

Introduction of pneumococcal vaccine
PCV13,
A handbook for district and health facility staff



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World Health Organization
Department of Immunization, Vaccines and Biologicals
CH-1211 Geneva 27
Switzerland
Fax: + 41 22 791 4227
Email: vaccines@who.int

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Introduction

This handbook has been developed for countries introducing PCV13 Pneumococcal Vaccine.

Other presentations of pneumococcal vaccine are available, and materials for specific products have been developed.

This handbook is most useful for staff working at district and health facility levels. Some adaptations will need to be made at national level (by the National EPI Manager, in-country partners, and others) before its distribution, to ensure that certain aspects, such as national schedule, waste disposal or Adverse Events Following Immunization (AEFI) monitoring, are aligned with national policies.

Training materials and other resources related to Pneumococcal vaccines can be found at <http://www.who.int/nuvi/pneumococcus/resources/en/index.html>

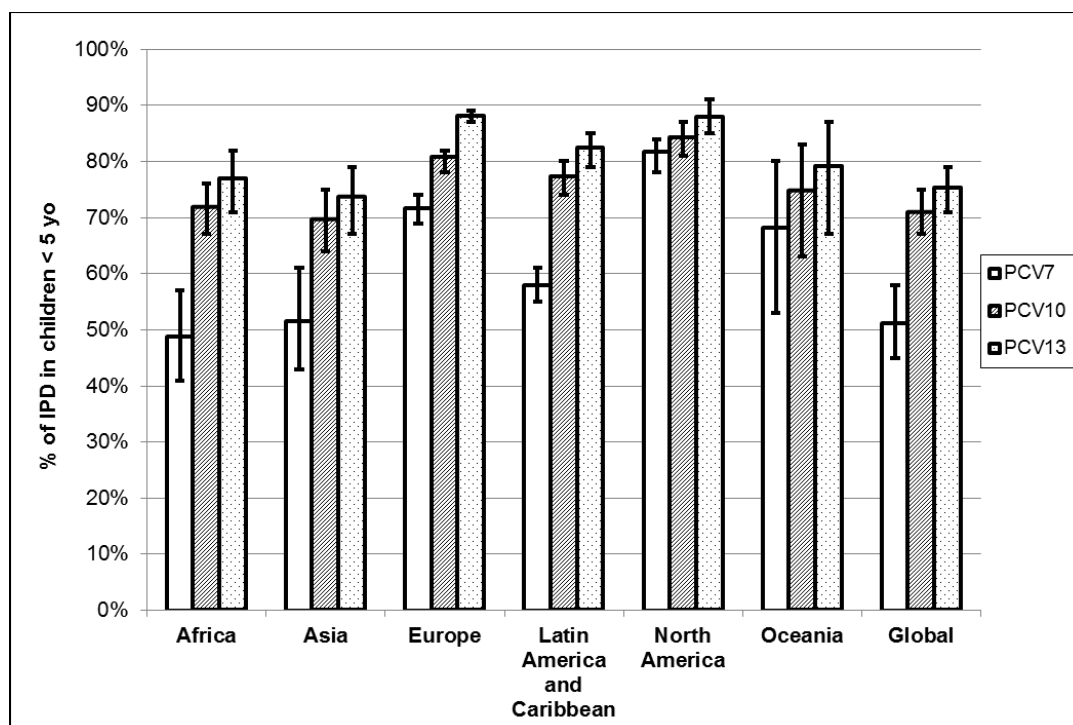
1. Pneumococcal Disease

1.1 What is pneumococcal disease?

Pneumococcal disease is the name given to a group of diseases caused by a bacterium called *Streptococcus pneumoniae*, (also known as pneumococcus). Pneumococcal infection and disease can affect a variety of organ systems resulting in a number of disease syndromes. Diseases caused by pneumococcus include 1) severe diseases such as pneumonia, meningitis and bacteraemia (presence of bacteria in the blood), and 2) milder diseases such as middle ear infection (otitis media), sinusitis and bronchitis. In 2000, about 14.5 million episodes of serious pneumococcal disease were estimated to occur globally. Of the estimated 8.8 million global annual deaths amongst children <5 years of age in 2008, WHO estimated that 541,000 (uncertainty range: 376,000- 594,000) global child deaths due to pneumococcal(*Streptococcus pneumoniae*) infections among those under 5 years, of which 476,000 (uncertainty range: 333,000 – 529,000) occurred among HIV-negative children.

Pneumococcus is classified into a number of serotypes, based on the composition of its outer capsule. There are about 93 known serotypes whose prevalence varies by geographic region of the world, as well as by age. These different serotypes have varying potential to cause disease with relatively few serotypes associated with severe disease in children. Some serotypes also are more frequently associated with antibiotic resistance. The current 10-valent and 13-valent formulations of the pneumococcal conjugate vaccine include pneumococcal serotypes which cause over 70% of serious pneumococcal disease in children in all geographic regions. Below is a bar graph that shows the global distribution of pneumococcal serotypes and the different vaccine formulations currently available with the serotypes included in the vaccines.

Figure 1: Proportion of regional Invasive Pneumococcal Disease represented by serotypes in vaccine formulations, 2008



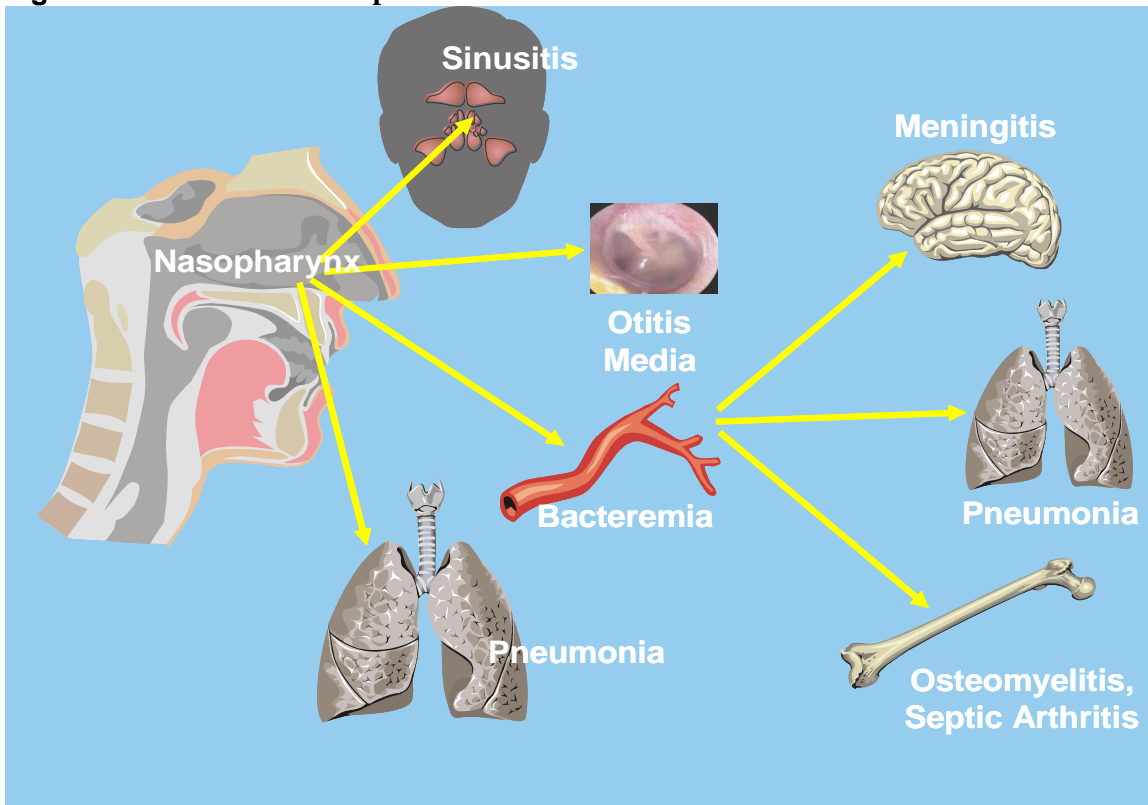
Source: Systematic Evaluation of Serotypes Causing Invasive Pneumococcal Disease among Children Under Five: The Pneumococcal Global Serotype Project

1.2 What are the common forms of pneumococcal disease?

Pneumococcus causes both severe and non-severe disease. Pneumococci frequently colonize the nose and throat asymptotically; a high proportion of children carry this bacteria in their nose or throat at any given time. Sometimes, within an individual pneumococcus can spread from the nose and throat to the blood stream causing bacteraemia and then infect sites such as the meninges (lining of the brain). Diseases caused by invasion of the blood stream and subsequent infection of other sites are collectively referred to as Invasive Pneumococcal Disease (IPD). Pneumococci can also be aspirated from the nose and throat into the lung resulting in pneumonia, or can spread to other adjoining sites such as the middle ear, causing otitis media, or to the sinuses, causing sinusitis. The most common severe form of pneumococcal disease is pneumonia. Less commonly, pneumococcus causes meningitis, which can be fatal or leave survivors with permanent disabilities. The less severe infections such as otitis media, sinusitis, and bronchitis all are much more common than pneumonia or meningitis, but not usually fatal.

In developing countries, deaths from pneumococcal disease are common in children under 5 years. In industrialized countries, pneumococcal disease is also a common cause of death in the elderly. In developing countries, the contribution of pneumococcal disease to death in the elderly is not well quantified.

Figure 2: Common forms of pneumococcal disease



1.3 How is pneumococcal disease transmitted?

Pneumococcus is transmitted by respiratory secretions of people carrying pneumococcus in their nose or throat.

1.4 How is pneumococcal disease diagnosed?

It can be difficult to establish whether pneumococcal infection is the cause of the patient's symptoms because even in true pneumococcal cases the specimens collected often do not yield the bacterium. This is particularly true of pneumococcal pneumonia because specimens from the actual site of infection (i.e. the lung) cannot be collected and in only a small fraction of pneumococcal pneumonia cases is the blood also infected. Nevertheless, pneumococcal infections are normally diagnosed through laboratory testing of the blood

(for bacteraemia and bacteraemic pneumonias) or in the case of suspected meningitis by performing a lumbar puncture, which involves inserting a needle into the epidural space to obtain a sample of cerebrospinal fluid (CSF). Pneumococcus is a difficult bacterium to grow in the laboratory and frequently goes undiagnosed even when blood or CSF samples are truly infected with the pneumococcus.

1.5 Who are most at risk for pneumococcal disease?

Children under 5 years of age and especially those under 2 years of age are most at risk of developing and dying from pneumococcal disease. Case fatality rates may be up to 20% for pneumonia, and as high as 50% for meningitis in developing countries. Lack of exclusive breastfeeding, nutritional deficiencies, and indoor air pollution are risk factors for pneumonia, including pneumococcal pneumonia, in infants and young children. Apart from the high incidence in children <2 years of age, the risk for pneumococcal disease is increased in the elderly (>65 years of age), and in people who use tobacco or alcohol excessively. This risk is also increased in individuals who suffer from chronic medical conditions, such as heart disease, lung disease, diabetes, asplenia, chronic kidney disease or from other conditions that suppress the immune system, such as advanced HIV infection. Preceding infection with influenza virus is also a risk factor for pneumococcal pneumonia.

1.6 What is the treatment for pneumococcal disease?

Pneumococcal disease, including pneumococcal pneumonia and pneumococcal meningitis, can be treated with antibiotics, usually amoxicillin. However, in many countries strains of pneumococcus are becoming resistant to some of the commonly used antibiotics. Pneumococcal infections which are resistant to these antibiotics require treatment using more expensive antibiotics

1.7 Why do we vaccinate against pneumococcal disease?

The risk of serious pneumococcal disease remains high throughout the first 24 months of life. Pneumococcal disease is associated with high mortality, especially when timely antibiotic treatment is not available. Vaccination can prevent substantial mortality and morbidity, especially in the underserved populations of the poorer countries.

2. Pneumococcal Conjugate Vaccine

2.1 What is Pneumococcal Conjugate Vaccine (PCV)?

Pneumococcal conjugate vaccine consists of sugars (polysaccharides) from the capsule of the bacterium *Streptococcus pneumoniae* that are conjugated to a carrier protein. Unlike the pneumococcal polysaccharide vaccine, the pneumococcal conjugate vaccine protects children younger than 2 years of age. It protects against severe forms of pneumococcal disease, such as pneumonia, meningitis and bacteraemia. It will not protect against these conditions if they are caused by agents other than pneumococcus or by pneumococcal serotypes not present in the vaccine. Two conjugate vaccines are available since 2009, one 13-valent (PCV13) the other 10-valent (PCV10). The first pneumococcal conjugate vaccine, a 7-valent product, is no longer in use.

2.2 What is the vaccination schedule for PCV?

For PCV administration to infants, WHO recommends 3 primary doses (the 3p+0 schedule) or, as an alternative, 2 primary doses plus a booster (the 2p + 1 schedule). In choosing between the 3p+0 and 2p+1 schedules, countries should consider locally relevant factors including the age distribution of pneumococcal disease, the likely vaccine coverage, and the timeliness of the vaccine doses.

If the 3p+0 schedule is used, vaccination can be initiated as early as 6 weeks of age with an interval between doses of 4 - 8 weeks, for example at 6, 10, and 14 weeks or at 2, 4, and 6 months, along with Pentavalent (DTP-HepB-Hib) and Rotavirus vaccine.

If the 2p+1 schedule is selected, the 2 primary doses should ideally be completed by six months of age, starting as early as 6 weeks of age with a minimum interval of 8 weeks or more between the two doses (for infants aged ≥ 7 months a minimum of 4 weeks between doses is acceptable) but every effort should be made to start vaccinations in children as early as possible). One booster dose should be given between 9 - 15 months of age. In this schedule, the booster does of pneumococcal vaccine may be given along with measles vaccine and Vitamin A supplementation.

Previously unvaccinated or incompletely vaccinated children (including those who had laboratory confirmed invasive pneumococcal disease) should be vaccinated using the recommended age appropriate regimens. Interrupted schedules should be resumed without repeating the previous dose.

For unvaccinated older children aged 12 - 24 months and children aged 2 - 5 years to who are at high risk of pneumococcal infection, two catch-up dose(s) at an interval of at least 8 weeks may be given.

2.2.1 Can a premature child be vaccinated?

Yes, prematurely born infants (i.e. <37 weeks gestation) should receive PCV at the recommended chronologic age concurrent with other routine vaccinations, unless there are contraindications as described in section 2.6.

2.2.2 What is recommended for children who are immunodeficient?

Regardless of the presence of underlying medical conditions (e.g., children with HIV infection, sickle cell disease or who are otherwise immunocompromised), the national schedule for giving PCV should be followed. In fact these children are in particular need of PCV because their risk of pneumococcal disease is high. PCV has been proven to be safe and well tolerated even among children infected with HIV. Children with HIV infection require a booster dose to sustain protection.

2.3 What steps can be taken to ensure that an infant is vaccinated on time?

It is important to use every opportunity to vaccinate eligible children on time. Whenever infants visit the health centre, their immunization record should be reviewed, and they should be given all of the vaccines they are eligible to receive. It is also important to hold immunization sessions as planned and not postpone or cancel immunization sessions.

When an infant comes to the health centre, his/her age and previous immunization status should be determined before deciding which vaccine doses to provide. It is therefore, very important to implement accurate recording of child health cards, and to remind the parents of the next visits and the importance of completing the full immunization schedule. One should also follow-up with children who are overdue for their vaccine.

Defaulter tracking systems can be used by health workers, working in collaboration with communities, to identify infants who are due for vaccination, and health workers should send reminders to parents of those children. For this to be effective, defaulters need to be tracked regularly every month. In many countries, community health workers play a critical role in mobilising communities for immunization and tracking defaulters.

2.4 How safe is PCV?

PCV is relatively safe and well tolerated; severe adverse reactions attributable to the vaccine are extremely rare. Mild side effects such as soreness at the injection site, and transient fever of $\geq 39^{\circ}\text{C}$ has been reported in less than 5% of vaccinees. It is important to note that, as DTP-HepB-Hib vaccine may be given at the same visit as PCV, reactions following immunization cannot usually be ascribed to one product or another. It will be important to emphasize to parents that although this vaccine has an excellent safety profile, the side effects as stated above may occur.

2.5 What are common PCV side effects

Local reactions have been reported in 10% - 20% of children receiving the vaccine. Of these, only about 3% were considered severe (for example, tenderness that interferes with arm or leg movement). Some children also have transient fever. More severe reactions than these are extremely uncommon.

2.6 What are the contraindications to PCV?

Pneumococcal vaccine should not be given to anyone who has had severe allergic reactions to a prior dose or to any component of the vaccine, including diphtheria toxoid. Infants with a moderate or severe illness (temperature $\geq 39^{\circ}\text{C}$) should not be vaccinated until they improve. Mild illness such as an upper respiratory tract infection is not a contraindication and children should be vaccinated.

2.7 How should PCV be given?

Pneumococcal vaccines for infant use are given by intramuscular (IM) injection in a dose of 0.5 ml. The PCV can be co-administered with other EPI vaccines. The vaccine cannot be mixed with other vaccines in the same syringe. If two injections are being given at the same immunization session, they should be administered at different injection sites - for example, if Pentavalent vaccine is given in the left thigh, then PCV injection should be given in the right thigh.

2.8 Pneumococcal Conjugate Vaccine Summary

Disease(s) prevented by the vaccine	Pneumococcal diseases, invasive (meningitis, pneumonia, other invasive diseases) and non-invasive (otitis media, sinusitis, bronchitis) caused by vaccine serotypes.
Type of vaccine	Polysaccharide conjugate vaccine (adsorbed). The PCV13 vaccine contains 13 serotypes.
Method of administration	Intramuscular (IM) injection.
Presentation and vial size	Single dose, fully liquid vial.
Target age group	Infants (under 12 months of age).
Number of doses needed	3.
Schedule	WHO recommends 3 primary doses (the 3p+0 schedule) starting as early as 6 weeks of age, or, as an alternative, 2 primary doses by the age of six months plus a booster dose at 9-15 months of age (the 2p + 1 schedule).
Minimum and maximum interval between doses	4-8 weeks interval.
Booster	The need for a booster dose is yet to be determined for a schedule with 3 primary doses.
Contraindications	Known hypersensitivity to a prior dose. Infants with a moderate or severe illness (temperature $\geq 39^{\circ}\text{C}$) should not be vaccinated until they improve.
Side effects	Local reactions (redness, pain and swelling), fever.
Co-administration with other vaccines or child health intervention	Can be co-administered with other EPI vaccines, i.e. during the same visit, but with a separate syringes and in a separate injection site.
Wastage rate per vial size	Wastage for single-dose vial is maximum 5%.
Storage conditions: heat and freeze sensitivity	2-8°C. Do not freeze.
Package volume per dose	Single dose presentation: The single dose presentation is available in cartons of 50 vials. The volume per dose is 12cm ³ .
Likely duration of protection	Available data suggests that protection will last at least four to six years in healthy children. Children with HIV infection may require a booster dose to sustain protection.
What type of VVM	PCV13 has VVM30. This means that the vaccine is quite stable under high temperatures.
Proposed or recommended approach for surveillance and monitoring	Sentinel surveillance for invasive pneumococcal disease (IPD).

3. Safe administration of the vaccine

3.1 Physical appearance of the packaging and the vaccine

Figure 3: Physical appearance of the packaging



Figure 4: Physical appearance of the vaccine



3.2 Storing the vaccine

PCV should be stored and transported between 2 °C and 8°C degrees Celsius. Liquid vaccines, including the pneumococcal vaccine, must not be frozen. Liquid vaccines lose their potency and provide no protection against the disease, if frozen. Previously frozen vaccines may also cause "aseptic abscesses".

If there is doubt, the "shake test" can be performed to check whether any of these vaccines have been frozen.




For further information on Shake test refer to Step by Step Shake Test-educational video (duration: 00:10:07), available at: <http://vimeo.com/8389435>

3.3 Preparing and administering the vaccine

1. First check the child's immunization status and any contraindication (refer to section 2.6).
2. Take the vaccine out of the refrigerator and remove it from its packaging.
3. Check the expiry date for validity.

4. Check the Vaccine Vial Monitor (VVM) on the vial. Besides freezing, heat exposure can also reduce the vaccine's potency, so the vaccine needs to be protected from heat and sun exposure.

Figure 5: Reading the VVM

Start point		Square lighter than circle. If the expiry date has not passed, USE the vaccine.
End point		Square matches the circle. Do NOT use the vaccine.
End point exceeded		Square darker than the circle. Do NOT use the vaccine.

5. Inspect if the vaccine is frozen. If there is a concern that the vaccine may have been frozen, prepare and perform the "shake test" to determine if the vaccine has been damaged by freezing. The vaccine label may need to be peeled back to view the results of the shake test. If the vaccine fails the shake test, it must be discarded.
6. Draw up 0.5 ml with a new auto-disable syringe (AD).
7. Administer an intramuscular (IM) injection in the right/left thigh (check national policy) of the infant.
8. All used injection equipment should be placed in a safety box (without recapping), immediately after use. Dispose of filled safety boxes according to national guidelines.
9. Record dose on tally sheet, immunization card, immunization register, and any other places as required by local guidelines.
10. Inform caregiver of the vaccines given, expected side effects and what to do.
11. Reinforce messages about care-seeking for pneumonia since the child may still get pneumonia from other pathogens in spite of vaccination.
12. Remind caregiver to return for the next dose and provide the date when the next dose is due.

3.4 Safe waste management

Sharps waste can cause serious health and environmental problems. Unsafe disposal can spread some of the very same diseases that we are trying to prevent. Leaving used syringes and needles in the open puts the community at risk. Most frequently, the unfortunate victims of needle-stick injuries from haphazard disposal of needles are children and health workers.

Safety boxes are puncture resistant, impermeable containers for the safe disposal of used syringes and needles and other contaminated sharps. Vaccinators should place all used needles and syringes in a safety box immediately after administering the vaccine, without recapping them, tape the nearly (i.e. not more than 3/4) full box securely shut and store the box in a safe place until it can be properly disposed according to national guidelines.

Figure 6: Safety box



3.5 Recording the PCV doses

Pneumococcal vaccinations given to infants should be recorded in the same way as other vaccines in the programme.

The main recording tools that are used for immunization-related activities should be adapted to include Pneumococcal vaccine. At the service delivery level these are:

1. Immunization or child health card
2. Tally sheet
3. Register
4. Defaulter register
5. Stock record
6. Integrated monthly report.

3.6 How to calculate PCV coverage

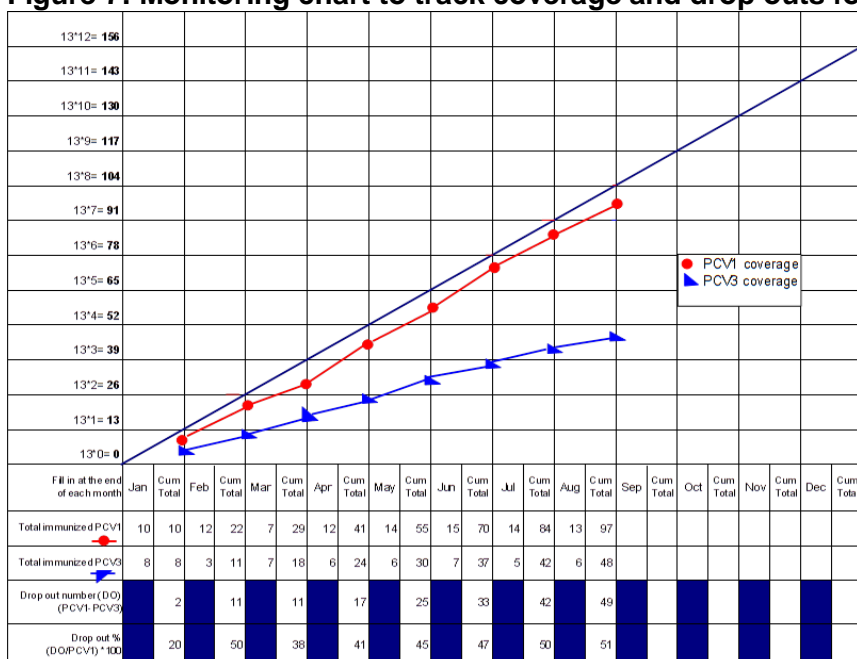
To compile coverage data, list each geographic area or community being served by the health facility and the target population for infants under one year of age. Then write the number of doses of vaccine administered to the target age group during the preceding 12 month period. To calculate the coverage for the current year, divide the total number of immunizations given over the preceding 12 month period by the target population.

Use the formula below:

Annual coverage for third dose of PCV		
Percentage coverage with the third dose of PCV	=	$\frac{\text{Number of infants under one year of age receiving the third dose of PCV}}{\text{Target population of infants under one year of age or live births}} \times 100$

A coverage monitoring chart which shows doses administered and dropout rates is a simple, effective tool for monitoring progress and graphically show doses given compared to the number of infants eligible to receive them. The chart can track the progress being made towards immunization of infants under one year of age each month and throughout the year. It also helps determine whether the target population is completing the series of vaccines or dropping out. Health workers should be trained on how to complete monitoring charts, interpret the results and take action. Supervisors should always check on monitoring charts and other documents during supportive supervision and provide on-job training, as necessary.

Figure 7: Monitoring chart to track coverage and drop outs for PCV



3.7 Reporting of adverse events following immunization (AEFI)

Adverse event following immunization (AEFI): is defined as any untoward medical occurrence which follows immunization and which does not necessarily have a causal relationship with the usage of the vaccine. The adverse event may be any unfavourable or unintended sign, abnormal laboratory finding, symptom or disease.

It is important to provide written procedures at health facilities to guide health workers on how handle and report cases of AEFI. AEFI that should be reported to the relevant manager by mobile phone immediately upon detection by a health worker, include:

1. Serious AEFI (that results in death, is life-threatening, requires in-patient hospitalization or prolongation of existing hospitalization or results in persistent or significant disability/incapacity)
2. Signals and events which are suggestive of a new potential causal association with the PCV vaccine and not listed in section 2.4 and 2.5 and the package insert.
3. AEFIs that may have been caused by an immunization error;
4. Significant events of unexplained cause occurring within 30 days after the PCV vaccination;
5. Events causing significant parental or community concern;

Although serious Adverse Events Following Immunization (AEFI) due to PCV per se are extremely rare, coincidental occurrence of a serious AEFI and sensational media coverage may seriously undermine immunization activities. Programme managers must therefore plan in advance a special communication strategy regarding Adverse Event Following Immunization (AEFI), so that the programme is prepared to respond if there is a problem. The rates of AEFI following pneumococcal vaccine can be accessed at http://www.who.int/vaccine_safety/initiative/tools/Pneumococcal_Vaccine_rates_information_sheet.pdf

Risk communication is important to build trust with the public. This includes providing information on possible side effects in the information, education and communications (IEC) materials and when communicating with parents and the community. Awareness among health workers and the public of possible adverse events will also facilitate early recognition and treatment of side effects, which may reduce their consequences. A poor response to a real or imagined adverse event can rapidly lead to a loss of trust that can take years to rebuild. Since the exact nature of the potential crisis is usually unpredictable, it is not possible to develop a specific plan tailor made for a particular event or events ahead of time. However, the following aspects can be considered by countries when preparing an advanced vaccine safety crisis preparedness plan

- national and/ or sub national AEFI committees that provide guidance on AEFI reporting at all levels, ensure maintenance of national policy and standards, and ensure prompt and thorough investigation of serious AEFI and provide clarity on who, how, when and where to contact for a vaccine safety crisis;
- prior identification of well-respected spokespersons at all levels to avoid conflicting messages coming from different sources;
- defining clear channels of communication with various media;
- engaging with credible opinion and traditional leaders to address misconceptions and rumours;
- training health workers in how to communicate with the public about AEFIs and safety concerns;

- having an AEFI action plan with clearly identified roles for immunization programme partners.

Additional information can be found at: <http://www.vaccine-safety-training.org/detection-and-reporting.html>

3.8 Key messages for parents

1. Pneumonia and meningitis (infection of the membranes covering the brain) are among the most common causes of death and disability in children.
2. Vaccines can help to greatly reduce your child's risk of contracting pneumonia and meningitis.
3. The Hib and pneumococcal conjugate vaccines (called PCV for short) are very safe and effective for protecting against the two most common and serious bacteria causing childhood pneumonia and meningitis.
4. Children who have received pneumococcal vaccine may still get pneumonia or meningitis from other pathogens however both these diseases will occur less frequently in immunized children.
5. Early treatment of pneumonia and meningitis can prevent serious complications and death, even in children who have received all their vaccines. Take your child immediately for assessment by a qualified health professional and possible treatment, if he/she has high fever, stiff neck, difficult or fast breathing.
6. In addition to vaccination, additional measures to protect children from getting pneumonia should be implemented. These additional measures include: adequate nutrition; exclusive breastfeeding; reducing indoor pollution (keep children away from smoke from cooking fires), assuring receipt of other vaccines especially DTP/Pentavalent and measles vaccine
7. If your child has severe cough or difficulty breathing or any other severe illness, always take your child immediately for assessment by a qualified health professional. Early treatment of pneumonia can prevent serious complications and death. This is also true for children who have received all their vaccines.
8. It is important to take your child to the nearest immunization post so that it will be easier to return if there are any unexpected side effects, as well as to receive subsequent vaccinations as needed. This also allows health workers to more easily follow-up with care-givers for missed doses. If, however, you are away from your normal place of residence, you should still have your child vaccinated at the correct time even if it is in a different immunization post than your usual one.
9. Millions of children have received the pneumococcal vaccine in recent years and the vaccine is very safe. Some children will experience mild side effects such as pain or swelling at the injection site and fever, but these generally get better quickly.
10. PCV vaccine will be given at the same time as already scheduled vaccines such as DTP-HepB-Hib (pentavalent vaccine), Rotavirus vaccine and OPV, therefore no extra visit is required for this vaccine.
11. The advantages of giving more than one injection on the same day include:
 - a. Caretakers do not have to return shortly for another injection.
 - b. Child will be well protected.
 - c. Child will have pain and other side effects only once.

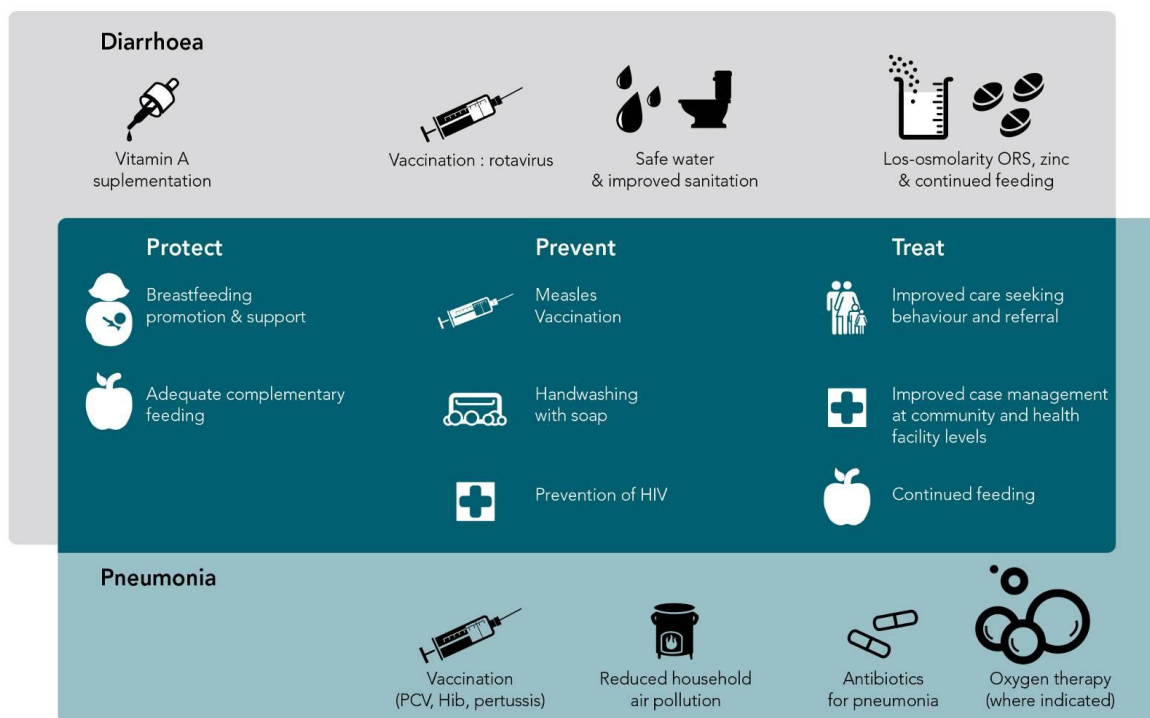
4. An integrated approach for saving lives: The “Protect, Prevent and Treat” framework for pneumonia and diarrhoea

Among partners, academics, NGOs, governments, communities and health workers themselves, it is well recognized that pneumonia and diarrhoea are most effectively addressed in a coordinated manner. They share the same determinants, and thus also share control strategies, as well as delivery systems. Both pneumonia and diarrhoea are caused by multiple pathogens and no single intervention alone can manage to address either problem. Most of the required actions are common to both diseases.

The goal to end childhood deaths due from pneumonia and diarrhoea by 2025 is the driving force behind the *WHO/UNICEF Integrated Global Action Plan for Pneumonia and Diarrhoea (GAPPD)*¹. The action plan identifies opportunities to better integrate activities as well as capture synergies and efficiencies. It envisions the various interventions for controlling pneumonia and diarrhoea in children less than five years of age as:

- *protecting* children by establishing and promoting good health practices;
- *preventing* children from becoming ill from pneumonia and diarrhoea by ensuring universal coverage of immunization, HIV prevention and healthy environments;
- *treating* children who are ill from pneumonia and diarrhoea with appropriate treatment.

Figure 1: Complementarity of pneumonia and diarrhoea interventions



¹ WHO/UNICEF. 2013. Ending Preventable Child Deaths From Pneumonia and Diarrhoea by 2025: The integrated Global Action Plan for Pneumonia and Diarrhoea (GAPPD). Available from http://www.who.int/maternal_child_adolescent/news_events/news/2013/gappd_launch/en/ (accessed July 25, 2013).

Over the past 20 years, research into specific pneumonia and diarrhoea interventions has shown that the following interventions and activities work (see Annex 1 for more details):

- Exclusive breastfeeding for 6 months and continued breastfeeding with appropriate complementary feeding reduces the onset and severity of diarrhoea and pneumonia.
- Preventive vitamin A supplementation reduces all-cause mortality and diarrhoea-specific mortality in children 6-59 months.
- Vaccination against *Streptococcus pneumoniae* (*Spn*) (pneumococcal conjugate vaccine – PCV), *Haemophilus influenzae* type b (Hib), rotavirus, measles and pertussis.
- Use of simple, standardized guidelines for the identification and treatment of pneumonia and diarrhoea in the community, at first-level health facilities and at referral hospitals, such as those for integrated management of childhood illness (IMCI), substantially reduces child deaths.
- Oral rehydration solution (ORS), especially the low-osmolarity formula, and use of zinc supplements are proven, life-savers for treatment of children with diarrhoea.
- Innovative demand creation activities are important for achieving behavior change and sustaining long-term preventive practices.
- Water, sanitation and hygiene interventions (WASH), including access to and use of safe drinking-water and sanitation, as well as promotion of key hygiene practices (e.g. handwashing with soap).
- Reduction of household air pollution with improved stoves has been shown to reduce severe pneumonia. Safer and more efficient energy in the home prevents burns, saves time and fuel costs, and contributes to better development opportunities.

Although these interventions form the core of primary health care (PHC) in many places they are not always promoted together to achieve maximum benefit. The proposed interventions outlined in GAPPD are not new, but implementing them to scale will require greater coordination and effort.

This overall approach builds on and is linked to the achievement of the Millennium Development Goal to reduce child mortality (*MDG4*), as well as to the successful implementation of the *UN Global Strategy for Women's and Children's Health*, including *Every Woman, Every Child*, the *UN Commission on Life-Saving Commodities*, the *Global Vaccine Action Plan (GVAP)* and the *A Promise Renewed* commitment to child survival.

Annex 1: Documented reductions in pneumonia and diarrhoea morbidity and mortality with selected interventions

Interventions to Protect

Exclusive breastfeeding for 6 months	23% reduction in pneumonia incidence (1); 10.5 times greater risk of death from diarrhoea and 15.1 times greater risk of death from pneumonia if not breastfed in first 6 months (2); not breastfeeding associated with 165% increase in diarrhoea incidence in 0-5 month-old infants (3); not exclusively breastfeeding resulted in excessive risk of diarrhoea incidence (RR 1.26 – 2.65), prevalence (RR 2.15 – 4.90), mortality (RR 2.28 – 10.52) and all-cause mortality (RR 1.48 – 14.40) in infants 0-5 months (4)
Continued breastfeeding from 6 – 23 months	2.8 times greater risk of death from diarrhoea if not breastfed (2); not breastfeeding associated with 32% increased diarrhoea incidence in infants 6-23 months (3); not breastfeeding resulted in excessive risk of diarrhoea incidence (RR 1.32) in infants 6-11 months and prevalence (RR 2.07), mortality (RR 2.18) and all-cause mortality (RR 3.69) in infants 6-23 months (4)
Adequate complementary feeding among children 6 – 23 months, including adequate micronutrient intake	6% reduction in all child deaths, including from pneumonia and diarrhoea (5)
Vitamin A supplementation (preventive)	23% reduction in all-cause mortality (6a) and 30% reduction in diarrhoea-specific mortality (6b) in children 6-59 months

Interventions to Prevent

Vaccination against measles, pertussis, PCV, Hib and rotavirus	Hib vaccine reduces radiologically confirmed pneumonia by 18% (7); 23 – 35% reduction in incidence of radiological pneumonia for PCV (1); reduction in very severe rotavirus infection by 74% (8); potential effectiveness of 30% for PCV in reduction of overall childhood pneumonia mortality (9)
Prevention of HIV in children	2% reduction in all child deaths (5)
Cotrimoxazole prophylaxis for HIV-infected children	33% reduction in AIDS deaths (10)
Handwashing with soap	31% diarrhoea risk reduction (11); 48% diarrhoea risk reduction (2)
Improved sanitation	36% diarrhoea risk reduction (2)
Increase quantity of water	17% diarrhoea risk reduction (recognizing a minimum quantity of at least 25 litres per person per day is recommended) (11)
Household water treatment and safe storage (to ensure safe drinking-water)	31 – 52% diarrhoea risk reduction (greater reductions realized when used correctly and exclusively by vulnerable populations) (3, 12)
Reduction in household air pollution (HAP) through lower emission stoves and/or clean fuels	Halving of HAP exposure with a chimney stove reduced severe pneumonia by 33% (13); other evidence indicates large exposure reductions may further reduce risk (14)

Interventions to Treat

Health facility case management for very severe pneumonia cases and vulnerable groups such as newborns, HIV-infected and malnourished children	29 – 45% reduction in case fatality (1); 6% reduction in all child deaths (5); 90% reduction in neonatal deaths due to pneumonia with hospital-based case management (15)
Increasing access to appropriate care through community-based case management of pneumonia/diarrhoea (CCM)	CCM results in 70% reduction in pneumonia mortality (16); 35% reduction in child pneumonia mortality (16); CCM of diarrhoea with ORS and zinc reduced diarrhoeal deaths among under-fives by 93% (17); 42-75% reduction in neonatal deaths due to pneumonia (15)
ORS	ORS reduces diarrhoea mortality by 69% with current coverage, or 93% if 100% coverage (17)
Zinc	Zinc for the treatment of diarrhoea reduces diarrhoea mortality by 23% (18); 14–15% reduction in incidence of pneumonia or diarrhoea (1)

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