

Pneumococcal disease and the new universal vaccination program

What is pneumococcal disease?

Pneumococcal diseases are caused by a common bacterium called *Streptococcus pneumoniae* (the pneumococcus).¹

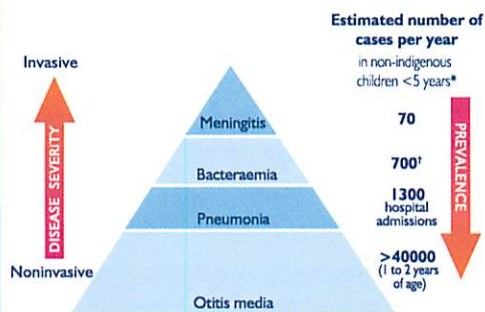
The pneumococcus bacterium has approximately 90 known serotypes, only some of which commonly cause disease.² Eleven serotypes are responsible for most of the disease in infants across the globe, with seven serotypes accounting for the majority of diseases in developed countries.^{1,2,3,4} The four remaining serotypes account for a significant proportion of disease in developing countries.⁴

S. pneumoniae can be non-invasive or invasive, depending on the infection site.

- Non-invasive pneumococcal disease is more common and results in significant morbidity.⁵ Non-invasive disease is caused by infection of mucosal tissue, such as the upper respiratory tract, middle ear and sinuses.¹ This can lead to pneumonia, acute otitis media and sinusitis.⁶
- Invasive pneumococcal disease results from dissemination of bacteria into the bloodstream and central nervous system,⁷ and can lead to meningitis, bacteraemia and bacteraemic pneumonia.⁵

The burden of pneumococcal disease

Disease burden in children in Australia

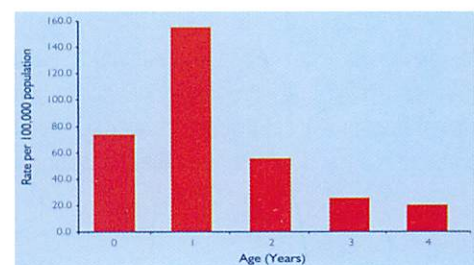


McIntyre PB et al. MJA 2000; 173: S54-S57.⁸

* Extrapolated from worldwide data from industrialised countries

† Includes 70 cases of Meningitis

Notification rates of invasive pneumococcal disease, Australia, 2002 by age under 5.⁹



- Pneumococcal disease is a leading cause of meningitis, bacteraemia, pneumonia and bacterial otitis media.⁹
- Pneumococcal disease is the leading cause of meningitis in children under 5 years.¹⁰
- Invasive pneumococcal disease is more common than the deadly meningococcal disease.¹¹ Pneumococcal meningitis may cause disability of greater severity than meningococcal meningitis.¹²

How does it spread?

Nasal carriage has been identified as the first step in the acquisition of pneumococci, and a necessary first step for invasive pneumococcal disease.¹³ *S. pneumoniae* can spread from person to person by the respiratory route via airborne droplets from the nasopharynx,¹⁴ i.e. by sneezing and coughing. Hence, close regular contact with other children, such as attendance at daycare centres, provides the potential for transmission of respiratory pathogens among infants and young children.¹⁵

Studies have shown that most children younger than 2 years become carriers of *S. pneumoniae* at one time or another. In fact, in one study, 91% of children between 6 and 54 months of age became nasal carriers of *S. pneumoniae* at least once during a 5-month period.

Young children have the highest carriage rates of pneumococci,¹⁶ and furthermore, the duration of nasopharyngeal carriage of penicillin-resistant *S. pneumoniae* is longest among those less than 1-year-old compared with older children and adults.¹⁷ Young children also play a major role in the transmission of the pathogen to older children.¹⁸

Can invasive pneumococcal disease be treated?

Invasive pneumococcal disease can usually be treated with antibiotics if detected early enough, however the disease can develop very quickly. Symptom-free to death can occur quickly and is not uncommon. Early symptoms are easily mistaken for a common cold.

The disease is becoming more resistant to antibiotics, making it harder to treat effectively. Vaccination can prevent pneumococcal disease as well as reduce the spread of the bacteria to other children; vaccination may also reduce antibiotic resistance.¹⁹

So why immunise?

Pneumococcal disease is now largely preventable through vaccination.¹⁰ The new Australian Standard Vaccine Schedule (ASVS) recommends immunising against pneumococcal disease for all infants at 2, 4 and 6 months of age and a catch up for all children born after 1 January 2003.²⁰

In overseas studies, vaccination with Prevenar has been shown to have dramatic efficacy against invasive pneumococcal diseases including meningitis, bacteraemia and bacteraemic pneumonia and significant

impact on otitis media and pneumonia.^{21,22}

- Vaccination may reduce the spread of pneumococcal disease.^{7,19,23}
- Vaccination may reduce the circulation of resistant strains of the organism.¹⁹
- Resistance of pneumococci to penicillin (all ages) fell from a peak of 15% in 2000 to 5% in the first half of 2003.²⁴
- There is evidence of a herd effect as well as a decrease in the antibiotic resistance in strains causing disease.²⁴

The vaccine Prevenar

Prevenar is the first and only vaccine available to prevent serious pneumococcal disease in infants and young children.

Prevenar contains the pneumococcus serotypes 4, 6B, 9V, 14, 18C, 19F and 23F, which are individually conjugated to diphtheria CRM₁₉₇ protein. CRM₁₉₇ is a non-toxic variant of diphtheria toxin isolated from cultures of *Corynebacterium diphtheriae* strain C7 (β197) and/or *C. diphtheriae* strain C7 (β197) pPx 350.³

Prevenar does not replace routine diphtheria immunisation. The role of diphtheria CRM₁₉₇ in Prevenar is that of a 'carrier' protein to which the seven capsular antigens of *S. pneumoniae* serotypes 4, 6B, 9V, 14, 18C, 19F and 23F are individually conjugated.³

Who should be vaccinated with Prevenar?

Prevenar is indicated for the active immunisation of infants and young children from 6 weeks to 9 years of age against invasive disease (meningitis, bacteraemia and bacteraemic pneumonia) and non-invasive disease (pneumonia and otitis media) caused by *S. pneumoniae*.³

Prevenar is expected to provide effective protection against the serotypes responsible for the majority of invasive disease in children, and is expected to cover between 80% and 85% of invasive isolates in urban Australian children.³

In the indigenous Australian population, Prevenar is expected to cover 67% of invasive isolates in indigenous children.³ Coverage for indigenous children is lower because of additional serotypes that can cause invasive disease in this population.⁵

Foods for a healthy eating pattern

There are several classifications of vegetarian. These are not important in name, but the types of foods which are included help identify the ways in which important nutritional needs can be met. Foods needing consideration in planning a vegetarian pattern are Protein, Calcium, Vitamin B12, Iron and Zinc. The sources of these nutrients are summarised in the table below.

Toddler eating

Many families find toddler eating presents problems. There are a few tips which may help:

- Children eat best if meals are eaten together as a family whenever possible.
- Occasional food refusal and appetite fluctuation is normal; forcing or bribing children is not helpful.
- Children need regular meals and snacks to provide energy and nutrients for growth and development. Healthy snacks in between meals make an important contribution to intake.
- Water should be offered to drink rather than cordial, juice or soft drink.

	VEGETARIAN TYPE	
	Ovo-lacto vegetarian – includes milk products & eggs	Vegan – No animal-based products
Nutrient	Food sources of nutrient	
Protein	Milk, eggs, cheese, yogurt, soy and tofu, pulses and beans (lentils, chickpeas, beans), cereals* Nut pastes after 12 mths (avoid whole nuts until about 5 years because of the risk of choking)	Fortified soy drinks, soy and tofu, pulses and beans, cereals* Nut pastes after 12 mths (avoid whole nuts until about 5 years because of the risk of choking)
Calcium	Milk and milk products	Fortified soy drinks Sesame (tahini)
Vitamin B12	Milk and milk products, eggs, dairy, yeast extracts	Yeast extracts (supplements of Vitamin B12 may be desirable)
Zinc	Milk and milk products, wholegrain cereals, nuts and seeds	Wholegrain cereal, nuts and seeds
Iron	Fortified infant cereal, prepared breakfast cereal, beans and pulses	Fortified infant cereal, prepared breakfast cereal, beans and pulses

* Choosing protein foods – All animal proteins, including milk and eggs, provide high quality proteins containing all the essential amino acids, or building blocks for use in building the body's own protein. Vegetable proteins have a lower protein quality, and the best use can be made of protein from vegetable sources by eating these in complementary combinations. This means combining a cereal protein with pulse, nuts, seeds, egg or a milk product. Good examples: baked beans on toast, dhal with rice.

Vegetarian eating patterns for younger children

Introduction

"Appropriately planned vegetarian diets are healthful, nutritionally adequate, and provide health benefits in the prevention and treatment of certain disease". While this quote from a Position Paper from the American Dietetic Association is not a suggestion that everyone become vegetarian it is recognition that vegetarian diets can be satisfactory for all groups in the population, including children. Most families, and others working with children, find some guidelines useful in planning and preparing meals for children; a vegetarian eating pattern does not change the basics of healthy early eating, but there are some different considerations.

For younger children, vegetarian eating is generally part of a family pattern; family eating is a very strong influence on development of children's eating patterns for life, so this is a good opportunity for the family to have a look at the planning of their own eating. There are occasional children who self-select to be vegetarian from an early age. However, refusal to eat meat by a young child in a meat-eating family is often a part of the normal toddler behaviour of refusing particular foods for a time. In this case it is wise to make no fuss, offer a variety of other foods and 'wait to see' before assuming this is a long-term decision.



Principles

The principles of a healthy diet for young children apply for vegetarian children:

- Breastfeeding alone is adequate to around 6 months. (a healthy diet for a breastfeeding mother is important; if the mother is a vegan, a supplement of Vitamin B12 is a good idea to ensure adequate B12 in the breast milk). Where breast milk is not available, an infant formula should be offered. This can be a soy-based infant formula if preferred.
- From around 6 months, babies may show signs of readiness to broaden their diet, and suitable solids should be offered. Children are ready to start eating solids when they are interested in others eating, seem regularly harder to satisfy with breastfeeds or formula feeds, and are able to take food from a spoon without pushing it out with the tongue.
 - Solids begin with small amounts of smooth foods, one food at a time initially. Iron is an important nutrient at this time and iron-fortified cereal, prepared with some expressed breast milk or formula is a good choice. This can be followed with vegetables and fruit.
 - Small amounts of cow's milk – in custard, on cereal, or as yoghurt can be included at around 7-8 months.
 - At around 7-8 months protein-rich foods can be included: lentils, beans, chickpeas or tofu can be readily prepared for young children.
 - Eggs and smooth nut butters can be offered from 10 months. Introduction of egg and nuts should be delayed until 12 months if there is strong family history of allergy. Consulting the family doctor or a dietitian about early feeding may be helpful for consideration of the combined needs of allergy restrictions and a vegetarian-eating pattern.
- At around 12 months most children can enjoy family meals. Breast-feeding can continue; children can now change to cows milk as a main drink – around 600 mls daily is adequate to meet calcium needs. If a soy-based drink is preferred it needs to be calcium-fortified.

How effective is the vaccine for pneumococcal disease?

Clinical studies in the United States showed that Prevenar is 97 percent effective in reducing invasive pneumococcal disease, caused by the 7 strains covered in the vaccine, in fully vaccinated children.¹⁸ The vaccine has also been shown to be effective in reducing the frequency of otitis media. In a US study conducted on children who had completed the primary series of Prevenar at 2, 4 and 6 months of age, there was a 24 percent reduction in all cause ear grommet insertions.²⁵

How many injections are required?

Infants born from 1 January 2005 are eligible to receive **free** pneumococcal conjugate vaccine. As a general guide, children born from 1 January 2005 will require 3 doses of Prevenar, given at 2, 4 and 6 months of age.²⁰ Prevenar should be administered to children on the same occasion as the DTPa vaccine, which follows a similar 2, 4 and 6 months vaccination pattern, excluding the DTPa dose at 4 years.²⁰

ASVS recommended dosage schedule for Prevenar²⁰

Age at first dose of Prevenar	
Dose 1	2 months
Dose 2	4 months
Dose 3	6 months

Catch-up doses for previously unvaccinated infants²⁰

Age at first dose of Prevenar	Number of doses required
2 - 6 months	3
7 - 17 months	2
18+ months	1

Children born from 1 January 2003 to 31 December 2004 are eligible for **free** pneumococcal vaccine through a catch-up program that will run in 2005. The number of doses required for catch-up vaccination varies depending on the age at which the first dose is given (see table above). Doses should be given 2 months apart where more than one dose is required.²⁰

How much vaccine is given?

Each dose of Prevenar is 0.5mL and will be given by intra-muscular (IM) injection.

The preferred injection site is the anterolateral muscle of the thigh for infants under 12 months and into the deltoid muscle for children over 12 months.^{10,3}

When administering 3 injections at the same visit to an infant under 12 months, two injections can be administered into the same thigh, but the injections should be separated by at least 25mm, so that local reactions (if they develop) do not overlap. It is recommended that Prevenar be given alone, in the opposite limb to other injectable vaccines.

A full list of references is available from www.rch.org.au/ccch/pub

Further information can be obtained from:

- Australian Government – Immunise Australia information for the general public and fact sheet: <http://immunise.health.gov.au/universal/public.htm>
- Wyeth Australia, Baulkham Hills 1800 500 498

The information included in this article has been adapted from the Australian Government – Immunise Australia information and materials prepared by Wyeth for health professionals and parents.

Reflection Questions

1. How would you explain to a parent the importance of having their child immunised for pneumococcal disease?
2. What do you believe will be the major concerns raised by parents?
3. Do you feel confident in your ability to respond to questions raised by parents?

Family lifestyle

Planning for shopping and meals should include a wide variety of foods from each of the basic food types:

- cereals, (A mix of wholegrain and refined cereals is fine. There is no need to put too much emphasis on wholegrain and high fibre foods, as bulky and high fibre meals can make it difficult for children to meet energy and nutrient requirements).
- milk, milk products, Calcium-fortified soy drink
- fruits and vegetables
- protein foods.

The healthiest family meals are based on the basic foods. Foods prepared at home tend to be lower in fat, salt and added sugar. Convenience and snack foods prepared for vegetarian eating patterns are not necessarily healthier

than their non-vegetarian counterparts. Keep foods high in fat, salt and sugar as sometimes foods.

Keeping active is a part of every healthy lifestyle, along with healthy eating. Family practices of walking to school or shops, encouragement of outdoor and active play, and 'house rules' for time spent in TV and screen activities are useful.

Author

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Parent Information

On the Australian Government website HealthInsite – www.healthinsite.gov.au – you will find useful information about feeding children.

Reflection questions:

1. *When a parent tells you their child is a vegetarian, how do you react?*
2. *Do you feel confident in your ability to provide advice/support to parents who indicate their child is vegetarian?*
3. *When would you consider referring a parent with a vegetarian child to see another professional, such as a doctor and/or dietician?*

Note from the Editor

On behalf of the CPR board, we are pleased to mail this first edition of CPR directly to you.

We would like to take this opportunity to highlight some of the changes and improvements that have been made to the CPR for 2005:

- 4 edition this year, each 6 pages in length
- The topics for the next editions will include:
 - Rickets
 - School readiness
 - Obesity in children
- Parent fact sheets will be included in 2 editions of the CPR. A single copy will be supplied with each edition.

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