We told them we would need to collect 
information about themselves, their movements on 7th April, and we asked for a blood 
sample. I enclosed an appointment for them to attend an outpatients clinic at Westmead 
Hospital and a fact sheet about Legionnaires' disease. I asked subjects to contact me if 
they were unable to attend at that time. The investment company included a covering 
letter. (The investment company ensured me that the response rate would be excellent. 
They always achieve a higher than 90% response to their letters.)

With a committee of authors (from WSPHU, the investment company, the Area Health 
Service, the Health Department Legal Branch) I spent 3.5 days of a week, full time, 
preparing the letter. Copies flew to and from all interested groups, including management 
at the hotel. Letters were mailed on 27/5/93.

Denominator and response:

The investment company provided a list of 165 people who attended the afternoon 
seminar. The list did not include one of the cases who attended the seminar, and included 
six people without addresses. They were included as part of the denominator because they 
may have attended on the day, and only gave the company their name. Four people on the
list notified us that they did not attend the seminar and another 23 people not on the
cOMPANY's original list informed us that they had attended. We identified 184 people who
attended the seminar, and 152 (83%) participated in the follow up.

One subject was hospitalised with pneumonia of unknown origin in Nepean hospital at the
same time as the cluster of cases. Although we identified this patient during our
surveillance for Legionnaires' disease cases, the doctor felt that he was not a case. No
specimens were collected for culture, but sera was collected for testing for Legionella
antibodies. We did not interview the patient, and did not know he had attended the
seminar until his name appeared on the list from the company.

I prepared a submission to the Health Department requesting funding to cover
investigation costs.

**Preparation for interviewing subjects and collecting blood specimens:**

we arranged:

- four sessions over two days, in outpatients clinics at Westmead Hospital
- two nurses to collect blood
- WSPHU staff to help meet and interview subjects
- Public Health Laboratory at ICPMR to test for Legionella antibodies
- complimentary tea or coffee and biscuits at the hospital coffee shop for subjects
- to interview and collect blood from subjects who could not come to Westmead hospital
  on the 3rd or 4th of June. We interviewed subjects and collected blood samples in the
  week prior to, and in the week following the Westmead clinic days. Some of these
  subjects came to the WSPHU, and others were visited in their home. I arranged for some
to have sera collected at a hospital near them. One couple on holidays, drove to Kempsey
hospital to have sera taken. I arranged for convalescent sera from three of the cases to be taken within three days of the subjects’ blood collection.

Seven employees of the investment company attended the seminar at the hotel. Three arrived unexpectedly at one of the sessions, for testing.

We prepared:

• questionnaires (Louisa prepared the movements questionnaire and maps), calendar, name tags, roles for staff ("deployed" as greeters, interviewers, and helpers)
• trained WSPHU staff to use the questionnaire for interviewing subjects about their movements around the Parramatta area on 7th April. Training included a drive around the area to familiarise staff with local landmarks.
• notices for outpatients reception staff
• appointment lists (who was expected at which sessions)
• supplies - for example - Mims, street directory, clipboards, pens - red and blue/black, vacutainers
• explanation of blood results - to give to subjects after collecting blood sample
• vouchers for tea and coffee
• labels with subjects names - for vacutainers and laboratory use
• draft media release (just in case)
• contacted Health Public Affairs in the Health Department (just in case)
• request for funding from the Health Department’s Legionella budget

Seven employees of the investment company attended the hotel for the afternoon seminar. Three arrived unexpectedly at one of the outpatients sessions, for antibody testing.

One of the PHOs (a pharmacist) coded information about current medication, and
medication taken as a result of subsequent illness. Using the maps and the movements questionnaire, Louisa and I coded the sites visited. After the data were collected and coded, the data entry clerk in WSPHU entered it into a dBase database I prepared. Louisa and I analysed data using Epi Info, and Statistix software.

**History of the hotel’s links with Legionellosis**

Our EHO recalled that the hotel’s evaporative condensers had been investigated in January 1993, after two patients with Legionnaires’ disease had visited that area during their incubation period. One patient had visited the hotel and the other had attended the theatre on the opposite side of the road. One patient died. Levels of 30,000 cfu/ml of *Legionella pneumophila* serogroup 1 were found in the evaporative condenser on the first floor, and levels <10 cfu/ml in the roof top evaporative condenser. The lower tower was decontaminated and re-tested. Levels of 60 cfu/ml and 10 cfu/ml were found when the condenser was resampled.

The first floor evaporative condenser had been leaking in April 1993, and had been repaired and cleaned. Levels of 28,000 cfu/ml and 3,400 cfu/ml were detected in April 1993 when the hotel’s condensers were tested during the investigation of the cluster of cases.

Another patient who was diagnosed in November 1993 with Legionnaires’ disease, had visited the hotel during the incubation period. This patient died. Laboratory results from the first floor and roof evaporative condensers showed counts of 130 and 250 cfu/ml respectively. DNA fingerprinting results are not yet available. The NSW Health Department’s Department of Analytical Laboratories (DAL) conducted all the tests.
Throughout this time, the hotel has been complying with NSW Public Health regulations for maintaining such water systems. Since the beginning of 1993, they have independently tested for *Legionella* levels in the evaporative condensers. However, results from the private laboratory have differed from results from those from DAL.

Results suggest that current Public Health regulations will not prevent *Legionella* growth in water systems, and that standards for *Legionella* testing should be investigated.

**Result of the investigation**

1. We informed the hotel as results became available. The hotel employed an engineering consultant with expertise in the *Legionella* and air-conditioning field. WSPHU arranged a meeting with hotel management and their consultant to give them the investigation results, and discuss further management of the cooling towers. The consultant planned to supervise a complete clean and disinfection, and to institute a new disinfecting system in the first floor cooling tower. WSPHU were to continue to sample and measure *Legionella* levels in the cooling towers. The hotel planned to continue to have the cooling towers tested, but would change to another laboratory.

2. There are only two Australian reports of *L. pneumophila* seroprevalence with which to compare our results. Seroprevalence varies between geographic areas and different populations. To obtain seroprevalence for a population aged 50-80 years, in the western Sydney area, we propose to test sera (IFA) from a random sample of 450 subjects from "The Blue Mountains Eye Study" (BMES). The BMES is a population based study, and over 80% of eligible subjects participated. Louisa prepared a proposal requesting funding from the Health Department’s Legionella budget.

I really enjoyed the cross-sectional study. After the initial difficulties producing the one
page letter, it ran very smoothly. Subjects all participated enthusiastically. Some who were away on holidays contacted us after they returned to ask if it was not too late to help. We had not expected to investigate without media attention. A tiny paragraph surrounded by waste management articles and advertisements in one of the local papers was the only media publicity.
Letter to the investment company requesting their cooperation:

20 May 1993

Mr ..........  
Investment Company  
Parramatta NSW 2124

Dear Mr ..........  

The Public Health Unit needs to follow up all people who attended a personal investment seminar run by your company on the afternoon of April 7th 1993 at the Hotel. A small number of people who attended this seminar became ill.

We need to contact each person who attended the seminar. We will ask them to complete a questionnaire about their health and their movements on that afternoon, and to attend a clinic to have a blood sample taken.

A letter of introduction could be sent by you, accompanied by a letter of explanation from us. The letters would need to be sent out by Monday afternoon. We could assist with the mail out if necessary.

Under the Public Health Act 1991, I request information about all people who attended this seminar. I need a list of surnames, first names, addresses, telephone numbers, and dates of birth or age. This information will be confidential.

Dr Jane Bell will be in touch with you about this matter.

Yours sincerely

Anthony Capon  
MEDICAL OFFICER OF HEALTH
Letter to people who attended the investment seminar:

May 1993

2–3–1
4–
5–
6–

Dear 2–1–

We understand that on the afternoon of Wednesday 7 April 1993 you may have attended a seminar in Parramatta. A small number of people who were in Parramatta that day became ill with Legionnaires’ disease. They all recovered fully. Please note, we are not suggesting that illness was due to attendance at the seminar.

Legionnaires’ disease is caused by Legionella bacteria. It is usually spread through the environment and is not spread from person-to-person.

We are asking people who attended the seminar to help us with our inquiries because we know they were all in the same area on that afternoon. There is absolutely no risk that you will become ill with Legionnaires’ disease because you were in Parramatta that day. It takes two to 12 days for symptoms to appear after someone has been infected with Legionella bacteria, and no other patients with Legionnaires’ disease have been reported since.

However, some of the people who attended the seminar may have become infected with Legionella bacteria without actually becoming ill. We would like to find out whether you fall into this category. This will improve our understanding of how Legionnaires’ disease is spread and help us to prevent it in future.

We are therefore asking you and all those who attended the seminar, to come to the Outpatients Department of Westmead Hospital to complete a questionnaire and to have a blood sample taken.

The questionnaire will ask you about your general health, any recent illness, and any medications you took in April. We will also ask you about your movements on the afternoon of 7 April 1993, such as where you walked or parked that afternoon. We would appreciate it if you would give this some thought. Your appointment details are attached.

We appreciate the Investment Company’s speed and responsibility in acting quickly in the best interests of their clients.

If you have any questions about this, or if this time does not suit you, please ring Dr Jane Bell at the Public Health Unit, on 840 3603. We have enclosed a fact sheet about Legionnaires’ disease for your information.

Yours sincerely

Dr Anthony Capon
Medical Officer of Health
Example of appointment details mailed with letter:

Appointment details

If you can, we ask you to come to Clinic D of the Outpatients Department of Westmead Hospital on Thursday 3rd June between 9am and noon.

Please enter through the Outpatients entrance. It is the entrance to Westmead Hospital on Hawkesbury Road furthest from Darcy Road. It has a sign "Entrance 3" and another sign "Outpatients". Please refer to the map of the area below.

Clinic D is on level 2 of the hospital, where you enter. The staff at the reception desk will direct you. Please ask to be directed to the Public Health Unit Study in Clinic D.

We will give you a questionnaire to complete and take a blood sample. Results of the blood test will be sent to you. All results will be confidential.

If this time does not suit you, please ring Dr Jane Bell at the Public Health Unit, on 840 3603.
FACT SHEET

LEGIONNAIRES' DISEASE

What is Legionnaires' disease?

Legionnaires' disease is caused by an infection with Legionella bacteria. Legionnaires' disease is a type of pneumonia, and can be fatal. Legionella infection may also cause a mild flu-like illness. Sometimes people can become infected and not have symptoms at all.

What are the symptoms?

- sudden high temperature
- chills
- dry cough
- headache
- stomach cramps
- diarrhoea
- aches and pains in muscles
- feeling confused

How is Legionnaires' disease spread?

Legionella bacteria live naturally in moist environments. The most common way of catching Legionnaires' disease is by breathing air contaminated with Legionella bacteria. Contaminated air can come from water cooling systems of some types of air-conditioning units, some warm water systems and from potting mix.

Legionnaires' disease is not spread from person to person.

It usually takes 2 to 12 days for symptoms to develop after breathing contaminated air.

Who is most at risk of catching Legionnaires' disease?

- older people with existing chronic health problems, such as bronchitis or other chest illnesses
- people taking medications to suppress the immune system, such as cancer patients or people with kidney or liver transplants
- heavy smokers and drinkers

What is the treatment?

Legionnaires' disease is treated with an antibiotic called erythromycin.
24 May, 1993

Dear Client,

We have been asked by the Western Sydney Area Health Service to provide assistance in contacting attendees at our Parramatta Client Seminar on the afternoon of 7 April, 1993.

This request has been made following the occurrence of Legionnaires’ disease amongst a small number of people who were present in that part of Parramatta on that day.

All those affected have completely recovered, and we understand that there is no possibility that you could become ill as a result of attending the Client Seminar.

The Western Sydney Area Health Service is naturally interested in identifying the source of the disease, and whether any people have come into contact with it without becoming ill.

Information relating to your personal details is maintained on a confidential basis by the Western Sydney Area Health Service. However, we believe it important to cooperate with the Western Sydney Area Health Service on this community issue. As our records indicate that you attended the Client Seminar on the afternoon of 7 April, we have consequently forwarded your name and address as requested.

Attached is a fact sheet and letter from the Western Sydney Area Health Service asking for your assistance in their studies. We ask that you provide such assistance as is requested.

Thank you for your consideration in this matter. If you have any questions, please do not hesitate to contact me.

Yours sincerely,
Copy of prepared media release (just in case)

Media release 28 May 1993

The Public Health Unit in Western Sydney is taking the opportunity to further knowledge about Legionnaires' disease. "Legionnaires' disease is a type of pneumonia caused by infection with Legionella bacteria. Legionella infection does not always cause Legionnaires' disease. It may cause a mild flu-like illness, or it may not cause any illness at all" Dr Capon, Director of Public Health in Western Sydney, stated.

In April this year, three people became ill with Legionnaires' disease. They all recovered fully. Subsequent investigation showed that they had all been in the Parramatta area on the afternoon of April 7th. The Unit has selected a group of people who attended a seminar in the same area that day, to follow up to see if other people became infected, and the degree (if any) of illness they had.

"This particular group is being asked to help because we know they were all in the same area on that afternoon" said Dr Capon.

"There is absolutely no risk that other people who were in Parramatta that day will contract Legionnaires' disease as a result. It takes 2 to 12 days for symptoms to occur after someone has become infected, and no other patients with Legionnaires' disease have been reported since.

Contact person: Dr Anthony Capon, phone 840 3603
The information you give us today will be confidential. It will help us find out more about the bacteria that causes Legionnaires' disease - how it affects people and how they can become infected.

The following questions are about your health and any medications you are taking. Please answer the questions by writing in the spaces provided, or by ticking the box with the correct response.

If you have any questions, please ask one of the Public Health Unit staff to help you.

1. Surname
2. First name
3. Date of birth
4. Sex male / female (please circle)
5. What is, (or if retired what was) your main occupation?
6. In case we need to contact you about this questionnaire, what is your home phone number?

Questions about your health:

7. In the list below please tick yes or no any conditions or diseases which you suffer from:
   - chronic bronchitis or emphysema  yes  no
   - asthma  yes  no
angina ........................................ yes □
........................................ no □

heart failure ................................ yes □
........................................ no □

hypertension ................................ yes □
........................................ no □

diabetes ........................................ yes □
........................................ no □

arthritis ........................................ yes □
........................................ no □

organ transplant ................................ yes □
........................................ no □

kidney disease ................................ yes □
........................................ no □

liver disease (such as cirrhosis) ........... yes □
........................................ no □

cancer (other than skin cancer) ............ yes □
........................................ no □

8. Please list any other long term conditions or diseases which you suffer from:

........................................................................................................................................
........................................................................................................................................
........................................................................................................................................

The following questions are about smoking.

9. Have you ever smoked cigarettes regularly? ........................................ yes □
........................................ no □

If "no", please go to question 12
10. Do you smoke now?  ... ... ... ... ... yes □
    ... ... ... ... ... no □

*If "no", please go to question 12*

11. How many cigarettes do you usually smoke each day? ..............

The next questions are about alcoholic drinks.

12. Do you now or, have you ever consumed alcoholic drinks regularly? (such as beer, wine, cocktails or spirits) ... ... ... yes □
    ... ... ... ... ... no □

*If "no", please go to question 16*

13. How often do you usually drink alcohol now? (please tick box)
    I don’t drink alcohol now □ (please go to question 16)
    Less than once a week □
    On 1 or 2 days a week □
    On 3 to 7 days a week □

14. On a day when you drink alcohol, how many drinks do you usually have? (please tick box)
    1 or 2 drinks □
    3 or 4 drinks □
    5 or more drinks □

15. Considering all types of alcoholic drinks, how many times during the last month did you have 5 or more drinks on any one occasion? ................. times
16. Please list any prescription or non-prescription medications you are currently taking:

..........................................................................................................................
..........................................................................................................................
..........................................................................................................................
..........................................................................................................................
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..........................................................................................................................
..........................................................................................................................

17. This year, have you been on steroid medications (such as Prednisone or Decadron)?

... ... ... yes ☐
... ... ... no ☐

If yes, please list:

..........................................................................................................................
..........................................................................................................................
..........................................................................................................................
..........................................................................................................................

18. This year, have you taken any anti-cancer drugs? ... ... yes ☐

... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... no ☐

If yes, please list:

..........................................................................................................................
..........................................................................................................................
..........................................................................................................................
CONSENT FORM

I consent to having a blood sample taken to be tested for antibodies to Legionella bacteria, as part of a study being conducted by the Western Sector Public Health Unit.

I understand that the purposes of the study are to further knowledge of Legionnaires’ disease and its prevention. I have been informed that results will be confidential. Although information gained during the study may be published, I will not be identified and my personal results will not be disclosed.

Name .................................................................
Signature ............................................................ Date ..............................................

Thank you very much for coming today and completing the questionnaire and interview, and giving us a blood sample. We will post your blood results to you. We expect results to be available at the beginning of July.
QUESTIONNAIRE ABOUT MOVEMENTS ON APRIL 7 1993
AND SUBSEQUENT ILLNESS

Date: ________________________________

Subject Firstname: ____________________

Subject Lastname: ____________________

Interviewer Initials: ___________________

Time interview commenced: ___________

Time interview finished: ______________

On the afternoon of Wednesday April the 7th (the Wednesday before Easter) this year, did you.....

1. Attend the 1.15 pm seminar at the Gazebo hotel run by Bridges Personal Investment?

   yes ..................................................... □ 1

   no ...................................................... □ 2

   If no, go to question 8

2. What time did you leave home to go to Parramatta? (eg. 1230)

   ________________________________
3. What form of transport did you use?

- car (go to question 4) □ 1
- bus (go to question 5) □ 2
- train (go to question 6) □ 3
- walked (go to question 7) □ 4
- other □ 5

specify, go to question 7: ____________________________

4. Car users

4.1 What time did you arrive in Parramatta CBD? (eg. 1300)

4.2 Where did you park? (mark on MAP 1 “P”)

4.3 Did you wait in the car before walking to the hotel?

- yes □ 1
- no □ 2

If no, go to question 7

4.4 How long (in minutes) did you wait in the car? (eg. 015)

- Go to question 7
5. Bus users

5.1 What number bus/bus route did you use?

if number is not known, specify name of route eg. Ryde to Parramatta:

5.2 What time did you arrive in Parramatta CBD? (eg. 1245)

5.3 Where did you get off the bus? (mark on MAP 1 "B")

→ Go to question 7

6. Train users

6.1 Where did you get on the train?

specify station:

6.2 What time did you arrive in Parramatta (CBD)? (eg. 1245)

6.3 Which exit did you use to exit the train station? (mark on MAP 1 "T")

→ Go to question 7
7. Everyone to answer

7.1 What route did you take to walk to the Gazebo hotel? *(draw on MAP I)*

7.2 Did you stop anywhere along the way for a period of 5 minutes or more?

- yes ........................................... ☐ 1
- no ............................................. ☐ 2

*If no, go to question 7.4*

7.3 Where did you stop and for how long?

*Mark each stop "S1 S2 S3" etc on MAP I*

*Specify location of each stop and write down time spent at each stop in minutes (eg 010)*

7.3.1 S1 Location: _____________________________ 

Time spent: [ ] [ ] [ ]

7.3.2 S2 Location: _____________________________ 

Time spent: [ ] [ ] [ ]

7.3.3 S3 Location: _____________________________ 

Time spent: [ ] [ ] [ ]

7.3.4 S4 Location: _____________________________ 

Time spent: [ ] [ ] [ ]

7.3.5 S5 Location: _____________________________ 

Time spent: [ ] [ ] [ ]
<table>
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<th>Question</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>7.4</td>
<td>What time did you arrive at the Gazebo Hotel? (eg. 1300)</td>
</tr>
<tr>
<td>7.5</td>
<td>Did you wait OUTSIDE the hotel before going in?</td>
</tr>
<tr>
<td></td>
<td>yes [□]</td>
</tr>
<tr>
<td></td>
<td>no [□]</td>
</tr>
<tr>
<td></td>
<td>If no, go to question 7.7</td>
</tr>
<tr>
<td>7.6</td>
<td>Where did you wait OUTSIDE and for how long?</td>
</tr>
<tr>
<td></td>
<td>Mark each waiting location &quot;W1 W2 W3&quot; etc on MAP 1</td>
</tr>
<tr>
<td></td>
<td>Specify each waiting location and write down time spent at each in minutes (eg 010)</td>
</tr>
<tr>
<td>7.6.1</td>
<td>W1 Location: ________________________________ Time spent: [□□□]</td>
</tr>
<tr>
<td>7.6.2</td>
<td>W2 Location: ________________________________ Time spent: [□□□]</td>
</tr>
<tr>
<td>7.6.3</td>
<td>W3 Location: ________________________________ Time spent: [□□□]</td>
</tr>
</tbody>
</table>
7.7 Did you wait inside the hotel before going into the seminar?

   yes ........................................... □ 1
   no ............................................ □ 2

*If no, go to question 7.9*

7.8 Where did you wait INSIDE the hotel and for how long?

*Mark each waiting location "W1 W2 W3" etc on MAP 2*

*Specify each waiting location and write down time spent at each in minutes (eg 010)*

7.8.1 **W1** Location:________________________

   Time spent: [ ] [ ]

7.8.2 **W2** Location:________________________

   Time spent: [ ] [ ]

7.8.3 **W3** Location:________________________

   Time spent: [ ] [ ]

7.9 What time did you go into the seminar room?

   [ ] [ ] [ ] [ ]

7.10 When you went into the seminar room, where did you sit? *(mark "S" on MAP 2)*

7.11 What time did you leave the seminar room?

   [ ] [ ] [ ] [ ]
7.12 After the seminar, did you have afternoon tea in the lobby?

yes ............................................. □ 1
no .................................................. □ 2
If no, go to question 7.14

7.13 How long did you stay in the lobby (in minutes)?

[Three options circled]

7.14 While you were at the Gazebo Hotel, did you use the toilet or bathroom?

yes ............................................. □ 1
no .................................................. □ 2
If no, go to question 7.16

7.15 Where were the toilets?

Mark each toilet location "T1 T2 T3" etc on MAP 2
7.16 Apart from the ground floor, did you go anywhere else in the hotel during or after the seminar?

yes ........................................... ... □ 1

no ........................................... ... □ 2

If no, go to question 7.18

7.17 Where else did you go in the hotel and long did you spend there?

Mark each other location "01 02 03" etc on MAP 2

Specify each other location and write down time spent at each in minutes (eg 010)

7.17.1 01 Location: ____________________________

Time spent: ___________ ___________ ______

7.17.2 02 Location: ____________________________

Time spent: ___________ ___________ ______

7.17.3 03 Location: ____________________________

Time spent: ___________ ___________ ______
7.18  What time did you leave the hotel?

7.19  Did you wait outside the hotel after leaving?

   yes ................................................... ■ 1
   no ..................................................... ■ 2

   If no, go to question 7.21

7.20  Where did you wait and for how long?

   Mark each waiting location “W1 W2 W3” etc on MAP 3

   Specify each waiting location and
   write down time spent at each in minutes (eg 010)

7.20.1  W1  Location: ______________________________

            Time spent:                            

7.20.2  W2  Location: ______________________________

            Time spent:                            

7.20.3  W3  Location: ______________________________

            Time spent:                            
7.21. What form of transport did you use to leave Parramatta CBD?

- car ................................................. □ 1
- bus .................................................. □ 2
- train ................................................ □ 3
- walked ............................................ □ 4
- other .............................................. □ 5

specify: ________________________________
7.22 What route did you take to walk back to your transport? (draw on MAP 3 "- - ")

7.23 Did you stop anywhere along the way for a period of 5 minutes or more?

<table>
<thead>
<tr>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>☐ 1</td>
<td>☐ 2</td>
</tr>
</tbody>
</table>

If no, go to question 7.25

7.24 Where did you stop and for how long?

Mark each stop "S1 S2 S3" etc on MAP 3

Specify location of each stop and write down time spent at each stop in minutes (eg 010)

7.24.1 S1 Location: ____________________________ Time spent: [ ] [ ] [ ]

7.24.2 S2 Location: ____________________________ Time spent: [ ] [ ] [ ]

7.24.3 S3 Location: ____________________________ Time spent: [ ] [ ] [ ]

7.24.4 S4 Location: ____________________________ Time spent: [ ] [ ] [ ]

7.24.5 S5 Location: ____________________________ Time spent: [ ] [ ] [ ]
7.25 What time did you leave Parramatta CBD?

8. In the three weeks after the seminar (between Thursday 8th April and Tuesday 27th April, after the Anzac Day long weekend), did you have any ill health?

   yes .................................................. □ 1

   no .................................................. □ 2

   * If no, terminate interview *

9. On what date in April did you become ill? (eg. 13)

10. How long did the illness last (days)

11. Did you have any of the following symptoms?

   11.1 Generally unwell

      yes .................................................. □ 1

      no .................................................. □ 2

   11.2 Muscle aches and pains

      yes .................................................. □ 1

      no .................................................. □ 2
<p>| 11.3  | Fever          | yes .............................................. | □ 1 |
| 11.4  | Shivering      | yes .............................................. | □ 1 |
| 11.5  | Nausea         | yes .............................................. | □ 1 |
| 11.6  | Diarrhoea      | yes .............................................. | □ 1 |
| 11.7  | Vomiting       | yes .............................................. | □ 1 |
| 11.8  | Abdominal cramps | yes ..............................................  | □ 1 |
| 11.9  | Chest pain     | yes .............................................. | □ 1 |
| 11.10 | Difficulty breathing or shortness of breath | yes .............................................. | □ 1 |</p>
<table>
<thead>
<tr>
<th>Question</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>11.11 Blurred vision</td>
<td>☐ 1</td>
<td>☐ 2</td>
</tr>
<tr>
<td>11.12 Dry cough</td>
<td>☐ 1</td>
<td>☐ 2</td>
</tr>
<tr>
<td>11.13 Moist cough</td>
<td>☐ 1</td>
<td>☐ 2</td>
</tr>
<tr>
<td>11.14 Sore throat</td>
<td>☐ 1</td>
<td>☐ 2</td>
</tr>
<tr>
<td>11.15 Severe headache</td>
<td>☐ 1</td>
<td>☐ 2</td>
</tr>
<tr>
<td>11.16 Unusual tiredness</td>
<td>☐ 1</td>
<td>☐ 2</td>
</tr>
<tr>
<td>11.17 Dizziness</td>
<td>☐ 1</td>
<td>☐ 2</td>
</tr>
</tbody>
</table>
12. Did you have any other symptoms?

   yes ................................................................. □ 1
   no ................................................................. □ 2

   (if no, go to question 14)

Please list your other symptoms:

12.1

12.2

12.3

12.4

12.5

12.6

13. Did you consult a doctor about your illness?

   yes ................................................................. □ 1
   no ................................................................. □ 2
14. Did you attend a hospital for this illness?

yes .................................................. □ 1

no .................................................. □ 2

(if no, go to question 15)

14.1 Which hospital did you attend?


14.2 How long did you stay in hospital? (days)


15. Were any antibiotics prescribed?

yes .................................................. □ 1

no .................................................. □ 2

(if no, go to question 16)

What were the name/s of the antibiotic/s?

15.1

15.2

15.3
16. May we contact your doctor about this illness?

  yes ............................................................................................................................................... □ 1

  no ................................................................................................................................................ □ 2

  (if no, go to question 18)

16.1 Doctor’s surname: ____________________________

16.2 Doctor’s firstname: ____________________________

16.3 Doctor’s street number and street name: ________________

16.4 Doctor’s suburb: ____________________________

16.5 Doctor’s postcode: ____________________________

16.6 Doctor’s phone number: ____________________________

17. Did you take any other prescription or non-prescription medications as a result of this illness?

  yes ............................................................................................................................................... □ 1

  no ................................................................................................................................................ □ 2

  (if no, terminate interview)

What were the names of the prescription or non-prescription medications you took?

17.1 ____________________________

17.2 ____________________________

17.3 ____________________________

17.4 ____________________________

17.5 ____________________________

17.6 ____________________________

Thank you very much for your help!
Maps used to record movements around Parramatta:
MAP 2

COFFEE SHOP
RESTAURANT

RECEPTION

SEMINAR

FEMALE/DISABLED
TOILETS

MALE

STAIRS

BAR

GLASS WALLED ROOM

LIFTS

AUTOMATIC
DOOR

REVOLVING
DOOR

CAR PARK

CHURCH ST
## April 1993

<table>
<thead>
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<th>Mon</th>
<th>Tues</th>
<th>Wed</th>
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<td>Easter Monday</td>
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<td>Public Holiday</td>
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<tr>
<td>(Anzac Day)</td>
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<td>(Anzac Day)</td>
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</tbody>
</table>

* school holidays 9 - 18 April
Information given to subjects who participated.

Thank you very much for coming today and completing the questionnaire and interview, and giving us a blood sample. We will post your blood results to you. You should have results by the beginning of July. Please phone Jane Bell at the Public Health Unit (840 3603) if you have any queries.

What will the blood test show?

The blood test will measure the level of antibodies to Legionella bacteria in the blood.

Legionella bacteria are widespread throughout the environment, and many people may have been exposed to Legionella in the past. This should show in the blood.

Antibody levels will indicate:

1. whether you have been infected with Legionella bacteria in the past - you may not have had Legionnaires’ disease

OR

2. you may never have been infected with Legionella bacteria before

If antibodies are detected, it does not mean that you are protected from getting (immune to) a Legionella infection in the future.
early July 1993

2- 3- 1-
4-
5-
6-

Dear 2- 1-

Thank you very much for participating in the Public Health Unit Study.

Your blood sample was tested for antibodies to *Legionella pneumophila* bacteria. Your blood had an antibody level <128. This level indicates that you probably have not been infected with *Legionella* bacteria before.

I have attached a copy of the laboratory results for your records.

If you have any questions about your blood results please ring Jane Bell at the Public Health Unit, phone 02 8403603.

Thank you again for your time and interest. Your participation has been very important in increasing our knowledge about *Legionella* infection. Information from the study will help us to learn more about how the bacteria are spread and how to decrease the risk of Legionnaires’ disease in the future.

Yours sincerely

Jane Bell
Public Health Officer
early July 1993

Dear

Thank you very much for participating in the Public Health Unit Study.

Your blood sample was tested for antibodies to *Legionella pneumophila* bacteria. Your blood had an antibody level of XXXXX. Around xx% of the general population have a similar antibody level.

This means that you have been infected with *Legionella* bacteria sometime in the past, but does not indicate when this was. You may not necessarily have been ill. You are not infected with *Legionella* bacteria now and can not spread the bacteria to other people.

This result does not mean that you will be protected from future *Legionella* infection because there are different types of *Legionella* bacteria.

If you have any questions about your blood results please ring Jane Bell at the Public Health Unit, phone 02 8403603.

Thank you again for your time and interest. Your participation has been very important in increasing our knowledge about *Legionella* infection. Information from the study will help us to learn more about how the bacteria are spread and how to decrease the risk of Legionnaires’ disease in the future.

Yours sincerely

Jane Bell
Public Health Officer
### Coding sheet for movements 7th April:

<table>
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<tr>
<th>Station</th>
<th>Movement</th>
<th>Yes</th>
<th>No</th>
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### Station Details:

- VIC
- MACQ
- WILDE
- WILLS
- GAZ
- GAZCP
- GAZLIFT
- GAZRAMP
- GAZLANE
- SORRELL
- LAMONT
- MARKET
- PALMER
- GAZCPST
- DJCP
- DJWALK
- RIVERB
- 1ST
- 2ND
- 3RD

### Code Explanation:

- **1**: Present
- **2**: Absent
- **3**: Checkmark

---

**110**
Request for funding:

Follow-up of a group of people who may have been exposed to *Legionella*.

**Background**
Two people who attended the same seminar held on 7 April 1993 in a hotel in Parramatta, and one person who passed nearby at that time, became ill with Legionnaires’ disease. In addition, one other person who attended the seminar was hospitalised with an illness similar to Legionnaires’ disease. We are awaiting serology for this latter patient.

All cases became ill on either 13 April or 14 April. All cases were infected with *Legionella pneumophila* serogroup 1 (LP 1). The two evaporative condensors at the hotel were contaminated with high levels of the same species. We are awaiting results of DNA fingerprinting of isolates from the patients and evaporative condensors.

**Proposal**
To obtain a blood sample for *Legionella* serology from all people who attended the April 7th seminar, and collect detailed information about their movements on that afternoon. It is believed that around 200 people attended the seminar.

**Aims**
To determine:
1. whether there is a difference between antibody levels in this population and background *L. pneumophila* antibody prevalence
2. whether exposure to any particular site in relation to the hotel’s evaporative condensors was more likely to result in *L. pneumophila* infection
3. the incidence of subclinical and less severe infection associated with *L. pneumophila* infection

**Method**
A list of people who attended the seminar will be obtained from the seminar organisers. All those who attended the seminar will be contacted by mail, and asked to complete a questionnaire and have a blood sample taken. They will be asked to attend a clinic at the Outpatients Department of Westmead Hospital on either Thursday 3rd June or Friday 4th June. On arrival at the clinic, subjects will be asked to fill in a self-administered questionnaire which will collect information on risk factors and medications. They will then be interviewed by one of the researchers to determine their movements on April 7th, and subsequent morbidity experience.

After completing the questionnaire, experienced venepuncture nurses will take 10ml blood from each subject. The blood samples will be taken to the Institute of Clinical Pathology and Medical Research (ICPMR) for testing for *Legionella* antibodies.
Sera will be tested for antibodies to the epidemic strain and total antibodies to *L. pneumophila* will be determined. Counts of 256 or higher will be further tested to determine the serogroup/s involved (*L. pneumophila* SG1-6).

Data from the questionnaire and serological data will be entered into a database and analysed. Public Health Unit staff will be responsible for entering, analysing and reporting the results.

**Analysis**

Total antibody levels, and levels to serogroups 1-6 in the seminar population will be compared with reported prevalence, and with prevalence estimated from ICPMR serological requests since 1987. It is anticipated that a total antibody count of \( \geq 256 \) will be used to indicate past, possibly recent infection with *Legionella*, although analysis will be repeated using a range of cut-off points.

Cross-tabulations and logistic regression will be used to evaluate predictors for *Legionella* infection, including sites visited on April 7th and risk factors such as age, sex, smoking history and chronic illnesses. Groups of subjects stratified by total antibody levels will be compared with regard to their morbidity experience in the three weeks after the seminar.

**Funding**

We request $5,500 from the NSW Health Department to cover serology and other costs.

Cost estimates are based on:

<table>
<thead>
<tr>
<th>Description</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Printing, postage</td>
<td>450</td>
</tr>
<tr>
<td>Serological tests 200 @ $15 each</td>
<td>3000</td>
</tr>
<tr>
<td>Consumables (needles, vacutainers, swabs etc)</td>
<td>397</td>
</tr>
<tr>
<td>Three registered nurses, for three days each</td>
<td>1176</td>
</tr>
<tr>
<td>Clinic hire</td>
<td>450</td>
</tr>
</tbody>
</table>

\[ \text{Total Cost} = 450 + 3000 + 397 + 1176 + 450 = 5476 \]
3. SURVEILLANCE

THE CHILD DENTAL HEALTH SURVEY (CDHS) IN NSW

I Public health importance of children’s oral health

Dental caries is the most prevalent oral condition affecting children. The consequences of dental morbidity are life long, and require continuing dental care. Untreated dental caries can cause pain, discomfort, reduced function and severe infections. Oral pain may cause disability in eating and a change in diet. Tooth loss may result in need for dentures or other complex dental treatment, and aesthetic problems. In the 1989-90 National Health Survey, 152,800 (18.2%) children aged 5-14 year reported dental problems in the two weeks before the survey. As well, symptoms from oral disease were ranked as the sixth most frequent illness condition.¹

Primary, secondary and tertiary interventions for dental caries are available. Primary prevention strategies include water fluoridation, fluoride toothpastes, fissure sealants, and healthy diets. Secondary interventions involve improving dental attendance patterns for early diagnosis and treatment. Tertiary interventions aim to restrict further damage and restore function. The earlier dental caries is detected in its natural history, the easier and less costly it is to restore, the smaller the restoration required with consequent increased longevity.
II  History of the Child Dental Health Survey (CDHS)

Although some states had school dental services (SDS), the Australian School Dental Scheme was initiated in 1973, following agreement between Commonwealth and State governments. It aimed to improve the dental health and dental awareness of the community. The SDS was based on training and employing dental therapists in clinics located in, or close to schools. Dental care was to be provided to children until they completed primary school and without direct cost to the parents.2

National evaluation of the SDS was initiated in 1975, but it was not until 1977 that clinical data were available from all states and territories. Clinical data were not available before, or soon after the SDS started. The specific grant from the Commonwealth for SDS stopped in 1981, and SDS grants were absorbed into general revenue grants. All States and Territories continue to operate school dental services.2

From 1977 to 1980, clinic data on every child examined in the SDS were forwarded to the Commonwealth Department of Health. Data were collated, and results reported back to the states. Between 1980 and 1985 some states adopted sampling procedures. Since 1989, the Child Dental Health Survey (CDHS) has been administered by the Dental Statistics and Research Unit (DSRU) of the Australian Institute of Health and Welfare (AIHW). Since that time, data have been collected from a random sample of children examined in the SDS in all states.3

In NSW, since 1992, data collection forms have been forwarded to the Dental Health Unit of the NSW Health Department. Data are scanned, and at the end of the calendar year, a file is copied and sent to the DSRU.
Flow chart of CDHS in NSW, 1992

Child attends school dental clinic

Dental examination by dental therapist or dentist

If child was born on the 3rd, 15th or 30th of any month, examination recorded on an optical mark reader (OMR) form

OMR forms collected in the clinic

Forms posted to Dental Health Unit, NSW Health Department (collection closes on the 1st and 15th of each month)

Scanned approx twice/month -> dBase file

Monthly reports prepared and sent to Principal Dental Officers around NSW

Annual report to be prepared by Dental Health Unit for NSW

Data sent annually to AIHW DSRU, which prepares an annual report for each state, and a national report
IV Components and operation of the CDHS

In NSW, all children to the age of 15 years, and children over 15 years who are dependents of card holders and attending school are eligible to attend school dental clinics. The SDS covers government, Catholic and independent schools.

Data are collected over the full year. The following information is collected for each child:

• clinic number (then related to district or health area, and whether fluoridated or not)
• school code

• month of this dental examination
• date of previous dental examination in SDS
• whether this is the first time the child has been examined in the SDS
• whether this is the first examination for this child for this year, or whether it is a subsequent or recall examination

• child’s date of birth (or age)
• child’s sex
• child’s country of birth
• maternal country of birth

• information on dental health status is obtained by clinical examination. This may or may not include radiographs. The status of each tooth is recorded, and summed to give an overall measure of an individual’s dental caries experience. DMFT is the index derived from the sum of decayed (D), missing (M), or filled (F) permanent teeth. A
similar index, dmft, measures the number of decayed (d), missing (m), or filled (f) primary teeth.

These measures can be used to show the proportion each component provides to the DMFT/dmft. For example, D/DMFT gives an idea of the proportion of the DMFT index which is untreated dental caries, and F/DMFT gives the proportion due to filled teeth. D+d gives a total number of teeth (permanent and primary) with untreated caries. Dental caries experience has fallen since the 1960s and 1970s, and the per cent of children with no caries experience (DMFT+dmft = 0) and those with no untreated decay (D+d=0) is often reported.

• whether the child requires immediate treatment or not

Dental therapists and dentists record dental examination results on an optical mark reader (OMR) survey form (see next page). Since June 1991, these forms have been collected in each clinic and posted to the NSW Health Department’s Dental Health Unit. Once a fortnight, the Data Manager in the Dental Health Unit scans the data into a database file. The Data Manager produces six monthly and annual reports which are posted to the Principal Dental Officers in each Health Area and District. The Principal Dental Officers distribute reports to people in their area. Annually a copy of the data is forwarded to the Dental Statistics and Research Unit of AIHW.

Between 1989 and June 1991 in NSW, survey forms were sent directly to the Dental Statistics and Research Unit, AIHW. NSW obtained child dental health information from the Dental Statistics and Research Unit, AIHW annually.
### School Dental Service Examination Record

**Clinic Name:**

**Patient's Name:**

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<th>Month</th>
<th>Year</th>
</tr>
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<td>Month</td>
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<tr>
<td>Year</td>
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<table>
<thead>
<tr>
<th>Country of Birth</th>
<th>Child</th>
<th>Mother</th>
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#### Deciduous Teeth

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<th>C</th>
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</table>

- Fissure Seal
- Extracted Due to Caries
- Restored - Not Decay
- To Be Extracted - Caries
- Unerupted/Missing
- Other Def - Replacement
- Decayed
- Sound & Filled
- Sound
- Sound & Filled
- Decayed
- Other Def - Replacement
- Caries Defective
- Unerupted/Missing
- Missing - Not Caries
- To Be Extracted - Caries
- Restored - Not Decay
- Extracted Due to Caries
- Fissure Seal

#### Permanent Teeth

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</tbody>
</table>

- Sound
- Sound & Filled
- Decayed
- Other Def - Replacement
- Caries Defective
- Unerupted/Missing
- Missing - Not Caries
- To Be Extracted - Caries
- Restored - Not Decay
- Extracted Due to Caries
- Fissure Seal

### School Code

**Immediate Treatment:**

**Sex:** Male / Female

**O.H.:**

**Soft Tissues:**

**Cal:**
Routine reports are collated from the database. Data are not checked, but the scanner rejects forms which have missing or inconsistent information. The Data Manager checks these, corrects them if possible or sends them back to the clinic to be amended.

Examples of routine reports:

- DMFT and dmft by age and sex, for NSW, for fluoridated, non-fluoridated and part-fluoridated regions, and for geographic regions
- Number of decayed teeth by age and sex, for NSW and Health Areas and Regions
- Number of teeth with decay and/or unsatisfactory restorations, for NSW and Health Areas and Regions
- Fissure sealant distribution by age and sex, for NSW and Health Areas and Regions

Changes in data collection over time:

- Number of children in survey. Originally, data from all children examined in the SDS was forwarded to the Commonwealth Department of Health. From 1989 to 1991, a random sample of 1/16 children has been used. In 1992, NSW increased its sampling ratio to 1/10.
- From 1977-88, all examinations were used to determine dental status, including repeat examinations on the same children in the same year. From 1989, only first examinations for each child in that year are used.
- OMR survey forms were introduced in 1989.
- Since 1989, information about when the child was last examined in the SDS, whether the child requires immediate treatment, previous treatment with fissure sealants, and child and maternal country of birth have been collected.
Information about oral hygiene status, presence of calculus, and health of oral soft tissues can also be collected, (but is not in New South Wales). The database in the Dental Health Unit holds information about whether the clinic attended is located in an area with water fluoridation, an area which is partly fluoridated or a non-fluoridated area.

The main indices, DMFT and dmft have remained constant over the time of the child dental health surveillance. However, perceptions of dental caries status may have changed. In the 1970s, dental staff may have been more eager to diagnose dental caries than staff now. We can not validate this.

Definitions are found in the Survey Guide. Decay is defined as the presence of untreated caries, whether or not the tooth has been restored and whether subsequent treatment will involve restoration, extraction, or no treatment at all. Recurrent caries (filled teeth with decay at the margins, or radiographic evidence of further decay at the restoration) should be recorded as decayed, as should teeth with hard arrested caries.

Teeth are recorded as missing if there is evidence of extraction due to caries. Teeth recorded as filled excludes teeth restored for reasons other than caries.

Examples of immediate treatment need include children with pain, abscessed teeth, grossly decayed teeth with pulp exposure, avulsed or fractured teeth, or if children have a life-threatening condition.

There is no specific training for CDHS coding and recording. Dental Therapy training is similar around Australia. The large number of dental operators (dentists and
therapists) would use similar diagnostic criteria. Any misclassification is expected to be non-differential.

The CDHS is an extensive and comprehensive database. Dental staff must record the date of birth of the child. Information related to the child’s date of birth aids in the classification of cases. It is part of a larger dataset used for research and planning. The specific and useful data generated can be used for various purposes.

V Usefulness of the CDHS

The CDHS can detect trends or changes in the occurrence of dental disease in children attending SDS, and help plan policy and services according to need.

The CDHS can:

• provide estimates of the magnitude of morbidity related to dental disease.

• identify groups and geographic regions with higher risk for dental disease.

• monitor progress towards Goals and Targets for the year 2000, and those of the State Dental Health Strategy

• lead to hypotheses requiring further investigation.

• highlight areas in clinical practice which may need improving. For example, the CDHS can compare the dental status of children having second (recall) examinations in the one year, with those having their first or new to the SDS. Those requiring second examinations should be those with highest need. The CDHS can also monitor the ratio of recall (or second) examinations with new or first examinations. Frequency of examination may also be monitored, indicating time between successive dental examinations.
VI Attributes of the CDHS

1. Simplicity

The CDHS is an extensive, but simple surveillance scheme. Dental staff must first check the date of birth of the child. If the child's date of birth falls on the 3rd, 15th or 30th of any month, then the survey form is completed. It is part of a routine dental examination and extra tests or information are not required. No specific staff training is needed to complete the forms. Information manuals are located in all clinics, and clinics liaise closely with the Data Manager.

Data comes only from SDS clinics around NSW. Most dental clinics are directly responsible to the Principal Dental Officers in Health Areas and Regions. Completed survey forms are collected in the clinic and posted to the Dental Health Unit.

After data have been sent to the Dental Health Unit, routine reports are easily obtained. These reports are sent six monthly, or when requested, to Principal Dental Officers in the Health Areas and Regions. From here, information is fed back to those working in the clinics.

2. Flexibility

Components of the CDHS can be altered easily. Increasing the sample, or increased sampling of certain population groups would be easy to implement. It would also be relatively easy to collect data on other parameters. There are un-allocated dots on the survey forms. The current survey form can also be adapted for other data collection. Staff in SDS clinics are familiar with completing OMR type forms. These changes could all occur with minimal additional cost in time, personnel and funds.
3. Acceptability

The compliance of individuals and Health Areas to participate can be gauged by comparing the number of examinations reported to the CDHS with the total number of dental examinations performed in that Health Area. The total number of examinations performed is collected routinely as part of a Dental Management Information System. Each dental operator records services provided for each patient, and these data are forwarded to the Dental Health Unit.

Participation rates in the CDHS, in each region, are determined by comparing the total number of first annual examinations (from the Dental Management Information System) with the number of examinations reported to the CDHS. Based on the sampling, 1/10 (10%) of all examinations in 1992 should be reported to CDHS. The proportion reported to CDHS ranged from 3.7% to 8.2%. In NSW overall, nearly 6% were reported (Figure 1).

![Figure 1: Per cent of examinations reported to CDHS, NSW 1992](image-url)
To evaluate the completeness of returned forms, I reviewed the proportion of first examinations containing unknown child’s and mother’s country of birth, and unknown child’s date of birth. Compliance with data recording is high for these variables (Table 1).

Table 1. Per cent of data recorded as unknown in CDHS, NSW 1992

<table>
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<tr>
<th>Variable</th>
<th>Per cent unknown</th>
</tr>
</thead>
<tbody>
<tr>
<td>child’s date of birth</td>
<td>2.1</td>
</tr>
<tr>
<td>child’s country of birth</td>
<td>1.8</td>
</tr>
<tr>
<td>mother’s country of birth</td>
<td>3.1</td>
</tr>
</tbody>
</table>

I reviewed the dates of birth recorded in 1992. In addition to the 2.1% which were unknown, 0.5% were reported to have been born on dates other than the 3rd, 15th and 30th of the month. Random sampling depends on selecting and recording data based on date of birth. I examined the proportion of examinations in which date of birth was unknown or an incorrect sampling date, by Areas and Regions. This was higher in the North Coast Region than other areas (Figure 2). This may have been due to a higher proportion of Aboriginal children whose date of birth may not be known. Statewide, only 2.4% of these dubious dates of birth were in Aboriginal children. The doubtful dates of birth occurred in two clinics in the region.
Of the correct dates of birth reported, children born on the 3rd of any month were significantly more likely to have been reported in 1992 than children born on the 15th and 30th (Table 2). If children are randomly selected based on these birth dates, there should be no difference between them. (Although there is no 30th of February.) Why this difference exists is unknown.

Table 2. Per cent of sample reported for the 3rd, 15th and 30th of any month, CDHS 1992

<table>
<thead>
<tr>
<th>Date</th>
<th>Percent of sample</th>
<th>95% Confidence interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>3rd</td>
<td>34.9</td>
<td>34.1 - 35.7</td>
</tr>
<tr>
<td>15th</td>
<td>32.0</td>
<td>31.2 - 32.7</td>
</tr>
<tr>
<td>30th</td>
<td>33.1</td>
<td>32.4 - 33.9</td>
</tr>
</tbody>
</table>
4. Coverage

Figure 3 shows the annual estimated proportion of children seen by age group in the SDS in NSW since 1977. In NSW from 1977 to 1986, the proportion of children using the SDS increased steadily. Years 1986 to 1988 show a decline in the number attending. At least part may be an under-estimation of numbers attending. Under-estimation is also likely to contribute to the decline from 1989 to 1991. Changes also reflect changes in Dental Health Unit administration.

![Figure 3](attachment:image)

These figures are based on Australian Bureau of Statistics estimated populations, Census populations, and the number of first annual examinations seen in the SDS.

From 1977-88, all examinations were reported to the Commonwealth Department of Health. In 1989, a sampling ratio of approximately 1/16 children was introduced, and in 1989 data were collected for five months only. The proportion has been adjusted for
this. From 1989 to 1991, estimates are based on the sampling ratio of 1/16. This is likely to be an under-estimation of the real number of children seen by the SDS. For 1992 we were able to adjust for the under-estimation.

Under-estimation is supported by results from the 1987-88 National Oral Health Survey.\(^1\) When surveyed (from September 1987 to July 1988), approximately 34% of 5-9 year olds, and 29% of 10-14 year olds in NSW visited a government dental clinic in the previous 12 months.\(^5\) Figure 4 shows the difference between the number reported to the CDHS in 1988, and the number reported in the National Oral Health Survey.

\[ \text{Comparison of number of reports to CDHS, NSW 1988} \]

![Figure 4](image-url)
Figure 5 shows that most children seen in the SDS in 1992 were primary school aged children; ages five to 11 years predominate.

Dental health estimates are based on children examined in the SDS. Thirty-two per cent of primary school aged children, and a lower proportion of younger, and older children were examined. This 32% can not be assumed to be representative of all NSW primary school aged children. CDHS results reflect the particular population attending the SDS. Those who attend SDS clinics may be quite different from those who do not. We need to be able to compare these two groups. Thirty-two per cent represents nearly 190,000 children.

Data on the number of therapists employed in the SDS in NSW are not available, so I can not compare the annual dental therapist:school age population with measures of caries experience and the proportion of children seen in the SDS.
Child and maternal place of birth for children examined in 1992 are shown in Table 3 and Figure 6.

Table 3. Place of birth (including Aboriginality), as percentage of sample, CDHS, NSW 1992

<table>
<thead>
<tr>
<th>Country of birth</th>
<th>Children</th>
<th>Mothers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Australia (non-Aboriginal)</td>
<td>88.9</td>
<td>76.9</td>
</tr>
<tr>
<td>Australia (Aboriginal or TSI)</td>
<td>1.8</td>
<td>1.8</td>
</tr>
<tr>
<td>United Kingdom and Ireland</td>
<td>0.5</td>
<td>2.5</td>
</tr>
<tr>
<td>Other English speaking</td>
<td>1.0</td>
<td>1.7</td>
</tr>
<tr>
<td>Southern Europe</td>
<td>0.5</td>
<td>2.5</td>
</tr>
<tr>
<td>Other Europe</td>
<td>0.4</td>
<td>1.1</td>
</tr>
<tr>
<td>Middle East</td>
<td>0.9</td>
<td>3.4</td>
</tr>
<tr>
<td>South East Asian</td>
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<td>3.3</td>
</tr>
<tr>
<td>Other Asia</td>
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<td>1.9</td>
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<tr>
<td>Other</td>
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<td><strong>Total</strong></td>
<td><strong>100</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

Figure 6

Country of birth reported in CDHS, NSW 1992

- Children's country of birth
  - Aust (non-Abor) 89%
  - Abor/TSI 2%
  - Other countries 9%

- Mothers' country of birth
  - Aust (non-Abor) 77%
  - Abor/TSI 2%
  - Other countries 21%
Figure 7 shows that of mothers born overseas, most were born in the Middle East and South East Asia. Nearly 400 (3%) mothers' place of birth was unknown.

![Figure 7](image)

Data on age-specific country of birth from the 1992 Census will be available from Migrant Health in the NSW Health Department in 1994. I will then compare the proportion of children seen in the SDS in 1992, with the NSW Census information on country of birth.

**VII Resources needed to operate the CDHS**

Minimal resources are needed to operate the CDHS. Much information is available from the child's dental record. The additional time taken by dentists and therapists to record examination data on approximately 1/10 to 1/16 children is small. Forms are easy to complete. At the Dental Health Unit, the Data Manager spends approximately one-third of his time on SDS and CDHS records.
VIII Conclusions and Recommendations

The CDHS is a simple system which provides data on an important public health problem. It comprises part of a national database, and comparisons between states and other groups, (depending on coverage) can be made. In NSW only 32% of primary school aged children are seen, and fewer younger and older children attend SDS. Inferences about all children’s dental health are difficult to make until we know more about those who use the SDS, and those who do not.

In NSW, we need to:

- to encourage SDS staff to include all children selected in the sample, to provide a sampling ratio of 1/10.

- monitor dental health in priority populations. We may need to increase the sampling fraction in these groups. For example, for one year collect data on all Aboriginal or Torres Strait Islander children, children born overseas, and children with mothers who were born overseas. This could be repeated at regular intervals.

- evaluate data quality to identify variables which are not well recorded.

- evaluate dental morbidity of those with caries experience.

- monitor recall periods and relate these to disease levels.

- consider extending the CDHS to include more younger and older children.
Children entering SDS appear to have high caries levels, and decay is increasing in older children.

- consider collecting supplementary data in the CDHS, or in additional surveys. For example, some socioeconomic data, information on the number of decayed, missing and filled surfaces of teeth, information on all children, whether attending SDS, private dental services or no dental services.
The mean DMFT for 12 year old children in NSW and Australia attending SDS clinics has decreased since the 1970s (Figure 8). In NSW from 1977 to 1992, in 12 year old children, the mean number of carious permanent teeth, or permanent teeth missing or filled due to caries decreased from 4 to 1.2. Reported mean DMFT in 12 year old children in NSW is lower than that for 12 year old children Australia-wide. Different eligibility criteria, and different population coverage in states needs to be considered when comparing data between states, and between the states and Australia.

Figure 8

Mean DMFT for 12 year old children, NSW and Australia, 1977-92*

The decrease in dmft of primary teeth of six year old children is not as marked as the decrease in DMFT (Figure 9). Again, NSW mean dmft is lower than the Australian mean.
Figure 9

Mean dmft for 6 year old children, NSW and Australia, 1977-92

- NSW
- Aust

*data unavailable for Australia 1987-88, and 1991-92

Figure 10

Per cent of 6 and 12 year old children with d+D=0, CDHS, NSW 1977-92

Per cent

12 years 6 years

Year

1977-1992

Figure 10 shows that the proportion of six and 12 year old children with no decayed teeth has increased since 1977. In 1977 approximately 34% of 12 year old children were caries free, compared with nearly 70% in 1992. Similarly for six year olds; 46% were caries free in 1977, and 60% in 1992.
The proportion of 6 and 12 year old children in NSW with no caries experience (dmft=0 and DMFT=0) has increased since 1977 (Figure 11). Thirty-four per cent of six year old children had no caries experience in 1977, compared with 52% in 1992. In 12 year old children the proportion has increased from 10% in 1977 to 48% in 1992.

Figure 11 shows that as the number of caries free (d+D=0) children increases, the mean number of decayed permanent teeth decreases. In recent years, D has been slowly increasing. Those with decay are experiencing proportionately more decay than previously. Approximately 6-8% of 12 year old children have more than four carious teeth.
From 1977-1992, DMFT has fallen in 12 year old children. Figure 13 shows the DMFT and the contribution of D to the DMFT, for 12 year old children in NSW from 1977-1992. The D component decreased between 1977 to the mid 1980s. Since then, the proportion of untreated dental caries has been increasing.
Results from CDHS, NSW 1992

In 1992, staff in the SDS conducted 12728 first dental examinations (children seen for the first time in the SDS, and children seen in the SDS before, but for the first time for 1992) and 2155 recall examinations, a total of 14883 examinations. Results reported are based on data from children receiving a first examination in 1992. The age and sex distribution of the sample is shown in Table 4. Other demographic data are described earlier in this chapter.

Table 4. Age and sex distribution, of children having first examinations in CDHS, NSW 1992

<table>
<thead>
<tr>
<th>Age group</th>
<th>Females</th>
<th>Males</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-4</td>
<td>228</td>
<td>226</td>
<td>454</td>
</tr>
<tr>
<td>5-11 (primary school age)</td>
<td>5492</td>
<td>5611</td>
<td>11103</td>
</tr>
<tr>
<td>12-18</td>
<td>611</td>
<td>560</td>
<td>1171</td>
</tr>
<tr>
<td>Total</td>
<td>6331</td>
<td>6397</td>
<td>12728</td>
</tr>
</tbody>
</table>

(i) Age specific caries prevalence

Figure 14

Age specific distribution of number of decayed teeth, CDHS, NSW 1992
Age specific caries prevalence (Figure 14) shows a general decrease as age increases. This is probably due to loss of primary teeth. The proportion of children without decay ranges from 56.6% of eight year olds to 68.8% of 12 year old children. The proportion of 14 year old children, caries free, drops to 62.6%. Figure 15 shows the general downward trend in mean number of decayed teeth (from a mean of 1.7 decayed teeth in five year old children to a mean of 0.8 in those aged 14 years.)
The mean DMFT increases from age five to age 14 years old (Figure 16). This is largely explained by the increasing number of permanent teeth, as age increases. Six year old children have about 4 to 5 permanent teeth present, compared with 23 to 24 permanent teeth in 12 year old children (data from CDHS, NSW 1977-88).
(ii) Caries experience by region

Mean dmft for 6 year old children, and mean DMFT for 12 year olds, in 1992 in NSW and in each area and region in NSW are shown in Figure 17. Although not shown, 95% confidence intervals show that the mean dmft for six year old children attending clinics in the South East Region of NSW, is significantly lower than NSW as a whole. This may be chance, a real difference, or due to the population covered by the SDS in this region. No statistical difference exists between other geographic areas and NSW as a whole for six and 12 year old children.

(iii) Caries experience by place of birth

The proportion of children without caries (d+D=0), varies between the child’s and the mother’s place of birth. Proportionately fewer Aboriginal and Torres Strait Islander children, and children born in South East Asia and the Middle East, than children from other groups are caries free (Figures 18 and 19).
Figure 18

Distribution of number of decayed teeth by child's place of birth, CDHS, NSW 1992

Figure 19

Distribution of number of decayed teeth by mother's place of birth, CDHS, NSW 1992
These results are reflected in the proportion of children requiring immediate treatment. Aboriginal and Torres Strait Islander children, and children born overseas are significantly more likely to require immediate dental treatment than non-Aboriginal/Torres Strait Islander Australian children. Mother’s place of birth has a similar effect (Figures 20 and 21).

Figure 22 shows indirect age-standardised mean DMFT indices in primary school children, by maternal place of birth. Aboriginal and Torres Strait Islander children, and children with mothers born in southern Europe, the Middle East, and South East Asia have a mean DMFT more than twice that of children whose mothers are Australian and non-Aboriginal. The number of decayed teeth in children whose mothers are Aboriginal or Torres Strait Islander, or born in the Middle East or South East Asia is more than double that of children whose mothers are non-Aboriginal Australian (Figure 23). To include confidence intervals around these estimates, I need to use multiple regression techniques.
Figure 22

Age standardised mean DMFT for children aged 5-11 years, by maternal place of birth, CDHS, NSW 1992

Figure 23

Age standardised mean number of decayed teeth (d+D) for children 5-11 years, by maternal place of birth, CDHS, NSW 1992
(iv) Need for immediate treatment

As expected, the mean number of decayed teeth was considerably higher among children reported to need immediate treatment (mean d+D=3.3) than those who did not (mean d+D=0.8) (CDHS, NSW 1992). Even so, in 1992, 236 (3.1%) children with no decayed teeth were reported to need immediate treatment (Figure 24).

![Figure 24](image)

Younger children are also more likely to require immediate treatment. The mean age of children requiring immediate treatment is 7.92 years, which is significantly younger than those who do not require immediate treatment (mean 8.25 years) (p=0). This finding is not surprising. As child’s age increases and primary teeth are lost, the number of decayed teeth (d+D) decreases.

(v) Caries experience by fluoridated, partly fluoridated and non-fluoridated area

There was no difference between fluoridated, partly fluoridated and non-fluoridated areas in NSW in 1992, in mean dmft, mean number of decayed primary teeth and total number of decayed teeth in six year old children. Similar results were obtained for 12 year old children. No differences in mean DMFT, mean number of decayed permanent
teeth, and total number of decayed teeth were observed.

(vi) Caries experience by geographic regions.

Differences in caries experience are observed between metropolitan, rural and mixed regions. Children in urban regions have a higher number of decayed teeth, and a lower proportion are caries free compared with children from rural and mixed regions (Figures 25 and 26). Rural areas report a significantly lower mean DMFT, and lower proportion of children requiring immediate treatment (Figures 27 and 28).
(vii) How do NSW results compare with National targets?

Table 5. Comparison of target mean DMFT ≤1.5*, with mean DMFT for 12 year old children from priority populations, CDHS, NSW 1992

<table>
<thead>
<tr>
<th>Priority population</th>
<th>N</th>
<th>mean DMFT (Target ≤1.5)</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rural</td>
<td>213</td>
<td>1.15</td>
<td>0.90-1.40</td>
</tr>
<tr>
<td>Non-English speaking</td>
<td>102</td>
<td>1.96</td>
<td>1.46-2.46</td>
</tr>
<tr>
<td>Aboriginal or Torres Strait Islander</td>
<td>7</td>
<td>3.43</td>
<td>2.03-4.83</td>
</tr>
</tbody>
</table>


Children living in rural areas appear to have reached the target. I don’t feel confident about this result. Results reflect the population attending SDS clinics. In rural areas, children who live in a town with a clinic, or close by, may have better access to services. We do not know the caries experience of those who do not attend clinics. Comparing proportions of children from rural and metropolitan areas who attend SDS clinics may help to clarify this. These figures suggest that Aboriginal and Torres Strait Islander children have not reached the target mean DMFT of ≤1.5. This sample included only seven children, and results are difficult to interpret meaningfully. The mean DMFT of children with mothers from non-English speaking backgrounds is very close to the target. Again, the number of children in the sample, and possible selection biases makes this difficult to interpret.
Summary

The CDHS provides information on dental health status of children attending SDS clinics in NSW. It is a simple, flexible system, easy to implement and manage.

Results show a marked improvement in the dental health of children attending the SDS. In the late 1960's the mean DMFT for 12 year old children was 8-9 teeth. From 1977 to 1992, the mean DMFT of 12 year old children in NSW declined from 4.0 to 1.2, and the proportion of 12 year old children with no caries experience increased from 10% to 48%. Some groups still suffer extensive dental caries. Approximately 6-8% of 12 year old children have four or more decayed teeth. The CDHS helps to identify these populations, such as Aboriginal children, and children from Middle Eastern and South East Asian countries. Without collecting risk factor data, this would not be possible.

The main limitation of the CDHS is the lack of population coverage. Only 32% of primary school aged children were examined in the SDS in 1992, which represents approximately 190,000 children.

The CDHS is an excellent tool for obtaining routinely collected data. It provides an estimate of the dental health of primary school aged children in NSW. It can be supplemented by additional surveys, and by collecting data on a larger sample of priority populations.
References


4. SCIENTIFIC PAPERS AND LETTERS SUBMITTED TO PEER REFEREED JOURNALS

Papers submitted to peer refereed journals


(see Appendix 1)

This was my first attempt at preparing a paper for publication. I had no idea how much time and detail was involved. We received widely varying comments from the referees and had two rounds responding to their comments. This was quite a different skill to the writing the paper. I had no idea how to respond to the first round of comments, but became much more familiar with the process during further correspondence with the editors.

2. JC Bell, EB Crewe, AG Capon. Seroprevalence of hepatitis A antibodies in clients living in a centre for the developmentally disabled in western Sydney.

(see Appendix 2)

We first submitted this to the Medical Journal of Australia. They replied that they would probably accept it in letter form. We then sent a revised version to the Australian and New Zealand Journal of Medicine. It is under review.
3. JC Bell, LR Jorm, M Williamson, N Shaw, D Kazandjian, R Chiew, AG Capon. Legionellosis linked with a hotel car park. (in preparation)

When written, we hope to submit this paper to the Journal of Infectious Diseases. This paper is still to be completed, and is not presented here.
Letters

(Appendix 3 comprises letters)


We wrote this letter in response to a Letter to the Editor which appeared in the Australian Journal of Public Health June 1992 16(2):207-8. The letter raised issues concerning measles immunisation and the management of measles cases, especially in the ACT. NSW has response protocols for dealing with notified measles cases. At that time we had not had the 1993 measles experience. Now, it seems an over-confident and foolish view!


This letter presents the results of our telephone survey of all LDC in western Sydney. We asked LDC directors about Hib, Hib vaccine and LDC policy on Hib immunisation.


Ana was responsible for reporting our March 1993 MAE survey.
Communicable Diseases Intelligence published reports of the "parvovirus" and hepatitis A field investigations. Copies of these papers are found in Appendices 4 and 5.
6. PRESENTATIONS AT SCIENTIFIC MEETINGS

I have presented at five scientific meetings, and also been a co-author for another presentation. For all presentations, I prepared and submitted abstracts, and prepared slides. With increased experience, my contribution to abstracts, content and presentation increased and preparation time decreased.

At times I have been preoccupied with the use of colour. For my first presentation at the PHA conference in Canberra, I unknowingly created teal green text on a blue background. I learned very quickly about Harvard Graphics and colour selection. This disaster also taught me to expect things to go wrong, and that it is better to prepare earlier to allow time to redeem the unfortunate!

The New South Wales Public Health Network Conference was an opportunity to learn to use Lite-pro software. I had an inordinate amount of fun trying to "animate" slides, fade slides in and out, and "razzle-dazzle" slides.

The latebreaker presentation at IEA was a challenge. It was much more difficult to include the information I wished to present in a five minutes talk with only four slides, compared with preparing a presentation of ten minutes.

I have not included copies of the slides from the first immunisation paper I presented. They are very similar to those included in the presentation at the PHA immunisation conference in 1993.
Copies of these presentations are found in Appendices 6-11.

List of presentations:

  Public Health Association of Australia, Annual Conference, Canberra, 1992

- J.C. Bell, A.G. Capon.
  Why investigate minor outbreaks of gastrointestinal illness?
  New South Wales Public Health Network Conference, Sydney, 1992

- L Jorm, J Bell, J Ferguson, P Whitehead, A Capon.
  Infectious disease outbreaks in long day care centres.
  New South Wales Public Health Network Conference, Sydney, 1992
  (presented by L Jorm)

  Which children are not fully immunised?
  Public Health Association of Australia, National Immunisation Conference, Melbourne, 1993

- J Bell, L Jorm, M Williamson, N Shaw, D Kazandjian.
  Follow up of 184 people exposed to Legionella bacteria at a seminar for retired people.
• **J Bell, E Crewe, A Capon.**

Hepatitis A in a community of people with developmental disabilities in western Sydney, Australia.

Field Epidemiology Training Program’s (FETP) Annual International Conference, Chiang Mai, 1994

• **J Bell, L Jorm, M Williamson, N Shaw, D Kazandjian, A Capon.**

A seminar for 184 retired people: were they exposed to *Legionella*?

Field Epidemiology Training Program’s (FETP) Annual International Conference, Chiang Mai, 1994
7. PRACTICAL EXPERIENCE GAINED DURING FIELD PLACEMENT

Experiences gained have included:

1. Responses to infectious diseases notifications
2. Managerial experience
3. General experience
4. Involvement in research projects
5. Talks and teaching responsibilities
6. Computer skills
7. Attendance at conferences, meetings
8. Course attendance
9. Regular seminars
10. Other experiences

1. Responses to infectious diseases notifications

After receiving infectious diseases notifications, the WSPHU responds according to guidelines prepared by the Infectious Diseases Section of Epidemiology and Health Services Evaluation Branch of the NSW Department of Health.

The following are examples of WSPHU responses in which I have been involved:
1.1 Response to a case of *Haemophilus influenzae* type b meningitis in a Child Care Centre

On Thursday, 14 May 1992 at 12.30 pm WSPHU was notified by Nepean Hospital of a case of Hib meningitis in a 20 month old male child. Laboratory culture identified the causal organism as *Haemophilus influenzae* type b. The hospital had arranged antibiotic prophylaxis for the parents and siblings.

The child attended a Child Day Care Centre (DCC) four days a week (Mon-Thurs) for 11 hours each day. The child first became unwell while at the Centre on Monday 11th May.

The DCC had an enrolment of approximately 70 children, ranging in age from a few months to five years old. Approximately 40 children attended on any given day. Children were separated according to age (0-3 and 4-5 years) for much of the day, but children of all ages mixed for five hours a day. The "case" belonged to the 0-3 years group.

According to NSW Department of Health guidelines, the DCC qualified for rifampicin prophylaxis. There were children younger than two years old in contact with the case for 25 hours or more per week. Most children in the centre had possible contact with the case for up to 20 hours per week. We offered prophylaxis to all children and staff at the DCC, because many of the children fulfil requirements for prophylaxis, and it would be too difficult and impolitic not to provide it for all children. A practical and just (in the eyes of the community) method of only treating some children could not be found. The only exception would have been any children who attended the DCC on
Friday only, the day the case does not attend.

For most benefit, prophylaxis should occur within one week of child becoming ill. We needed to organise and begin the prophylaxis before the weekend.

NSW Health Department policy was that antibiotic prophylaxis should be provided to staff and children in a DCC after 1 case of Hib, if there are children <2 years old in contact with the case for 25 hours/week or more.

WSPHU actions:

- Prepared a letter and fact sheet on rifampicin for parents and staff - double sided sheets
- A Public Health Nurse (PHN) attended the DCC on the Thursday afternoon to distribute a letter to staff to give to parents and to weigh the children who were present.
- We estimated the amount of rifampicin needed, based on the number of children by age, using average weight for age. 1 dose per day for four days. Estimated total requirement: 4.5 litres
- Supplies of Rifampicin were organised by the PHU. Nepean Hospital had "heaps". This meant 4 bottles of 60 mls each (a total of 240 mls). Westmead had 20 bottles which could be available. Nepean Hospital pharmacy ordered 20 bottles from the supplier.
- The letter advised parents of the need for rifampicin and that WSPHU would be dispense and distribute it at the DCC on Friday.
- The DCC contacted parents whose children do not attend on Thursday/Friday to inform them.
- Nepean Hospital Pharmacy prepared appropriate doses of rifampicin for the children weighed on the Thursday. WSPHU prepared dosages for other children
at the DCC the following day (Friday). Arrangements were made for children or parents who could not attend the DCC on the Friday to collect the rifampicin from Nepean Hospital.

Friday 15th May:

Information left with PHN at WSPHU for inquiries. PHN collected prepared rifampicin from Nepean Hospital pharmacy, and brought it to DCC. PHN then returned to the pharmacy to collect the next delivery of rifampicin. Parents of all children had been asked to attend the DCC at approximately noon - and they did.

WSPHU staff (PHN, PHO and me) attended the DCC. We obtained a computer print-out of all children, their age, date of birth, and address. Total enrolment was 66.

We weighed children, and the appropriate amount of rifampicin was distributed with instructions and an information sheet. We measured doses, and wrote labels and gave instructions for each child.

WSPHU staff (PHO and me) explained to parents and carers about Hib meningitis, reasons for offering prophylaxis, how to administer of rifampicin, side-effects of rifampicin, and drug interactions.

Parents wanted to know whether siblings and family and other contacts of the DCC children, also needed prophylaxis. They also asked about Hib vaccine.

Parents were told that the rifampicin prophylaxis was recommended, but not compulsory. One mother of two children elected not to have it. Parents of children
who attended on fridays only were also told that rifampicin probably not necessary. All in this group chose to have it.

Comments:

• WSPHU notified on Thursday, but the child first became ill on Monday and was admitted on Monday night.

• Meningitis should be notified by the hospital, on suspicion.

• Had WSPHU been notified earlier, we would have had more time to prepare.

Although we would not have given prophylaxis until confirmation, we could have located rifampicin supplies, and had more time to be more selective about which children required prophylaxis.
1.2 Outbreak of gastroenteritis in people living in a retirement village.

A doctor notified WSPHU of numerous cases of gastroenteritis in people living in a retirement centre. Many doctors care for people living in the centre, but only one doctor notified us. Follow up and obtaining details was difficult. Centre management were not cooperative. This was probably because they provided meals for their clients and also prepared and supplied meals for other similar centres. It was a commercial business and they were not keen for adverse publicity. As cases did not continue, no further follow up was taken.

I accompanied a food inspector (before food inspectors joined Public Health Units), to visit the centre. We visited the kitchens where meals were prepared and also the kitchens in the buildings where cases were. The food inspector found no major breaches in food handling.

This notification also taught me not to jump in too early. If I had checked where the outbreak was, I would have discovered that it was in the Northern Sydney Area.
1.3 Report of gastroenteritis outbreak in a Tresillian family care centre at Nepean Hospital

Between September and October 1993, there were at least 30 cases of gastroenteritis at the Tresillian centre at Nepean Hospital. Cases occurred among Tresillian clients (parents and children) and staff. The centre has 41 nursing staff, seven administrative staff, 3.4 cleaning staff and four social workers. Clients are admitted for a six day period.

WSPHU did not investigate fully, but tried to help and advise staff. To do this, we needed accurate up-to-date information about current events and illness. Cases continued to occur, in spite of staff ensuring stringent hygiene practices and changes in infection control procedures. Cases of gastroenteritis in the community were also reported.

Control measures:

1. After the outbreak started, staff adhered tightly to good hygiene practices.
2. WSPHU was notified of the outbreak on 5 October 1993. A Public Health Nurse (PHN) and a Food Inspector visited the centre on 8 October and provided recommendations for improving infection control procedures.
3. Current clients were discharged by 15 October, to allow thorough cleaning of the centre during the weekend.
4. Tresillian management and WSPHU staff agreed that the Centre would close from 15 October until 24 October.

Reasons for this were:
a. cases were still occurring, and may have continued to occur in the next week. The cause of illness, and therefore the incubation period was unknown.
b. we did not wish to place healthy people, babies and toddlers especially, at risk of illness.

The other option considered was weekend cleaning, followed by admission of clients with children over 6 months of age only. This would have ensured that very young children were not at risk. Young children can become severely ill very quickly. It would still have placed older children at risk, but they are less likely to be severely ill. We also needed to consider what our response would be if we had a case of gastroenteritis next week. If we then opted to close the centre for an intake, it would have disrupted the centre again, and for a longer period of time.

Comments:
I believe that we could have been managed the outbreak better. Two major problems were the lack of personal contact and not communicating with the appropriate management staff. Our PHN was investigating, and I was to supervise and advise her. I did not supervise closely enough. Our PHN did not meet the staff there, and all communication was by phone and fax. The PHN spoke with the Clinical Nurse Consultant (CNC), and did not contact the centre manager, or other Tresillian management.

WSPHU was not entirely responsible for mismanagement. We were not notified of the outbreak until cases had been occurring for more than two weeks. The Clinical Nurse Consultant (CNC) responsible for infection control at the centre reported that she
worked full-time on the outbreak, but she was not able to keep WSPHU up-to-date with information. The CNC also did make herself available when the PHN and food inspector visited on Friday 8 October.

We should have:

- identified senior management early, and dealt through one person
- visited the centre early and met and spoken to the staff we would be contacting
- developed stronger relations with staff we would be contacting
- emphasised the need for accurate and timely information
- we should have provided clearer instructions about the information we wanted the CNC to collect
- if necessary, we should have advised management that we were not receiving the information we needed

I found that it was important for everyone to meet and make a joint decision. The personal approach was vital. There may have been less confusion and more cooperation if we had met management earlier.
2. Managerial experience

Between July 1992 and June 1993, I managed the infectious diseases team in WSPHU. The following is a duty statement for that position.

**Western Sector Public Health Unit**

| Duty Statement: Team Leader, Communicable Diseases |

**Responsible to:** Director, Public Health Unit

**Duties**

1. managing staff in communicable diseases team of the Public Health Unit
2. receiving and responding to infectious diseases notifications
3. investigating outbreaks of communicable disease
4. liaising with Western Sydney and Wentworth Area Health Services, NSW Health Department, and other Public Health Units where appropriate
5. supporting health workers in Area Health Services, local councils and other health services in communicable disease matters
6. coordinating and implementing immunisation policy in Area Health Services
7. developing and implementing policy in communicable diseases for Area Health Services
8. conducting General Practice Sentinel Surveillance
9. informing public and health care providers about travel health
10. supporting data entry and collation in the Public Health Unit
11. monitoring of, and liaising with the media
12. supporting the Western Sydney Day Care Centre Study
13. providing health information and education to the public
Examples of some of this work:

- coordinating development of Western Sydney and Wentworth Health Areas' Management Plan for quarantinable diseases, including viral haemorrhagic fevers.

- liaising with hospitals, including designating a hospital contact person for outbreaks and other emergencies.

- supervising staff
  - interviewing and selecting a Public Health Nurse
  - training Public Health Nurses to respond to infectious diseases notifications, general enquiries, data entry
  - supervising a food inspector new to WSPHU. We had hoped to include a food inspector in the infectious diseases team, whose main role was to be enteric infections, and food-borne outbreaks.
  - supporting data entry in WSPHU
  - "media watching". One staff member was assigned to check the Sydney Morning Herald and local press for items of a public health nature.
  - coordinating staff involved in infectious diseases notifications - public health nurses, environmental health officers (who were traditionally responsible for following up Legionnaires' disease, arboviral diseases, typhoid, and paratyphoid and food inspectors (for food borne illnesses).
• Media releases

On Dr Capon’s behalf, I wrote and sent releases to local radio, local papers, and responded to articles or letters in the local press. To inform other associated interested groups, we faxed copies of the releases to Community Health Centres, our Area Health Services, adjacent Public Health Units, and Epidemiology Branch. Examples of media releases and responses are found in Appendix 12.

Our approach changed over time. Our first responses were bland. We tried to get away from the "Health Department" approach by asking a medical practitioner to comment about immunisation and be available for media follow up if requested. It seemed to make little difference. When measles hit the west in late 1993, WSPHU released more dramatic information. We contacted families with ill children who we thought would be likely to agree to be interviewed by media. It certainly made more impact, and WSPHU was approached by "A Current Affair" for interviews. The pieces appearing on television were not as pro-immunisation as we would have liked. We probably should have expected that, and criticised expected anti-immunisation commentary. Even so, that does not guarantee that our preferred message is broadcast. As Pru Goward told us, the media are there to entertain.

WSPHU is primarily responsible to its Area Health Services and issues media releases as it chooses. Liaison with Epidemiology Branch can markedly alter our planned response. This is especially so with Legionnaires’ disease investigations.

(See chapter 2)
• Monthly newsletters

Each month we prepared a short newsletter. It was distributed with the NSW Public Health Bulletin to notifiers of infectious diseases and to members of the General Practice Sentinel Surveillance Program. We limited the newsletter to one page. Subjects included WSPHU-responses to specific notifications and current outbreaks, immunisation guidelines and travel health information. The reverse side was a table of infectious diseases notifications received by WSPHU. We did not want to deluge the infectious diseases or PHU newsletter market with yet another paper which would not be read. I was responsible for editing, and for much of the content.

Examples of newsletters are shown in Appendix 13.

• General Practice Sentinel Surveillance program

The General Practice Sentinel Surveillance program (GPSS) was established in March 1992 and was conducted by one of the Public Health Nurses. During my placement I assisted the PHN to collate results and report them to participants. In June 1992, I also helped the PHN introduce an influenza monitoring scheme in collaboration with the Virology Department at the Institute of Clinical Pathology and Medical Research.

For patients fitting the influenza clinical case definition, we asked for throat swabs to be taken for testing at the Virology Department, ICPMR. We organised local pathology laboratory couriers to deliver swabs and specimens. In August 1992, after the program had been operating for six months, I assisted the PHN organise to a telephone survey of GPSS participants to review the GPSS program.

As workload increased, and with staff changes, GPSS did not receive the attention it
required to run well, and we lost participants. The program is being revamped this year, with more collaboration from the Division of General Practice.

- hepatitis B immunisation program for at-risk neonates

One of the Public Health Nurses introduced and ran the NSW "Hepatitis B vaccination program for neonates at high risk of hepatitis B acquisition" in the Wentworth Health Area. I prepared an Epi Info database and program for obtaining reports. After the first nine months of the program, I assisted the Public Health Nurse to interpret the data received. The PHN then used this information to report back to the participating staff in hospitals, and to implement the program in Western Sydney.

I learned that a managerial role is very time consuming. I found that it limited the time available for other work. When our Public Health Nurse returned from maternity leave, I was happy to relinquish these responsibilities. Many of the areas I was responsible for did not receive all the attention they deserved or required. For example, staff supervision, especially of the new food inspector, General Practice Sentinel Surveillance, and the hepatitis B immunisation program for neonates.
3. General experience

When I arrived in the WSPHU in 1992, the PHU infectious diseases notification system had just been reviewed. I helped implement the review’s recommendations.

To improve notifications from Westmead Hospital, I liaised with medical and nursing administration, prepared an information letter and list of notifiable diseases which were distributed to doctors with their payslips, and prepared a list of notifiable diseases with diagnostic criteria for hospital wards. I also liaised with ICPMR to streamline notifications from their laboratories. I encouraged PHNs to fully complete detail on disease notifications. Missing information for some fields decreased from xx to xx between date and date. I helped staff learn more about IDSS and Epi Info.

We also provided travel health information. Due to increased WSPHU workload, priorities changed. We no longer give travel health information to individuals, but speak directly to doctors who telephone the WSPHU.

We supplied general advice on infectious disease matters. Enquiries ranged from head lice in Shepparton to head lice in Brisbane. I also advised health workers in Area Health Services, local councils and other health services about communicable disease concerns. I answered general enquiries from the public, schools, day care centres, and other health professionals. Anything, anywhere. Benenson got a battering.
4. Involvement in research projects

• Immunisation survey

At the beginning of 1992, WSPHU conducted an immunisation survey of children starting school in the Wentworth Health Area in 1992. Data were collected before I arrived in WSPHU. I was responsible for data analysis, preparing a report and paper for publication. I presented survey results at the Public Health Association of Australia, Annual Conference, Canberra, 1992, and the Public Health Association of Australia, National Immunisation Conference, held in Melbourne in 1993. (See Appendices 1, 6, 8 and 19.)

• Day Care Centre Diarrhoea Study

I had minor involvement in the early stages of the Diarrhoeal Outbreaks in Long Day Care Centres (LDC) study, a joint venture of WSPHU and Clinical Microbiology, ICPMR. I participated in early discussions about its development, planning, and implementation. Prior to this study, WSPHU conducted a telephone survey of all LDCs in western Sydney. We aimed to determine the incidence of diarrhoeal outbreaks in day care centres. Each LDC was contacted twice, six months apart, and we collected information about outbreaks during the preceding six months. During the second telephone contact we asked LDC directors about Hib, Hib vaccine and any policy their LDC had on Hib immunisation. (See Appendix 3.)

• Quality Assurance grant application 1992

I contributed in a minor way, to prepare an unsuccessful grant application for a Quality Assurance program in 1992, on surgical wound infection surveillance. (Another joint venture of WSPHU and Clinical Microbiology, ICPMR)
5. Talks and teaching responsibilities

During my placement, I gave the following presentations, and ran the following seminars:

- A lunch time talk to physicians at Mt Druitt Hospital about the Fairfield outbreak of Legionnaire’s disease, July 1992.

- Investigating an outbreak of Legionnaires’ disease (using Fairfield outbreak as an example), with other members of the WSPHU, three hour session, to MPH students, enrolled in Applied Epidemiology elective: 1992 and 1993.

- Questionnaire design, a lesson to students enrolled in MAE course, NCEPH, Canberra, March 1993.

The lesson was scattered with some fine examples of my flops, and some more successful examples. At the end of the lesson I asked students to work in pairs to construct a short questionnaire. This illustrated some of the points made in the lesson. The hand out I prepared for students outlines the lesson. (See Appendix 14)

- Vaccine types and cold chain maintenance. A lecture, part of an immunisation accreditation course for registered nurses, Nepean Hospital, June 1993. (Conducted by WSPHU)

- Medical microbiology postgraduate course - Laboratory notification of Infectious Diseases - Why is it important and how are the data used?
(Course conducted by Centre for Infectious Diseases and Microbiology), August 1993 (See Appendix 15)


New to the NSW and its Public Health Network, I thought Bug Breakfasts were a monthly breakfast gathering at which Balmain bugs were consumed. Knowing now that many public health professionals are shy about eating shell-fish, my original premise seems rather foolish.

- **Epi Info workshop** for members of South West Region Public Health Unit, 30-31 July 1993 (See Appendix 16)

- **Introduction to Epi Info** for members of WSPHU, 10 and 12 November 1993 (see Appendix 17)
6. Computer skills

Prior to the MAE course I lived in the wonderful world of Macs. After two years in a DOS and Windows world, I have learnt to cope with programs claiming to be "user-friendly", which require baffling thought, and which have no consistency between program commands. I have become competent in Wordperfect, Epi Info, Harvard Graphics, Excel (spreadsheets) and our local email. I have also had limited experience using dBase, Reference Manager (reference database software), Lite-pro (computerised slide show), Statistix and SAS. In spite attending an introductory SAS course, and an advanced dBase course, I have had little experience with these programs.
7. Attendance at Conferences, Meetings

I attended the following conferences and meetings:

• Combined Scientific Meeting of Australian Society for Microbiology and New Zealand Society for Microbiology, Sydney, 12-17 July 1992

• Public Health Association of Australia, Annual Conference, Canberra, September 1992

• New South Wales Public Health Network Conference, Sydney, November 1992

• Public Health Association of Australia, National Immunisation Conference, Melbourne, April 1993

• International Epidemiological Association, Sydney, September/October 1993

• Field Epidemiology Training Programs’ (FETP) Annual International Conference, Chiang Mai, Thailand, January 1994
8. Attendance at seminars and courses

- Large data base workshop, 13th and 14th April 1992, conducted by WSPHU
- Wordperfect course, 25th and 26th May 1992, conducted by WSPHU
- Effective writing course, conducted by Anne Austin for NSW Department of Health, 20-21 August 1992
- Epidemiology Workshop, University of Sydney, December 1992
- Western Sydney Public Health Consortium Annual Retreat, December 1992
- Fundamentals of SAS, SAS Institute, Sydney, 1-3 February 1993
- Advanced dBase IV, Conducted by Drake Training, 27 October and 1 November 1993

9. Regular seminars

- Seminars at Epidemiology and Health Services Evaluation Branch, NSW Department of Health, including Bug Breakfasts
- Postgraduate microbiology seminars, weekly, semester 1, 1992, at Westmead Hospital, and occasionally during 1993
- occasional attendance at Epidemiology Methodology seminars, held weekly at University of Sydney
10. Other experiences

- In mid 1992, Epidemiology branch, with pressure from AIDS Branch, asked me to investigate possible sources of infection for a 78 year old woman diagnosed with AIDS in 1992. She had no known risk behaviours for HIV infection. Her family were keen to find the source of her infection and believed the virus must have been medically acquired.

I first contacted the Red Cross Look Back coordinator, who had also been investigating. There was no record of the case ever receiving blood products. I reviewed hospital records, dental and eye hospital records, spoke to the general practitioner and visited the patient. The patient had separated from her husband, about 40 years previously, and denied any sexual relationships since. Her husband died in 1992, from pneumonia of unspecified cause. At this stage, the investigation was transferred back to AIDS Branch. I heard no results of further investigation. In 1993 Epidemiology Branch were again involved, and I was asked to provide any information I had.

In December 1993, the NSW Health Department announced that four women had acquired HIV infection on one day, from minor surgical procedures performed by a Sydney surgeon. The case I had been investigating was one of the four. I had not discovered that she had visited the particular surgeon. (Reference: Lancet, 18 December 1993)
• In 1992, I prepared a discussion paper and draft recommendations for cold chain maintenance, for the Communicable Diseases Standing Committee, NHMRC. (See Appendix 17) In December 1993, I participated in a teleconference with the National Immunisation Strategy Working Group on handling vaccines.

• In 1992, I organised and collected New South Wales data for a national study about overseas screening and tuberculosis undertakings. Data were collected for people diagnosed with tuberculosis in 1991, who were born overseas. The survey was conducted by David Cheah and Aileen Plant. I collected the data from David after he completed the MAE course, but only performed data cleaning and preliminary analysis before handing it back to Aileen. This is being written for publication, and I will be a co-author.

• As part of the MAE course in March 1993, we (MAE students) designed and conducted a telephone survey to assess the knowledge of, attitudes to, and use of Hib vaccine in parents with children younger than five years old in the ACT. All students participated in telephoning. I prepared the application for ethics approval (twice). We first applied to the ACT Health Authority. They approved it subject to changes in survey design and methodology. As that would have completely changed the survey, we approached the Australian National University Ethics in Human Experimentation Committee for approval. (Appendix 18) I learned that Ethics committees do not meet often, that applications for ethics approval should be prepared well in advance, that negative responses from Ethics committees can hinder study plans and
timetables, and that Ethics committees can choose to make decisions on their perception of scientific, as well as ethical concerns.

• I prepared a database in Epi Info for *Legionella* serology results from the Public Health Laboratory at ICPMR. Results from 1992, and for six months of 1993 have been entered. Analysis and reporting still need to be done.

• I made a small contribution to DHHLGCS document on managing infectious diseases in child care establishments

• I am a member of the Organising Committee for the NSW Public Health Network Annual Conference to be held in March 1994.
8. CONTINUING PROJECTS

- complete the *Legionella* paper (Legionellosis linked with a hotel car park)

- analyse and report the *Legionella* serology results from the Public Health Laboratory, ICPMR. (With staff from the Public Health Laboratory)

- With staff from WSPHU and ICPMR, a seroprevalence study of *Legionella* antibodies - Using stored sera from a random sample of 450 subjects from "The Blue Mountains Eye Study" (BMES), a population based study of people aged 50-80 years, living in the Blue Mountains.

- With staff from the Department of Clinical Microbiology, I will be involved in developing a database for surgical wound infection surveillance.

- NSW Public Health Network Conference, Sydney, March 1994 - I have submitted abstracts for the hepatitis A outbreak and Legionellosis linked with the hotel car park.

- In April 1994, another performance at Bug Breakfast - Lessons learned from each other: Encounters with the anti-fluoridation and anti-immunisation lobbies.

- Oral health surveillance: continue the Child Dental Health Survey
APPENDICES
Appendix 1: Paper - Epidemiology of incomplete childhood immunisation


**THE EPIDEMIOLOGY OF INCOMPLETE CHILDHOOD IMMUNISATION: AN ANALYSIS OF REPORTED IMMUNISATION STATUS IN OUTER WESTERN SYDNEY**

**ABSTRACT**

We surveyed parents of children enrolled in kindergarten in 1992, in outer western Sydney and the Blue Mountains. Using parents’ reports, we determined the prevalence of immunisation uptake for children starting school, compared the prevalence of immunisation uptake between Catholic, Government and Independent schools, and identified immunisation providers. We also documented parental beliefs about immunisation and their influence on immunisation status, and identified risk factors for incomplete immunisation. Nearly 89% of children were reported to be fully immunised. Immunisation status did not vary significantly between the different types of school. General practitioners provided 84% of all immunisations, and local councils 11%. Incomplete immunisation was associated with more negative beliefs in immunisation, with post-secondary education and with families who do not speak English at home. Reminder letters had little effect on immunisation status.

**KEY WORDS**

child; educational status; ethnic groups; immunisation; reminder systems; risk factors.
INTRODUCTION

Immunisation against childhood infectious diseases is practised throughout the world, and with improved hygiene, has had a marked effect on the incidence of these diseases. Immunisation protects individuals, and protects the community by reducing the number of people who can transmit the disease. Immunisation has been demonstrated to have cost benefits for measles, mumps and rubella, and pertussis.

METHODS

In Australia, immunisation against diphtheria, tetanus, pertussis, poliomyelitis, measles, mumps and rubella is offered to all children. Data from the 1989-90 National Health Survey identified only 53% of children aged six years and under, as fully immunised. The proportion of children immunised differs between states. School entry data from Victoria showed that around 85% of children entering primary school in 1991 and 1992 were fully immunised.

The New South Wales Health Department has run a number of media campaigns promoting the benefits of immunisation. The Department is developing a policy whereby all children entering school, preschool, and child care facilities will be required to provide documentation of their immunisation status. When a vaccine preventable disease occurs in such an institution, children not immunised appropriately for age will be excluded for the duration of the outbreak to prevent transmission.

The Western Sector Public Health Unit is responsible for coordinating immunisation in outer western Sydney and the Blue Mountains. We undertook a cross-sectional survey of children starting school in 1992 to measure prevalence of immunisation uptake and incomplete immunisation, and to provide a basis for assessing the impact of policy.
changes. We determined the prevalence of immunisation uptake, compared immunisation uptake between Catholic, Government and Independent schools, and identified immunisation providers. We also documented reasons for incomplete immunisation, parental beliefs about immunisation and their association with immunisation status, and identified risk factors for incomplete immunisation.

METHODS

Approval for the study was granted by the Ethics Committee of the Wentworth Area Health Service, which is constituted according to National Health and Medical Research Council guidelines.

We surveyed parents or guardians of children enrolled in kindergarten in 1992 in the Wentworth Health Area. The Wentworth Health Area comprises the local government areas of Blue Mountains, Hawkesbury and Penrith. Compared with other areas in New South Wales, Wentworth Health Area is a rapidly growing area with a young population. People living in the Wentworth Health Area have similar economic well-being, but higher levels of educational attainment and occupational skill, when compared to others in New South Wales.8

In New South Wales, all children enter kindergarten. It is their first formal year of education. Children starting kindergarten are at least five years old, or turning five during the school year. We stratified schools into three groups, Catholic, Government and Independent. Each educational authority provided a list of primary schools in the Area. Within each stratum, schools were randomly sampled, with probability proportional to the size of the kindergarten population. Five Catholic, eleven
Government, and six Independent schools were selected. One Government and one Independent school declined to participate.

Within each participating school, we included all children entering kindergarten in the study. The sample was 1066 children. We calculated sample size to provide 95% confidence that point estimates of children’s immunisation uptake would be within 2% of the true population uptake.

A covering letter, consent form and questionnaire were given to each child to take home. A parent or guardian completed the questionnaire, and returned it to the class teacher. A member of the Public Health Unit collected questionnaires from the schools. A reminder letter and another questionnaire were posted to non-respondents. A maximum of three reminders were sent to each non-respondent. Questionnaires from late respondents were posted to the Public Health Unit.

The questionnaire elicited information on immunisation uptake, immunisation providers, beliefs in immunisation, and immunisation reminder letters. Parents were asked if their child had received all three triple antigen (TA) injections, a measles-mumps (MM) injection, a TA booster at 18 months (TAB), and a pre-school booster (PSB). They were also asked if their child had missed out on the pertussis component of the TA immunisation. We did not elicit information on oral poliomyelitis vaccination status because it is highly correlated with triple antigen immunisation status. We requested information on child demographics, such as age, sex and country of birth. Finally, we asked parents their age, country of birth, language spoken at home, and educational qualifications.
Data were coded, entered into a database\textsuperscript{10} and analysed using SAS statistical software package.\textsuperscript{11} We adjusted point estimates for the sampling method and calculated 95% confidence intervals around point estimates. We estimated risk factors for incomplete immunisation using a logistic regression model.\textsuperscript{12}

RESULTS

We investigated children’s immunisation status, but the term "respondents" refers to the parents or guardians who completed the questionnaires.

Table 1 presents the response rates, and age composition of the sample. The 1066 children sampled represented 40.8\% of the kindergarten population (\(n=2610\)) in the Wentworth Health Area in 1992. We received completed questionnaires from 966 (91\%) children. Of these 966 children, 350 were from Catholic schools, 532 from Government schools, and 84 from Independent schools. The response rate from Independent schools was significantly lower than that from Catholic and Government schools.

There were approximately equal numbers of males and females. One-third of the children were younger than five years when they started school, and two-thirds were five years or older. The mean age of the children was 5.2 years. The average age of respondents was 33.2 years, with a range from 21 to 47 years.

Table 2 summarises immunisation rates by type of school. Nearly 89\% of children were reported to be fully immunised. They had received three injections of TA, or a combination of TA and combined diphtheria-tetanus (CDT), MM vaccination, TAB and PSB. Almost 11\% were reported to be incompletely immunised, including four children.
who had not received any immunisations at all. Immunisation status, classified as full or incomplete, did not vary significantly between the different types of schools.

Immunisation rates for specific vaccine types are presented in Table 3. Most children had received three TA, a TAB, and MM vaccinations. About 91% reported that their child received a pre-school booster. Complete pertussis immunisation was reported for 82% of children.

General practitioners were the main providers of immunisation services, providing all immunisations for about 72% of children. Local councils provided all immunisations for only 4%, and a combination of private doctors, local councils and "other places" provided immunisations for 24% of children. When the group of mixed providers was re-distributed, 84% of all immunisations were provided by private doctors, 11% by local councils, and only 1% by "other" providers.

Ninety respondents gave reasons for incomplete immunisation. These respondents were responsible for 90% of the children with incomplete immunisation. Table 4 lists the reasons given for incomplete immunisation. We grouped reasons for incomplete immunisation into: parental indifference, professional advice, personal beliefs, child’s ill health or allergic reaction, lack of access, and other reasons.

Parental indifference and receipt of professional advice against immunisation were the two most common reasons given for incomplete immunisation. Indifference included reasons such as "I didn’t get around to it" and "I find it difficult to remember when
immunisations are due". Inappropriate contraindications, such as minor illnesses or ill health, were also reported as reasons for non-compliance with immunisation. Difficulties accessing immunisation services included timing of immunisation clinics, lack of private transport, and the cost of visiting the local doctor. Only one parent reported family relocation as a reason for incomplete immunisation.

We examined the independent and combined effects of demographic factors, ethnicity, educational level, beliefs, and reminder letters on immunisation status using logistic regression. We calculated crude (univariate) odds ratios, and odds ratios adjusted by the logistic regression models. Crude odds ratios are similar to adjusted odds ratios, and therefore only adjusted odds ratios are presented. Odds ratios greater than one indicate increased likelihood of incomplete immunisation compared with the reference group. Odds ratios less than one indicate groups more likely to be fully immunised.

Table 5 presents the adjusted odds ratios for incomplete immunisation, by selected family characteristics. Children younger than five years had lower immunisation uptake than children five years and over. Similar percentages of children under five years old, and five years and over, were immunised with TA, MM and TAB. But the percentage of children who received PSB was significantly lower in children under five years (88%) than in children five years and over (93.5%) ($\chi^2 = 5.1; p=0.02$).

Children of respondents with post-secondary education were more than twice as likely to be incompletely immunised, compared with children whose parents only had secondary education. When levels of post-secondary education were considered, children
whose parents had a bachelor degree or higher were over four times more likely to be incompletely immunised than children whose parents had no post-secondary education (OR: 4.4; 95%CI: 2.2-9.0). There was no difference in immunisation status between children whose parents had a diploma or certificate (OR: 1.3; 95%CI: 0.7-2.5), or trade (OR: 1.1; 95%CI: 0.4-3.4), and children whose parents had only secondary education (OR=1.0).

Children born outside Australia were three times more likely to be incompletely immunised than children born in Australia. If respondents do not speak English at home, their children were six times more likely to be incompletely immunised than children from an English speaking background. Parent’s country of birth was not associated with children’s immunisation status.

We asked about beliefs in the importance of childhood immunisation, the effectiveness of immunisation in preventing childhood diseases, and the safety of immunisation. The majority of respondents believed that immunisation is "very" or "quite" important, effective or safe. Table 6 presents adjusted odds ratios by parental attitudes towards immunisation. Those who thought immunisation was "quite important" were 3.5 times more likely to have children who were incompletely immunised than those who thought immunisation is "very important". Those who thought that immunisation is either "not very important" or "not important at all", were five times more likely to have children who were only partly immunised compared with those who believe it is "very important". Trends were similar for beliefs in the effectiveness and the safety of immunisation.
DISCUSSION

There have been few population studies of immunisation status in Australia. The National Health Survey, conducted by the Australian Bureau of Statistics every five years, is the only national population survey of immunisation status. Our response rate of 91% is excellent for a self administered questionnaire\textsuperscript{13} and compares well with the 96% response rate for the 1989-90 National Health Survey.\textsuperscript{14}

We chose a stratified sampling procedure to enable comparisons between Catholic, Government and Independent schools. Differences in immunisation uptake between different types of schools have been reported.\textsuperscript{15,16}

Providers of immunisation vary throughout Australia. Immunisation services in Victoria, Western Australia, the Northern Territory, the Australian Capital Territory and South Australia are provided mainly by public authorities. In contrast, immunisation services in Queensland are provided mainly by the private sector.\textsuperscript{17} Our finding that general practitioners provide most immunisation services in the Wentworth Health Area is consistent with previous reports for New South Wales as a whole.\textsuperscript{17}

We found higher rates of immunisation for measles/mumps, pertussis and pre-school booster in our study than reported for the Wentworth Health Area from the 1989-90 National Health Survey.\textsuperscript{8} We were unable to compare immunisation rates for triple antigen because of differences in data collection. Our reported rate for measles immunisation uptake (98%) is also higher than the 91% reported by Ferson and Christie\textsuperscript{15} in their study of children entering school in the Eastern Sydney Health Area.
in 1989.

The high levels of immunisation uptake reported may reflect a bias in parental recall. Parental report often over-estimates children's immunisation status.\textsuperscript{18,19} We did not validate immunisation status. Standard immunisation records are not available for this cohort of children, and such immunisation records are not always reliably maintained.\textsuperscript{18} Ethical and resource considerations prevented serological validation. Selection bias, from our 9\% refusal rate, may also have contributed to our high level of reported immunisation uptake. Non-respondents may have lower levels of immunisation uptake.

Incorrect advice from health professionals about contraindications for immunisation, may have contributed to less than optimal vaccine uptake in the Wentworth Health Area.\textsuperscript{20,21,22} Only 82\% of the children we surveyed are reported to be immunised against pertussis. This level is lower than the 92-95\% necessary for herd immunity.\textsuperscript{1} Of those who did not receive all pertussis immunisations, the main reason given was "professional advice against it". The benefits of pertussis vaccination outweigh any risks.\textsuperscript{4,23} Health professionals should be updated regularly about true contraindications for immunisation.

The slightly lower levels of immunisation uptake in children younger than five years of age compared to those five years and older, appear to be related to the pre-school booster. National Health and Medical Research Council guidelines\textsuperscript{24} recommend that the pre-school booster should be given at five years of age or prior to school entry. Although a child has started school, parents may be waiting for his/her fifth birthday
before immunising. Confusion about when this booster should be given may be an important reason for children not being protected at school entry.

We are surprised that children whose parents have post-secondary qualifications are less likely to be fully immunised than children of parents without post-secondary education. This can not be explained by possible awareness of risks of immunisation. There are no differences in beliefs in immunisation between those with, and those without post-secondary education. In Western Australia, Blaze-Temple et al. did not find an association between immunisation uptake and educational levels. The National Health Survey found that parents with post-school qualifications reported slightly higher proportions of children immunised with each vaccine type.

Children whose parents do not speak English are six times more likely to be incompletely immunised. This association is stronger than that for either the child’s or parent’s country of birth. Similar results are reported in a recent study of children attending a hospital casualty department. Poor immunisation compliance was associated with parents who spoke and understood little English, but not associated with the parent’s country of birth. Lower immunisation rates have also been found in certain ethnic minorities in the United States of America and in New Zealand Maoris. Our findings suggest that communication is important in determining immunisation levels, and that ethnic groups should be targeted in their primary language.

The receipt of reminder letters from immunisation providers is not associated with increased immunisation uptake. Reminder letters theoretically increase immunisation
uptake. We found that they make no difference. This may be characteristic of the Wentworth Health Area. Reminder letters are usually distributed by local councils, and in the Wentworth Health Area, local councils are minor providers of immunisation. The cost effectiveness of sending reminder letters should be evaluated.

In our study, beliefs in the importance, effectiveness and safety of immunisation are positively associated with complete immunisation uptake. The majority of respondents believe that immunisation is "very" or "quite" important, effective or safe. The likelihood of incomplete immunisation increases as the belief becomes more negative. The numbers of respondents are small in the more negative groups, and confidence intervals are therefore wide.

To maintain high levels of immunisation in the community, health care professionals and parents need to be convinced of the benefits of immunisation. General practitioners are the main providers of immunisation services in outer western Sydney, and have an important role in encouraging immunisation uptake. Low pertussis immunisation prevalence suggests that we need specific campaigns to encourage increased uptake. Ethnic and other subgroups, such as certain socio-economic subgroups, need targeting. Health professionals should reinforce the importance, effectiveness and safety of immunisation.

Responsibilities for immunisation policy and delivery are shared between the Commonwealth and the states. The NH&MRC recommend immunisation for all children according to a routine immunisation schedule. School entry legislation, requiring
documentation of immunisation status at school entry encourages parents to consider immunisation rather than let it lapse through ignorance or apathy.\textsuperscript{6} Since certification of immunisation status began in Victoria in 1991, the proportion of schools reporting full immunisation for their preparatory pupils has increased.\textsuperscript{6} Similar legislation will be introduced in New South Wales in 1994. In the United States of America such legislation has also increased immunisation prevalence in this age group.\textsuperscript{27}

High levels of immunisation are important to protect the community from childhood infectious diseases. No comprehensive strategies currently exist for monitoring vaccine coverage in Australia. Different methodologies, such as those used by the Australian Bureau of Statistics’ National Health Survey, the Victorian School Entry Data and our survey, will produce different results in the same population. We need a standardised approach to monitor age-specific immunisation levels to compare children’s immunisation status between States, and between population sub-groups. School entry policy will enable monitoring of levels for this age group, but other methods are needed to monitor immunisation levels in younger children.

In summary, we found that approximately 89\% of children are reported to be fully immunised. Immunisation prevalence does not vary between school types. General practitioners are the main providers of immunisation services. Reminder letters have little effect on immunisation status. Incomplete immunisation is associated with more negative beliefs in immunisation, with post-secondary education, and with families who do not speak English at home.
ACKNOWLEDGEMENTS

We would like to thank the staff and principals of the Association of Independent Schools of NSW; the Catholic Education Office, Diocese of Parramatta; and the Department of School Education, Metropolitan West Region, who participated in the survey. We would also like to thank Stephen Crone and Marea Mears for collecting and entering data. Finally, we thank Sue Jobson from the New South Wales Health Department, Dr Mahomed Patel from the Northern Territory Department of Health and Community Services, and Dr Michael Lane and Dr Aileen Plant from the National Centre for Epidemiology and Population Health, Canberra, for their helpful comments.
REFERENCES


Table 1. Response Rates, and Age Distribution of Study Children by Type of School, Wentworth Health Area, NSW, 1992

<table>
<thead>
<tr>
<th>Type of School</th>
<th>Catholic</th>
<th>Government</th>
<th>Independent</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Children</td>
<td>371</td>
<td>588</td>
<td>107</td>
<td>1066</td>
</tr>
<tr>
<td>Enrolled</td>
<td>350</td>
<td>532</td>
<td>84</td>
<td>966</td>
</tr>
<tr>
<td>Number of Respondents</td>
<td>350</td>
<td>532</td>
<td>84</td>
<td>966</td>
</tr>
<tr>
<td>Response Rate(^1)(%)</td>
<td>94</td>
<td>91</td>
<td>79</td>
<td>91.0</td>
</tr>
<tr>
<td>95% CI</td>
<td>92-97</td>
<td>88-93</td>
<td>71-86</td>
<td></td>
</tr>
<tr>
<td>Child’s Age(^2)</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Less than 5 years</td>
<td>110</td>
<td>167</td>
<td>24</td>
<td>301</td>
</tr>
<tr>
<td>5 years and older</td>
<td>239</td>
<td>363</td>
<td>59</td>
<td>661</td>
</tr>
<tr>
<td>Total</td>
<td>349</td>
<td>530</td>
<td>83</td>
<td>962</td>
</tr>
</tbody>
</table>

\(^1\)Adjusted for sampling method

\(^2\)The ages of four children were not reported.
Table 2. Reported Immunisation Status of Children, by School Type, Wentworth Health Area, NSW, 1992

<table>
<thead>
<tr>
<th>Immunisation status¹ (%)</th>
<th>School type</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Catholic</td>
<td>Government</td>
<td>Independent</td>
<td>Total</td>
<td></td>
</tr>
<tr>
<td>Full immunisation²</td>
<td>92</td>
<td>88.5</td>
<td>82.1</td>
<td>88.7</td>
<td></td>
</tr>
<tr>
<td>95% CI</td>
<td>75.3-100</td>
<td>72.3-100</td>
<td>58.4-100</td>
<td>77.0-100</td>
<td></td>
</tr>
</tbody>
</table>

¹Adjusted for sampling method
²Full immunisation defined as 3 TA/CDT vaccinations, a MM, TAB and PSB

Table 3. Percentage¹ of Children Reported Immunised by Vaccine Type, Wentworth Health Area, NSW, 1992

<table>
<thead>
<tr>
<th>Vaccine type</th>
<th>Fully immunised (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Triple antigen/CDT (3 vaccinations)</td>
<td>98.9</td>
</tr>
<tr>
<td>Measles/Mumps</td>
<td>98.3</td>
</tr>
<tr>
<td>Triple antigen booster</td>
<td>97.1</td>
</tr>
<tr>
<td>Pre-school booster</td>
<td>91.4</td>
</tr>
</tbody>
</table>

¹Adjusted for sampling method
Table 4. Reasons given for Incomplete Immunisation, Wentworth Health Area, NSW, 1992

<table>
<thead>
<tr>
<th>Reasons for incomplete immunisation</th>
<th>Number of times this reason was cited¹</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parental indifference</td>
<td>32</td>
</tr>
<tr>
<td>Doctor advised against immunisation</td>
<td>28</td>
</tr>
<tr>
<td>Personal beliefs</td>
<td>12</td>
</tr>
<tr>
<td>Child’s ill health when immunisation due</td>
<td>8</td>
</tr>
<tr>
<td>Severe or allergic reaction to a previous immunisation</td>
<td>6</td>
</tr>
<tr>
<td>Lack of access</td>
<td>5</td>
</tr>
<tr>
<td>Other reasons</td>
<td>11</td>
</tr>
</tbody>
</table>

¹Respondents could give more than one reason
Table 5. Odds Ratios for Incomplete Immunisation, by Selected Family Characteristics and Immunisation Reminder Letter, Wentworth Health Area, NSW, 1992

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Adjusted OR (95%CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Child’s age</td>
<td></td>
</tr>
<tr>
<td>5 years or older</td>
<td></td>
</tr>
<tr>
<td>Younger than 5 years</td>
<td>1.60 (0.97-2.64)</td>
</tr>
<tr>
<td>Parent had post-secondary education</td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>0.45 (0.26-0.77)</td>
</tr>
<tr>
<td>Child’s country of birth</td>
<td></td>
</tr>
<tr>
<td>Australia</td>
<td></td>
</tr>
<tr>
<td>Outside Australia</td>
<td>3.12 (1.16-8.39)</td>
</tr>
<tr>
<td>Respondent’s country of birth</td>
<td></td>
</tr>
<tr>
<td>Australia</td>
<td></td>
</tr>
<tr>
<td>Outside Australia</td>
<td>1.13 (0.61-2.09)</td>
</tr>
<tr>
<td>Respondent’s language</td>
<td></td>
</tr>
<tr>
<td>English</td>
<td></td>
</tr>
<tr>
<td>Not English</td>
<td>5.93 (1.97-17.84)</td>
</tr>
<tr>
<td>Immunisation reminder letter</td>
<td></td>
</tr>
<tr>
<td>Received</td>
<td></td>
</tr>
<tr>
<td>Not received</td>
<td>0.77 (0.44-1.32)</td>
</tr>
</tbody>
</table>

Reference group
Table 6. Odds Ratios for Incomplete Immunisation, by Beliefs in Immunisation, Wentworth Health Area, NSW, 1992

<table>
<thead>
<tr>
<th>Belief in importance</th>
<th>Adjusted OR (95%CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very important¹</td>
<td></td>
</tr>
<tr>
<td>Quite important</td>
<td>3.49 (1.67-7.32)</td>
</tr>
<tr>
<td>Not very/not important</td>
<td>5.15 (0.49-53.74)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Belief in effectiveness</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Very effective¹</td>
<td></td>
</tr>
<tr>
<td>Moderately effective</td>
<td>1.17 (0.61-2.25)</td>
</tr>
<tr>
<td>Somewhat/ineffective</td>
<td>6.02 (0.94-38.55)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Belief in safety</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Very safe¹</td>
<td></td>
</tr>
<tr>
<td>Quite safe</td>
<td>1.03 (0.59-1.79)</td>
</tr>
<tr>
<td>Not very/very unsafe</td>
<td>2.61 (0.62-10.94)</td>
</tr>
</tbody>
</table>

¹Reference group

Seroprevalence of hepatitis A antibodies among residents of a centre for people with developmental disabilities.

Short title: Seroprevalence of hepatitis A antibodies.

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Abstract

Background: In February 1993, 11 cases of hepatitis A were identified in permanent residents of a centre for young people with developmental disabilities.

Aims: To define the extent of the outbreak in the centre, to determine the seroprevalence of hepatitis A antibodies (anti-HAV) in permanent residents, and to ascertain risk factors for serological evidence of hepatitis A (HAV) infection.

Methods: A cross-sectional serological survey of 270 permanent residents, aged eight to 40 years, in a centre for people with developmental disabilities in western Sydney. Using a radioimmunoassay technique, sera were tested for anti-HAV (IgM and total antibody). We used logistic regression to determine risk factors for presence of anti-HAV.

Results: Blood samples were collected from 259 permanent residents (96%). Serological testing revealed anti-HAV in 128 residents tested (49%). Presence of anti-HAV was associated with living in specific residential units, and with residents’ age and length of stay at the centre, but was not associated with reported behavioural factors.

Conclusions: More than half of the residents of the centre were susceptible to HAV infection. Behavioural characteristics of the residents and their close contact with each other make HAV transmission difficult to control. Hepatitis A vaccine should be promoted in communities at risk, such as those with developmental disabilities.

Key words: cross-sectional studies, disabled, hepatitis A, hepatitis antibodies, prevalence, residential facilities
Introduction

In early February 1993, the Public Health Unit in western Sydney was notified of a case of acute hepatitis A (HAV) infection in a child living in a centre for people with developmental disabilities in western Sydney.

Seven of the 13 residents in the same unit as the index case (Unit H) were anti-HAV IgM positive, indicating current or recent HAV infection. Of the remaining six residents in Unit H, two had anti-HAV IgG and the remaining four had no antibodies to HAV. Despite receiving human immunoglobulin, the four susceptible residents in Unit H became ill, and anti-HAV IgM was detected. We sought to define the extent of the outbreak in the centre and to identify further cases.

Methods

The centre cares for approximately 270 people with severe developmental disabilities in 11 residential units, and employs about 410 staff. Residents are children, adolescents and young adults, and the majority are long term residents. The centre also provides temporary care for some other residents.

Administrative staff provided a list of permanent residents in each residential unit, and residents’ date of birth and date of admission to the centre. We sought permission from parents and guardians to take blood samples for testing for anti-HAV. Over a three day
period, nursing staff at the centre collected blood samples from permanent residents, and completed a short questionnaire about behavioural risk factors for HAV infection. Risk factors included whether residents fed themselves, were toilet trained, incontinent, coprophagic, and whether they smeared faeces, or manually evacuated themselves.

Residents’ sera were tested for anti-HAV IgM and total antibody at the Institute of Clinical Pathology and Medical Research, Westmead Hospital, using a radioimmunoassay technique (HAVAB-M and HAVAB, Abbott Laboratories, Chicago). Tests were performed according to the manufacturer’s instructions. We used logistic regression\textsuperscript{12} to identify risk factors associated with evidence of HAV infection, defined as the presence of total anti-HAV in serum. Residents from Unit K were the reference group as this unit housed more residents than others and its residents were less disabled.

Results

We obtained demographic information on 266 of the 270 (98%) permanent residents. Their ages ranged from eight to 40 years (mean age 25 years). The length of time they had lived at the centre ranged from less than one year to 24 years (mean 14 years).

Blood samples were collected from 259 permanent residents (96%). Serological testing revealed total anti-HAV in 117. There were 11 acute hepatitis A cases, all from Unit H, giving a total of 128 (49%) with serological evidence of past or present hepatitis A infection.
Table 1 presents adjusted odds ratios for risk factors for HAV infection in residents at the centre. Serological evidence of HAV infection was associated with living in Units C, E, G, H and J, and resident's age and length of stay at the centre had a small effect. Gender was not a risk factor. None of the behavioural factors reported was associated with serological evidence of HAV infection.

**Discussion**

In developed countries such as Australia, HAV infection occurs mainly in travellers, contacts of cases, in outbreaks in child day care centres, institutions, and in certain population groups such as injecting drug users and homosexual men[^3^,^4^,^5^]. Carers of faecally incontinent people, and others in contact with them, are also at increased risk of HAV infection.

We found that evidence of HAV infection was associated with living in specific residential units. Residents were housed according to type of disability. Although specific behavioural factors were not associated with serological evidence of HAV infection, it was possible that HAV was readily transmitted to other susceptible residents in the same unit because of behavioural characteristics and the difficulty recognising mild infections in young disabled people. The pool of susceptible people can be quickly exhausted. This was illustrated by the 100% attack rate in susceptible residents in Unit H.

There are no recent Australian data with which to compare our anti-HAV prevalence. The 49% seroprevalence of anti-HAV in this population with developmental disabilities was lower than the 75% seroprevalence found in a group of 1000 mentally retarded adults and children aged 3-76 years, in Victoria in 1977. This is probably due to declining incidence of infection coincident with improved environmental hygiene.

More than half of the residents of the centre were susceptible to HAV infection. In this outbreak, one staff member from the centre contracted hepatitis A and there were other cases in western Sydney in children with developmental disabilities and their families. A safe and efficacious hepatitis A vaccine has recently become available in Australia. People with disabilities, their carers, and family members are obvious target groups for hepatitis A immunisation.

Acknowledgments

We thank staff and residents at the centre for their help investigating and controlling the outbreak, particularly Dr Aruna Sandanam, Dr John Sullivan, Ann Miller and Susan Alexander. We also thank Drs Anthony Cunningham, Louisa Jorm, Angela Merianos and Aileen Plant for their helpful discussions, Stephen Crone and Marea Mears for assisting with data collection, and Lee Mackay and Robert Capeski for serological testing.
References


Table 1. Adjusted Odds Ratios for Risk factors Associated with Serological Evidence of HAV Infection in 259 Permanent Residents of a Centre for People with Developmental Disabilities, 1993

<table>
<thead>
<tr>
<th>variable</th>
<th>adjusted OR*</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>age</td>
<td>1.1</td>
<td>1.0-1.2</td>
</tr>
<tr>
<td>length of stay at centre</td>
<td>1.1</td>
<td>1.0-1.1</td>
</tr>
<tr>
<td>sex†</td>
<td>1.7</td>
<td>0.9-3.2</td>
</tr>
<tr>
<td>Unit A</td>
<td>0.7</td>
<td>0.2-2.8</td>
</tr>
<tr>
<td>Unit B</td>
<td>1.3</td>
<td>0.3-4.7</td>
</tr>
<tr>
<td>Unit C</td>
<td>4.5</td>
<td>1.3-16.1</td>
</tr>
<tr>
<td>Unit D</td>
<td>1.7</td>
<td>0.5-5.4</td>
</tr>
<tr>
<td>Unit E</td>
<td>16.1</td>
<td>3.3-79.4</td>
</tr>
<tr>
<td>Unit F</td>
<td>3.0</td>
<td>0.7-12.3</td>
</tr>
<tr>
<td>Unit G</td>
<td>4.7</td>
<td>1.3-16.6</td>
</tr>
<tr>
<td>Unit I</td>
<td>2.3</td>
<td>0.7-8.0</td>
</tr>
<tr>
<td>Unit J</td>
<td>6.6</td>
<td>1.6-27.2</td>
</tr>
</tbody>
</table>

*adjusted for age, length of stay at the centre, sex, and residential unit.
†OR for males compared with females.
‡Unit denotes residential unit. Each unit is compared with Unit K. OR for Unit H could not be calculated because all residents had serological evidence of HAV infection.
Appendix 3: Letters published in peer reviewed journals

Control of Measles in NSW


We read with interest the letter of Shane Marsh and Ian Lucas of Canberra regarding the control of measles in the Australian Capital Territory (*AJPH* 16(2) 1992). The authors raise important issues about notification and immunisation.

Prompt notification and public health action prevent further cases of this potentially serious disease. As pointed out, measles is a notifiable disease in New South Wales. Doctors and hospitals are required to notify measles on clinical suspicion to Public Health Units. Throughout New South Wales there are 14 Public Health Units responsible for responding to infectious disease notifications.

Our experience in the Western Sector Public Health Unit is that many parents, schools and day care centres also notify infectious diseases. Notifications from all sources are investigated. This informal arrangement works well. We believe that a more formal responsibility for parents and schools to notify is not appropriate. Most parents and schools would not welcome the legislative responsibility for diagnosing and notifying infectious diseases.

In New South Wales all Public Health Units follow established guidelines in responding to infectious disease notifications. For measles, the current guidelines advise excluding...

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cases from school, work or day care for five days after the appearance of the rash. Contacts who have not been immunised are offered prophylaxis according to the protocol outlined in the following table.

Management of Unimmunised Contacts of Measles Cases, in NSW

<table>
<thead>
<tr>
<th>Age of Contact</th>
<th>Recommended Prophylaxis</th>
</tr>
</thead>
<tbody>
<tr>
<td>≥ 12 months</td>
<td>MMR* within 72 hours of identification of index case</td>
</tr>
<tr>
<td>9-11 months</td>
<td>as above, and after 3 months immunise again with MMR</td>
</tr>
<tr>
<td>6-8 months</td>
<td>normal immunoglobulin within 6 days of contact with index case</td>
</tr>
<tr>
<td>&lt; 6 months</td>
<td>no prophylaxis (maternal antibodies persist)</td>
</tr>
</tbody>
</table>

*measles/mumps/rubella vaccine

These guidelines will be revised if and when currently planned documentation of immunisation status at school, pre-school or day care enrolment is introduced. When a case of measles occurs in such an institution, children not immunised appropriately for age will be excluded from the institution for the incubation period, to prevent further transmission. However, if unimmunised children receive the recommended prophylaxis they may return to the institution immediately.

Shane Marsh and Ian Lucas have brought important issues to our attention. As public health professionals we must respond to their pleas.

References

To the Editor:

In February 1993, we surveyed the directors of all 92 long day care centres in the Western Sydney Health Area to determine their knowledge of *Haemophilus influenzae* type B (Hib) disease and vaccine. All 92 responded. Sixty-three (68.5%) had heard of a disease called *Haemophilus influenzae* type B or Hib disease. When asked to name conditions caused by Hib, 30 directors (48%) named meningitis and four (6%) named epiglottitis. Twenty-eight (44%) could not name an illness caused by Hib, while three (5%) named influenza, and six (10%) said it causes other illnesses.

Of the 63 who knew of Hib disease, 50 (79%) were aware of a Hib vaccine. This represented 54% of the day care centre directors. We asked how they heard of Hib vaccine. Of the 50 directors aware of Hib vaccine, 17 (34%) heard about it from a doctor or nurse, 11 (22%) from a health poster or leaflet, nine (18%) from the radio or television, and seven (14%) from a newspaper. Twenty-one (42%) heard about it from other people. Only 19 of the 50 directors aware of Hib vaccine (21% of all day care centre directors surveyed) specifically advised parents to immunise their children against Hib disease.

Children attending day care centres are 1.4-17 times more likely to acquire Hib infection, compared with children who do not attend day care. Relative risk of infection
is highest in the youngest children,\textsuperscript{1,2} and increases with hours of attendance.\textsuperscript{1} Our experience suggests that day care attendance is a risk factor in western Sydney. Eighteen cases of Hib in children younger than five years old have been notified to our Public Health Unit between January 1992 and March 1993. Seven of these (39\%) attended long day care. About 26\% of children in Western Sydney under five years old attend long day care.\textsuperscript{3}

Hib vaccine is now part of the recommended childhood immunisation schedule. We believe that Hib immunisation should be more actively promoted in child care centres.

References


Haemophilus influenzae type b vaccination

To the Editor: Haemophilus influenzae type b (Hib) vaccination significantly decreases the risk of invasive Hib disease in children younger than five years of age. In Australia the PRP-D vaccine and more recently other conjugate Hib vaccines have become available through general practitioners. The PRP-D vaccine is only for the 18 month to five year age group. The relatively high incidence of invasive Haemophilus influenzae disease in the Australian Capital Territory (ACT)1 can be reduced by widespread use of these vaccines.

To assess knowledge of, attitudes to and use of Hib vaccine in parents with children younger than five years of age we conducted a systematic telephone survey using the 1993 telephone book for the ACT, Queanbeyan and Yass to provide phone numbers. A total of 1355 calls were made over three days in March 1993, identifying 180 eligible parents with 244 children younger than five years.

Six per cent of all calls resulted in refusals (n = 81) and 80% of respondents had no children under five (n = 1094). The 180 parents answered a six-question survey on their knowledge of Hib disease and Hib vaccine, whether their children were vaccinated and reasons for non-vaccination. The Epi Info program was used for data entry and analysis.1

Sixty per cent of parents had heard of Hib disease and 66% had heard of Hib vaccine. Only 17% of all children in the risk age group of younger than five years had been vaccinated. When parents were aware of Hib vaccine, 25% of children at risk had been vaccinated. Awareness of Hib vaccine was greatest in parents of children aged two and three years (71%) and vaccination rates were also highest in this group (26%). When parents were aware of Hib vaccine, 40% of the children aged two to three were vaccinated compared with only 14% of children aged 18 months to two years and 18% of those aged four years. The Figure compares parental knowledge of Hib vaccine with Hib vaccination by age groups of children.

The major reason parents gave for not having their child vaccinated was that they would like to but had not got around to it (40%). Other reasons for non-vaccination included the child being younger than 18 months (14%), expense (12%) and opposition to vaccination (5%). A further 9% had been advised against or misinformation about the need for Hib vaccination and 14% lacked information or were worried about the risks of vaccination. Six per cent gave expense as a secondary reason for non-vaccination.

We found that although knowledge of the existence of Hib vaccine is relatively high in the ACT region vaccination rates are low, especially in the 18 to 23 month age group. Very few parents are actually opposed to immunisation. The discrepancy between knowledge and action may be attributed to difficulty of access, expense and lack of information. Higher vaccination rates in children aged two to three years may be due to the publicity surrounding the introduction of the PRP-D vaccine when those children were close to 18 months of age. Older children may also have higher vaccination rates because of publicity through child care centres. Current methods of administration of Hib vaccines are logically difficult and expensive for many parents to access. Many parents want more information on Hib disease and Hib vaccine before their child is vaccinated and this information should be more widely disseminated. Higher vaccination rates can be achieved by making Hib vaccination easily accessible at less cost to parents of all children at risk.

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1. Margaret Ashwell, Jane Bell, L. Fan, Brianne Harvey, Ana Herceg, Louise McDonald, Rana Macpherson, Irene Pask, Aileen Poke, Thomas Ray, J. Rowbottom, Alan Ruben, John Scott, Sue Seddon, Nigel Stocks, Catherine Streeter, Mark Veech, Ting Voedmann

Parental awareness of Haemophilus influenzae type b vaccine and vaccination status of 244 children younger than five years of age in the Australian Capital Territory region March 1993.
Appendix 4: Seventh disease?

*CDI 1994; 18(2):35-36*

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Seventh disease?

Background

In June 1992, a general practitioner notified the Public Health Unit in western Sydney of a case of fifth disease in a child attending a local public school. Anecdotal reports indicated that other children at the school were also affected.

An instinctive reach for Benenson. Fifth disease is also called slapped face (or slapped cheek disease) and erythema infectiosum. It is caused by human parvovirus B19 (B19).\(^1\) Professor Yvonne Cossart from Sydney University discovered the virus in 1975\(^2\) (she calls herself the virus’ grandmother), and was keen to follow up the cases. B19 activity had been low in NSW in recent years.

Investigation

We contacted the school. It seemed that fifth disease was present in the infant classes. As well, there were probably cases in the adjacent preschool, because many of the children intermingle. Both the principal of the public school and the director of the preschool agreed to participate in investigating the disease.

We aimed to determine the extent of the B19 outbreak in both schools, define the range of symptoms reported, and in the younger children, ascertain the proportion of cases with asymptomatic infection.

Information sheets and questionnaires were sent to parents of all children in both schools. Due to the difficulties diagnosing rash-like illnesses in children, and in determining recent infection (asymptomatic infections are common), we asked parents for consent to collect...
finger-prick blood samples. Samples were collected from children in the kindergarten and year one at the public school and all children at the preschool, where most cases had been reported. We also collected data and blood samples from staff at both schools.

Results

Fifty-four per cent (193/359) of children enrolled at both schools, and 71% (20/28) of staff returned questionnaires. We obtained finger-prick blood samples from 61/143 (43%) children in preschool, kindergarten and year 1, and venous blood samples from 16/28 staff (57%). All those we collected blood samples from, returned questionnaires.

Of the 193 children who returned questionnaires, 126 (65%) reported illness. Of the staff who returned questionnaires 12 (60%) reported being ill since June. The epidemic curve is shown in Figure 1.

Serological testing kits are not widely available. Testing kits became available in July 1993, but kit numbers were limited. To confirm B19 diagnosis we selected six children with symptoms most compatible with B19 infection, including the case first notified by the general practitioner. These were tested for B19 antibodies (IgM and IgG). All were IgM negative and four were IgG positive. Using PCR, we tested the same six for B19 DNA. Again, results were negative.

As we did not collect enough blood for further testing, we could not test children’s blood samples for other likely causes, such as other viruses. We tested four adults who reported being ill and who had the most severe symptoms for rubella. All were rubella IgM
negative, but IgG positive.

**Discussion**

Fifth disease is the fifth of a group of illnesses which have a similar clinical appearance, and include rubella, measles, scarlet fever, and Filatov-Dukes disease (an atypical form of scarlet fever).³ Roseola is known as sixth disease.⁴ Fifth disease is very difficult to differentiate clinically from these.

As well as fifth disease, B19 can result in asymptomatic infection. It can also cause serious complications; transient aplastic crisis in people with chronic haemolytic anaemias and chronic anaemia in those with immunodeficiency. B19 infection during pregnancy has also been linked with fetal death.⁵

The epidemic curve shows a gradual increase in the number of people ill, consistent with the spread of an infectious agent between susceptible people. The decrease in cases could be due to exhausting the number of susceptible people, to school holidays, or because active surveillance was over.

Without diagnostic testing, we could not ascribe illness to B19. Individuals vary in the symptoms they report and in the severity of their symptoms. Fifth disease is usually characterised by a facial and body rash. Joint symptoms are common, especially in adults. Appearance of the rash may be preceded by mild systemic symptoms.⁵

More than a year after questionnaires and blood samples were collected, we could say that B19 did not cause the outbreak, but we were unable to identify the infectious agent. This
outbreak investigation illustrates the importance of being able to clearly define cases. For diseases such as fifth disease, which have non-specific clinical features, and which may easily be confused with other diseases, case definition depends on the availability of laboratory testing procedures. As well, many B19 infections are asymptomatic and may not be recognised. Diagnostic testing is important for surveillance, defining outbreaks caused by B19, and for those at risk of serious complications.

Acknowledgments

We thank staff, parents and students at the public school and the preschool for their help investigating the outbreak. We also thank staff from the community health centre and Stephen Crone and Marea Mears for assisting with data collection, and Aileen Plant, Mike Lane and Louisa Jorm for their helpful discussions.

References


Figure 1

Date of onset of illness in children and staff in preschool, kindergarten, and year 1 classes in a preschool and public school 1992

number ill

- children
- staff

May 15 – 30
June 1 – 5 7 9 11 13 15 17 19 21 23 25 27 29 1 – July

Date of onset of illness 1992
Appendix 5: Hepatitis A in a community of people with developmental disabilities in western Sydney.

CDI 1994; 18(1): 4-6

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Introduction

On 2 February 1993 the Virology Department at the Institute of Clinical Pathology and Medical Research, Westmead Hospital (ICPMR) notified the Western Sector Public Health Unit in western Sydney, of a case of acute hepatitis A (HAV) infection in a child living in a centre for people with developmental disabilities. Within two weeks of this case, a further six residents in the same unit as the original case (Unit H) became ill, and anti-HAV IgM was detected, indicating current or recent infection.

After receiving the initial notifications we contacted the centre. We sought to limit the outbreak, to identify further cases, and to detect possible sources of infection.

Outbreak control and investigation

The centre and cares for approximately 270 residents with severe developmental disabilities in 11 residential units, and employs about 410 staff. Residents are children, adolescents and young adults, and the majority are long term residents at the centre. The centre also provides temporary care for some other clients. Residents are housed according to type of disability. Unit H specifically cares for children and adolescents.

Staff at the centre tightened their hygiene practices and access to Unit H was limited. All permanent residents in Unit H were tested for hepatitis A antibodies (anti-HAV). Staff and other residents in Unit H, and close contacts of the cases were given human immunoglobulin. Medical and nursing staff closely monitored all residents for clinical evidence of HAV infection. Nursing staff collected blood samples from all residents over three days. Administrative staff provided a list of permanent residents in each residential
unit, and residents’ date of birth and date of admission to the centre. Staff were asked to contact their own doctor or medical staff at the centre if they developed any signs or symptoms of illness.

We actively sought cases outside the centre. We contacted all centres, hostels and respite care homes for people with developmental disabilities in the western Sydney area, as well as the Department of Community Services and other Public Health Units in New South Wales. We contacted recent and new hepatitis A cases to ask about contact with people with developmental disabilities.

Sera from all permanent residents and from nine other cases were tested for anti-HAV (IgM and total antibody) at the ICPMR. Anti-HAV were determined using a radioimmunoassay (RIA) technique (HAVAB-M and HAVAB, Abbott Laboratories, Chicago). Sera for 20 cases were tested in other laboratories in the Sydney area. We defined recent or current infection as anti-HAV IgM positive, and previous infection as total anti-HAV positive and anti-HAV IgM negative.

**Results**

We obtained demographic information for 266 (98.5%) of the permanent residents at the centre. Ninety (34%) residents were female, and 176 (66%) were male. Their ages ranged from eight to 40 years (mean age 25 years). They had lived at the centre between less than one year and 30 years (mean 14 years). Compared with other residents, those in Unit H were younger (mean age 13.5 years, p<0.05) and had lived at the centre for less time (mean 4 years, p<0.05).
A total of 14 cases was connected with the centre. Serological testing revealed that two of the 13 permanent residents in Unit H had past HAV infection. All 11 susceptible residents in Unit H developed symptoms consistent with acute HAV infection, and anti-HAV IgM was detected. During January, four temporary care residents stayed in Unit H. Three were tested for anti-HAV. Although none had been symptomatic, two were anti-HAV IgM positive and the third showed evidence of past HAV infection. We were unable to test the fourth temporary care resident. A nurse working in Unit H became ill four weeks after the first case and anti-HAV IgM was detected. Many of the other staff who worked in Unit H were tested for anti-HAV. No data are available on the numbers tested, or their results.

Blood samples were collected from 259 of the 270 (96%) permanent residents. Serological testing revealed evidence of past HAV infection in 117 residents. With the 11 cases from Unit H, a total of 128 (or 49%) showed serological evidence of past or current HAV infection.

In addition to the 14 cases connected with Unit H, active surveillance revealed another 26 cases of acute HAV infection linked with people with developmental disabilities.

Of all 40 cases, 24 occurred in children with developmental disabilities and 16 in able people, including four nursing or teaching staff caring for children with developmental disabilities. Nine asymptomatic infections were discovered in children with developmental disabilities. Two were temporary care residents from Unit H and the other seven were identified after a family member was diagnosed with HAV infection. Not all household contacts were tested for anti-HAV, so we could not determine a household attack rate.
Onset of illness for the 31 cases with symptomatic infection occurred over four months (Figure 1).

Figure 2 shows the epidemiological links between 36 of the 40 cases. Cases were linked to the centre, a special school and two respite care centres. Dates of illness onset are shown for those with symptomatic infection. No direct epidemiological link could be found for four cases. Three were disabled children and one was a staff member from a special school.

Discussion

It is likely that permanent residents at the centre were exposed to HAV through contacts with temporary care clients. Two of the temporary care residents who stayed in Unit H in January were anti-HAV IgM positive. Cases in the community occurred earlier than those in the centre. The nurse from Unit H probably became infected after the residents became ill.

HAV transmission in the centre was unlikely to have been food or water borne. Meals were prepared in a central kitchen, and distributed to all units and the water supply was common to all units. Cases were confined to Unit H. HAV was probably transmitted between residents in this unit by the faecal-oral route. Residents' behaviours make this likely.

All 11 cases in permanent residents were symptomatic, compared with four of the 13 other cases in children with developmental disabilities. This difference probably relates to awareness of the HAV infection and constant vigilance for clinical signs in residents at the
centre. If people can not communicate easily, mild illness may not be recognised by carers, particularly if carers are unaware of circulating virus. Expression of clinical illness is age-related. About 40-50% of children 10-14 years old are symptomatic. There was no difference in mean age between permanent residents with HAV infection, and other cases with developmental disabilities.

That asymptomatic infections were only recognised in young people with developmental disabilities reflects a detection bias. Developmentally disabled contacts of cases were tested for anti-HAV, whereas other contacts of cases were warned of the symptoms and asked to seek medical care if they became ill. Asymptomatic cases in able people were more likely to be missed.

In developed countries such as Australia, HAV infection occurs mainly in travellers, contacts of cases, in outbreaks in child day care centres, institutions, and in certain population groups such as injecting drug users and homosexual men. HAV is an important hazard to health care workers. Carers of faecally incontinent people, and others in contact with them, are also at increased risk of HAV infection.

**Conclusion**

In this outbreak, 24 children with developmental disabilities, four employed carers of these children and 12 of their family contacts acquired HAV infection. Also, more than half of the permanent residents of the centre were susceptible to HAV infection. A safe and efficacious hepatitis A vaccine is now available in Australia. People with disabilities, their carers, and family members are obvious target groups for hepatitis A immunisation.
Acknowledgments

We thank staff and residents at the centre for their help investigating and controlling the outbreak, particularly Dr Aruna Sandanam, Dr John Sullivan, Ann Miller and Susan Alexander. We also thank Drs Anthony Cunningham, Louisa Jorm, Angela Merianos and Aileen Plant for their helpful discussions, Stephen Crone and Marea Mears for assisting with data collection, and Lee Mackay and Robert Capeski for serological testing.

References


Figure 1

Figure 1. Date of illness onset in 31 symptomatic hepatitis A cases linked with people with developmental disabilities in western Sydney, Dec 1992 - Mar 1993

- Permanent residents
- Other disabled
- Contacts of disabled

<table>
<thead>
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<th>20</th>
<th>27</th>
<th>3</th>
<th>10</th>
<th>17</th>
<th>24</th>
<th>31</th>
<th>7</th>
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</table>

S = staff member from RU-H

Figure 2

Figure 2. Links between 36 hepatitis A cases** and 4 institutions caring for people with developmental disabilities in western Sydney, Dec 1992-Mar 1993

- SPECIAL SCHOOL A
  - 1 staff 20/12/92
  - 1 disabled child* 29/1
  - 1 disabled child*
  - 1 family member 22/2
  - 2 family members 15/2, 20/2
  - 3 extended family members 17/2, 17/2, 25/2

- RESPITE CARE B
  - 1 disabled child 25/1
  - 2 disabled children* (1 family)
  - 2 family members 7/1, 19/1

- RESPITE CARE C
  - 1 disabled child* (temporary resident)
  - 2 disabled children* and 1 family member 17/3
  - 2 family members 7/3, 13/3

- CENTRE D
  - 1 temporary resident*
  - 11 permanent residents 20/1-10/2
  - 1 family member 17/2

*asymptomatic infection

**dates of illness onset (1993 unless stated) are given for those with symptomatic infection
Immunisation status of children at school entry in the Wentworth Health Area, 1992

Time: 12 minutes presentation, 3 minutes discussion

SLIDE - Title

P Whitehead, J Bell, T Chey, B Jalaludin, W Smith, A Capon

Comment - on the appalling choice of colour for the slides

I am presenting the results of a survey of the immunisation status of children at school entry in the Wentworth Health Area this year

Introduction

In Australia, immunisations against diphtheria, tetanus, pertussis, poliomyelitis, measles, mumps and rubella are offered to all children. In New South Wales immunisation uptake is between 70 and 85 percent. To encourage its acceptance, the New South Wales Health Department has run a number of media campaigns promoting the benefits of immunisation. The Department is also developing a policy whereby all children entering school, preschool, long day care and playgroup will be required to provide documentation of their immunisation status.

SLIDE - Aims

Our study aims were: first, to determine the prevalence of immunisation uptake in children starting school; second, to compare immunisation levels between Catholic, Government and Independent schools; third, to identify immunisation providers; fourth, to document
parental beliefs in immunisation and their influence on immunisation status and finally, to identify risk factors for incomplete immunisation.

**SLIDE - Method**

We surveyed children enrolled in kindergarten for the first time in 1992, in the Wentworth Health Area. The Wentworth Health Area encompasses the area west of Sydney between Penrith and Katoomba. We stratified schools into three groups; Catholic, Government and Independent. Each educational authority provided a list of primary schools in the area. Within each stratum, schools were randomly sampled, with probability proportional to the size of the kindergarten population. Five Catholic, ten Government, and five Independent schools participated. Within each participating school, we included all children entering kindergarten in the study; a total of one thousand and 66 (1066) children. A covering letter, consent form and a questionnaire were given to each child to take home. The questionnaire was completed by a parent or guardian, and returned to the class teacher. A member of the Public Health Unit collected questionnaires from the schools.

**SLIDE - Results**

The one thousand and 66 (1066) children sampled, represent about 40% of all children enrolled in kindergarten in the Wentworth Health Area this year. \( n=2610 \)

**SLIDE - Response**

This slide shows the response rates. Completed questionnaires were obtained from 91% of the children selected. Of these 966 children, 350 were from Catholic schools, 532 from Government schools, and 84 from Independent schools. The response rate from Independent schools was significantly lower than that from Catholic and Government schools. The mean age of the children is 5.2 years. Approximately one-third were younger
than five when they started school, and two-thirds had passed their fifth birthday. The average age of respondents is 33 years, with a range from 21 to 47 years.

SLIDE - Immunisation status I

Nearly 89% of the children are fully immunised. They had received three injections of Triple Antigen or a combination of Triple Antigen and combined diphtheria-tetanus, a Measles/Mumps vaccination, and the 18 month and preschool boosters. Almost 11% are incompletely immunised, including four children who have not received any vaccinations at all.

There is no difference in immunisation status between the three school types.

SLIDE - Immunisation status II

This slide shows that most children (97-99%) had received three Triple Antigen injections, a measles/mumps vaccination and the 18 month triple antigen booster.

About 91% reported that their child had received a pre-school booster.

(Limitations) This was a self administered questionnaire. The high immunisation levels reported here may reflect a bias in parental recall. We did not validate immunisation status against records or serological markers. Standard immunisation records are not available for this cohort of children, and there are fiscal, administrative, and ethical problems with serological testing.

SLIDE - Immunisation providers

General practitioners are the main providers of immunisation services, providing all immunisations for about 72% of children. Local councils provide all immunisations for only 4%. A combination of general practitioners, local councils or other places provide immunisations for 24%.
Using logistic regression, we examined the effects on immunisation status of demographic factors, parents educational level, ethnicity, beliefs and reminder letters. This slide lists the variables included in the model.

We calculated crude and adjusted odds ratios. Adjusted odds ratios were similar to crude odds ratios, and only adjusted odds ratios are presented.

**SLIDE - Age**

Odds ratios refer to the risk of incomplete immunisation. Odds ratios greater than 1 indicate that this group of children is more likely to be incompletely immunised compared with the reference group. Odds ratios less than 1, indicate groups more likely to be fully immunised. This slide shows that children younger than 5 had marginally lower immunisation prevalence than children aged 5 years and over.

The fact that children younger than 5 years of age have lower immunisation levels is probably related to the pre-school booster immunisation. Similar percentages of children under five years old, and five years and over, were immunised with Triple Antigen, a Triple Antigen Booster and Measles/Mumps. The percentage of children who received a pre-school booster is significantly lower in children under five years (88%) than in children five years and over (93.5%). \( X^2_{df=1}=5.1; \ p=0.02 \) NH & MRC guidelines recommend that the pre-school booster should be given at five years of age or prior to school entry. Even though a child has started school, parents may be waiting for the child’s fifth birthday before immunising.

**SLIDE - Education**

This slide shows the odds ratios for incomplete immunisation, according to parental
education level. Children of respondents with post-secondary education are more than twice as likely not to be completely immunised, compared with children of parents who had no post-secondary education.

When levels of post-secondary education are considered, children whose parents have a bachelor degree or higher are more than 4 times more likely to be incompletely immunised than children whose parents have only secondary education. We are surprised that children whose parents have post-secondary qualifications are less likely to be fully immunised than children of parents without post-secondary education. Better health knowledge and behaviours are usually associated with higher educational levels.

SLIDE - Ethnicity

Looking at ethnological variables, children who were born outside Australia are three times more likely to be incompletely immunised than children born in Australia. The parents country of birth did not influence children’s immunisation status significantly. However, if respondents do not speak English at home, their children are six times more likely to be partly immunised than children with an English speaking background. Confidence intervals are wide, since only a small number of respondents do not speak English at home. This suggests that communication is important in determining immunisation levels, and that specific ethnic groups should be targetted in their primary language.

SLIDE - Beliefs

We asked about beliefs in the importance of immunisation, the effectiveness of immunisation in preventing childhood diseases, and the safety of immunisation. These beliefs seem to be important. The likelihood of incomplete immunisation increases as the belief becomes more negative.
Those who thought immunisation is quite important are 3 and 1/2 times more likely to have children who are incompletely immunised than those who thought immunisation is very important. Those who think that immunisation is either not very important, or not important at all, are 5 times more likely to have children who are only partly immunised compared with those who think it is very important. Beliefs in effectiveness and safety of immunisation yielded similar results. The majority of respondents believe that immunisation is very or quite important, effective and safe. Numbers are very small in the more negative groups, and confidence intervals are therefore wide.

SLIDE - Reminder letters

We looked at the effect of reminder letters on immunisation status and found that the receipt of reminder letters did not increase immunisation uptake. This is an administratively important finding. Reminder letters theoretically increase immunisation uptake. We found that they make no difference. This may be characteristic of the Wentworth Health Area. Reminder letters are usually distributed by local councils, and in the Wentworth Health Area, local councils are minor providers of immunisation. High levels of immunisation are important to protect the community from childhood infectious diseases. To monitor immunisation levels, we need a standardised approach to compare children’s immunisation status between states and between population sub-groups.

SLIDE - Summary I

In summary, we found that approximately 89% of children entering school in the Wentworth Health Area are reported to be fully immunised. Immunisation prevalence does not vary between school types. General practitioners are the main providers of immunisation services. Reminder letters have little effect on immunisation status.
SLIDE - **Summary II** Incomplete immunisation is associated with more negative beliefs in immunisation, with post-secondary education and with families who do not speak English at home.

SLIDE - **Acknowledgements**

I would like to acknowledge the help of my colleagues at the Western Sector Public Health Unit.
Appendix 7: NSW Public Health Network Conference 1992

Title

Why investigate minor outbreaks of gastrointestinal illness?

Thank you to Mike Lane and Aileen Plant for their help with this presentation.

On the Monday of the June long weekend this year, the Western Sector Public Health Unit was notified of twelve people who had presented to a local hospital that day, with gastroenteritis. They had all been attending a church camp during the long weekend.

I was so excited. It was my first investigation.

I telephoned the hospital for more information. Yes, twelve people had attended with diarrhoea and vomiting. No, no specimens had been taken.
I rang the head of the church. But he was out at the campsite checking that everything had been cleaned and tidied up. The receptionist said that a few people had become ill, but it was nothing serious.

My initial rush of enthusiasm faded.

When I did speak to the head of the church, he said that the camp was an annual youth camp. About 200 people from around NSW had attended. A few people, about 25, had become ill. He felt that the cause was the spread of pre-existing illness among the campers. People with recent illness had attended the camp, and conditions may have been ideal for illness to spread, because a large number of people were gathered together, especially for church services. New gas heaters had just been installed in the chapel, and
people were crowded together in this close, warm atmosphere. He was less than enthusiastic about us investigating further.

We did investigate because a large number of people had become ill in a short period of time. We wanted to determine the cause.

There may have been wider public health implications. And, it would also be a good training exercise for me.

The pastor couldn’t give me the names and addresses of those who attended the camp. But he could get, from each church, the approximate number of people who attended.

I was told that the main caterer could not be contacted. A pastor’s wife who had helped with the catering, gave me a list of the foods eaten. Meals had been prepared in the main kitchen and everyone had eaten together in the dining hall.

The head of the church and I agreed to send a questionnaire to the churches, to be distributed to those who attended the camp. After checking the questionnaire, he was able to procure a list of names of the campers, their local church and pastor.

I contacted the pastors of the churches. They were happy to help. After speaking to them, reports of the number who became ill, varied from 25 to 40 or more. I sent bunches of
questionnaires with explanatory letters and reply paid envelopes to the pastors, who were asked to distribute them to all campers. I emphasised the importance of all campers completing the questionnaire, not just those who were sick.

The questionnaire elicited demographic information, and information about gastrointestinal illness prior to, during, and after the camp. I also asked the campers to complete a food history and to provide information about their activities at the camp.

A total of 232 questionnaires were sent. 111, or nearly 48%, were returned.

Of the 111 respondents, 63 (56.8%) were female, 47 (42.3%) were male, and one person did not answer this question. The age range was 1 to 69 years, with a mean of 24 years.

Nine people reported being ill before the camp - three had a cold or influenza-like illness, and six had gastrointestinal symptoms. I excluded these nine people from the analysis.

Of the 102 campers who were not ill before the camp, 71 reported becoming ill with gastrointestinal symptoms during or after the camp. These 71 represent 31% of all campers, and 70% of respondents who were not ill before camp. Twenty-seven people were not ill, and four did not say whether they were ill or not.
The epidemiologic curve shows that most people became ill from the Sunday of the long weekend to the following Wednesday. The incidence of illness was greatest during the night of Sunday and early morning of the Monday. The sudden onset of gastrointestinal illness suggests a common or point source.

Four people became ill approximately one week after the camp finished. This suggests secondary spread, indicating an infectious agent, rather than a toxin.

This slide is a list of symptoms and the frequency with which they were reported. Nausea, vomiting, fever, and headache were the most common symptoms. Over 50% of those ill experienced these symptoms. Symptoms are typical of food-borne gastroenteritis, and do not rule in or out any particular agent. Possible sources are food, water, and crowding.

I calculated food specific attack rates for the food prepared and eaten at the camp. Nineteen people were excluded from this analysis; those who were ill before the camp, four who didn’t say whether they were ill or not, one who did not give a food history, and the four whose onset of illness was nearly a week later.
This slide shows the foods with the highest attack rates, and the odds ratios. Given the limitations of retrospective food histories, none of the foods are uniquely associated with this illness. The difference between attack rates of those who ate the foods and those who didn’t were not significant. For all foods, 95% confidence intervals around odds ratios include one.

<table>
<thead>
<tr>
<th></th>
<th>% Ill, who ate the food</th>
<th>% Ill, did not eat food</th>
<th>OR</th>
</tr>
</thead>
<tbody>
<tr>
<td>chicken mexican</td>
<td>87</td>
<td>66</td>
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</tr>
<tr>
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</tr>
<tr>
<td>roast pumpkin</td>
<td>77</td>
<td>59</td>
<td>2.3</td>
</tr>
</tbody>
</table>

The campsite is supplied by the Windsor water supply. The water supply is unlikely to have been the cause of the outbreak. The hospital did not observe a marked increase in attendances for gastrointestinal illness from other residents in the area. It was also unlikely that the water supply to the camp itself, was the cause, because the caretakers who live there permanently, were not, and had not been ill. Also, the camp has been used since the June long weekend, and no further outbreaks of illness have occurred.

Secondary spread to other household members indicates that the cause was likely to be infectious. Eleven of those ill reported that other members of their household who had not attended the camp, became ill after they returned home. Of the four who attended the camp, and were ill one week later, three had other family members who attended the camp and 2 of these 3 were ill at the camp. I did not gather information on all members of all
households, and so cannot calculate a household secondary attack rate.

The illness may have been brought in and transmitted by those who had been ill in the preceding week. Conditions were ideal for an infectious agent to spread. People were cooped up together for extended periods of time. One woman with gastrointestinal illness before the camp, helped in the kitchen. Although she reported that she had recovered by the start of the camp, she may have contributed to transmission of the illness.

The illness was serious. Forty-five, nearly two-thirds of those ill, were sufficiently sick to lose time from school or work. The time lost ranged between one and six days. A total of 112 days was lost. The mean number of days lost was 2.5.

Thirty-one of the 71 patients consulted a doctor or hospital due to the illness.

And, many reported that their camp activities included tending the sick.

This investigation illustrates some of the problems associated with field investigation of outbreaks well after they occur.
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And, many reported that their camp activities included tending the sick.

This investigation illustrates some of the problems associated with field investigation of outbreaks well after they occur.
Everyone knows that when a government health agency is on to you, it’s not good news. As soon as the head pastor heard that the camp was being investigated, he was out at the camp, supervising the cleanup.

No food remained for sampling.

I could not contact the campers directly. I was given a list of campers’ names only, no addresses and no phone numbers. I had difficulty obtaining a list of the food and meals provided. I was not allowed to speak to the main caterer and had to rely on the pastor’s wife’s memory.

Poor response rates are a likely source of selection bias. Our response rate was only 48%. People who return questionnaires are more likely to be those who are ill. And in our study, two-thirds of respondents were ill.

Past exposures are more likely to be more vivid or meaningful to cases, if they are aware of potential risk factors for the illness. People who have had gastroenteritis probably remember differently which foods they ate, compared with those who do not become ill.
Questionnaires were not received by campers until at least one week after the camp. And after this, it was a long time before some questionnaires were returned. Initially 84 were returned, and then a block of 27 arrived much later. The quality and accuracy of the data is influenced by the time between the disease occurring and when people are expected to remember something that happened in the past.

We are unable to determine the probable source of the illness. Although twelve people from one campsite with gastrointestinal symptoms, attended an accident and emergency department, no specimens were collected. Four respondents did report that they had specimens taken, but I didn’t follow them up because I hadn’t ask their permission to do so, and I also did not have direct contact with them.

These difficulties are often cited as reasons or excuses for not investigating so-called minor outbreaks of gastrointestinal illness.
But, in spite of these difficulties, we were able to show that the cause of the illness was almost certainly an infectious agent and was possibly the spread of pre-existing illness. It is important to be able to rule out exposure to agents to which other members of the public may also be exposed. In this outbreak, the source was unlikely to have been a particular food or the water supply.

What at first may appear to be a minor outbreak, may be an under-estimation of the extent of the illness. In our minor outbreak, 71 people were ill, 112 days were lost from school or work, and 31 people consulted a doctor or hospital. Although we could not estimate the cost of this outbreak, it was considerable.

It is also important to establish a reputation for responding to such notifications. Although the church may not have appreciated our interest, our response will make it more likely that we will be notified by that hospital again. Compared with laboratory notifications for individual cases, surveillance for outbreaks relies on someone noticing something extraordinary, and actively reporting it.

If we are known to respond, then we are more likely to be notified again.

And it was good training for me. Thankyou.

---

**so, why investigate?**

- to exclude continuous source of exposure
- to determine extent of outbreak
- to establish a reputation for action
Which children are not fully immunised?

Time: 10 minutes presentation, and 5 minutes discussion

I would like to acknowledge the help of my colleagues at the Western Sector Public Health Unit.

J Bell, B Jalaludin, P Whitehead, T Chey, W Smith, A Capon

Authors: J Bell* B Jalaludin P Whitehead T Chey W Smith A Capon

Western Sector Public Health Unit
*and National Centre for Epidemiology and Population Health
Aims

We surveyed parents of children entering kindergarten in the Wentworth Health Area in 1992.

Our study aims were: first, to determine the prevalence of immunisation uptake in children starting school; second, to document reasons for incomplete immunisation; third, to determine parental beliefs in immunisation and their influence on immunisation status and finally, to identify risk factors for incomplete immunisation.

Method

We surveyed children enrolled in kindergarten for the first time in 1992, in the Wentworth Health Area. The Wentworth Health Area encompasses the area west of Sydney between Penrith and Katoomba.

We stratified schools into three groups; Catholic, Government and Independent. Within each stratum, we randomly sampled schools, with probability proportional to the size of the kindergarten population. Five Catholic, ten Government, and five Independent schools participated. Within each participating school, we included all children entering kindergarten in the study; a total of one thousand and 66 (1066) children. A covering letter, consent form and a questionnaire were given to each child to take home. The questionnaire was completed by a parent or guardian.
Limitations

This was a self administered questionnaire. We did not validate immunisation status against records or serological markers. Standard immunisation records were not available for this cohort of children, and there are financial, administrative, and ethical problems with serological testing.

Results

The one thousand and 66 (1066) children sampled, represented about 40% of all children enrolled in kindergarten in the Wentworth Health Area in 1992. \( n = 2610 \)

Completed questionnaires were obtained from 91% of the children selected. The mean age of the children was 5.2 years. Approximately one-third were younger than five when they started school, and two-thirds had passed their fifth birthday.

Nearly 89% of the children were fully immunised. They had received three injections of Triple Antigen or a combination of Triple Antigen and combined diphtheria-tetanus, a Measles/Mumps vaccination, and the 18 month and preschool boosters. Almost 11% were incompletely immunised, including four children who had not received any immunisations at all. There was no difference in immunisation status between the three school types.
Most children (97-99%) had received three Triple Antigen injections or a combination of triple antigen and combined diphtheria-tetanus, a measles/mumps vaccination and the 18 month triple antigen booster.

About 91% reported that their child had received a pre-school booster.

Complete pertussis immunisation was reported for only 82% of children.

The high immunisation levels reported on this slide may reflect a bias in parental recall.

### Reasons

Ninety respondents gave reasons for incomplete immunisation. We grouped reasons for incomplete immunisation into seven general categories.

Receipt of professional advice against immunisation, and parental indifference were the two most common reasons given for incomplete immunisation. Indifference included reasons such as "I didn't get around to it" and "I find it difficult to remember when immunisations are due". Of those who did not receive all pertussis immunisations, the main reason given was "professional advice against it". The main reasons given by those who had received all immunisations except the pre-school booster, were that immunisation schedules were "difficult to remember", or that "they didn’t get around to it".

<table>
<thead>
<tr>
<th>Type of vaccine</th>
<th>Per cent of respondents fully immunised</th>
</tr>
</thead>
<tbody>
<tr>
<td>triple antigen (or TA/CDT)</td>
<td>99</td>
</tr>
<tr>
<td>measles/mumps</td>
<td>98</td>
</tr>
<tr>
<td>triple antigen booster</td>
<td>97</td>
</tr>
<tr>
<td>pre-school booster</td>
<td>91</td>
</tr>
<tr>
<td>pertussis</td>
<td>82</td>
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</table>

<table>
<thead>
<tr>
<th>Reasons for incomplete immunisation*</th>
<th>No. times cited</th>
</tr>
</thead>
<tbody>
<tr>
<td>parental indifference</td>
<td>32</td>
</tr>
<tr>
<td>professional advice</td>
<td>28</td>
</tr>
<tr>
<td>personal beliefs</td>
<td>12</td>
</tr>
<tr>
<td>child’s ill health</td>
<td>8</td>
</tr>
<tr>
<td>severe or allergic reaction</td>
<td>6</td>
</tr>
<tr>
<td>lack of access</td>
<td>5</td>
</tr>
<tr>
<td>other reasons</td>
<td>11</td>
</tr>
<tr>
<td>Total</td>
<td>90</td>
</tr>
</tbody>
</table>

*Parents could give more than one reason
Personal beliefs about whether immunisation is important, and balancing side effects and benefits were also important. Inappropriate contraindications, such as minor illnesses or ill health, were reported as reasons for non-compliance with immunisation.

Five parents reported difficulties accessing immunisation services, due to times of immunisation clinics, lack of private transport, and the cost of visiting the local doctor. Only one parent reported family relocation as a reason for incomplete immunisation.

**Logistic regression**

We examined the effects of demographic factors, ethnicity, parents educational level, beliefs and reminder letters, on immunisation status using logistic regression. We calculated crude and adjusted odds ratios. Adjusted odds ratios were similar to crude odds ratios. Only adjusted odds ratios are presented.

Odds ratios refer to the risk of incomplete immunisation. The odds ratio for the reference group is 1. Where odds ratios are greater than 1, this indicates groups of children more likely to be incompletely immunised compared with the reference group. Odds ratios less than 1, indicate groups more likely to be fully immunised.
This slide shows that children 5 years and older are the reference group. When compared with them, children younger than 5 were 1.6 times more likely to be incompletely immunised.

The fact that children younger than 5 years of age had lower immunisation levels was probably related to the pre-school booster immunisation. Similar percentages of children under five years old, and five years and over, were immunised with Triple Antigen, a Triple Antigen Booster and Measles/Mumps. The percentage of children who received a pre-school booster is significantly lower in children under five years (88%) than in children five years and over (93.5%). \( X^2_{df=1}=5.1; p=0.02 \)

NH & MRC guidelines recommend that the pre-school booster should be given at five years of age or prior to school entry. Even though a child had started school, parents may have been waiting for the child’s fifth birthday before immunising. Documenting immunisation status at school entry is likely to increase pre-school booster uptake.

Children of respondents with post-secondary education were more than twice as likely not to be completely immunised, compared with children of parents who had no post-secondary education.

When levels of post-secondary education were considered, children whose parents had a bachelor degree or higher were more than 4 times more likely to be incompletely immunised.
immunised than children whose parents had no post-secondary education.

We were surprised that children whose parents had post-secondary qualifications were less likely to be fully immunised than children of parents without post-secondary education. Better health knowledge and behaviours are usually associated with higher educational levels.

Looking at ethnological variables, children who were born outside Australia were 3 times more likely to be incompletely immunised than children born in Australia. Confidence intervals are wide, since only a small number of children were born overseas.

The parents country of birth did not influence children’s immunisation status significantly. However, if respondents did not speak English at home, their children were 6 times more likely to be partly immunised than children with an English speaking background.

This suggests that communication is important in determining immunisation levels, and that specific ethnic groups should be targetted in their primary language.

We asked about beliefs in the importance of immunisation, effectiveness of immunisation in preventing childhood diseases, and the safety of immunisation. These beliefs seem to be important. The likelihood of incomplete immunisation increased as the belief became more negative. Numbers were very small in the more negative groups, and confidence intervals are therefore wide.
Beliefs in effectiveness and safety of immunisation yielded similar results. The majority of respondents believed that immunisation was very or quite important, effective and safe.

These results show that parents need to be convinced of the benefits of immunisation.

Reminder letters theoretically increase immunisation uptake. We found that they made no difference. This is an administratively important finding. It may be characteristic of the Wentworth Health Area. Reminder letters are usually distributed by local councils, and in the Wentworth Health Area, local councils are minor providers of immunisation.

To maintain high levels of immunisation in the community, health care professionals and parents need to be convinced of the benefits of immunisation.

General practitioners are the main providers of immunisation services in the Wentworth Health Area, and have an important role in encouraging immunisation uptake. Low pertussis immunisation prevalence and inappropriate contraindications, such as minor illnesses or ill health, suggest we need specific campaigns to encourage increased uptake. Health professionals should educated about contra-indications to immunisation.

High levels of immunisation are important to protect the community from childhood infectious diseases. To monitor immunisation levels, we need a standardised approach to compare children’s immunisation status between states and between population sub-groups.
Summary

In summary, we found that approximately 89% of children were reported to be fully immunised. Reminder letters had little effect on immunisation status.

Professional advice against immunisation and parental indifference were the most common reasons given for incomplete immunisation.

Incomplete immunisation was associated with more negative beliefs in immunisation, with post-secondary education and with families who do not speak English at home.

Thankyou
Follow up of 184 people exposed to Legionella bacteria, at a seminar for retired people.

Latebreaker session - 5 minutes presentation, and 5 minutes questions

SLIDE 1

Follow up of 184 people exposed to Legionella bacteria at a seminar for retired people.

J Bell, L Jorm, M Williamson, N Shaw, D Kazandjian

Aims:
1. to identify further cases of Legionellosis
2. to determine site of environmental exposure

I would like to acknowledge the help of my colleagues.

In April this year, the PHU in the western Sydney area identified four cases of Legionnaires' disease. All had illness onset on the 13th or 14th of April and all had Legionella pneumophila serogroup 1 cultured from specimens. Two cases had attended an investment seminar for retired people at a hotel on 7 April, another case had eaten at a take-away food shop 15 metres from the hotel on the same day, and the fourth case had visited the same area that day, but not within 1 kilometre of the hotel. Environmental sampling and testing of all known evaporative condensers and cooling towers in the area, and DNA fingerprinting, implicated the two evaporative condensers at the hotel as the most likely source of infection. To identify further cases of Legionellosis and to determine the site of environmental exposure, we conducted a cross sectional study of people who attended the seminar at the hotel on the afternoon of 7 April. We asked all who attended
the seminar to attend an outpatients clinic in early June, eight weeks after the presumed
exposure. At the clinic subjects completed a self-administered questionnaire about possible
risk factors for Legionellosis and were interviewed about their movements at the hotel and
around the local area on 7 April, and any illness between the 8th and 26th of April. A
blood sample was collected from each subject and sera were tested for total antibodies to
Legionella pneumophila serogroups 1-6. We defined clinical illness compatible with
Legionellosis as illness characterised by fever and/or two or more of the following
symptoms: cough, shortness of breath, chest pain, muscle aches and pains, severe
headache, dizziness, and diarrhoea.

SLIDE 2

<table>
<thead>
<tr>
<th>Response</th>
<th>152/184 (83%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>titre &lt;128:</td>
<td>78.3% seronegative</td>
</tr>
<tr>
<td>titre &gt;128:</td>
<td>21.7% seropositive</td>
</tr>
</tbody>
</table>

Group | Definition | Number |
------|------------|--------|
A     | compatible illness + seropositive | 9      |
B     | no compatible illness + seropositive | 24     |
C     | compatible illness + seronegative  | 19     |
D     | no compatible illness + seronegative | 100    |

Of those people who attended the seminar, 152 people participated. There were 92 males
and 60 females and their mean age was 61 years.

Thirty-three subjects (22%) had titres to Legionella pneumophila serogroup 1 of 128 or
higher. For the purposes of this talk, we regarded those with titres less than 128 as
seronegative, and those with titres of 128 or higher as seropositive. Twenty-eight subjects
reported symptoms compatible with Legionellosis in the period 8-26 April 1993.
To reduce misclassification bias, we classified subjects by clinical features and serological results into four groups. The nine subjects in group A had compatible illness and titres of 128 or higher. Those in group B were seropositive, but reported no compatible illness. Subjects in group C reported illness compatible with Legionellosis but titres were less than 128. Group D comprised two-thirds (66%) of subjects. They did not fulfill the clinical definition and were seronegative.

Using logistic regression, we examined risk factors for disease by subject group. Group D, those with no compatible illness and seronegative, are the reference group in each model. This slide shows the results of a model including age, sex, current smoking status, and use of the hotel car park, and for a second model replacing car park with use of the car park lift and use of the car park ramp.

Respondents in group A were over 14 times more likely to have used the car park (p=0.01) than group D. When use of the car park ramp and car park lift replaced car park in the model, group A subjects were 14 times more likely to have used the car park ramp (p=0.002) than group D, but were no more likely to have used the car park lift. Those in
group A were also 29 times more likely to be current smokers than those in group D (p=0.02).

We found no difference in risk factors between members of groups B and D.

Those in group C were over four times more likely to have used the hotel car park than those in group D, but were no more likely to have used the car park ramp or lift than group D. There was no difference in the other risk factors examined between members of groups C and D.

Discussion

Our logistic models indicate that the hotel car park was the site of exposure to Legionella. An engineering inspection indicated that it was possible for contaminated plume to have entered the car park through the fresh air intake. The fresh air intake is approximately 15 metres from the hotel first floor evap condenser, and on the same level. Air from this intake is not filtered and is ducted around, and released into the car park.

SLIDE 4

Public Health Implications

- wide spectrum of clinical illness
- variable serological response
- active surveillance is crucial
Our findings highlighted difficulties in defining illness caused by Legionella pneumophila SG-1 and in interpreting serological results, particularly with only one serum sample per subject. There is a wide spectrum of illness, and a large proportion of cases may not be recognised clinically, nor seroconvert. Only two who attended the seminar were originally diagnosed with Legionnaires’ disease, but our findings suggest that there were other cases. This demonstrates that to identify as many cases as possible, active surveillance is crucial.

It also illustrates that when sporadic cases occur, there may in fact be undiagnosed cases in the community, possibly infected from a common source.
Appendix 10: FETP Conference 1994

Hepatitis A presentation

Hepatitis A in a community of people with developmental disabilities in western Sydney, Australia, 1993.

10 minutes presentation, 10 minutes questions

SLIDE - title

I'm reporting an outbreak of hepatitis A, in a community of people with developmental disabilities. I would like to acknowledge the help of my co-authors.

SLIDE - map aust

In early February 1993, we were notified of a case of acute hepatitis A infection in a child living in an institution for people with developmental disabilities. Within two weeks of this case, other residents in the institution, all living in the same unit, which I'll refer to as Unit H, became ill, with hepatitis A IgM confirmed infections.

SLIDE - buildgs
The institution cares for approximately 270 residents with developmental disabilities in 11 residential units, and employs about 410 staff. Residents are children, adolescents and young adults, and the majority are long term residents. All have moderate to severe intellectual disability, and most have associated physical disabilities. They are housed according to type of disability. Unit H, where the cases were, cares specifically for children and adolescents. The institution also provides temporary care for some other disabled people.

SLIDE - aims

After receiving the initial notification we contacted the institution. We sought to limit the outbreak, to identify further cases, and to detect the possible source of infection. We also aimed to identify risk factors for serological evidence of hepatitis A infection in permanent residents.

SLIDE - method

Staff and other residents in Unit H, and close contacts of the cases were given human immunoglobulin. Staff at the institution tightened their hygiene practices and access to Unit H was limited. Medical and nursing staff monitored all residents in the institution.
closely for clinical evidence of hepatitis A infection. Staff were advised to contact their own doctor or see medical staff at the institution if they developed any signs or symptoms of illness.

Over a three day period, staff collected blood samples from residents. Sera were tested for hepatitis A IgM and total antibody using a radioimmunoassay technique. We defined recent or current infection as hepatitis A IgM positive, and past infection as total antibody positive and IgM negative.

SLIDE - method2

Staff also completed a short questionnaire about residents' behavioural risk factors for hepatitis A infection. Risk factors included whether residents fed themselves, were toilet trained, incontinent, coprophagic, and whether they smeared faeces, or manually evacuated themselves. We used logistic regression to identify risk factors associated with evidence of hepatitis A infection, defined as the presence of hepatitis A total antibody in serum.

We actively sought cases outside the institution. We contacted all institutions, hostels and respite care homes for people with developmental disabilities in the western Sydney area, as well as the Department of Community Services and other Public Health Units in our state. We reviewed our hepatitis A notification data and contacted recent and new
hepatitis A cases to ask about contact with people with developmental disabilities.

Our results: We identified 40 cases of acute hepatitis A infection in people with developmental disabilities and their contacts. Fourteen cases were linked with Unit H in the institution, and active surveillance revealed another 26 cases of acute infection.

SLIDE - result2
First, considering the cases at the institution. The 14 cases all occurred in Unit H. Of the 13 permanent residents, 11 had acute infections, and two had serological evidence of past infection.

Of the four disabled children who stayed in Unit H during January, two had acute asymptomatic infections, and one had been infected in the past. We were unable to test the fourth temporary care resident. The fourteenth cases was a nurse working in Unit H.

Transmission in the institution was unlikely to have been food or water borne. Meals were prepared in a central kitchen, and distributed to all units and the water supply was common to all units.

SLIDE - epicurve
Now, looking at the whole outbreak of 40 cases. This slide shows the epidemic curve of symptomatic cases. The outbreak began in December 1992, in the community, in family and staff of disabled children - shaded blue on the slide. It was introduced into the
institution from the community. Cases in permanent residents are coloured yellow. The cases in pink are other cases in disabled children.

SLIDE-linksB

This complicated slide shows the epidemiological links between 36 of the 40 cases. Cases were linked to a special school - on the left of the slide, to two respite care institutions, and to Unit H in the institution, on the RHS. Those with asymptomatic infections are shown in white. No direct epidemiological link could be found for four cases, of whom three were disabled children and one was a staff member from another special school.

SLIDE - result7

Of all 40 cases, 24 occurred in children with developmental disabilities. Eleven were permanent residents, and 13 occurred in other children with developmental disabilities. Sixteen cases occurred in family contacts and staff.
I will now discuss the seroprevalence study of permanent residents in the institution.

SLIDE - result1

We obtained demographic information for over 98% (266/270, 98.5%) of the 270 permanent residents at the institution. Ninety (34%) were female, and 176 (66%) were male. Their mean age was 25 years, and the mean length of time they had lived in the institution was 14 years. Unit H residents were significantly younger and had also lived there for significantly less time than other permanent residents. This difference was expected as Unit H reopened in 1992 to care specifically for children.

SLIDE - seroll:

Blood samples were collected from 259 of the 270 (96%) permanent residents. Serological testing revealed evidence of past infection in 117 residents. With the 11 cases from Unit H, a total of 128 (or 49%) showed serological evidence of HAV infection.

SLIDE - logreg2

We used logistic regression to determine risk factors for the presence of hepatitis A antibodies in permanent residents at the institution. This slide shows the significant adjusted odds ratios.
Residents’ age and length of stay in the institution had a small effect.

Of the 11 alphabetically named residential units, the presence of hepatitis A antibodies was associated with living in Units C, E, G, H and J.

Unit H was omitted from the slide because all were infected and odds ratios could not be calculated. Residents from Unit K were the reference group as this unit housed more residents than others and its residents were less disabled.

Residents’ sex and specific behavioural factors were not associated with evidence of hepatitis A infection.

**SLIDE - summary2**

In summary, it is likely that hepatitis A virus was brought in to the institution from the community and was probably transmitted by the faecal-oral route.

After we were notified of the first case at the institution, another 10 permanent residents, one staff member, and two temporary residents, all from Unit H, had acute hepatitis A infections. In addition to the 14 cases at the institution, 26 cases occurred in the community - a total of 40 cases.

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<table>
<thead>
<tr>
<th>Variable</th>
<th>Adjusted odds ratio</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>age</td>
<td>1.1</td>
<td>1.0-1.2</td>
</tr>
<tr>
<td>stay</td>
<td>1.1</td>
<td>1.0-1.1</td>
</tr>
<tr>
<td>Unit C*</td>
<td>4.5</td>
<td>1.3-16.1</td>
</tr>
<tr>
<td>Unit E*</td>
<td>16.1</td>
<td>3.3-79.4</td>
</tr>
<tr>
<td>Unit G*</td>
<td>4.7</td>
<td>1.3-16.6</td>
</tr>
<tr>
<td>Unit J*</td>
<td>6.6</td>
<td>1.6-27.2</td>
</tr>
</tbody>
</table>

*All units are compared with Unit K.*

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Summary

- source of infection: community, faecal-oral transmission
- limit of outbreak and identify cases: Unit H, 40 cases
- risk factors for presence of anti-HAV: living in certain residential units
- role HAV vaccine

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267
The presence of hepatitis A antibodies in permanent residents was associated with living in specific residential units. Although specific behavioural factors were not associated with serological evidence of HAV infection, they probably contributed to the ready transmission to other susceptible residents in the same unit. Residents are grouped according to disability, and all residents require help with daily activities. The pool of susceptible people can be quickly exhausted. This is illustrated by the 100% attack rate in susceptible residents in Unit H.

In conclusion, in this outbreak, 24 children with developmental disabilities, four employed carers of these children and 12 of their family contacts acquired hepatitis A infection. Also, more than half of the permanent residents in the institution were susceptible to hepatitis A infection. At the time of the outbreak, hepatitis A vaccine was not licensed in Australia. A safe and efficacious hepatitis A vaccine is now available. People with disabilities, their carers, and family members are obvious target groups for hepatitis A immunisation.
Appendix 11 : FETP Conference 1994

Legionnaires’ disease presentation

10 minutes presentation, 10 minutes questions

A seminar for 184 retired people: were they exposed to *Legionella*?

SLIDE - title

I’m presenting an investigation we carried out, after two cases of Legionnaires’ disease were found to have attended the same investment seminar.

I’d like to acknowledge the help of my co-authors.

SLIDE - method

We connected by mail all 184 attendees to assess whether they had been exposure.

SLIDE - Aust

In April 1993, we identified 4 cases of Legionnaires’ disease. All had illness onset on the 13th or 14th of April and all had *Legionella pneumophila* serogroup 1 cultured from specimens. Two cases had attended an investment seminar for retired people at a hotel on 7 April, another case had eaten at a take-away food shop 15m from the hotel on the same day. The fourth case had visited the same area that day, but not within 500 metres of the hotel. Environmental sampling and testing of all
known evaporative condensers and cooling towers in the area, and DNA fingerprinting, implicated the two evaporative condensers at the hotel as the most likely source of infection. Legionella pneumophila serogroup 1 was isolated from the hotel’s first floor and rooftop cooling towers and DNA fingerprinting of these environmental cultures and from all cases’ specimens matched.

SLIDE - aims
We aimed to identify further cases of Legionellosis and to determine the site of environmental exposure. We conducted a cross-sectional study of people who attended the investment seminar at the hotel on the afternoon of 7 April 1993.

SLIDE - method
We contacted, by mail, all who attended the seminar and asked them to attend an outpatients clinic in early June, nine weeks after the presumed exposure. At the clinic subjects completed a self-administered questionnaire about possible risk factors for Legionellosis, including age, sex, occupation, chronic illnesses, medications, and smoking and alcohol intake. Using a standardised questionnaire, interviewers recorded details of subjects’ movements at the hotel and around the local area on 7 April and of any illness between the 8th and 26th of April.
We felt that an investment seminar was an extra-ordinary event, and that circumstances related to it would be likely to be remembered. To aid recall and minimise bias, we asked subjects about illness in the period between the seminar and the Anzac Day Public Holiday on 26th April, an important public holiday in Australia, and a period which included the Easter holiday.

We defined clinical illness compatible with Legionellosis as illness characterised by fever and/or two or more of the following symptoms: cough, shortness of breath, chest pain, muscle aches and pains, severe headache, dizziness, and diarrhoea.

A blood sample was collected from each subject. Using indirect fluorescent antibody test (IFA), sera were tested for total antibodies to *Legionella pneumophila* serogroups 1-6 using pooled antigen. Subjects whose titres were 128 or more, were then tested with monovalent antigens of serogroups 1-6 and also tested for IgM antibodies.

The Bureau of Meteorology supplied wind direction data from the two closest meteorological stations.

SLIDE - result1

184 people attended the seminar, and 152 (or 83%) participated in this study. There were 92 males and 60 females and their mean age was 61 years. (range 43-79)
Appendix 12 : Media releases and responses to our media releases
Health risk to children

By STEPHANIE PURCELL

PARENTS have been warned to immunise their children following an outbreak of measles and whooping cough in the Penrith and Blue Mountains area.

The Western Sector Public Health Unit recorded a significantly higher number of cases of measles and whooping cough in the local area during October than in previous months.

"NSW Health" Department director of epidemiology Dr George Rubin said the outbreak was primarily due to low immunisation rates, showing 30 per cent of children had not been administered with vaccine.

Dr Rubin said outbreaks occurred in NSW every three to four years because so many children were unimmunised and numbers needed to increase to 95 per cent to control the potentially fatal disease.

He urged parents to have babies protected with Triple Antigen vaccine, which immunises against whooping cough, tetanus and diphtheria and should be given at the ages of two months, four months, six months and a booster dose at 18 months.

If parents are not sure if their children have immunity to measles, children should still be given the vaccine as a second dose would not be harmful.

The symptoms of whooping cough included spasms of coughing with a high pitched tone, and early stages of measles showed a rash, fever and flu-like running nose.

"What could be a mild cough in an adult may be a serious disease in babies," Dr Rubin said.

Penrith Star
24 November 1992
Ensure children are immunised

An increase in cases of whooping cough and measles has prompted an urgent warning to have children immunised.

Wentworth Area Health Service public health director Tony Capon has urged parents to ensure their children are fully protected.

"The number of cases of measles and whooping cough reported to the public health unit in October was higher than in previous months," Dr Capon said.

"Most of the reported cases of whooping cough live in the Lower Mountains. Measles has been reported mainly from the Windsor area.

"Whooping cough can be a serious infection, especially in infants, but is preventable by immunisation."

The triple antigen vaccine provides protection against whooping cough. It is given at the ages of two months, four months, six months and a booster at 18 months.

The State Health Department recommends children be vaccinated against measles when they are 12 months old.

Dr Capon said a second dose of vaccine was not harmful if parents were unsure if children already had immunity to measles.

An outbreak of whooping cough and measles had been reported in other parts of NSW as well, he said.

Parents can obtain more information about immunisation from general practitioners, councils, community health centres or by phoning the Western Sector Public Health Unit on (02) 890 6060.
Important to Immunise

Parents have been urged to make sure their children are fully immunised, following an increase in measles and whooping cough.

"The number of cases of measles and whooping cough reported to the Public Health Unit in October was higher than in previous months," Dr. Tony Capon, Director of Public Health in the Wentworth Health Area, said this week.

"Most of the reported cases of whooping cough live in the "Lower" Blue Mountains. Measles has been reported mainly from the Windsor area.

"Triple antigen vaccine provides protection against whooping cough. It is given at the ages of two months, four months, six months and a booster at 18 months.

"The NSW Health Department recommends that children be vaccinated against measles when they are 12 months old. Dr. Capon said that if parents are not sure whether their children have immunity to measles, the children should still be given the vaccine. A second dose of vaccine is not harmful.

"Parents can obtain further information about immunisation from their general practitioners, local councils, the "Western" Sector, Public Health Unit (02) 890-6060 or from their local community health centre.

Blue Mountains Gazette
25 November 1992
A LOCAL State MP has launched a crusade against compulsory child immunisation, claiming the public is ill-informed about its disadvantages.

Carl Scully (Labor, Smithfield) says most parents are simply not aware vaccines do not work all the time and that they can be a health hazard.

He used his entire year’s parliamentary printing allowance to produce a 250-page book, Immunisation: Is It Worth The Risk? to back his campaign.

It was to help fellow MPs last week debate against a new law requiring documented proof of children’s immunisation.

The law was passed and Mr Scully’s book will now go into local libraries and at his office (his electorate includes South Wentworthville, Greystanes and Merrylands West).

“I’m not telling people not to immunise their kids,” he emphasises. "That’s their business. "I’m asking them to question the worth of immunisation, to read the counter-arguments and ask whether the Health Department’s obsession with getting immunisation rates up is worth it.”

He says he is “passionately interested” in the issue because he fears modern society’s lazy approach to health is leading us to poor health later in life.

State Health Minister John Hannaford replied: “Immunisation has prevented more suffering and saved more lives than any other medical intervention in this century.

"It is one of the safest and most effective procedures in modern medicine..."
14 December 1992

Media release: Immunisation

"Parents should be aware that the benefits of immunisation far outweigh any disadvantages. So-called minor children’s diseases can have serious complications" Dr Tony Capon, Director of Public Health in the Western Sydney Area, said in response to a recent report by Carl Scully (Member of Parliament, Smithfield). "Side effects of immunisation are far less frequent than the complications caused by the diseases themselves."

A general practitioner in child health in the Blacktown area, Dr Michael Fasher, said that this anti-immunisation propaganda endangers the health and welfare of children in western Sydney. "The generation of people who taught me worked in a children’s hospital filled with paralysed children in iron lungs. The horror of widespread polio, tetanus and diphtheria has been forgotten in the general population, and this is the only reason Mr Scully might be taken seriously" he said.

Even though standards of living have improved, these preventable diseases still occur. When they do occur, the chances of serious complications are as high as they were in the past. This year, in New South Wales, reported cases of measles, whooping cough and
rubella have increased. Nearly 480 cases of measles have been reported to the Health Department. Not enough children are immunised. The large number of unimmunised children means that these diseases can easily spread.

If parents would like more information about immunisation they should ring their family doctor, their community health centre or the Public Health Unit, phone 890 6060.

spokesperson: Jane Bell  phone 890 6060
Dr Tony Capon, Director of Public Health for Western Sydney, said benefits of immunisation far outweighed any disadvantages.

"Mr Scully is not exaggerating when he insists on compulsory vaccination of children," he said. "No one should be threatened and coercion is against the law." But there are a lot of people who believe there is a relationship so it is worth checking."

Carl Scully (Lab, Smithfield) is crusading against compulsory vaccination of children by saying parents were not fully informed of the ill-effects (Mercury, December 3).

"So-called minor children's diseases can have serious complications," Dr Capon said, "such as Side effects of immunisation are far less frequent than the complications caused by the diseases themselves.

Parramatta, MP, Andrew Zolkower, feared parents would be scared off protecting their children against diseases spreading outbursts of childhood diseases.

Dr. Walfred Levy, Newcastle Hospital, said there had been a few deaths when resistance was blunted for brain damage and an epidemic swept the country. A few children had complications with tetanus and whooping cough when immune for whooping cough.

"Extensive research suggests there is no relationship between immunisation and sudden infant death syndrome in 500 babies born to two parents."

"But there are a lot of people who believe there is a relationship so it is worth checking," Dr Capon said.

"Prof. Dr. Walfred Levy, Newcastle Hospital, said there had been a few deaths when resistance was blunted for brain damage and an epidemic swept the country. A few children had complications with tetanus and whooping cough when immune for whooping cough."

"Extensive research suggests there is no relationship between immunisation and sudden infant death syndrome in 500 babies born to two parents."

"But there are a lot of people who believe there is a relationship so it is worth checking," Dr Capon said.

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"But there are a lot of people who believe there is a relationship so it is worth checking," Dr Capon said.
One of the pro-immunisation letters in the local press:

**LETTER TO THE EDITOR**

**Mother's plea for immunisation**

SIR.—On Friday, September 12, 1986 at 8.10 a.m. I entered my daughter's room to check on her. She laid motionless. I picked her up and looked. She was as white as a sheet. Her tiny body was limp in my arms with her eyes rolled back. She was making little moaning sounds. At first I panicked and started running around the house screaming with her in my arms. My husband had been in bed. He got up and in less than 10 minutes we were in casualty at Blacktown District Hospital. I was hysterical.

Nissa (my daughter) respiratory arrested within seconds of arrival. The staff resuscitated her, put a drip in her little arm and injected her with massive doses of penicillin. They called the paediatrician immediately. Initial diagnosis was missed cot death.

Midday: Nissa could not breathe without the aid of a respirator.

2 p.m.: Her little head was room than twice its original size.

5 p.m.: Nissa had been transferred to the Lower Todman Intensive Care Unit at Royal Alexandra Hospital for Children. She was considered moribund — for those ignorant of the term. — Nissa was dying and not expected to live through the night. Diagnosis: Haemophylic meningitis.

Nissa was nine weeks old and had contracted meningitis without any previous noticeable signs or symptoms. She went to her basinett on 11.2.86 as a normal two month old baby and never woke again as she is now 86 years old but she is profoundly intellectually disabled. She suffers from cerebral palsy, chronic chest infections, intante spasms which are now developing into grand mal seizures, cortical blindness and has never rolled, sat alone, had her hands in her face, licked a tablespoon, laughed at a clown nor any of a million experiences that a normal six year old has had.

For the past two years she has lived at Greysacres Children's Home,Laura of which I am a member of the executive board. These people are the saviours for families like my own.

I have not painted this grim picture to shock you. My story is true and no matter how many years past I will never forget that day. If the Hib vaccination was available then my Nissa would have been a normal little girl now.

To be bluntly honest I don't thank God for letting her live. I curse him. As I curse all fanatics out there who make your so called convincing arguments against all forms of immunisation. Visit your local institutions where we hide our mistakes and then take a good, long look at your own children. Can you let statistics control your judgement for children because I know for a fact statistics do not control bacteria.

Hazzlebrook.

— "ANGRY."

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Blue Mountains Gazette
Consequences highlighted

SIR. — "Angry's" letter in a recent Blue Mountains Gazette, highlights the serious consequences that infection with Haemophilus influenzae (Hib) can cause. "Angry"s" letter in a recent Blue Mountains Gazette, highlights the serious consequences that infection with Haemophilus influenzae (Hib) can cause. 

Haemophilus influenzae bacteria (Hib) mainly affect children. They cause meningitis (inflammation of the brain coverings), epiglottitis (blocked windpipe) and other serious life-threatening diseases.

Unfortunately for "Angry's" child, a vaccine against this disease was not available in 1986. Vaccines against Hib disease are now available. These vaccines are recommended for all children up to five years old. Hib vaccine is safe and effective.

Since the beginning of 1992, in the Wentworth area, 13 children younger than five years old have had meningitis or epiglottitis caused by Hib. Had the vaccine been available, all these children could also have been protected by immunisation.

If parents would like more information about immunisation against Hib disease, they should ring their family doctor, their community health centre or the Public Health Unit, phone (02) 890-6060.

ANTHONY CAPON.

Director,
Public Health Unit.

Blue Mountains Gazette
31 March 1993
I would like to reply to Warragamba’s Gail Young (letters, Press, March 23).

Your narrow-minded view of immunisation is typical of parents being sucked along by the “protection” of immunisation.

It is just to clear your mind of any guilt. If you really love and cherish your child, you would get off your butt and do some research (Penrith does have a library).

You will discover how unsuccessful it has been and that is has been claimed by the medical profession not to be 100% safe.

People do use “herbal treatments” instead of allopathic immunisation because they are responsible.

You obviously have a lot to learn about how our wonderful body works and how vitamins, diet, herbs and homeopathy enhance your well-being to fight these diseases. A healthy body is disease-free.

If the government makes immunisation compulsory, it is only for the money, and not our good-health.

I agree with Viera Scheibner and Roger French of the Natural Health Society — they have done their homework. If you are a responsible parent, you will too.

Monica Morris, Faulconbridge

Eating well is not any protection

I WOULD like to reply to the Natural Health Society (letters, Press, March 23).

My daughter, now nine, had encephalitis when she was four years old and had a cardiac arrest which paralysed her and put her into hospital for a considerable time.

It was a severe illness, similar to meningitis.

She now has cardiomyopathy (heart disease) from this illness.

My daughter was healthy and ate healthily until that point.

The neurologist at the hospital told me that if she had not been immunised she would not be here today.

Unless you have been through this painful and agonising time with your own children you have no right to comment on immunisation.

Let me tell you it has nothing to do with a healthy lifestyle and good nutrition.

You cannot go on facts alone because there is always a chance that you are wrong.

I used to wonder what immunisation really did and now I know from my own experiences with my child.

Julie Parker

Cambridge Park

Find out a few facts

I would like to reply to Warragamba’s Gail Young (letters, Press, March 23).

Your narrow-minded view of immunisation is typical of parents being sucked along by the “protection” of immunisation.

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Monica Morris, Faulconbridge
Child stats tell story

JULIE Parker’s letter (Press, March 30) highlights the serious consequences that some childhood diseases can cause.

So-called minor children’s diseases can have serious complications.

Even though standards of living have improved, these preventable diseases still occur.

When they do occur, the chances of serious complications are as high as they were in the past.

Since the beginning of 1992, in the Wentworth health area, we know of at least 51 children with meningitis. One child suffered serious brain complications as a result.

Thirty-seven children had whooping cough and nine had rubella.

Fourteen children suffered meningitis (inflammation around the brain) or epiglottitis (blocked windpipe) due to Hib bacteria.

Children are getting these preventable diseases because not enough children are immunised.

The large number of unimmunised children mean these diseases can easily spread.

Parents who do not immunise their children are putting their own children’s health, and other children’s health at risk.

The benefits of immunisation far outweigh any disadvantages.

Children should be immunised against diptheria, tetanus, whooping cough, poliomyelitis, measles, mumps and rubella.

New vaccines against Hib disease are available.

Hib vaccine is safe and effective and is recommended for all children up to five years old.

If parents would like more information about immunisation, they should ring their family doctor, their community health centre or the public health unit, phone (02) 890 6060.

Anthony Capon
director of public health
Wentworth Area
Health Service
Appendix 13: Examples of monthly newsletters
The New *Haemophilus influenzae* type b Vaccines

*Haemophilus influenzae* type b (Hib) causes nearly all cases of epiglottitis and in NSW, is the most common cause of bacterial meningitis. In 1991 in NSW, 36% of Hib infections occurred in children aged less than 18 months. Almost all cases of Hib disease in Aboriginal children occur before the age of 12 months.

"ProHIBit", the first vaccine to be licensed in Australia against Hib, is recommended as a single dose for children aged 18 months to five years who attend day care or who are otherwise at increased risk of Hib disease.

Other conjugate Hib vaccines which provide protection at an earlier age have been submitted for licensing and will probably become available in late 1992. The vaccine schedules will involve either three or four doses, to be initiated concurrently with Triple Antigen from two months of age.

Public Health Response to a case of Hib meningitis in a Day Care Centre

During May the Public Health Unit was notified of a 20 month old child with Hib meningitis.

The child attended a day care centre four days per week, for eleven hours each day. As all children at the centre mixed together during part of each day, they were all at risk of contracting Hib disease. The Public Health Unit offered all children and staff prophylaxis with Rifampicin. Explanatory letters were distributed to staff and parents at the child care centre, and staff of the Public Health Unit attended the centre, spoke to parents and staff, and distributed the Rifampicin.

Note
- to maximise benefit, chemoprophylaxis should be given within one week of onset of disease in the index case.
- *prior immunisation* against Hib does not prevent carriage of the micro-organism and any children who had been immunised were also advised to have chemoprophylaxis.

The reverse of this sheet is a table of infectious diseases notifications received by this unit.
NEWSLETTER

September, 1992

The Western Sector Public Health Unit in conjunction with the General Practice Unit at Westmead Hospital commenced a general practitioners sentinel surveillance network in April 1992. The general practitioners were drawn from the eight local government areas in the Western Sydney and Wentworth Health Areas.

These general practitioners report the frequency of influenza, acute tonsillitis, infectious mononucleosis, rubella and chickenpox and Herpes zoster to the project manager, Stephen Crone, once a week.

The graph shows the average number of times these diseases have occurred, per 100 consultations, between 5 April and 8 August 1992.

Pertussis

We have been notified of six cases of pertussis in July and August this year.

The Health Department recommends that:

- cases of pertussis should be excluded from school or work for 14 days from the onset of the illness, or until they have received at least five days of a minimum 14 day course of antibiotics.
- household and other close contacts should have a 14 day course of antibiotics, regardless of immunisation status.
- household contacts who have not had pertussis or been immunised against it should be excluded from child care for 21 days after the last exposure to infection. Contacts should not be excluded from any other class at school.

The reverse of this sheet is a table of infectious diseases notifications received by this Unit.
6 November 1992

MEASLES:
During the month of October eleven cases of Measles were reported to the Public Health Unit. Three did not fit the notification criteria (a general rash lasting ≥ 3 days, a temperature ≥ 38.3°C and cough or coryza or conjunctivitis). The other ten were diagnosed on clinical presentation, nil were serologically confirmed. The cases ranged from one to sixteen years with a mean age of seven. All reported cases had been immunised. Four of the ten cases were from the same family and attended the same school. A letter was sent to the school to inform parents of the cases and the need for measles immunisation.

HEPATITIS A:
Twelve serologically proven cases of hepatitis A were reported from various laboratories during October. The age of the cases ranged from five to sixty two years of age with the mean age of twenty one. Two of the cases were twin sisters who had contracted the disease whilst travelling overseas; another two were class mates. School and family contacts in both these cases were contacted and lists of possible contacts were obtained. A letter was sent to all close contacts explaining the nature of the disease and the mode of transmission. Contacts were also advised to attend their local general practitioner for an immunoglobulin injection.

RUBELLA:
There was a surprising increase in the notifications rate for rubella. Sixteen cases were reported in October. All cases were serologically confirmed by laboratories. The cases consisted of nine males and seven females. Only one case had been in contact with a pregnant women during the infectious period and the pregnant women was advised to consult her obstetrician. All cases were advised of the precautions to take and the mode of transmission of the disease.

PERTUSSIS:
An increase has also been observed in the notification rate for pertussis. A total of eight cases were notified in the month of October. Six of the cases live in the Blue Mountains Local Government area. All cases, their household and family contacts have been given a fourteen day course of Erthromycin regardless of immunisation status. This is Department of Health protocol.

The reverse of this sheet is a table of infectious diseases notifications received by this unit.
March 1993

Changes at the Public Health Unit

The Environmental Health Officers and the Food Inspectors are now working from the Nepean Hospital office. Their phone number is (047) 24 2613.

Cissy Chow is our new Public Health Nurse. She works in the communicable diseases section of the Unit, at North Parramatta.

Hepatitis A

Most recent notifications of hepatitis A have been associated with developmentally disabled people and their carers. To help prevent further transmission, if you have contact with this group of people, please stress the importance of toilet and food hygiene.

Flu vaccine

Now is the time to begin promoting influenza vaccine. The vaccine should be targeted to those at risk of influenza. They are:

- people over 65 years
- people with chronic debilitating disease, especially those chronic cardiac, pulmonary, renal and metabolic disorders
- residents of nursing homes and other chronic care facilities
- those receiving immunosuppressive therapy.

The vaccine available this year is slightly different from the 1992 version. The 1993 vaccine contains A\Shanghai\2490 (H3N2-like), A\Texas\3691 (H1N1-like), and B\Panama\4590.
Appendix 14 : Questionnaire design - hand out for students

Questionnaire design

2/3/93
Jane Bell

Objectives

1. list the main methods of data collection
2. identify main types of questions, and their advantages and disadvantages
3. define reliability and validity
4. list principles of wording questions, sequence of questions, and layout

Data collecting methods

1. using documentary sources - existing records eg clinical records, death certificates, census data
2. observation - eg clinical examinations
3. interviews / questionnaires
   - personal (face-to-face)
   - self-administered
   - telephone

Advantages of questionnaires:
- cheap to produce and administer
- quick to distribute (self-administered)
- can elicit information not available by other means
- can have high external validity

Disadvantages of questionnaires:
- question validity
- biases eg measurement, recall
- researcher has little control over self-administered questionnaires

Basic idea is to communicate with the potential respondent
- questions must be understood - respondents must be able to give you the information you want
- respondent should be encouraged to reciprocate the communication
Constructing a questionnaire

Consider context / culture of questionnaire

The questionnaire is based on our conceptual framework. The questions we ask, and the way we ask them are influenced by our ideas and biases. The way we ask questions determines whether we make useful and unbiased measurements. We must remember that our potential respondents also have own culture. Questions which can be asked vary between populations and within populations.

Measurement quality:

1. **precision** - not always necessary - can collapse categories later

2. **reliability** - is also called reproducibility or repeatability. It refers to the consistency or stability of information - the extent to which similar information is supplied when a measurement is performed more than once. A reliable measure gives the same result each time it measures the same thing.

   Improving reliability
   - standard questions asked in a standard way
   - instrument should give relatively consistent measurements
   - appropriate training, observers should work together
   - watch - reluctance to use extremes of a scale; positive skew towards favourable end of scale.

   - reliability depends on
     - ability to answer
     - relevance
     - clarity

3. **validity** - validity of a measure refers to how well a measurement measures the characteristic that the investigator wants to measure. A valid measure measures what it is supposed to.
Levels of measurement

1. nominal - separate categories, mutually exclusive
   eg receding hairline: yes/no; religion: Methodist/Catholic/Other

2. ordinal - categories with some logical or meaningful ranking - no absolute values
   eg formal education: none/primary/secondary/post-secondary/tertiary
   eg Likert scale: strongly agree/agree/neutral/disagree/strongly disagree

3. interval (or continuous) - numbers where difference between them has true meaning
   eg difference between 1 and 2 is the same as difference between 6 and 7

Types of questions

Questions can be classified into two types
- "open-ended" (or "free response") - respondents answer in own words), or,
- "closed" (or "fixed alternative") - respondents choose from a number of fixed alternatives.

Open ended questions do not suggest any specific response - respondent is required to remember something and answers freely in his/her own words

advantages open-ended:
- important role in exploratory surveys - to indicate range of likely responses and provide guide to forming alternative responses to closed questions
- can elicit new information
- qualitative research uses open-ended rather than closed questions
- allows and encourages respondents to give full answers - respondent uses own vocabulary, and can express individual experience - shows that you care what the respondent thinks
- usually get more detailed responses

disadvantages open-ended:
- take more time to answer - risk of respondent fatigue
- require greater interviewer skill - to recognise ambiguities and to probe and draw people out
- collect irrelevant material
- difficulty categorising responses - data can be difficult to summarise in a concise form - eg code into categories
Closed-ended questions

- respondent can give answer from a number of given responses - ie respondent must recognise something
- recorded in predetermined categories (field coding vs pre-coding - field coding - like open-ended, but interviewer checks each topic which respondent mentions; pre-coded - alternatives are explicitly stated in the question or printed on a card
  types - dichotomous eg yes/no
  - multiple choice
  - check list
  - alternative statement ) these are versions of multiple choice
  - rating scale )

advantages closed:
- popular and easy to use
- quick ) ie economical
- easy to process )
- greater uniformity of answers and simpler analysis
- can help elicit information about sensitive information

disadvantages closed:
- restricted responses
- investigator needs to be aware of full range of possible responses
- questions must be mutually exclusive
- "other" category required
- limit variety and detail of responses
- bias - "appropriate answer"

Questionnaire wording

- often overlooked
- context is important
- precise wording very important

What to aim for:

- use as few words as possible
- use simple words
- use familiar words - use words that all respondents will understand - avoid slang (but there may be times when slang is appropriate)
- check the meaning of words with a dictionary or thesaurus
- make the question as specific as possible
- as short as possible
- may use aided recall procedure - eg select from list, select from prompt cards
- if using a closed question, make sure all reasonable alternative answers are included
- limit the time period and use the appropriate time period
Avoid:
- double barrelled or multiple ideas
  example:
  - Have you had diarrhoea or vomiting? If want to distinguish between these, ask two questions
- double negatives, (and avoid single negatives if possible)
  examples:
  - Are you against not having prohibition?
  - non-weekdays
- long questions - but longer questions can often improve recall - provide memory cues, give time for respondent to think
- complex questions
- vague/ambiguous words
  examples:
  - "often" "occasionally" - use more precise terms - In the past two weeks have you had two or more nose bleeds?
  - Do you have any trouble with your hearing? What does trouble mean? hearing loss? or ringing in ears?
  - "the government" means local? state? federal? a department?
- leading questions
  examples:
  - Do you think you should be involved in present family planning services?
    Need to add should or should not
  - As you know, ....
    ie question indicates a "right" response
- loaded questions
  use acceptable words and phrases
  examples:
  - may use termination or miscarriage, rather than abortion (abortion = illegal to public)
  - use working class, rather than lower class
  - use employers, rather than bosses
  - What do you do to make sure the water is clean? - Assumes they do something (do you do anything to make sure the water is clean?) problems with this too, or do you do anything to the water?
  - Do you own a compact disc player?
Leading and loaded words may bias respondent
- embarrassing questions - many options
  examples:
  - assume all respondents engage in a wide variety of "socially unacceptable" behaviour - When did you first have..? rather than Did you ever have..?
  - use check list, with embarrassing question embedded in list
Question sequence

- start with easy, necessary, non-threatening questions
- put more difficult questions near the end to avoid embarrassment or resentment
  eg about age, education, income are often left to the end (unless needed for screening) -
  some demographic questions are threatening
- questions should follow an order which seems natural to respondent
- general questions first, followed by more specific and detailed questions - "funnel"
- avoid long sequences of questions - prevent "response set"
- if asking about more than one topic, finish one topic before moving on to next topic
- when switching topics, use a phrase to introduce the topic (transition statements)
- "filter" or "branching" system - if respondents answer "no", skip the specific questions
  and proceed to next general question
- be consistent using chronological order - either forwards or backwards

Layout

- use visually impacting questionnaire - to arouse interest of respondent - appearance is
  important - should look easy to answer, professionally designed and printed
- start with introduction
- put title of study, name of organisation, identifiers on first page
- use clear print - easy to read - use different sizes and styles to distinguish between
  questions and instructions
- number each question - so easy to follow
- leave enough space for answers - space questions
- keep each question on one page - do not split a question between two pages
- use strong paper which can withstand constant handling
- use coloured paper - may be useful if multiple forms, or complex skips
- always end interview with a thank you, and instructions on what to do with the
  completed questionnaire

Covering letter/introduction

- need some form of introduction for any method of data collection
- need to interest respondents in the interview and persuade them to participate

some points which might be covered in letter/introduction:
- what the study/survey is about
- importance of respondent's participation
- how respondent will benefit from the research
- how long the questionnaire will take
- how the respondent was selected
- replies are confidential
- feedback of results
- note of urgency
- credibility of importance of your organisation
- your appreciation
- contact person for inquiries or more information
And then keep letter/introduction to a minimum! (maximum of one page)
Pilot work is essential. In the early stages it may be exploratory eg to find familiar words and phrases, the types of responses and reactions to the questions. Should be tested on same population as you intend to survey. Retest if any changes.

Pilots can be used for:
- question wording
- question order
- length of questionnaire
- convert open-ended questions to closed questions
- test lead-ins/introductions to questions
- always ask for general information about the questionnaire at the end of pilot

Summary

- questionnaires used to gather data - need to communicate with the potential respondent - questions must be understood - respondents must be able to give you the information you want
- respondents should be encouraged to participate
- types of questions - open-ended and closed
- validity and reliability
- make answering easy - wording, instructions, sequence, layout, introductory/covering letter

References

Angela’s notes from 1992


Class exercise:

You are investigating an outbreak of gastroenteritis, Oswego style.

You need to collect some pretty basic information.

Prepare a questionnaire to collect the following information:

- name
- age
- sex
- illness
- date of onset
- symptoms (ask about nausea, diarrhoea, myalgia, arthralgia)
- foods eaten (you may want to limit your questions to pop-corn, chocolate ice-cream, oysters, chicken, lettuce)

The exercise showed that there are many different ways of asking for the same data. And that our own attitudes and beliefs influence the ways we ask questions.
Appendix 15: Talk to medical microbiologists

In August 1993, I gave a lecture and seminar as part of the postgraduate course in medical microbiology, conducted by the Centre for Infectious Diseases and Microbiology, Westmead Hospital.

The topic: Laboratory notification in infectious diseases: Why it is important and how the data are used.

I was asked to present a 40-45 minutes "state of the art" lecture on the topic - including an overview, recent theoretical and/or practical advances, new developments and areas of controversy. After the lecture there were 10-15 minutes for questions, followed by a short break. I also prepared a seminar/discussion for the session after the break.

The audience included medical scientists and medical microbiologists with practical experience and a good basic knowledge of diagnostic medical microbiology, potential candidates for FASM and FRCPA, and senior microbiologists wishing to update their theoretical knowledge.

An outline of the presentation, the overhead transparencies, and the handout I prepared follow. I also distributed a copy of the New South Wales Public Health Bulletin which contained information about the infectious diseases notification system in New South Wales, a list of the notifiable conditions and a list of the Public Health Units.

I presented an informal lecture, and encouraged people to ask questions during the presentation. I illustrated the talk with examples of our Public Health Unit's responses to
infectious diseases notifications, including responses to hepatitis A, Hib meningitis, and Legionella. After the break I presented the initial results from the Legionella follow up study. Discussion about the study, including Legionella serological testing, and general discussion about infectious diseases surveillance, for example TB prevalence and TB and migrant screening followed.

Outline

1. Introduce topic:
   
   Laboratory notification in infectious diseases: Why it is important and how the data are used

2. Topics to cover:
   
   a. Infectious diseases surveillance in general
      
      Laboratory based surveillance
   
   b. Surveillance in NSW
      
      The NSW Infectious diseases control system and Role of Public Health Units
      
      Practical aspects of the notification system in NSW
   
   c. What do we do with the notifications we receive? Examples

3. break

4. Legionella follow up study
Surveillance

1. ongoing and systematic collection
2. collation
3. analysis and interpretation of data
4. feedback to those who need to know
5. action

Infectious diseases surveillance is used to:

- describe trends and patterns in disease occurrence
- detect unusual disease patterns eg outbreaks
- implement disease-control and prevention (initiate public health action)
- plan health services
- allocate resources
- evaluate control and prevention programs
- stimulate research
- provide a history of disease activity
Sources of data for infectious diseases surveillance:

- Laboratories*
- Doctors, hospitals
- Population based surveys
- Schools, preschools, day care centres
- Sentinel medical practices
- Death certificates
- Media
- Concerned public

Laboratory based surveillance:

- is the core of infectious disease surveillance
- hard to get reliable clinical data
- often can not distinguish between new and recurrent cases eg hepatitis B
- often do not know the number of specimens examined, or the population at risk
- data are limited to infections for which there is a suitable laboratory test
Why is lab based surveillance is so popular?

- useful in detecting wide-spread outbreaks of disease
- useful in characterising aetiological agent eg antibiotic/drug resistance
- provides basis for analysing national trends
- some diseases can only be monitored accurately through laboratories
- coverage and timeliness of notification greatly improved using lab based system
- laboratory reports are generally more complete

Why we respond to notifications:

- provide greater understanding/knowledge of an evolving epidemic
- prevent further spread
- identify source of infection - and eliminate
- verify malaria free status to WHO
- monitor immunisation programs
- protect unimmunised people
Examples of public health action

- rubella
- measles
- *Haemophilus influenzae* type b
- Hepatitis A
- *Legionella*
Laboratory notification in infectious diseases: Why it is important and how the data are used.

5 August 1993.

**Surveillance** is the ongoing and systematic collection 1. of data (time, place and person) and analysis and interpretation of data 2. and 3. and feedback to those who need to know so can get 4. action

**Infectious diseases surveillance** is used to:

- describe long-term trends and patterns in disease occurrence
- detect unusual disease patterns eg outbreaks
- implement disease-control and prevention (initiate public health action)
- planning health services
- allocate resources
- evaluate control and prevention programs
- stimulate research
- provide a history of disease activity

**Sources of data for infectious diseases surveillance:**

- Laboratories*
- Doctors, hospitals
- Population based surveys
- Schools, preschools, day care centres
- Sentinel medical practices
- Death certificates
- media
- concerned public

Some of these are legally required to notify. Others are not.

**Why we respond to notifications:**

- prevent further spread eg immunisation, education, vector control, antibiotic prophylaxis, exclude cases,
- identify source of infection
- verify malaria free status to WHO
- monitor immunisation programs
References


Appendix 16 : Epi Info workshops

Epi Info workshops

1. Epi Info Workshop at South West Region PHU

July 29th and 30th, 1993

Tony Kolbe, the Acting Director of the South Western Region PHU invited me to run a two day Epi Info course for his PHU staff in Albury.

Course objectives were to

- familiarise students with Epi Info's capabilities
- enable students to access and use Epi Info programs confidently

Nine students with varying abilities in computing skills attended. Four had driven from Wagga Wagga for this two day extravaganza. I focussed on the less computer literate. Those with more computing ability were able to learn quickly and use the manual to increase their knowledge. They had a greater capacity for self teaching and required less attention.

Resources:

I used the Epi Info Training Guide prepared by the Health Department of Victoria.1 It was an excellent guide and all students found it easy to follow. I also prepared extra files to illustrate other Epi Info features and to practice certain skills. For examples, qes files with variable names which needed changing, a rec file to be used as a template for a check file, and a recfile to show certain features of analysis.
Content: Day 1

• Introduction to Epi Info
• Using eped for word processing and qes files
• Using enter for making recfiles from qes files, entering and editing data, updating recfiles from revised qes files
• Using analysis, by reading in data files and performing simple analysis (list, freq and tables), select, browse, update,
• Using check to make check files

Content: Day 2

• Revision of eped, enter, and analysis
• Import and convert
• Revision and more advanced analysis
• Statcalc introduction
• Programming
• Summary

I thoroughly enjoyed the opportunity to promote Epi Info, and to show how useful and easy it is. While preparing for the workshop, I learned a lot more about Epi Info. It was also an opportunity to visit a rural PHU, and meet more public health network staff. All members of the SWR PHU ensured I enjoyed my visit. We lunched at different Albury lunch spots, dined at TGs, visited the Terminus Hotel, and drove around the monument on the hill twice to see the lights of Albury and crossed the border into Victoria.
2. **Introduction to Epi Info for WSPHU**

November 10th and 12th, 1993

On two afternoons I ran an introduction to Epi Info workshop for seven members of the WSPHU. Again I used the Training Guide prepared by the Health Department of Victoria. Each student used his/her own computer. Many had limited computer experience.

Objectives of the first session

To be able to use:

- XTree Gold to look at directory structures, make subdirectories, copy files, etc
- DOS to find epi5 subdirectory start Epi Info program
- Set up (F9) to set up directory structure for Epi Info files
- Eped to make a questionnaire, save and retrieve it
- Enter to make a recfile from the qesfile, enter data, search for records, update records, and delete records

Objectives for the second session

To be able to use:

- Check to make check files
- Analysis for simple analysis, for example list, frequency, browse, update, select

In session two, I started by revising skills gained in the first session. In each session I gave examples of Epi Info’s uses, revised new work, repeated exercises,
and summarised skills students had learned.

All students received an "I am an Epi Info Expert" certificate.

Reference

Appendix 17: Discussion paper - Cold chain maintenance

Cold chain maintenance: an important component of effective immunisation programmes.

Introduction:
Both vaccine coverage and vaccine efficacy determine the effectiveness of immunisation programmes. High levels of vaccine coverage alone do not ensure success.

Vaccine efficacy depends on vaccine potency, which depends on the appropriate transport, storage and use of vaccines. Live virus vaccines particularly lose their potency if exposed to temperatures which are too warm or too cold. The effect of adverse temperatures on vaccines is cumulative and irreversible.

The system of people and equipment which ensures that the correct quantity of potent live virus vaccines reaches those who need it, is defined as the cold chain. The cold chain must be monitored to ensure that vaccines are kept at their recommended temperatures.

Generally, live virus vaccines should be kept at temperatures between 2-8°C. Vaccines vary in their susceptibility to heat and cold. Recommended vaccine storage temperatures are shown in Appendix 1.

An effective cold chain is often assumed, especially in industrialised countries. Errors, however, are more common than generally thought.
Cold chain problems in developed countries:

A vaccine storage study of 50 pediatric practices in the Los Angeles area revealed a high prevalence of avoidable vaccine storage errors. Only 8/50 vaccine coordinators knew the appropriate vaccine storage temperature. Only 18/50 refrigerators had a thermometer and only 10 checked the temperature at least weekly. The refrigerator temperature was too high (>8°C) in 11/50 sites. Vaccines were kept in the door of 31/50 refrigerators. In 8 offices, vaccines were stored in the open in uninsulated trays during the day. More than half the refrigerators contained at least one outdated vial of vaccine. More than half contained food or drink. Eleven also reported having had a power failure.

Cold chain monitor studies in Europe have revealed general weaknesses in cold chain procedures. Although Europe has a temperate climate, approximately 10% of oral polio vaccine (OPV) and 3% of diphtheria/tetanus/pertussis vaccine (DPT) were exposed to unacceptably high temperatures, and 11% of DPT had been exposed to freezing temperatures.

A cold chain monitoring survey in Spain, found that 48 per cent of health centres were using or likely to have been using OPV affected by the cold chain. The authors identified problems in storage, transport and stock control.

A study of 40 practices in England showed that only 16/40 were aware of the correct vaccine storage conditions. Of the 8/40 who had maximum/minimum thermometers, only one monitored temperatures daily. Temperatures in eight refrigerators were monitored, and six exposed vaccines to subzero temperatures, or temperatures up to 16°C.
Cold chain problems in Australia:

Deficiencies in the cold chain are a probable contributory factor to vaccine failure in Australia. Barrand et al. reported that 46 per cent of children with documented evidence of measles immunisation were seronegative, which might partly be explained by inadequate adherence to cold chain standards.

Inadequate cold chain standards have been shown in Australia. In the Northern Territory, Miller found that 100% of OPV was exposed to temperatures over 12°C, and that 23% of OPV was unusable due to heat stress. Nearly half (47.5%) of hepatitis B vaccine was exposed to temperatures lower than -3°C. Most exposures to inappropriate temperatures occurred during storage.

Cold chain problems also exist in more temperate and less isolated areas. In the Hunter area of New South Wales, Miles found that many refrigerators were inadequate for vaccine storage. She recorded the temperature of 59 refrigerators in council and community health centres, general medical practices and local pharmacies. Of the 59 refrigerators, only 29 recorded a temperature between 2° and 8°C. Of these 29, only 14 had vaccines stored in the central area of the refrigerator. Most refrigerators were also used for other purposes; commonly for storing food and drink. Miles also monitored two vaccine storage refrigerators for 21 days with maximum/minimum thermometers. One refrigerator was within limits for 7/21 days and the other for only 1/21 days. Mostly, the temperature was too cold (<2°C).

In the Illawarra area, temperatures of refrigerators used for vaccine storage, in local councils, hospitals, pharmacies and general medical practices were measured
for four weeks. Only 4/17 sites recorded temperatures between 2-8°C for the entire four weeks. Eleven sites recorded temperatures above 8°C for some period, and 11 recorded temperatures below 2°C for some period during the four weeks. Four sites were always unsatisfactory, and were almost always too cold.

We can not assume that the cold chain is effective. Findings show that many medical workers are not familiar with appropriate cold chain procedures, that generally, the cold chain is not monitored, and that breaches of the cold chain occur frequently. Studies document that vaccines are often exposed to temperatures which affect their potency.

Vaccine handlers must be educated about transporting, storing and monitoring vaccines within recommended temperatures. Guidelines for vaccine handling (Appendix 2) should be developed and distributed, and correct handling should be encouraged. Adequate equipment should be supplied, and regular monitoring and recording of temperatures should be reinforced.

References


3. EPI/WHO. *Cold chain newsletter* 1991;91(2).


5. Thakker Y, Woods S. Storage of vaccines in the community: weak link in


8. Miles T. *The vaccine cold chain in the Hunter area.* Hunter Area Health Service or NSW Health Department, 1992.

Appendix 1.

**Table: Recommended vaccine storage temperatures.**

<table>
<thead>
<tr>
<th>Vaccine</th>
<th>Storage temperature</th>
</tr>
</thead>
<tbody>
<tr>
<td>diphtheria and tetanus toxoids, pertussis (DPT, ADT, CDT, TT)</td>
<td>2-8°C. Do <strong>not</strong> freeze</td>
</tr>
<tr>
<td>measles/mumps/rubella, and diluent</td>
<td>2-8°C. Reconstituted vaccine is stable at 2-8°C and should be used within 8 hrs. Vaccine may be frozen, but <strong>not</strong> diluent</td>
</tr>
<tr>
<td>rubella</td>
<td>2-8°C.</td>
</tr>
<tr>
<td>oral poliomyelitis vaccine</td>
<td>store unopened vials at -10°C</td>
</tr>
<tr>
<td>inactivated poliomyelitis vaccine</td>
<td>vaccine is stable at 2-8°C for 3 mth-1yr</td>
</tr>
<tr>
<td>hepatitis B vaccine</td>
<td>2-8°C. Do <strong>not</strong> freeze</td>
</tr>
<tr>
<td>BCG</td>
<td>2-8°C. May be frozen</td>
</tr>
<tr>
<td>Hib vaccine (fluid form) (HIBtiter, ProHIBit)</td>
<td>2-8°C. Do <strong>not</strong> freeze</td>
</tr>
<tr>
<td>Hib vaccine (lyophilised) (PedavaxHIB)</td>
<td>2-8°C. Unreconstituted vaccine may be frozen. Store reconstituted vaccine at 2-8°C, and use within 24 hrs or discard. Do <strong>not</strong> freeze reconstituted vaccine or diluent.</td>
</tr>
</tbody>
</table>

---

Appendix 2.

**Draft guidelines for ensuring an effective cold chain.** Guidelines may need to be altered to suit local conditions.

One person should be appointed as the vaccine coordinator, with clear responsibility for maintaining the cold chain.

**Vaccine refrigerators**

- Check that the temperature is always between 2-8°C. Measure and record the temperature in the central area of the refrigerator daily. Use a maximum/minimum thermometer, even if the refrigerator has a thermometer dial.

- Keep the maximum/minimum thermometer in the central area, near the front, so that it is easy to read.

- Store vaccines in the central area of the refrigerator. Do not store vaccines in the door or the bottom of the refrigerator, because the temperature is warmer here.

- Avoid packing vaccines tightly together. Keep spaces between vaccine trays so that cool air can circulate.

- Open the refrigerator only when necessary. If possible, only using the refrigerator for vaccine storage. Do not store food and/or drink in vaccine refrigerators because more frequent opening causes higher temperatures.

- Keep several chilled water bottles in the empty space at bottom of the refrigerator. This helps keep the refrigerator temperature constant.

- Make and store ice packs in the freezer. These can be used to keep vaccines cool during transport, and in emergencies.

- Tape the power switch to "on" and tape the plug into the socket, to avoid the refrigerator being turned off accidentally.

- Make sure that the seal of the refrigerator door fits perfectly. (A piece of paper should be held firmly when the door is closed.)

- Defrost the refrigerator regularly if it does not defrost automatically. A build-up of ice makes the temperature inside the refrigerator warmer, not cooler. If more than 5mm (0.25 inch) of ice has built up, the refrigerator needs defrosting.

- Have an emergency plan and storage container, in case of power failures, if temperatures are outside the specified range, or for defrosting the refrigerator.
• Maintain the refrigerator in good working condition. Know how and where to get a refrigeration expert quickly, in case of an emergency.

Vaccines

• Transport and store vaccines at 2-8°C.

• Check the condition of vaccines on receipt. Ensure that they are not out of date, and have not been exposed to harmful temperatures. Do not accept vaccines if there is evidence that they have been compromised (for example, if there is no ice left in the cold box).

• Order vaccines regularly, and ensure a reliable supply. To avoid storing vaccines for too long, order only as much vaccine as you need.

• Check vaccine expiry dates once/month and discard vaccines which are past their expiry date.

• Use the "shake test" before using DPT, ADT, CDT, or tetanus toxoid vaccines to check that they have not been frozen.

• Store unreconstituted MMR and OPV in the freezer.

• All vaccines should be correctly labelled.

• Generally, discard unused reconstituted vaccines, and unused open vials of vaccine at the end of immunisation sessions.

• Discard opened vials after 24 hours if they do not contain a bacteriostatic agent.

• Store vaccine vials which contain a bacteriostatic agent (most DPT do), they can be stored for up to 30 days before risk of contamination.

• Discard MMR which is not used within 8 hrs of reconstitution.

• Store vaccines which have been taken out for use, or partly used, in a special tray in the refrigerator, labelled "returned". Use "returned" vaccines as soon as possible.

• Wrap BCG and measles vaccines in foil when out of the refrigerator, because they are sensitive to light.
The "shake test"

- Use before opening any DPT, DT, or TT to detect if vials have been frozen and then thawed.
- Shake the vial. Let it stand for 15 minutes (not in sunlight). If small clumps or sediment are present, do not use. If the liquid is cloudy and smooth, it can be used.

Cold boxes or insulated containers

Cold boxes must be used for transporting vaccines between storage areas, or to immunisation clinics. They may also be used as temporary storage during defrosting, or a power failure. They must be lined with ice packs. A cold box without ice packs will not keep vaccines cold.

- Cold boxes must be strong, well insulated and airtight. They must not have any cracks and the lid must fit tightly.
- There should be enough ice packs to line the sides, bottom and top of the cold box.
- Ice packs must be completely frozen. If they are not completely frozen, they melt quickly and do not keep vaccines cold for very long.
- Let ice packs stand at room temperature for 5-10 minutes before packing them in the cool box.
- Vaccines must not be frozen. So, when ice packs are used, the vaccines should not be in direct contact with ice. Wrap the ice packs in paper, or wrap vaccines in paper or bubble plastic.
- If ice packs have melted when the cold box is opened, the vaccines have not been kept cold enough.
- A thermometer could be packed, so that the temperature can be monitored. This should not be necessary for short trips, if the cold box is packed correctly.

Other temperature recorders, thermometers and indicators are also available for cold chain monitoring.
References: Appendix 2


Tropical Centre for Disease Control. *Guidelines for the transportation and storage of vaccines*. Queensland Health.


Appendix 18: Application for ethics approval

We note the need for statistical knowledge of, and potential for misunderstanding inferences about health status and treatment in patients in the ACT. This includes the understanding of the potential interactions in children. We would expect education and training, but not necessarily from other sources. In 1981, there were no such tests in the ACT. Therefore, it would be an advantage to patients and medical authorities to observe. The NHMRC recommends this, particularly for children who do not have specific communication skills. These will be used by patients and doctors, where possible, and as part of the research program.

We have planned a random telephone survey of approximately 100 households, within the ACT. A standard questionnaire will be completed for each subject who has a child between the ages of 0 and 12 years of age, and who agree to participate.

Describe the research procedures as they affect the research subjects and any other parties involved.

Telephone numbers will be randomly selected from the ACT white pages index number, and only one telephone call will be made. The questionnaire will be completed by the respondent and the survey will be completed. Any questionnaire that is lost or damaged will be replaced. The interviewer will be trained, and all questions will be asked to the best of the interviewer's ability. Any information referred to will be handled in a confidential manner. Any self-administered questionnaires will be accompanied by a pre-numbered return envelope.
THE AUSTRALIAN NATIONAL UNIVERSITY
ETHICS IN HUMAN EXPERIMENTATION COMMITTEE

SUMMARY SHEET

Name of person submitting research proposal

Dr Aileen Plant, MBBS, DTM&H, MPH, FAFPHM.

Position held  Senior Research Fellow  Date 19th February 1993

Department/Group/Centre  National Centre for Epidemiology and Population Health

Project Title  A survey of parents' attitudes to, and knowledge of, vaccines and haemophilus influenzae type B (Hib) disease in the ACT.

1. (a) Briefly describe the basic purposes of the research proposed:

We aim to determine knowledge of, and attitudes to haemophilus influenzae type B (Hib) disease and vaccination in parents in the ACT. Hib infections are a common cause of serious bacterial infections in children. Hib mainly causes meningitis and epiglottitis, but can also cause other serious diseases. In 1991, there were nine cases in the ACT. Vaccines are now available to prevent this serious children's disease. The NH&MRC recommends Hib vaccines for all children who do not have specific contraindications. Results will be used for planning education, vaccine promotion and vaccination programmes.

(b) Outline the design of the project:

We have planned a random telephone survey of approximately 700 households in the ACT. A standard questionnaire will be completed for each subject who has a child younger than five years of age, and who agrees to participate.

(c) Describe the research procedures as they affect the research subjects and any other parties involved:

Telephone numbers will be randomly selected from the ACT white pages telephone book. Parents will be interviewed once, for approximately five minutes. The purposes of the survey and the subject's participation will be explained. Verbal consent for the interview will be obtained. Subjects will be free to withdraw from the survey at any stage during the interview, and will be advised of this when the interview is explained. All information collected will be confidential. A standard questionnaire will be administered. Parents who do not consent to be interviewed will not be included in the study.

(If it is possible, please try to make (a), (b) and (c) intelligible to a non-specialist).
2. What in your opinion are the ethical considerations involved in this proposal? (You may wish to comment, for example, on issues to do with consent, confidentiality, risk to subjects, etc).

The purposes of the survey and the subject's involvement will be explained. Verbal consent for the interview will be obtained. Subjects will be free to withdraw from the survey at any stage during the interview. All information collected will be confidential. Subjects who do not consent to be interviewed will not be included in the study.

3. Outline the reasons which lead you to be satisfied that the possible benefit to be gained from the research proposed justifies the discomforts and risks involved (if any).

Subjects will experience no risks or discomfort. Subjects who agree to participate will be asked to spend about five minutes being interviewed. The community and ACT Health will benefit by obtaining information about attitudes to, and knowledge of Hib disease. This will be used to plan community education programmes and community immunisation programmes.

4. Who are the investigators (including assistants) who will conduct the research and what are their qualifications and experience?

Students enrolled in the Master of Applied Epidemiology course at the National Centre for Epidemiology and Population Health:

Margaret Ashwell, MBBS, MPH, PhD.
Jane Bell, BDS, DipEd.
Raina MacIntyre, MBBS.

Jill Rowbottom, BSc, Mb.Ch.B., DA, DipVen.
Alan Ruben, MBBS, FRACP.
John Scott, MBBS, DipRACOG, FRACGP.

5. Can the proposer certify that the persons listed in answer to 4 above have been fully briefed on appropriate procedures and in particular that they have read and are familiar with the guidelines issued by the NH&MRC or relevant professional body (please specify?)

The proposer will ensure other investigators and research personnel are fully briefed on the study procedures. They will all be familiar with NH&MRC guidelines.

6. Are arrangements for the provision of clinical facilities to handle emergencies necessary? If so, briefly describe the arrangements made.

Emergency clinical facilities will not be required.

7. In cases where subjects are identified from information held by another party (e.g. doctor, hospital association) describe the arrangement whereby you gain access to this information. (You may wish to attach relevant correspondence.)

Subjects will be selected from the ACT white pages telephone book.
8. Specify whether subjects will include students, children, the mentally ill or others in a dependent relationship, and whether payment will be made to any subject.

Subjects are parents who are not in a dependent relationship.

9. Describe the procedures to be followed in obtaining the informed consent of subjects and/or of others responsible. If information for the purpose of obtaining consent is provided in writing, attach any relevant documents; otherwise specify the information provided.

The purposes of the study, and each subject's involvement, including confidentiality issues, will be explained. Informed verbal consent will be obtained. If the subject agrees to participate, the interview will continue. A completed interview indicates that consent was given. We have attached a copy of the questionnaire, including the information for prospective subjects.

10. Comment on any cultural or social attitudes of subjects which have affected the design of the research or which may affect its conduct.

No efforts will be made to influence parents' attitudes to vaccination.

11. Give details of the measures which will be adopted to protect confidential information about subjects.

A separate data sheet will be kept for each subject. These data sheets will be stored in a locked file. Data will not contain any individual identifiers (for example, names and addresses), but each subject will have a unique identification number. Information will remain confidential. Individuals will not be identifiable in published results.

12. Date on which project will begin 11/3/93... and end 14/3/93....

We have enclosed a copy of the questionnaire.

Signed ......... Date .........
(Proposer of research)
Where the proposal is from an Honours student, the Supervisor is asked to certify the accuracy of the above account.

Signed . . . . . . . . Date . . . . . . . .
(Supervisor of Honours scholar)

COMMENT ON PROJECT FROM HEAD OF DEPARTMENT/GROUP/CENTRE:

Wentworth Health Area, 1992

Signed: . . . . . . . . Date . . . . . .
(Head of Department/Group/Centre)

The completed protocol form should be sent to
The Secretary, EHEC,
c/- Vice-Chancellor’s Office,
Room 309, Chancery.
Appendix 19: Immunisation survey report

Immunisation Survey,
Wentworth Health Area, 1992

A survey of immunisation status of children starting school
in the Wentworth Health Area, NSW, 1992

Jane Bell, Pam Whitehead, Tien Chey, Wayne Smith
Anthony Capon, Bin Jalaludin

Western Sector Public Health Unit
13 New Street
North Parramatta NSW 2151
ACKNOWLEDGEMENTS

We thank the parents and guardians of children starting school in the Wentworth Health Area for participating in the study.

We also thank the staff and principals of the Association of Independent Schools of NSW; the Catholic Education Office, Diocese of Parramatta; and the Department of School Education, Metropolitan West Region; for helping with the survey.

Stephen Crone and Marea Mears collected and entered the data. We are very grateful for their help.

Finally, we thank Professor Rufus Clarke for his suggestions and comments on drafts of this report.
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<td>Children's and Parents' Country of Birth, and Parents' Language Spoken at Home, Wentworth Health Area, NSW, 1992</td>
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<th>Abbreviation</th>
<th>Description</th>
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<tbody>
<tr>
<td>BHC</td>
<td>Baby Health Centre</td>
</tr>
<tr>
<td>CDT</td>
<td>Combined diphtheria and tetanus immunisation</td>
</tr>
<tr>
<td>CI</td>
<td>Confidence interval</td>
</tr>
<tr>
<td>GP</td>
<td>General practitioner</td>
</tr>
<tr>
<td>LGA</td>
<td>Local Government Area</td>
</tr>
<tr>
<td>MM</td>
<td>Measles/Mumps immunisation</td>
</tr>
<tr>
<td>NSW</td>
<td>New South Wales</td>
</tr>
<tr>
<td>OR</td>
<td>Odds ratio</td>
</tr>
<tr>
<td>PSB</td>
<td>Pre-school booster immunisation</td>
</tr>
<tr>
<td>TA</td>
<td>Triple antigen immunisation</td>
</tr>
<tr>
<td>TAB</td>
<td>Triple antigen booster immunisation</td>
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EXECUTIVE SUMMARY

Full immunisation was reported for 89% of children. Most children had received three TA injections, MM and the 18 month TAB. About 91% reported that their child had received PSB. General practitioners were the main providers of immunisation services. Reminder letters had little effect on immunisation status. Incomplete immunisation was associated with more negative beliefs in immunisation, parents with post-secondary education, and with families who do not speak English at home. Hepatitis B immunisation status was associated with non-English speaking parents, and attendance at Government or Independent schools.
RECOMMENDATIONS

Recommendations are drawn from the findings of this survey and the Review of Childhood Immunisation in NSW.¹

The Public Health Unit should:

- collaborate with others in the Wentworth Area Health Service to promote uptake of all childhood immunisations, with particular emphasis on pertussis immunisation. Targeted promotion of the CDT booster before school entry or at five years of age, whichever is sooner, is also warranted.

- continue to monitor childhood immunisation uptake. Data on immunisations provided by public immunisation services should be collated. The implementation of the neonatal hepatitis B programme should be monitored.

The Wentworth Area Health Service should:

- take every opportunity to educate and convince health care workers and parents of the benefits of immunisation, and to update immunisation providers about the true contraindications for immunisations.

- ensure that immunisation status of clients is checked, and upgraded if necessary, at each contact with the service.

- support the evaluation of the cost effectiveness of reminder letter systems.
INTRODUCTION

Immunisation against childhood diseases is practised throughout the world, and with improved hygiene, has had a marked effect on the incidence of these diseases. Immunisation protects individuals, and protects the community by reducing the number of people who can transmit the disease. Immunisation also has cost benefits. Cost benefits have been demonstrated for measles, mumps, rubella and pertussis.

In Australia, routine childhood immunisations against diphtheria, tetanus, pertussis, poliomyelitis, measles, mumps and rubella are offered to all children. Data from the 1989-90 National Health Survey identified only 53% of children aged six years and under, as fully immunised. The proportion of children immunised differs between states. Bazeley in 1988, and Sullivan in 1991, compiled detailed reports on immunisation services in western Sydney and the Blue Mountains.

To encourage immunisation uptake, the New South Wales Health Department has run a number of media campaigns promoting the benefits of immunisation. The Department also plans to develop a policy whereby all children entering child care facilities and schools will be required to provide documentation of their immunisation status. When a vaccine preventable disease occurs in such an institution, children not immunised appropriately for age will be excluded from the institution for the duration of the outbreak, to prevent transmission.

The Western Sector Public Health Unit is responsible for coordinating immunisation in the Wentworth Health Area. We undertook a cross-sectional survey of children starting school in the Wentworth Health Area in 1992, to measure prevalence of immunisation uptake and to provide a basis for assessing the impact of policy changes.

The study aims were:

- to determine the prevalence of immunisation uptake
- to compare immunisation uptake between Catholic, Government and Independent schools
- to identify immunisation providers
- to document parental beliefs about immunisation
- to identify risk factors for incomplete immunisation
METHOD

We surveyed children enrolled in kindergarten for the first time in 1992, in the Wentworth Health Area. The Wentworth Health Area comprises the local government areas (LGAs) of Blue Mountains, Hawkesbury and Penrith (Figure 1).

Ethics approval was granted by the Research and Ethics Committee of the Wentworth Area Health Service. Approval was obtained from the Catholic Education Office, the New South Wales Education Department, and from the Association of Independent Schools. Each educational authority provided a list of primary schools in the Wentworth Health Area.

Schools were stratified into three groups, Catholic, Government and Independent. Within each stratum, schools were randomly sampled with probability proportional to the size of the kindergarten student population. Five Catholic, eleven Government, and six Independent schools were selected. One Government and one Independent school did not participate. Within each participating school, all children entering kindergarten were included in the study. The study population was 1066 children. We calculated sample size to have a 95% certainty that point estimates of children's immunisation uptake would be within 2% of the true population uptake. Children starting kindergarten would be at least five years of age or turning five during the school year.

A covering letter, consent form and questionnaire were given to each child to take home. A parent or guardian completed the questionnaire, and returned it to the class teacher. Questionnaires were collected by a member of the Public Health Unit. A reminder letter and another questionnaire were posted to non-respondents. A maximum of three reminders were sent to each non-respondent. Questionnaires from late respondents were posted to the Public Health Unit.

The questionnaire (Appendix) elicited information on immunisation uptake, immunisation providers, and possible factors influencing immunisation uptake. Parents were asked if their child had received all three triple antigen (TA) injections, a measles-mumps (MM) injection, a TA booster (TAB) at 18 months and a pre-school booster (PSB). They were also asked if their child had missed out on the pertussis component of the TA injection. Oral poliomyelitis vaccination status was excluded because it is highly correlated with triple antigen immunisation status. We also asked about hepatitis B immunisation.

We asked parents their reasons for missing any recommended immunisations. Parents were also asked about beliefs in, and sources of information about immunisation.
We asked for information on the child’s age, sex and country of birth. Finally we asked parents their age, country of birth, language spoken at home, educational qualifications and postcode of residence.

Data were coded, entered into a database and analysed using the SAS statistical package. We adjusted point estimates for the sampling method, and calculated 95% confidence intervals around point estimates. Using logistic regression models, we determined risk factors for incomplete immunisation, and factors associated with hepatitis B immunisation.
Figure 1  Location of the Wentworth Health Area, NSW
RESULTS

We investigated children's immunisation status, but the term "respondents" refers to the parents or guardians who completed the questionnaires.

Table 1 presents the response rates, and age and sex composition of the sample. The 1066 children sampled represent 41% of the kindergarten population in the Wentworth Health Area in 1992. We received completed questionnaires from 966 (91%) children. Of the 966 children, 350 were from Catholic schools, 532 from Government schools, and 84 from Independent schools. The response rate from Independent schools was significantly lower than that from Catholic and Government schools. The mean age of the children was 5.2 years. The average age of respondents was 33.2 years, with a range from 21.0 to 47.0 years.

<table>
<thead>
<tr>
<th>Type of School</th>
<th>Catholic</th>
<th>Government</th>
<th>Independent</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Children</td>
<td>371</td>
<td>588</td>
<td>107</td>
<td>1066</td>
</tr>
<tr>
<td>Number of Respondents</td>
<td>350</td>
<td>532</td>
<td>84</td>
<td>966</td>
</tr>
<tr>
<td>Response Rate (%)</td>
<td>94</td>
<td>91</td>
<td>79</td>
<td>91.0</td>
</tr>
<tr>
<td>95% CI</td>
<td>92-97</td>
<td>88-93</td>
<td>71-86</td>
<td></td>
</tr>
<tr>
<td>Child's Age</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Less than 5 years</td>
<td>110</td>
<td>167</td>
<td>24</td>
<td>301</td>
</tr>
<tr>
<td>5 years and older</td>
<td>239</td>
<td>363</td>
<td>59</td>
<td>661</td>
</tr>
<tr>
<td>Sex</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Females</td>
<td>182</td>
<td>264</td>
<td>41</td>
<td>487</td>
</tr>
<tr>
<td>Males</td>
<td>168</td>
<td>268</td>
<td>43</td>
<td>479</td>
</tr>
</tbody>
</table>

1 Adjusted for sampling method
2 The response rate from Independent schools was significantly lower than that from Catholic and Government schools.
3 The ages of four children were not reported.
Immunisation status

Nearly 89% of children were reported to be fully immunised (Table 2). They had received three injections of TA or a combination of TA and combined diphtheria-tetanus (CDT), MM vaccination, TAB and PSB. Incomplete immunisation was reported for 11% of children, including four children who had not received any vaccinations at all. Immunisation status, classified as full or incomplete, did not vary significantly between the school types.

Table 2  Reported Immunisation Status of Children, by School Type, Wentworth Health Area, NSW, 1992

<table>
<thead>
<tr>
<th>Immunisation status(^1) (%)</th>
<th>School type</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Catholic</td>
<td>Government</td>
<td>Independent</td>
<td>Total</td>
<td></td>
</tr>
<tr>
<td>Full immunisation(^2)</td>
<td>92</td>
<td>89</td>
<td>82</td>
<td>89</td>
<td></td>
</tr>
<tr>
<td>95% CI</td>
<td>75-100</td>
<td>72-100</td>
<td>58-100</td>
<td>77-100</td>
<td></td>
</tr>
<tr>
<td>Incomplete immunisation(^3)</td>
<td>8</td>
<td>11</td>
<td>18</td>
<td>11</td>
<td></td>
</tr>
</tbody>
</table>

\(^1\)Adjusted for sampling method  
\(^2\)Full immunisation defined as 3 TA/CDT injections, MM, TAB and PSB  
\(^3\)Includes four children who had received no immunisations

Hawkesbury LGA has higher immunisation uptake than the Blue Mountains and Penrith LGAs (Table 3).

Table 3  Percentage of Children Reported to be Fully Immunised, by Local Government Area, Wentworth Health Area, NSW, 1992

<table>
<thead>
<tr>
<th></th>
<th>Blue Mountains</th>
<th>Hawkesbury</th>
<th>Penrith</th>
</tr>
</thead>
<tbody>
<tr>
<td>%(^1) Fully immunised</td>
<td>87.5</td>
<td>98.1</td>
<td>90.2</td>
</tr>
<tr>
<td>95% CI</td>
<td>82.8-92.2</td>
<td>97.0-99.2</td>
<td>84.6-95.8</td>
</tr>
</tbody>
</table>

\(^1\)Adjusted for sampling method
Table 4  Percentage\(^1\) of Children Reported to be Fully Immunised by Vaccine Type, Wentworth Health Area, NSW, 1992

<table>
<thead>
<tr>
<th>Vaccine type</th>
<th>Fully immunised (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Triple antigen/CDT (3 vaccinations)</td>
<td>98.9</td>
</tr>
<tr>
<td>Measles/Mumps</td>
<td>98.3</td>
</tr>
<tr>
<td>Triple antigen booster</td>
<td>97.1</td>
</tr>
<tr>
<td>Pre-school booster</td>
<td>91.4</td>
</tr>
</tbody>
</table>

\(^1\)Adjusted for sampling method

Immunisation rates for specific vaccine types are presented in Table 4. Complete pertussis immunisation was reported for only 82% of children.

Table 5  Percentage\(^1\) of Children Reported to be Fully Immunised, by Vaccine Type in Each Local Government Area, Wentworth Health Area, NSW, 1992

<table>
<thead>
<tr>
<th></th>
<th>Blue Mountains</th>
<th>Hawkesbury</th>
<th>Penrith</th>
</tr>
</thead>
<tbody>
<tr>
<td>Triple antigen/CDT (3 vaccinations)</td>
<td>98.5</td>
<td>99.8</td>
<td>99.2</td>
</tr>
<tr>
<td>Measles/Mumps</td>
<td>98.2</td>
<td>99.8</td>
<td>98.0</td>
</tr>
<tr>
<td>Triple antigen booster</td>
<td>97.1</td>
<td>99.5</td>
<td>97.6</td>
</tr>
<tr>
<td>Pre-school booster</td>
<td>90.6</td>
<td>98.4</td>
<td>92.6</td>
</tr>
</tbody>
</table>

\(^1\)Adjusted for sampling method

There is little difference between the three LGAs in the percentage of children fully immunised with each type of vaccine (Table 5).
Immunisation providers

General practitioners provided most immunisation services in the Wentworth Health Area (Table 6). General practitioners provided all TA, MM, TAB and PSB immunisations for about 72% of children. In contrast, local councils provided all immunisations for 4% of children. A combination of private doctors, local councils or "other places" provided immunisations for 24% of children.

Table 6  Percentage of Children who Received All Immunisations from One Type of Provider, Wentworth Health Area, NSW, 1992

<table>
<thead>
<tr>
<th>Immunisation provider</th>
<th>Percentage of children</th>
</tr>
</thead>
<tbody>
<tr>
<td>General Practitioners</td>
<td>72.3</td>
</tr>
<tr>
<td>Local Council</td>
<td>3.9</td>
</tr>
<tr>
<td>Mix of Providers</td>
<td>23.5</td>
</tr>
<tr>
<td>&quot;Other Place&quot;</td>
<td>0.3</td>
</tr>
</tbody>
</table>

When the particular providers used by people who used a mix of providers is redistributed, 87.5% of immunisations were provided by private doctors, 11.5% by local councils, and only 1% by other providers.
In Penrith LGA, general practitioners provided more immunisation services, and the local council, less services, compared with the Blue Mountains and Hawkesbury LGAs (Table 7).

Table 7  Percentage of Children who Received all Immunisations from One Type of Provider, by Local Government Area, Wentworth Health Area, NSW, 1992

<table>
<thead>
<tr>
<th></th>
<th>Blue Mountains</th>
<th>Hawkesbury</th>
<th>Penrith</th>
</tr>
</thead>
<tbody>
<tr>
<td>General Practitioners</td>
<td>64.4</td>
<td>70.3</td>
<td>80.6</td>
</tr>
<tr>
<td>Local Council</td>
<td>6.3</td>
<td>8.9</td>
<td>0.7</td>
</tr>
<tr>
<td>Mix of Providers</td>
<td>29.0</td>
<td>20.8</td>
<td>18.3</td>
</tr>
<tr>
<td>&quot;Other Place&quot;</td>
<td>0.3</td>
<td>0</td>
<td>0.5</td>
</tr>
</tbody>
</table>

Table 8 shows the percentage of all immunisations given by general practitioners, local councils and other providers in each LGA, after the particular providers used in the mix of providers has been redistributed.

Table 8  Percentage of All Immunisations Provided by Each Source, by Local Government Area, Wentworth Health Area, NSW, 1992

<table>
<thead>
<tr>
<th></th>
<th>Blue Mountains</th>
<th>Hawkesbury</th>
<th>Penrith</th>
</tr>
</thead>
<tbody>
<tr>
<td>General practitioners</td>
<td>82.2</td>
<td>84.1</td>
<td>93.5</td>
</tr>
<tr>
<td>Local council</td>
<td>16.9</td>
<td>15.6</td>
<td>5.5</td>
</tr>
<tr>
<td>&quot;Other Place&quot;</td>
<td>0.9</td>
<td>0.3</td>
<td>0.9</td>
</tr>
</tbody>
</table>
Reasons for incomplete immunisation

Ninety respondents gave reasons for incomplete immunisation. These respondents were responsible for 90% of incomplete immunisations. We grouped reasons for incomplete immunisation into: parental indifference, professional advice, personal beliefs, child's ill health or allergic reaction, lack of access, and other reasons (Table 9).

Table 9 Reasons given for Incomplete Immunisation, Wentworth Health Area, NSW, 1992

<table>
<thead>
<tr>
<th>Reasons for incomplete immunisation</th>
<th>Number of times this reason was cited¹</th>
</tr>
</thead>
<tbody>
<tr>
<td>parental indifference</td>
<td>32</td>
</tr>
<tr>
<td>doctor advised against immunisation</td>
<td>28</td>
</tr>
<tr>
<td>personal beliefs</td>
<td>12</td>
</tr>
<tr>
<td>child's ill health when immunisation due</td>
<td>8</td>
</tr>
<tr>
<td>severe or allergic reaction to a previous immunisation</td>
<td>6</td>
</tr>
<tr>
<td>lack of access</td>
<td>5</td>
</tr>
<tr>
<td>other reasons</td>
<td>11</td>
</tr>
</tbody>
</table>

¹Respondents could give more than one reason

Receipt of professional advice against immunisation, and parental indifference were the two most common reasons given for incomplete immunisation. Indifference included reasons such as "I didn't get around to it" and "I find it difficult to remember when immunisations are due". Of those who did not receive all pertussis immunisations, the main reason given was "professional advice against it". The main reasons given by those who had received all immunisations except the pre-school booster, were that immunisation schedules were "difficult to remember", or that "they didn't get around to it".

Personal beliefs about whether immunisation is important, and balancing side effects and benefits were also important. Inappropriate contraindications, such as
minor illnesses or ill health, were reported as reasons for non-compliance with immunisation.

Some parents reported difficulties accessing immunisation services, due to times of immunisation clinics, lack of private transport, and the cost of visiting the local doctor. Only one parent reported family relocation as a reason for incomplete immunisation.

Table 1: Variables included in the Logistic Regression Model

<table>
<thead>
<tr>
<th>Variable</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>school type</td>
<td></td>
</tr>
<tr>
<td>child's sex</td>
<td></td>
</tr>
<tr>
<td>respondent's role</td>
<td></td>
</tr>
<tr>
<td>respondent's education</td>
<td></td>
</tr>
<tr>
<td>child's country of birth</td>
<td></td>
</tr>
<tr>
<td>respondent's country of birth</td>
<td></td>
</tr>
<tr>
<td>respondents know how to carry out immunisation reminder letter</td>
<td></td>
</tr>
<tr>
<td>belief in importance of immunisation</td>
<td></td>
</tr>
<tr>
<td>belief in effectiveness of immunisation</td>
<td></td>
</tr>
<tr>
<td>belief in safety of immunisation</td>
<td></td>
</tr>
</tbody>
</table>

We calculated crude and adjusted odds ratios. Adjusted rates were estimated when crude odds ratios and only adjusted odds ratios are presented. Odds ratios greater than one indicate the group of mothers is more likely to be incompletely immunised compared with the reference group. Odds ratios less than one indicate mothers more likely to be fully immunised. Table 1 presents the adjusted odds ratios for influencing immunisation by selected family characteristics, immunisation reminder letter and beliefs in immunisation.
Logistic regression model

We examined the independent and combined effects of demographic factors, ethnicity, educational level, beliefs, and reminder letters, on immunisation status using a logistic regression model (Table 10).

Table 10  Variables included in the Logistic Regression Model

<table>
<thead>
<tr>
<th>Variable</th>
</tr>
</thead>
<tbody>
<tr>
<td>school type</td>
</tr>
<tr>
<td>child's age</td>
</tr>
<tr>
<td>respondent's age</td>
</tr>
<tr>
<td>respondent's education</td>
</tr>
<tr>
<td>child's country of birth</td>
</tr>
<tr>
<td>respondent's country of birth</td>
</tr>
<tr>
<td>respondent's language spoken at home</td>
</tr>
<tr>
<td>immunisation reminder letter</td>
</tr>
<tr>
<td>belief in importance of immunisation</td>
</tr>
<tr>
<td>belief in effectiveness of immunisation</td>
</tr>
<tr>
<td>belief in safety of immunisation</td>
</tr>
</tbody>
</table>

We calculated crude and adjusted odds ratios. Adjusted odds ratios were similar to crude odds ratios and only adjusted odds ratios are presented. Odds ratios greater than one indicate this group of children is more likely to be incompletely immunised, compared with the reference group. Odds ratios less than one, indicate groups more likely to be fully immunised. Table 11 presents the adjusted odds ratios for incomplete immunisation, by selected family characteristics, immunisation reminder letter and beliefs in immunisation.
Table 11  Odds Ratios for Incomplete Immunisation, by Selected Family Characteristics, Reminder Letter and Beliefs in Immunisation, Wentworth Health Area, NSW, 1992

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Adjusted OR(95%CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Child's age</td>
<td></td>
</tr>
<tr>
<td>5 years or older²</td>
<td></td>
</tr>
<tr>
<td>Younger than 5 years</td>
<td>1.6 (1.0-2.6)</td>
</tr>
<tr>
<td>Parent had post-secondary education</td>
<td></td>
</tr>
<tr>
<td>Yes²</td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>0.5 (0.3-0.8)</td>
</tr>
<tr>
<td>Child's country of birth</td>
<td></td>
</tr>
<tr>
<td>Australia²</td>
<td></td>
</tr>
<tr>
<td>Australia²</td>
<td>3.1 (1.2-8.4)</td>
</tr>
<tr>
<td>Outside Australia²</td>
<td></td>
</tr>
<tr>
<td>Outside Australia²</td>
<td>1.1 (0.6-2.1)</td>
</tr>
<tr>
<td>Respondent's country of birth</td>
<td></td>
</tr>
<tr>
<td>Australia²</td>
<td></td>
</tr>
<tr>
<td>Australia²</td>
<td>3.1 (1.2-8.4)</td>
</tr>
<tr>
<td>Outside Australia²</td>
<td></td>
</tr>
<tr>
<td>Outside Australia²</td>
<td>1.1 (0.6-2.1)</td>
</tr>
<tr>
<td>Respondent's language</td>
<td></td>
</tr>
<tr>
<td>English²</td>
<td></td>
</tr>
<tr>
<td>Not English</td>
<td>5.9 (2.0-17.8)</td>
</tr>
<tr>
<td>Reminder letter</td>
<td></td>
</tr>
<tr>
<td>Received²</td>
<td></td>
</tr>
<tr>
<td>Not received</td>
<td>0.8 (0.4-1.3)</td>
</tr>
<tr>
<td>Belief in importance</td>
<td></td>
</tr>
<tr>
<td>Very important²</td>
<td></td>
</tr>
<tr>
<td>Quite important</td>
<td>3.5 (1.7-7.3)</td>
</tr>
<tr>
<td>Not very/not important</td>
<td>5.2 (0.5-53.7)</td>
</tr>
<tr>
<td>Belief in effectiveness</td>
<td></td>
</tr>
<tr>
<td>Very effective²</td>
<td></td>
</tr>
<tr>
<td>Moderately effective</td>
<td>1.2 (0.6-2.3)</td>
</tr>
<tr>
<td>Somewhat/ineffective</td>
<td>6.0 (0.9-38.6)</td>
</tr>
<tr>
<td>Belief in safety</td>
<td></td>
</tr>
<tr>
<td>Very safe²</td>
<td></td>
</tr>
<tr>
<td>Quite safe</td>
<td>1.0 (0.6-1.8)</td>
</tr>
<tr>
<td>Not very/very unsafe</td>
<td>2.6 (0.6-10.9)</td>
</tr>
</tbody>
</table>

1 Odds ratios >1 indicate groups more likely to be incompletely immunised, and odds ratios <1 indicate groups more likely to be fully immunised, compared with the reference group.
2 Reference group
Parents’ educational level

Figure 2 shows the percentage of children fully immunised, by level of parental education.

**Figure 2** Percentage of Children Fully Immunised, by Parents’ Educational Level, Wentworth Health Area, NSW, 1992

Children of respondents with post-secondary education were more than twice as likely to be incompletely immunised, compared with children whose parents had only secondary education (Table 11).
When levels of post-secondary education were considered, children whose parents had a bachelor degree or higher were more than four times as likely to be incompletely immunised as children whose parents had no post-secondary education. There was no difference in immunisation status between children whose parents had a diploma, certificate or trade, and children whose parents had only secondary education (Table 12).

<table>
<thead>
<tr>
<th>Educational level</th>
<th>Adjusted OR (95%CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Secondary school only¹</td>
<td>1.1 (0.4-3.4)</td>
</tr>
<tr>
<td>Trade or apprenticeship</td>
<td>1.3 (0.7-2.5)</td>
</tr>
<tr>
<td>Certificate or diploma</td>
<td>4.4 (2.2-9.0)</td>
</tr>
<tr>
<td>Bachelor degree</td>
<td></td>
</tr>
</tbody>
</table>

¹Reference group
Ethnicity

Children born outside Australia were three times more likely to be incompletely immunised than children born in Australia (Table 11). If respondents did not speak English at home, their children were six times more likely to be incompletely immunised than children of respondents who did speak English at home. Parent's country of birth did not influence children's immunisation status. Table 13 gives the proportion of children and parents born in Australia, and the proportion of parents who speak English at home.

Table 13 Children's and Parents' Country of Birth, and Parents' Language Spoken at Home, Wentworth Health Area, NSW, 1992

<table>
<thead>
<tr>
<th>Ethnicity</th>
<th>%(^1) of total (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Child's country of birth</td>
<td></td>
</tr>
<tr>
<td>Australia</td>
<td>96.3 (90.5-100)</td>
</tr>
<tr>
<td>Other</td>
<td>3.7 (0-9.5)</td>
</tr>
<tr>
<td>Respondent's country of birth</td>
<td></td>
</tr>
<tr>
<td>Australia</td>
<td>77.5 (66.6-88.4)</td>
</tr>
<tr>
<td>Other</td>
<td>22.4 (11.5-33.3)</td>
</tr>
<tr>
<td>Language spoken at home</td>
<td></td>
</tr>
<tr>
<td>English</td>
<td>95.8 (87.8-100)</td>
</tr>
<tr>
<td>Other</td>
<td>2.6 (0-9.4)</td>
</tr>
</tbody>
</table>

\(^1\)Percentages adjusted for sampling method
Immunisation reminder notices

Two hundred respondents (23%), reported receiving immunisation reminder cards or letters, and 640 (74%) stated that they did not receive reminder notices.

Receipt of reminder letters was not associated with increased immunisation uptake (Table 11). Of those who received reminder notices, 89.3% were fully immunised, whilst 89.5% of those who did not receive reminders were fully immunised.

Child’s age

Children younger than five years were less likely to be fully immunised than children five years and over. Similar percentages of children under five years old, and five years and over, had been immunised with TA, MM and TAB. But the percentage of children who had received PSB was significantly lower for children under five years (88%), than for children five years and over (93.5%) ($\chi^2_{df=1}=5.1; p=0.02$).
**Personal beliefs and immunisation**

Beliefs in the importance, effectiveness and safety of immunisation were associated with immunisation uptake (Table 11). The likelihood of incomplete immunisation increased as the belief became more negative. The majority of respondents believed that immunisation was "very" or "quite" important, effective or safe. The numbers of respondents were small in the more negative groups, and confidence intervals are therefore wide.

Figures 3-5 present the numbers of respondents with each belief.

**Figure 3** Belief in Safety of Immunisation, Wentworth Health Area, NSW, 1992

![Bar chart showing beliefs in safety of immunisation](chart)
Figure 4  Belief in Importance of Immunisation, Wentworth Health Area, NSW, 1992

Figure 5  Belief in Effectiveness of Immunisation, Wentworth Health Area, NSW, 1992
Source of information about immunisation

Figure 6 shows where information about childhood immunisation was obtained. The main sources of information about immunisation were Baby Health Centres (BHC) and general practitioners (GP).

Figure 6 Sources of Information About Immunisation, Wentworth Health Area, NSW, 1992
Adequacy of the information received

Most respondents (88%) felt that the information they received was either very adequate or quite adequate (Figure 7). Ten per cent reported that the information they received was somewhat adequate or inadequate.

For the different sources of information, similar proportions of respondents reported that the information received was very or quite adequate. The proportions ranged from 86.2% for Community Health Centres to 91.6% for general practitioners.

Figure 7  Adequacy of Information Received About Immunisation, Wentworth Health Area, NSW, 1992
Hepatitis B immunisation

Parents reported that hepatitis B immunisation had been commenced or completed for 79 children (8.7%±12.6). The vaccine had not been given for 807 children, and 55 parents were unsure.

We used a logistic regression model to determine predictors of hepatitis B immunisation. We felt that parents would be likely to know whether their children had received a hepatitis B vaccination or not, and so children with a negative answer, and those whose parents were unsure were grouped together. We calculated crude and adjusted odds ratios. Adjusted odds ratios were similar to crude odds ratios and only adjusted odds ratios are shown (Table 14). Odds ratios greater than one indicate this group of children is more likely to have had hepatitis B immunisation compared with the reference group. Odds ratios less than one, indicate groups less likely to have had hepatitis B immunisation.

Compared with children at Catholic schools, children who attend Government schools were twice as likely to have received hepatitis B immunisation, and children enrolled at Independent schools were over three times more likely to have received hepatitis B immunisation. Children of respondents with a non-English speaking background were three times more likely to have had hepatitis B immunisation compared with children whose parents spoke English at home. Parent's educational qualification and age, and the child's age did not influence hepatitis B immunisation status.

Based on NSW Health Department guidelines for the hepatitis B neonatal immunisation programme,16 we categorised countries as either high hepatitis B prevalence, or low prevalence. Children born in countries known to have high hepatitis B prevalence, and children whose parents were born in these countries, did not have significantly different hepatitis B vaccination rates to the rest of the children.
Table 14  Odds Ratios for Hepatitis B Immunisation, by Selected Characteristics, Wentworth Health Area, NSW, 1992

<table>
<thead>
<tr>
<th>Variable</th>
<th>Adjusted OR$^1$ (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>School type</td>
<td></td>
</tr>
<tr>
<td>Catholic$^2$</td>
<td></td>
</tr>
<tr>
<td>Government</td>
<td>2.0 (1.1-3.5)</td>
</tr>
<tr>
<td>Independent</td>
<td>3.1 (1.5-6.6)</td>
</tr>
<tr>
<td>Parent had post-secondary education</td>
<td></td>
</tr>
<tr>
<td>No$^2$</td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>1.4 (0.8-2.2)</td>
</tr>
<tr>
<td>Language spoken at home</td>
<td></td>
</tr>
<tr>
<td>English$^2$</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>3.0 (1.2-7.5)</td>
</tr>
<tr>
<td>Respondent’s country of birth</td>
<td></td>
</tr>
<tr>
<td>Low hepatitis B prevalence$^2$</td>
<td></td>
</tr>
<tr>
<td>High hepatitis B prevalence</td>
<td>1.2 (0.5-2.9)</td>
</tr>
<tr>
<td>Child’s country of birth</td>
<td></td>
</tr>
<tr>
<td>Low hepatitis B prevalence$^2$</td>
<td></td>
</tr>
<tr>
<td>High hepatitis B prevalence</td>
<td>1.5 (0.5-4.0)</td>
</tr>
</tbody>
</table>

$^1$Odds ratios >1 indicate groups more likely to be incompletely immunised, and odds ratios <1 indicate groups more likely to be fully immunised, compared with the reference group.

$^2$Reference group
DISCUSSION

There have been few population studies of immunisation status in Australia. The National Health Survey, conducted by the Australian Bureau of Statistics every five years, is the only national population survey of immunisation status.

Our response rate of 91% is excellent for a self administered questionnaire and compares well with the 96% response rate for the 1989-90 National Health Survey. We found higher rates of immunisation for MM, pertussis and PSB in our study than reported for the Wentworth Health Area from the 1989-90 National Health Survey. We were unable to compare immunisation rates for TA because of differences in data collection. Our reported rate for measles immunisation uptake (98%) is also higher than the 91% reported by Ferson and Christie in their study of children entering school in the Eastern Sydney Health Area in 1989.

The high levels of immunisation uptake reported may reflect a bias in parental recall. Parental report often over-estimates children's immunisation status. We did not validate immunisation status. Standard immunisation records were not available for this cohort of children, and ethical and resource considerations prevented serological validation. Selection bias, from our 9% refusal rate, may also have contributed to our high level of reported immunisation uptake. Non-respondents may have lower levels of immunisation uptake.

Hawkesbury LGA has higher immunisation uptake than the Blue Mountains and Penrith LGAs. It also has slightly higher PSB uptake. This may be because only a relatively small number of children from Hawkesbury LGA were surveyed. Sampling was based on school type, not residential area.

We chose a stratified sampling procedure to enable comparisons between Catholic, Government and Independent schools. Differences in immunisation uptake between different types of schools have been reported. Point estimates obtained from crude analysis were similar to adjusted point estimates allowing for the sampling method. However, confidence intervals were wide, illustrating that differences between schools within strata were greater than differences between strata.

Providers of immunisation vary throughout Australia. In Queensland, immunisation services are provided mainly by the private sector. In contrast, immunisation services in Victoria, Western Australia, the Northern Territory, the Australian Capital
Territory and South Australia are provided mainly by public authorities. In New South Wales, childhood immunisation is offered by general practitioners, local councils, and baby and community health centres. We found that general practitioners provided most immunisation services in the Wentworth Health Area. Our findings are consistent with previous reports for the Western Sydney and Wentworth Health Areas and for NSW as a whole.

The lower levels of immunisation uptake in children younger than five years of age compared to those five years and older, appear to be related to PSB. Parental indifference was the most common reason given for missing PSB. National Health and Medical Research Council guidelines recommend that PSB should be given at five years of age or prior to school entry. Although a child has started school, parents may be waiting for his/her fifth birthday before immunising. Confusion about when this booster should be given may be an important reason for children not being protected at school entry.

Professional advice against immunisation, and parental indifference were the two most common reasons given for incomplete immunisation. Similar reasons have been reported in other studies. To maintain high levels of immunisation in the community, health care professionals and parents need to be convinced of the benefits of immunisation.

Inappropriate contraindications, such as minor illnesses or ill health, were reported as reasons for non-compliance with immunisation. Other studies report similar findings. General practitioners are the main providers of immunisation services in the Wentworth Health Area, and have an important role in encouraging immunisation uptake. Ethnic and other subgroups need targeting. Health professionals should reinforce the importance, effectiveness and safety of immunisation.

The level of complete pertussis immunisation (82%) is lower than the 92-95% necessary for herd immunity. Incorrect advice from professionals about immunisation, especially pertussis immunisation, has contributed to less than optimal vaccine uptake. In our study, many parents whose children had missed one or more pertussis vaccinations reported that their doctor had advised against it. The benefits of pertussis vaccination outweigh risks. Low pertussis immunisation prevalence suggests we need specific campaigns to encourage increased uptake. Health professionals should be updated regularly about true contraindications for
Children of respondents with post-secondary education were more than twice as likely to be incompletely immunised, compared with children whose parents had only secondary education. This could not be explained by possible awareness of risks of immunisation. There were no differences in beliefs in immunisation between those with, and those without post-secondary education.

The 1989-90 National Health Survey found that children of parents born overseas were less likely to be fully immunised than children of Australian born parents. Lower immunisation rates have also been found in certain ethnic groups in the United States of America and in New Zealand Maoris. The association of incomplete immunisation with parents who do not speak English at home was stronger than that for either the child's or parent's country of birth. Similar results were reported in a recent study of children attending a hospital casualty department. Incomplete immunisation was associated with parents who spoke and understood little English, but not associated with the parent's country of birth.

These findings suggest that communication is important in determining immunisation levels, and that ethnic groups should be targeted in their primary language.

Reminder letters theoretically increase immunisation uptake. We found that they made no difference. This may be characteristic of the Wentworth Health Area. Reminder letters are usually distributed by local councils, and in the Wentworth Health Area, local councils are minor providers of immunisation. The cost effectiveness of sending reminder letters should be evaluated.

After controlling for possible confounding variables, children's hepatitis B vaccination status was associated with non-English speaking parents, and attendance at Government or Independent schools. These factors are not direct risks for hepatitis B infection. We did not ask about other factors which may influence hepatitis B immunisation, such as parents who are health care workers or injecting drug users. We are therefore unable to determine whether hepatitis B vaccination follows recommended guidelines. Children born in countries known to have high hepatitis B prevalence, and children whose parents were born in these countries, did not have significantly different hepatitis B vaccination rates compared with the rest of the children. The NSW neonatal hepatitis B immunisation programme was introduced in 1987. Children in the study were born before or
around the time of the programme's introduction and so it can not be expected to have influenced hepatitis B immunisation status.

School entry legislation increases immunisation levels at the age of school entry. In countries where it has been adopted, the incidence of reported vaccine preventable diseases has decreased.\textsuperscript{32} Although documentation of immunisation at school entry has increased the prevalence of children with completed immunisation schedules, studies report that some immunisations are given later than the recommended age.\textsuperscript{32,35,36} Delayed immunisation places children at increased risk of infection for prolonged periods.

Immunisation status could be reviewed and upgraded if necessary, at each contact with the health care system. Opportunities for such programmes exist in hospitals. Hospitals are often used as a source of primary health care\textsuperscript{31} and immunisation prevalence is lower in hospitalised children.\textsuperscript{12,37} Immunising children attending hospitals will protect a vulnerable group of children.

An effective immunisation programme is essential for maintaining public health benefits. The Carey report\textsuperscript{1} recommends that Public Health Units should be collating immunisation information provided by public providers, monitoring immunisation coverage, and ensuring that missed opportunities for immunisation are minimised. We need a standardised approach to monitor age-specific immunisation status to compare children's immunisation status between areas, and between population sub-groups. School entry policy will facilitate monitoring in this age group, but other methods are needed to monitor immunisation status in younger children.
SUMMARY

In summary, 89% of children were reported to be fully immunised. General practitioners were the main providers of immunisation services. Reminder letters had little effect on immunisation status. Incomplete immunisation was associated with more negative beliefs in immunisation, parents with post-secondary education, and with families who do not speak English at home.

Hepatitis B immunisation status was associated with non-English speaking parents, and attendance at Government or Independent schools.


REFERENCES


25. Klein N, Morgan K, Wansbrough-Jones MH. Parents’ beliefs about vaccination:


Appendix: Questionnaire used in immunisation survey, Wentworth Health Area, NSW, 1992.

IMMUNISATION PREVALENCE STUDY

This questionnaire is to be answered by a parent or guardian of the child. All you need to do is tick the appropriate box/boxes, or write a short answer in the space provided.

1. What is the date of birth of your child? _______________________

2. What sex is your child?
   - Male ............
   - Female ...........

3. In which country was your child born? _______________________

4. The next few questions are about your child’s immunisations status.
   (You may wish to check with your child’s immunisation records)
   Did your child receive all the three Triple Antigen injections that are usually given in the first year of life?
   - Yes ............
   - No .............
   - Unsure ........

5. Did your child receive the Measles-Mumps injection (usually given at 12-15 months of age)?
   - Yes ............
   - No .............
   - Unsure ........
6. Did your child receive the 18 month Triple Antigen booster injection?

Yes .......... 0
No ........... 0
Unsure ........ 0

7. Did your child receive the pre-school booster injection?

Yes .......... 0
No ........... 0
Unsure ........ 0

8. Where did you go to receive the above immunisations for your child?

(Please tick the appropriate box)

<table>
<thead>
<tr>
<th>Private Doctor</th>
<th>Local Council Place</th>
<th>Other Place</th>
</tr>
</thead>
<tbody>
<tr>
<td>Triple Antigen injections in the first year of life</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Measles/Mumps injection</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>18 month Triple Antigen booster</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Pre-school CDT booster</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

9. Did your child miss out on the Whooping Cough part of any of the Triple Antigen injections?

Yes ........... 0
No ........... 0
Unsure ......... 0
10. Please answer this question only if your child has missed out on any of the above immunisations.

Can you tell me why your child has not been fully immunised?

(You may tick more than one box)

☐ The doctor advised against the immunisation

☐ I do not think that immunisations are necessary

☐ I feel that the side effects of immunisations are worse than the benefits of immunisations

☐ The times when immunisation services were available were not convenient for me

☐ I do not have private transport and find it difficult to get to where I have my child immunised

☐ I live too far away from any doctor or local council that provides immunisation services

☐ I find it difficult to remember when the immunisations are due

☐ I cannot afford to get my child immunised at the local doctor

☐ I did not get around to it

☐ Other reason/s

Please specify __________________________________________

11. Is there anything that the Health Department can do to make it easier for you to get your child immunised?

Please specify __________________________________________

12. Has your child been immunised against or has commenced immunisation against Hepatitis B?

Yes ........... ☐

No ........... ☐

Unsure ....... ☐
13. These next few questions are about immunisations in general.

From where have you obtained most of your information about immunisation?

(Please tick one box only)

Public Hospital ............
Baby Health Centre ........
Community Health Centre ....
General Practitioner ........
Day Care Centre ...........
Public Health Unit ........
Other ........................

If Other, please specify _________________________

14. How adequate was the information that you were able to obtain?

Very Adequate ..............
Quite Adequate ............
Somewhat Adequate ........
 Totally Inadequate .......

15. From where would you prefer to obtain your information about immunisation?

(Please tick one box only)

Public Hospital ............
Baby Health Centre ........
Community Health Centre ....
General Practitioner ........
Day Care Centre ...........
Public Health Unit ........
Other ........................

If Other, please specify _________________________
16. Did you ever receive 'reminder cards' or 'reminder letters' that let you know when your child's immunisations were due?

Yes ........... ○
No ........... ○
Unsure ......... ○

17. How important do you think it is for all children to be fully immunised?

Very important ................. ○
Quite important ................. ○
Not very important ............. ○
Not important at all ........... ○

18. How effective do you think immunisations are in preventing childhood infectious diseases?

Very effective ................. ○
Moderately effective ........... ○
Somewhat effective ............ ○
Not effective ................... ○

19. How safe do you think childhood immunisations are?

Very safe ...................... ○
Quite safe ...................... ○
Not very safe ................... ○
Very unsafe .................... ○

20. Do you believe that alternate forms of immunisation (such as homoeopathy) work as well as those that are used by the medical profession (such as triple antigen injection, measles-mumps injection and oral polio vaccine)?

Yes ............. ○
No ............. ○
Don't know ... ○
21. Finally I would like to ask some background questions about yourself and your family.

How old are you? _____ years

22. Were you born in Australia?

Yes ............

No ............

If No, please specify your country of birth ____________

23. If you were NOT born in Australia, when did you arrive in Australia?

Year Arrived ____________

24. What language do you usually speak at home?

Please specify ____________

25. Are you an Aboriginal or Torres Strait Islander person?

Yes ............

No ............

26. Have you obtained a trade or any other qualification since leaving school?

Yes ............

No ............

27. If you have obtained a qualification, what is the highest qualification that you have obtained since leaving school?

Batchelor degree or higher ........

Trade/Apprenticeship ........

Certificate/Diploma ........

Other ____________________

28. What is the postcode of your usual place of residence?

Please specify ____________

This is the end of the questionnaire. Thank you very much for your help with this survey. Please return the completed questionnaire to the school teacher.