PNG Department of Health

Child Morbidity and Mortality

Annual Report 2016

Child Health Advisory Committee
PNG National Department of Health
PNG Paediatric Society

2016 Annual Report on Child Morbidity and Mortality

Summary

- This report covers admissions and outcomes for children in 2016 from 14 provincial hospitals.
- In 2016 there were 22,799 admissions and 1679 deaths recorded (mortality rate 7.3%), comparable to 2015 of 7.7%. There were 1123 post-neonatal deaths and 556 neonatal deaths.
- Pneumonia was the most common reason for admission (24.9% of admissions).
- 30.1% of all admissions were in the neonatal period. Neonatal deaths accounted for one third (33.1%) of all childhood deaths. The leading causes in neonates were birth asphyxia, neonatal infections and very low birth weight.
- Although malnutrition is usually not the primary reason children present, severe malnutrition was present in 11.6% of admissions, making it in the top 5 most common problem seen in hospitals. Malnutrition either directly caused or contributed to 26% of all deaths, and many additional children had moderate malnutrition.
- Anaemia, also a rare *primary* cause of admission, was present in at least 10% of patients, and in 17.2% of all deaths, including 25% of post-neonatal deaths. Anaemia and malnutrition are important comorbidities which increase the risk of serious illness and death. Most anaemia in PNG is nutritional in origin.
- Neonatal deaths accounted for one third (33.1%) of all childhood deaths. The leading causes of death in neonates were: birth asphyxia, neonatal infections and very low birth weight.

Summary of major recommendations

In response to the findings, the Child Health Advisory Committee of the National Department of Health has made 12 recommendations which are described in this report:

1. Addressing unnecessary child deaths will depend to a large extent on reducing deaths from pneumonia and neonatal conditions, which together made up 51% of admissions and 50% of deaths in 2016.
2. Reducing deaths from **severe pneumonia** requires both prevention and treatment. Prevention includes the use of the new pneumococcal conjugate vaccine (PCV), improving breast-feeding and the quality of complementary feeding, and reducing indoor air pollution. Education of parents is needed on the signs of pneumonia so that parents recognise the signs of illness and seek care. Improved treatment in health centres and hospitals, including use of triage, and pulse oximetry for identification of the sickest children, giving appropriate antibiotics, and oxygen therapy to those with hypoxaemia. Treating co-morbidities including malnutrition and anaemia and identifying children who may have tuberculosis are also essential for reducing pneumonia deaths.
3. Reducing **neonatal deaths** requires improved access to skilled birth attendants, access to obstetric care and early essential newborn care. Essential newborn care includes *immediate and thorough drying*, which stimulates breathing and prevents hypothermia. *Sustained skin-to-skin*

contact prevents hypothermia, reduces infection, calms the baby and facilitates successful intake of colostrum and sustained breastfeeding. *Delaying cord clamping until cord pulsations stop* - typically around one to three minutes from birth - reduces the risk of anaemia and in preterm infants and other complications. *Exclusive breastfeeding and elimination of formula* can prevent a large proportion of neonatal sepsis deaths. *Avoid harmful practices*, such as separation of babies from their mothers in the first hours of life for bathing or unnecessary observation. To reduce deaths from neonatal sepsis, all newborns should have 4% chlorhexidine applied to the umbilical cord.

4. **Better care for very low birth weight babies, neonatal sepsis and birth asphyxia** is needed. This includes the increased use of Kangaroo Mother Care (skin-to-skin contact), prevention and treatment of hypoxaemia, apnoea, hypoglycaemia, improved feeding with breast milk, more rational use of antibiotics, more careful use of IV fluids, audit and ward organisation. In many hospitals nosocomial infections are common, and some are resistant to multiple antibiotics. To prevent these greater adherence to hand hygiene and other infection control practices, and reducing the use of antibiotics is needed.
5. Improving obstetric care is needed to reduce deaths from birth asphyxia. Improved use of partographs during labour is needed. Family planning would reduce many unwanted pregnancies.
6. **Malnutrition** also needs both prevention and treatment. Prevention of malnutrition at the community level is the best way to avoid children dying from malnutrition. Identification and timely treatment of children with severe malnutrition is also essential and often poorly done in hospitals. Increased use of Mid Upper Arm Circumference (MUAC) measurement would improve identification of the children at highest risk of death. Children with severe malnutrition need special attention to feeding, prevention and treatment of infections, and close monitoring for complications. A step-by-step approach to the management of severe malnutrition should be followed; this is outlined in the Pocket Book of Hospital Care for Children and the PNG Standard Treatment Manual. Major problems in the management of malnutrition are inadequate feeding: starting feeds too late, not giving enough milk feeds and not frequent enough feeds. Use of the new milk formulas F75 and F100 would improve the feeding of malnourished children who are not breast fed.
7. Children with **meningitis** have a high risk of death, and survivors are at risk of disabilities. Meningitis deaths can be prevented by the Hib vaccine (contained within the Pentavalent vaccine given at 1, 2 and 3 months), and the pneumococcal conjugate vaccine (PCV). Children presenting with meningitis need to be recognised and treated early, and monitored closely in a high dependency area of the ward. The common causes of meningitis are resistant to chloramphenicol so third-generation cephalosporins (such as ceftriaxone or cefotaxime) are the only effective antibiotic to treat meningitis.
8. **Tuberculosis** caused 12% of child deaths. Extra-pulmonary tuberculosis made up over 40% of children diagnosed with TB, and children with EPTB have a higher mortality. Every effort should be made to help children complete therapy. For many children this requires keeping them under supervision in a health facility for the 2 months of intensive phase, good education of parents to ensure adherence in the continuation phase, and active community-based follow-up.

9. There are more children with **chronic diseases**, including asthma, bronchiectasis, epilepsy, rheumatic and congenital heart diseases, cerebral palsy, and diabetes.
    - Children with chronic illnesses have many needs, including a long-term treatment plan, good follow-up by a paediatrician or skilled child health nurse, going to school regularly and having education about their condition.
    - Most children with chronic illness have to remain on some long-term medication, and the regular supply of this and help with taking the medicines on time is a challenge.
    - Rheumatic heart disease is common in school-aged children and adolescents in PNG, but is often missed. Adherence to benzathine penicillin every 4 weeks to prevent further attacks of acute rheumatic fever is crucial, to prevent further serious damage to the heart.
    - Some life-saving medicines are hard to get, such as insulin, but special effort needs to be made for children with uncommon but treatable conditions.
    - Children with chronic illness have to understand their illness well, and children even as young as 4 or 5 years can start to understand their illness, and this will help them manage it as they get older.
    - Some children with chronic illness have problems with hearing and vision, which can be addressed to make their lives better, and some have motor and mobility problems that can be addressed with physiotherapy, regular exercise and aids such as wheelchairs or walking frames.
    - Programs are needed in every province that better support children with chronic illness. Encourage such children to attend school and contact the school to educate the teachers about the child's condition.
10. **The National Child Health Plan** outlines a plan for improving child health until 2020. The Child Health Advisory Committee recommends that everyone involved in health care for children be familiar with this, and that Provincial and District Health officials use it to formulate their Annual Activity Plans. This plan can be downloaded at http://pngpaediatricsociety.org/png-child-health
11. **The PNG Standard Treatment Manual for Common Illnesses in Children** 10th Edition was published in 2016. This should be available for all health workers to use when they are treating children.
12. **Although in 2016 there were very few cases of measles, vaccination coverage is too low, and it is only a matter of time until the next measles epidemic.** The only way to prevent this is to immunize more children against measles. There are still many vaccine-preventable diseases, and vaccine coverage and awareness of the importance of vaccines needs to increase.

2016 Annual Report on Child Morbidity and Mortality

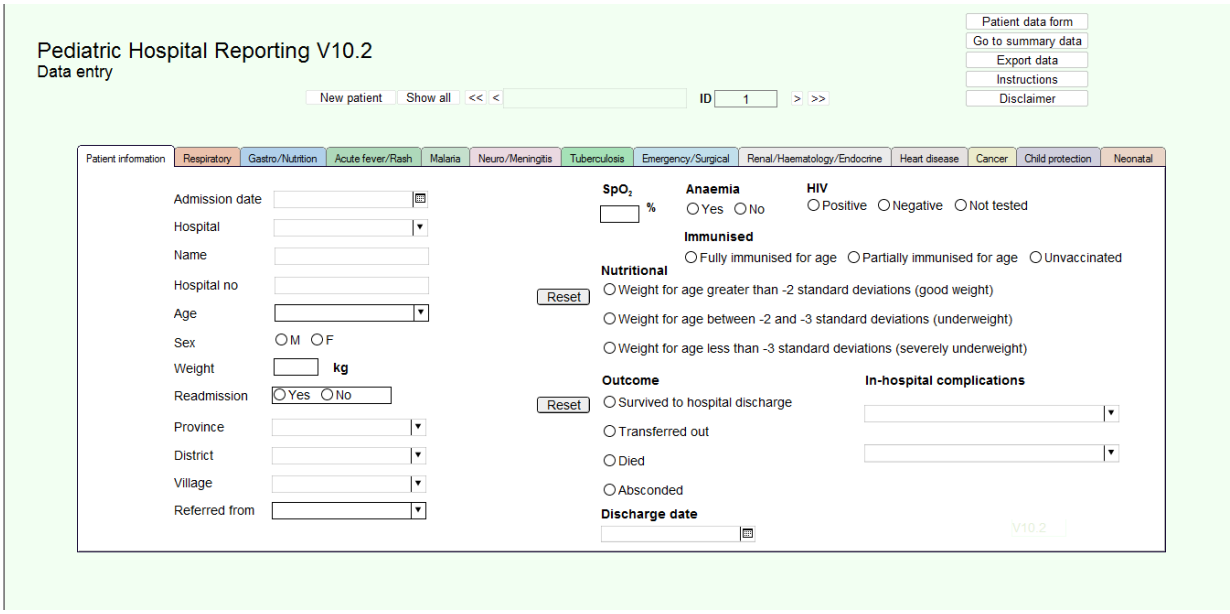
Introduction

The Child Health Advisory Committee of the National Department of Health releases the fifth Annual Report on Child Morbidity and Mortality in Papua New Guinea. The Committee believes the data and recommendations contained in this report should be read by all health workers and health administrators. It is only by examining health outcomes that we can improve our services. The data are current, covering all of 2016, with some comparisons throughout to data collected in the previous 6 years. The recommendations cover clinical and public health solutions that would result in many children's lives being saved each year.

Paediatric Hospital Reporting System (PHR)

The Paediatric Hospital Reporting System enables hospitals to record admissions, calculate mortality rates and monitor trends in disease burdens and outcomes over time. When the data are compiled from all hospitals, this can focus on areas of high mortality where there is scope for improvement. The data are reported using standardised diagnostic criteria, consistent with clinical and public health practice in Papua New Guinea.

Last year a new version of the PHR was introduced (V10.2), with some changes to improve the recording of chronic illnesses in children, and better recording of neonatal diagnoses.



The Paediatric Hospital Reporting program V10.2

Mortality rates for hospitals and common diseases

Case fatality rates (CFR) vary: low overall CFR in some smaller hospitals, such as Alotau (3%) to above 10% in Kimbe and PMGH. Differences in CFR reflect many things, including case mix, severity of illness at the time of presentation, human and other resources available to manage seriously ill children, and serious disease outbreaks. In some hospitals it may also reflect missing data.

Hospital	Admissions	Deaths	Overall CFR
Alotau	1513	45	3.0
Angau			
Buka	681	79	11.6
Daru			
Goroka	2731	201	7.4
Kavieng	505	32	6.3
Kimbe	1197	122	10.2
Kerema			
Kundiawa	1597	89	5.6
Manus			
Mendi	1557	78	5.0
Modilon	1735	117	6.7
Mt Hagen	3593	188	5.2
Nonga	1062	66	6.2
Oro	961	65	6.8
Port Moresby	4257	489	11.5
Vanimo	530	30	5.7
Wabag	880	78	8.9
Wewak			
Total	**22,799**	**1679**	**7.3**

Table 1. Summary of admission, death and case fatality rates in participating hospitals in 2016.

Diagnoses	Total Admissions 2016	Deaths 2016	CFR 2016
All paediatric admissions	22,799	1679	7.4
Pneumonia	5688	231	4.1
Severe pneumonia	1881	192	10.2
Neonatal conditions	6930	556	8.0
Diarrhoea	2433	149	6.1
Malaria	1015	46	4.5
Severe malnutrition	2635	438	16.6
Tuberculosis	1758	194	11.0
Meningitis	803	173	21.5
HIV	532	86	16.2
Anaemia *	2469	289	11.7
Rheumatic heart disease *	66	7	10.6
Congenital heart disease *	113	39	34.5
Measles	6	0	0.0
Cancer *	120	49	40.8
Tetanus	19	4	21.1
Acute flaccid paralysis	18	1	5.6
Whooping cough	14	0	0.0
Child protection *	60	14	23.3

Table 2. Most common causes of hospital admission and case fatality rates in children for 2016, and comparative CFR for years 2009-2015

Pneumonia

In 2016 there were 5688 admissions for pneumonia reported through the PHR. Pneumonia makes up 24.9% of admissions overall.

The overall pneumonia CFR was 4.1% (231 deaths from 5688 cases of pneumonia), slightly lower than the pneumonia case fatality rate for previous years 2009-2015.

The PHR system enables the calculation of mortality rates for both total cases of pneumonia overall and for cases of *severe* pneumonia. The overall case fatality rate for severe pneumonia was 10.2%.

Severe pneumonia case fatality rates, as they are partly standardised for illness severity at the time of presentation, better reflect systems of practice, staff skills training and resources. High case fatality rates from severe pneumonia may occur if children present late, or are not recognised to be very unwell, if antibiotics and oxygen are not given promptly, or if children are not monitored closely.

Recommendations

It is recommended that hospitals ensure that there is:

- a system of triage and rapid treatment of the sickest patients in the emergency and outpatients departments

- a part of the children's ward that is properly equipped and stocked to provide high dependency care and close monitoring
- adequate oxygen supplies and staff trained in when and how to effectively give oxygen
- appropriate stocks of antibiotics to treat pneumonia
- regular clinical monitoring, including the use of pulse oximetry
- training for staff in the care of seriously ill children
- sufficient nursing and medical staff to provide clinical care at all times
- senior supervision of nursing and medical practice

In the 2016 Standard Treatment Book, the recommended treatment for severe pneumonia is penicillin (or ampicillin) and gentamicin, or ceftriaxone for the seriously ill or deteriorating child with pneumonia.

The high numbers of deaths from pneumonia (231) and meningitis (173); 24% of all deaths when combined) underline the importance of *Hemophilus influenzae* type b (Hib) – given as part of Pentavalent vaccine, and the pneumococcal conjugate vaccine (PCV, introduced in 2014); both vaccines given at 1, 2 and 3 months .

These vaccines are best solution to preventing deaths and disability from bacterial meningitis. There are other common causes of pneumonia, including viruses (particularly respiratory syncitial virus, influenza) and bacteria that are not prevented by these two vaccines (such as Group A streptococcus, *Staphylococcus aureus*, enteric gram negative bacilli, Chlamydia, Mycoplasma and tuberculosis). This means that even with these important vaccines, pneumonia will continue to be a major cause of hospitalisation and death in children in PNG.

The persisting high mortality rate from severe pneumonia (10%) is partly due to (i) the common presence of comorbidities (diseases that increase the risk of pneumonia, including malnutrition, anaemia, HIV, tuberculosis), (ii) late presentation of children, especially from poor environments, and (iii) the challenges of providing good supportive care (oxygen, nutrition, fluids, and intensive care, including CPAP) in provincial and district hospitals. Training in these areas is needed.

The PNG Child Health Plan 2009-2020 outlines a comprehensive approach to pneumonia and other acute respiratory tract infections.

This includes key areas to address:

Prevention

- Nutrition and breast feeding
- Helping parents be aware of the signs of pneumonia and the need for seeking care
- Reduction in indoor air pollution
- Hand-washing
- Vaccines: measles, Hib, pneumococcal

Treatment

- Improving quality of hospital and health centre care of pneumonia through IMCI, Standard Treatment Guidelines and Hospital Care for Children training
- Oxygen, pulse oximetry and CPAP, intensive care management
- Identification and treatment of comorbidities, including anaemia, malnutrition, and HIV.
- Improved infection control practices, particularly hand hygiene, and addressing rising rates of bacterial resistance, and improving rational antibiotic prescribing
- Outpatient or day-care treatment for moderate pneumonia, so that hospitals are not crowded by children who can safely be treated without hospitalisation.

Diarrhoea

2433 admissions and 149 deaths (CFR 6.1%) due to diarrhoea were reported in the 14 hospitals in 2016. Diarrhoea case mortality rates varied widely, from 2.7% (10 / 372) in Goroka to 12.1% (60 / 496) in PMGH. Diarrhoea mortality rates are also dependent on similar factors which influence severe pneumonia mortality rates (comorbidities, especially malnutrition, HIV, anaemia), and late presentation.

Deaths from diarrhoea can be due to (i) severe dehydration where the child does not have access to effective rehydration, (ii) from sepsis from bacillary dysentery, or (iii) other co-morbidity.

Severe diarrhoea can be prevented by timely use of oral rehydration in the community, by parents bringing their child to a health facility if they have diarrhoea, by improved assessment of the severity of dehydration, the use of zinc as additional treatment, and the appropriate use of antibiotics in bloody diarrhoea.

Most watery diarrhoea is due to viruses and does not require antibiotics, but require that children have access to ORS, zinc and breast feeding. If children receive adequate rehydration and nutrition when they have watery diarrhoea, death is very unlikely.

Dysentery is bloody diarrhoea, and is commonly due to a bacterium called *Shigella flexneri*. Studies in PNG found very high levels of resistance to amoxicillin and cotrimoxazole among *Shigella flexneri* isolates causing diarrhoea. The study confirmed that cotrimoxazole is ineffective and ciprofloxacin is needed to treat dysentery. Oral ciprofloxacin is currently recommended treatment by WHO for dysentery in a dose of 10-15mg/kg twice daily for 5 days. If children are too sick to take oral medications, give ceftriaxone intravenously (IV) or intramuscularly (IM).

Recommendations

- Deaths from watery diarrhoea usually means the child did not receive sufficient fluids
- Give ORS and zinc to all children with diarrhoea
- Treat bloody diarrhoea (dysentery) with ciprofloxacin
- Recognise the high risk of mortality among children with chronic or persistent diarrhoea

Malaria

In 2016 malaria accounted for 1015 admissions and 46 deaths (case fatality rate of 4.5%). The number of reported cases and deaths from malaria has fallen in recent years, although in 2016 more admission from malaria were reported than in 2015 (852).

PNG has changed malaria guidelines to:

- Uncomplicated malaria: artemether-lumefantrine
- Severe or complicated malaria: artesunate as initial treatment, followed by artemether-lumefantrine

It is important that health workers are familiar with these new treatments. They are described in the Standard Treatment Book for Common Illnesses in Children, new edition published in 2016.

Malnutrition

The PHR records malnutrition as a co-morbidity or a main diagnosis, so even if it is not the primary diagnosis it is still recorded. In 2016 in the 14 hospitals that reported using the PHR, 2635 children were admitted with severe malnutrition (weight for age <3 SD below the median), or with severe wasting or kwashiorkor. This represented 11.6% of all admissions; a lower proportion than in previous years. Severe malnutrition in these 14 hospitals was associated with 438 deaths: 34% of all deaths, and the case fatality rate for severe malnutrition was 16.6%, again lower than in earlier years of the PHR reporting where CFR was consistently 20% or above. However, as in previous years, in 2016 case fatality rate for malnutrition were more than 20% in 4 hospitals.

Recommendations

Health centres and hospitals need early identification and treatment for children with severe *and moderate* malnutrition:

- Breast feeding should be strongly promoted and mothers supported to breast-feed while their babies are in hospital
- growth monitoring should be a regular part of child health care
- There should be ready access in the health centre or hospital to adequate formulas (F75 and F100 ideally), nutritious fresh fruits and vegetables and other fresh food, and ready-to-use therapeutic food (RUTF).
- The main problems in the management of malnutrition are inadequate feeding (starting feeds to late, not enough milk feeds and not frequent enough feeds).
- Guidelines for the management of malnutrition should be in place and used. These include prevention and treatment of fatal complications such as sepsis, hypothermia and hypoglycaemia
- Children with severe acute malnutrition should be nursed in a high dependency area in the children's ward, where close monitoring and identification of complications can occur

- Children with chronic illnesses that are likely to result in malnutrition, such as HIV, tuberculosis, osteomyelitis or chronic cardiac, respiratory or renal disease should be identified early and provided with supplemental feeding
- Zinc and vitamin A should be available
- Staff should be trained in the management of malnutrition

The *prevention* of malnutrition must have the highest priority. This requires improved rates of breast feeding and complimentary (weaning) feeding. This will be helped by increased participation in education by girls and by greater economic independence for mothers. Mothers who have been educated to at least primary school completion are much more likely to breast feed their infants for longer, as well as more likely to seek care when their children are sick, and be up-to-date with immunization.

The *management* of malnutrition is outlined in the PNG Standard Treatment Manual and the WHO Pocket Book of Hospital Care for Children. Many children in hospitals are inadequately supplied with food. Steps should be taken to improve the caloric intake of sick hospitalised children. Having trained paediatric nurses skilled in the management of malnutrition is essential to reducing the case fatality rates from malnutrition.

Meningitis

In the 14 hospitals meningitis accounted for 803 admissions and 173 deaths. The case fatality rate for meningitis was 21.5%.

For every death from meningitis many children survive with serious brain injury which will reduce the child's ability to gain a proper education, or participate in the community or workforce. This tragedy is often preventable by vaccination and early presentation and treatment.

The best method of preventing meningitis is the use of conjugate Hib and pneumococcal vaccines. Hib vaccine (in Pentavalent) was introduced in PNG in 2008. Too many cases of Hib meningitis are still being reported in 2016, suggesting that the vaccine is not yet reaching all children. Meningitis due to *S. pneumoniae*, one of the two commonest causes, can be prevented by the pneumococcal conjugate vaccine (PCV), which was introduced in 2014.

Most Hib and many pneumococci causing meningitis are resistant to chloramphenicol, so do not use chloramphenicol for children with suspected meningitis. Ceftriaxone or cefotaxime is needed for true meningitis.

Recommendations

All children should receive Pentavalent and PCV vaccines at 1, 2 and 3 months of age.

Pentavalent contains the Hib vaccine and also protects against diphtheria (a throat infection), tetanus, pertussus (whooping cough) and hepatitis B (a liver infection which eventually can cause liver cancer in adults). PCV protects against the other most common cause of meningitis.

All children with suspected meningitis should have a lumbar puncture if it is safe to do so. If the CSF is cloudy or has cells on microscopy, treated with ceftriaxone 50mg/kg twice daily IV or IM for 10 days.

Acute complications can lead to high case fatality rates, and these complications can be minimised:

- Nurse all children with meningitis or unconsciousness in a high dependency or intensive care section of the ward
- Monitor with pulse oximetry to detect hypoxaemia
- Monitor the blood glucose and prevent hypoglycaemia
- Close observation for convulsions
- Do not give too much IV fluids, this leads to body and brain swelling and results in poor outcomes

Recommendations on identification and treatment of severe infections

It is very important that health workers recognise the signs of severe sepsis (severe pneumonia, meningitis, septicaemia), and know how to give emergency management.

There should be a system of Triage in every emergency or outpatients department to enable prompt identification of seriously ill children.

The **general signs of severe sepsis** include:

- high fever
- fast breathing and respiratory distress
- Heart rate >160 with pulses that are difficult to feel
- cold skin of arms and legs
- low blood pressure
- prolonged poor capillary refill
- pallor
- lethargy or unconsciousness

There may be **localising signs suggesting meningitis**

- severe headache
- neck stiffness
- severe vomiting
- repeated convulsions
- bulging fontanelle
- extreme irritability or high-pitched cry

There may be **purpura** (red or black spots on the skin).

There may be **signs of Staph infection**

- skin sepsis: boils, pustules, abscess, infected scabies or infected skin sores, cellulitis
- swollen red, hot, tender and painful joint
- empyema (pus in the chest)

The **emergency treatment for severe sepsis** should be known by all health workers. This includes:

- If the child is unconscious or convulsing, nurse on the side and keep the airway clear
- Give oxygen if there is severe respiratory distress, cyanosis or the oxygen saturation is <90%
- If the child has signs of shock (several signs: lethargy or drowsiness, low volume pulses, heart rate >160, cold skin or low blood pressure), give an IV bolus of Normal Saline or Hartmanns, 20ml/kg, then reassess.
- Promptly give IV or IM antibiotics: ceftriaxone, (plus flucloxacillin if signs of Staph infection are present)
- Monitor in a high dependency or ICU section of the ward. Monitor with pulse oximetry to detect hypoxaemia
- Check blood glucose. Give a bolus of glucose if the BSL is low
- Seek assistance from an experienced doctor
- Look up treatment recommendations in the PNG Standard Treatment Book for Children, and the WHO Pocketbook of Hospital Care for Children.

Neonatal admissions

Neonatal admissions made up 6930 (30%) of all 22,799 paediatric admissions to the 14 hospitals in 2016. There were 556 neonatal deaths reported, meaning that 33% of all deaths in children were in the neonatal period.

Neonatal infections

64% of all neonatal admissions were associated with infections (n=4477), with a CFR of 6.1%, comparable with previous years. Neonatal infections included pneumonia, meningitis, cord sepsis, skin sepsis and diarrhoea. Because of comorbidity infections may occur in babies with other diagnoses, including low birth weight.

Measures to prevent neonatal infections are described below in early essential newborn care.

Birth asphyxia

Birth asphyxia is lack of oxygen at or around the time of birth. Many babies survive without serious damage, but the consequences for some children are severe brain injury or death. There were 1478 hospital admissions due to birth asphyxia, and the CFR was 19.3% (285 of 1498). 51% of neonatal deaths were due to or associated with perinatal asphyxia. 11 of 14 hospitals had more than 50 cases of birth asphyxia for the year – that's more than one per week. The largest hospitals (PMGH, Goroka, Mt Hagen and Angau) had between 3 and 4 cases per week on average.

The developmental implications for many surviving children are significant: cerebral palsy, intellectual disability, blindness, and seizures are common. Prevention of perinatal asphyxia requires encouragement of delivery with a skilled midwife, identification of delays in labour, active management of labour and close communication between obstetric / midwifery services and paediatric services. Provision of immediate newborn care described below can also prevent some cases of asphyxia, as babies are stimulated to initiate breathing early by drying. Neonatal resuscitation training for nurses and doctors can also reduce the effects of birth asphyxia.

Very low birth weight

Very low birth weight is a birth weight between 1000 and 1499g. There were 356 very low birth weight admissions in the 14 hospitals. In 2016, 120 (33%) of VLBW newborns died while in hospital, but 2/3 survived hospitalisation.

	2016		
Diagnoses	**Admissions**	**Deaths**	**CFR**
All neonatal	6930	556	**8.0**
Neonatal sepsis	4477	273	**6.1**
Asphyxia	1478	285	**19.2**
VLBW (1000-1499 g)	356	120	**33.7**

Table 3. The most common causes of neonatal admissions and deaths for 2015

Recommendations for improving neonatal care

Provision of early essential newborn care can have a big impact on reducing neonatal sepsis, birth asphyxia and other complications. All newborns need the following:

- ***Immediate and thorough drying*** stimulates breathing and prevents hypothermia which can threaten newborns with delayed foetal-to-newborn circulatory adjustment, acidosis, hyaline membrane disease, coagulation defects, infection, hypogycaemia and brain haemorrhage. In some studies the number of babies who do not breathe at birth was found to decrease by more than half once immediate and thorough drying was instituted.
- ***Sustained skin-to-skin contact*** prevents hypothermia, initiates colonization of the newborn with maternal flora (as opposed to hospital flora which often includes multi-resistant bacteria), calms the baby and facilitates successful intake of colostrum and sustained breastfeeding.
- ***Delaying cord clamping until cord pulsations stop***, typically around one to three minutes from birth, reduces the risk of anaemia and in preterm infants, intraventricular haemorrhages.
- ***Exclusive breastfeeding and elimination of formula*** can prevent a large proportion of neonatal sepsis deaths.
- ***Avoiding harmful practices***, such as separation of babies from their mothers in the first hours of life for bathing or unnecessary observation. Separation reduces the chance a baby will breast feed successfully and means they are less likely to receive colostrum, which contains antibodies that protect against infection.

Babies who require resuscitation or special care

Despite thorough drying, 2-3% of newborns will not breathe at birth. ***Bag and mask resuscitation*** for all babies who are not breathing at birth reduces neonatal mortality

All hospitals should have neonatal areas that reach a minimum standard to care for babies who require a higher level of care. However in a Special Care Unit it is vital that newborn care practices are as least invasive and most natural as possible, and that babies spend as much time as possible with their mothers having skin-to-skin warming and breast feeding.

Maintain skin-to-skin contact with the mother to protect babies from hypothermia, hypoglycaemia, apnoea and infection

Improved care for sick neonates includes early essential newborn care, *plus*:

- Keeping babies warm, best done using Kangaroo Mother Care (KMC). KMC is even safe for many very low birth weight babies, unless they are also very sick with danger signs such as apnoea, cyanosis or severe hypoxaemia.
- Supplemental oxygen administration and pulse oximetry. Because clinical signs predicting hypoxaemia in neonates are relatively insensitive, use of protocols for supplemental oxygen administration based on monitoring of pulse oximetry is recommended.
- Detecting and treating apnoea. Apnoea is a major cause of neonatal mortality among premature neonates and also among babies with sepsis and birth asphyxia. The use of apnoea monitors, aminophylline for premature neonates and close observation of all very sick babies are recommended.
- Prevention and treatment of hypoglycaemia. Hypoglycaemia complicates many neonatal conditions, particularly low birth weight and sepsis. Early breast feeding and close contact with the mother immediately after birth prevents hypoglycaemia – this is best achieved by early skin-to-skin contact and KMC. In neonates hypoglycaemia occurs because of insufficient glycogen stores in the liver, inability to feed or separation from the mother, and increased glucose metabolism during illness. The clinical signs are non-specific, and regular blood glucose monitoring of high-risk ill neonates is required. Contact with the mother is essential for most sick babies. Careful correction of hypoglycaemia using breast feeds in babies who can suck, or nasogastric expressed breast milk feeding or IV glucose in babies too sick to feed should be started.
- Ward organisation to ensure close observation of the most seriously ill and highest risk ill babies
- Safe use of intravenous fluids in seriously ill neonates. In very low birth weight neonates, large volumes of enteral feeding in the first day or two of life is not well tolerated and may increase the risk of necrotising enterocolitis. The use of any artificial formula feeding is not recommended at any time in low birth weight babies. For babies less than 1.5 kg, slow increases in expressed breast milk with cautious intravenous fluids to maintain hydration and prevent hypoglycaemia in the first few days of life is recommended.

Babies on IV fluids are at risk of overhydration and nosocomial infection through the IV drip site.

- Antibiotics. Although many seriously ill neonates have bacterial infections, the inappropriate use of broad-spectrum antibiotics will lead to colonization of babies, and of neonatal units, with bacteria that are resistant to standard antibiotics. Standard treatment of neonatal sepsis is benzylpenicillin (or ampicillin or amoxicillin) and gentamicin, which are effective against most bacteria causing sepsis. *Staphylococcus aureus* is another common cause of infection in young infants in some hospitals, and resistant enteric gram negative bacilli are a common cause of neonatal death. Flucloxacillin or cloxacillin should be used if there are signs Staphylococcal infection, such as purulent umbilical cord, skin pustules or purulent conjunctivitis.
- Prevention of neonatal sepsis. Strict hand washing and other basic infection control measures are recommended. There is good evidence now that prolonged antibiotics lead to colonisation of the newborns gastrointestinal tract with pathogenic bacteria that are likely to be invasive, rather than the protective bacteria that comes from the mother. So avoiding antibiotics in babies who do not have serious infections also helps to protect them against infection. Ceasing antibiotics after 24 or 48 hours if the baby is well will also reduce colonisation with pathogenic or highly-resistance bacteria, and reduce infections in babies.
- Auditing of practice. It is only by keeping accurate records of all admissions and outcomes that patterns of adverse events will become identified. Clinical audit is essential to reduce neonatal mortality.
- Training of nurses in early essential newborn care and neonatal high-dependency care

Tuberculosis

In the 14 hospitals in 2015 there were 1758 children admitted with tuberculosis, with 194 known deaths, and a case fatality rate of 11.0%. This may represent only a fraction of the children with TB in PNG, given that many cases are diagnosed by other hospitals or health facilities or remain undiagnosed in the community. However these data underlines that in its severest forms TB cause many childhood deaths.

Extra-pulmonary tuberculosis (TB meningitis, lymph node TB, spinal TB, abdominal TB, miliary TB) makes up over 43% of children diagnosed with TB (636 reported cases). EPTB has a higher hospital mortality rate than PTB (15.6% compared with 9.3%), often reflecting the multi-system nature of many cases of EPTB which are treated as in-patients in hospitals.

The source of transmission of TB to a child is usually an adult family member who has sputum smear-positive pulmonary TB (PTB), although many adults who pass on TB to children will not know they are affected. Children who develop TB disease usually do so within a year after being infected. Children under the age of 3 are at much higher risk of developing TB disease if infected.

Malnutrition contributes substantially to high case fatality rates for children with PTB and EPTB.

Recommendations

Every effort should be made to help children complete therapy, and for many children this will require 2 months of hospitalisation to ensure adherence, and active community follow-up

It is important to screen all family members (particularly children) of adult patients who are known to be sputum smear-positive PTB.

If there is a person with sputum smear-positive PTB in the household child contacts should be screened. If they are asymptomatic they should be commenced on Isoniazid Preventive Therapy (see paediatric Standard Treatment Manual). If they have symptoms of TB do a TB score. If the score is >7, register them and commence TB treatment.

The most effective way to prevent transmission of TB to children is by early identification and treatment of those people in the community with infectious TB i.e. usually adults and older children with PTB, especially sputum smear-positive PTB.

BCG immunization is effective in preventing severe and disseminated forms of TB (such as miliary TB and TB meningitis) in young children.

Early identification and treatment of children with TB disease will reduce the numbers of childhood deaths and complications (such as bronchiectasis and cerebral palsy) due to TB.

In remote areas, where chest xray and acid fast bacilli staining is not possible, it is valid to diagnose TB clinically, based on symptoms, signs and the TB score. It is better to treat and closely monitor response than to have children deteriorate because diagnostic tests were not available.

The new GeneXpert test can help diagnose TB and multi-drug resistant TB. This is only available in some provincial hospitals. However it should not be relied upon to diagnose TB, the diagnosis of TB is a clinical diagnosis based on the history of contact, the clinical features, and where available radiology, sputum or gastric aspirate for acid fast bacilli and other tests such as GeneXpert. If uncertain refer to the PNG Standard Treatment Guidelines on TB and to your provincial paediatrician, more details are in the National Child Health Plan.

GeneXpert testing should be done on all children who are:

- Contacts of known MDR cases or suspected MDR cases
- Relapsed or re-treatment cases
- HIV positive
- Failing treatment despite supervised treatment and proven adherence.

Do not discharge patients with TB too early: keep children in hospital for the duration of their intensive phase treatment (2 months) if this is feasible. To do this child and family friendly health facilities are needed, where children can go to school while they receive supervised treatment, and parents can receive appropriate education on how to care for their child with TB, and receive proper family screening and treatment themselves if they have TB.

TB programs that are successful in achieving good treatment completion rates have nurse outreach services for identification and supervision of DOTs providers, checking of adherence, nutritional, social and economic support and follow-up in the home.

HIV

In 2016 there were 532 new cases of HIV admitted to the 14 hospitals, and 86 known HIV-related deaths. This only represents cases that were reported in hospitals, based on admissions, and may be an underestimate of new cases in the population, as some children are diagnosed as outpatients or through Prevention of Parent to Child Transmission (PPTCT) programs.

Recommendations

- Mothers who are diagnosed with HIV during or after pregnancy are now treated with three anti-retroviral drugs for life, not just for shorter periods to prevent transmission to the baby. The ongoing care of the mother is paramount, and what is good for the mother is good for her children.
- Early infant diagnosis of HIV with PCR testing is now available. Children who have HIV confirmed by early infant diagnosis and start on ante-retroviral therapy (ART) before they become symptomatic have a much better chance of healthy life than children diagnosed in late stages because of AIDS-defining infections.
- All children diagnosed with HIV should see a paediatrician regularly, for starting on and follow-up of antiretroviral therapy.
- All children with HIV need prophylaxis with cotrimoxazole and INAH, treatment of intercurrent infections and good nutrition.
- **Teach children with HIV about their condition, they are more likely to take their ART reliably if they understand more, and even young children have a right to this knowledge. Educational resources are available to teach children who are living with HIV about their condition in ways that are age-appropriate.**

Vaccine preventable diseases

There were 19 cases of tetanus (4 deaths), 14 cases of whooping cough, 6 measles, 3 rubella, tetanus and 18 cases of acute flaccid paralysis in 2016.

Cases of suspected measles, acute flaccid paralysis, and tetanus are all reportable. Measles and AFP require laboratory investigation and confirmation.

There were important changes to immunization in 2016. The new schedule is in Table 4.

Immunization Schedule for Papua New Guinea (0 month-24 months)							
Immunization to be given at	**Birth**	**1 month**	**2 months**	**3 months**	**6 months**	**9 months**	**18 months**
BCG	√						
Hepatitis B	√						
OPV		√	√	√			
IPV				√			
Pentavalent		√	√	√			
PCV-13		√	√	√			
Measles-Rubella (MR)					√	√	√
Vitamin A					√	√	√

Table 4. PNG's new Immunization Schedule for children 0-24 months as of November 2016

Although in 2016 there were very few cases of measles (6 reported), vaccination coverage in PNG is far too low, and it is inevitable that there will be another measles epidemic in the next few years unless action is taken.

In the epidemic of 2013-2014 measles killed many children, as it did in 1999-2002. The only way to prevent this happening again is to immunize more children against measles.

The coverage rate for measles vaccine throughout PNG is about 60%. At least 90% coverage is needed to prevent outbreaks of measles. Every child we vaccinate is another child protected. The most at risk children are those who don't come to get vaccines, so we have to go to their homes and communities to immunise them.

No.	Vaccine	Age Group	Dose	Route	Disease Protects
1.	BCG	At Birth	0.05 ml (only one dose)	Intradermal	Tuberculosis
2.	OPV	Under 2 years old	2 drops (in 1 month, 2 months, 3 months)	Oral	Poliomyelitis
3.	Hepatitis B	At Birth	0.5 ml	Intramuscular	Hepatitis B
4.	IPV (inactivated Polio vaccine)	At 3 months	0.5 ml (one dose with 3rd dose of OPV	Intramuscular	Poliomyelitis
5.	Pentavalent	Under 2 years	0.5ml (3 doses in 1st ,2nd and 3rd months)	Intramuscular	Diphtheria, Whooping Cough, pneumonia and meningitis due to H. Influenzae, tetanus, Hepatitis B
6.	PCV-13 Pneumococcal Conjugate Vaccine)	Under 2 years	0.5ml (3 doses at 1st, 2nd and 3rd months)	Intramuscular	Pneumonia and meningitis due to Streptococcus pneumoniae
7	MR (Measles, Rubella)	Under 2 years	0.5ml (3 doses at 6,9 and 18 months)	Subcutaneous	Measles and Rubella
8	Tetanus Toxoid	Pregnant Mother, School Entry. School Leaving	0.5ml (2 doses in one month apart	Intramuscular	Tetanus
9.	Vitamin A	06 months - 2 years	3 doses (6 months, 9 months blue capsule 100,000 IU and 18 months Red capsules 200,000 IU)	Oral	Protects from night blindness

Table 5. The vaccines and diseases prevented

Chronic diseases in children

There are increasingly children with **chronic diseases**, including asthma, epilepsy, rheumatic (66 cases and 7 deaths in 2016) and congenital heart diseases (113 cases and 39 deaths in 2015), cerebral palsy, and cancer (120 cases and 49 deaths).

Children with chronic diseases have many needs, including

- **a long-term treatment plan**
- **good follow-up by a trusted doctor or nurse**
- **going to school regularly and having schools informed about their condition**
- **regular supply of medicines on time, and good adherence**
- **optimal nutrition**

Children with chronic illnesses have to understand their condition well. Children as young as 4 or 5 years can start to understand. This is empowering and helps them manage their illness as they get older.

Some children with chronic illness have problems with hearing and vision, which can be addressed to make their lives better, and some have motor and mobility problems that can be addressed with physiotherapy, regular exercise and aids such as wheelchairs or walking frames. Programs are needed in every province that better support children with chronic illness.

Guidelines for the management of common cancers are available at www.pngpaediatricsociety.org (under Treatment Guidelines, Cancer Protocols)

Child protection

Data on child physical, sexual and other forms of abuse are now being collected by the PHR. There were 60 cases of child abuse reported in 2016, and 14 deaths. This is also an under-estimate of the burden of child abuse and maltreatment, but it is a start at systematic gathering of data on this problem. Social issues are also a frequent root causes of malnutrition and its disease risks.

More emphasis on child protection is needed, and more resources, including a child social worker in each hospital to deal with the range of common social issues.

Summary

The Paediatric Hospital Reporting System has highlighted problem areas in hospitals and the health system. Addressing these in a systematic way will lower the death rates from common diseases. The Child Health Advisory Committee asks that all health workers and hospital administrators play their part to address specific problems, adopt the recommendations in this report, and see these results improve in the coming years.

Diagnoses	Total Admissions 2016	Deaths 2016	CFR 2016	Admissions 2009-2016	Deaths 2009-2016	CFR 2009-2016
All paediatric admissions	22,799	1679	7.4	136,075	10054	7.39
Pneumonia	5688	231	4.1	35121	1691	4.81
Severe pneumonia	1881	192	10.2	12625	1425	11.29
Neonatal conditions	6930	556	8.0	30434	2999	9.85
Diarrhoea	2433	149	6.1	15323	636	4.15
Malaria	1015	46	4.5	9605	432	4.50
Severe malnutrition	2635	438	16.6	16430	2964	18.04
Tuberculosis	1758	194	11.0	10333	1184	11.46
Meningitis	803	173	21.5	7248	1303	17.98
HIV	532	86	16.2	2543	383	15.06
Anaemia *	2469	289	11.7	6892	971	14.09
Rheumatic heart disease *	66	7	10.6	237	20	8.44
Congenital heart disease *	113	39	34.5	309	91	29.45
Measles	6	0	0.0	2155	64	2.97
Cancer *	120	49	40.8	339	116	34.22
Tetanus	19	4	21.1	102	5	4.90
Acute flaccid paralysis	18	1	5.6	82	3	3.66
Whooping cough	14	0	0.0	112	1	0.89
Child protection *	60	14	23.3	167	13	7.78

Table 2: Admissions, deaths and case fatality rates for common diagnoses 2009-2016

* Diagnoses that were introduced in later versions of the PHR as annually reported, some hospitals were still using older versions, so data reporting are incomplete, even in 2016.

Pneumonia admissions and outcomes in 2016

Hospital	Pneumonia admissions	Pneumonia deaths	Pneumonia CFR		Severe pneumonia admissions	Severe pneumonia deaths	Severe pneumonia CFR
Alotau	223	2	0.9		10	1	10.0
Angau							
Buka	177	10	5.6		93	7	7.5
Daru							
Goroka	948	33	3.5		382	32	8.4
Kavieng	56	7	12.5		26	7	26.9
Kimbe	204	22	10.8		74	17	23.0
Kerema							
Kundiawa	322	10	3.1		141	10	7.0
Manus							
Mendi	614	9	1.5		125	8	6.4
Modilon	284	6	2.1		73	5	6.8
Mt Hagen	1415	40	2.8		453	23	5.1
Nonga	187	12	6.4		62	10	16.1
Oro	224	11	4.9		65	3	4.6
PMGH	646	56	8.7		250	56	22.4
Vanimo	99	2	2.0		31	2	2.0
Wabag	289	11	3.8		96	11	11.5
Wewak							
Total	5688	231			1881	192	

Diarrhoea admissions and outcomes in 2016

Hospital	Diarrhoea admissions	Diarrhoea deaths	Diarrhoea CFR
Alotau	68	0	0.0
Angau			
Buka	72	7	9.7
Daru			
Goroka	372	10	2.7
Kavieng	21	0	0.0
Kimbe	123	7	5.7
Kerema			
Kundiawa	154	3	1.9
Manus			
Mendi	215	7	3.3
Modilon	113	5	4.4
Mt Hagen	561	30	5.3
Nonga	41	4	9.8
Oro	104	9	8.7
PMGH	496	60	12.1
Vanimo	21	0	0.0
Wabag	72	7	9.7
Wewak			
Total	2433	149	

Malaria admissions and outcomes in 2016

Hospital	Malaria admissions	Malaria Deaths	Malaria CFR
Alotau	32	2	6.3
Angau			
Buka	14	1	7.1
Daru			
Goroka	56	3	5.4
Kavieng	122	2	1.6
Kimbe	174	11	6.3
Kerema			
Kundiawa	6	0	0.0
Manus			
Mendi	5	0	0.0
Modilon	243	5	2.1
Mt Hagen	108	8	7.4
Nonga	37	4	10.8
Oro	76	4	5.3
PMGH	21	1	4.8
Vanimo	121	5	4.1
Wabag	0	0	0.0
Wewak			
Total	1015	46	

Severe malnutrition admissions and outcomes in 2016

Hospital	Severe malnutrition admission	Severe malnutrition deaths	Malnutrition CFR
Alotau	17	1	5.9
Angau			
Buka	94	8	8.5
Daru			
Goroka	548	98	17.9
Kavieng	27	5	18.5
Kimbe	214	45	21.0
Kerema			
Kundiawa	65	3	4.6
Manus			
Mendi	117	26	22.2
Modilon	205	20	9.8
Mt Hagen	422	71	16.8
Nonga	73	8	11.0
Oro	196	23	11.7
PMGH	534	107	20.0
Vanimo	56	5	8.9
Wabag	67	18	26.9
Wewak			
Total	2635	438	

Meningitis admissions and outcomes in 2016

Hospital	Meningitis admissions	Meningitis deaths	Meningitis CFR
Alotau	16	4	25.0
Angau			
Buka	27	7	25.9
Daru			
Goroka	108	30	27.8
Kavieng	9	2	22.2
Kimbe	42	11	6.3
Kerema			
Kundiawa	56	5	8.9
Manus			
Mendi	52	6	11.5
Modilon	71	17	23.9
Mt Hagen	164	20	12.2
Nonga	18	9	50.0
Oro	50	9	18.0
PMGH	149	43	29.0
Vanimo	10	3	30.0
Wabag	31	7	22.6
Wewak			
Total	803	173	

TB admissions and outcomes in 2016

Hospital	TB admissions	TB deaths	TB CFR		Pulmonary TB admissions	Pulmonary TB deaths	Pulmonary TB CFR		Extra Pulmonary TB admissions	Extra Pulmonary deaths	Extra Pulmonary CFR
Alotau	32	3	9.4		20	0	0.0		12	0	0.0
Angau											
Buka	66	6	9.1		43	4	9.3		23	2	8.7
Daru											
Goroka	150	15	10.0		62	4	6.5		88	11	12.5
Kavieng	18	1	5.6		8	0	0.0		10	1	10.0
Kimbe	209	16	7.7		151	10	6.6		58	6	10.3
Kerema											
Kundiawa	216	7	3.2		115	4	3.5		91	2	2.2
Manus											
Mendi	77	9	11.7		40	3	7.5		37	6	16.2
Modilon	146	22	15.1		80	5	6.3		66	17	25.8
Mt Hagen	107	9	8.4		66	6	9.1		41	3	7.3
Nonga	53	8	15.1		27	3	11.1		26	5	19.2
Oro	149	11	7.4		76	5	6.6		73	6	8.2
PMGH	455	80	18.0		275	49	27.5		180	50	27.8
Vanimo	27	2	7.4		13	0	0.0		14	2	14.3
Wabag	53	5	9.4		29	0	0.0		24	5	20.8
Wewak											
Total	1758	194			1005	93			743	116	

PTB = Pulmonary tuberculosis EPTB = Extra-pulmonary tuberculosis

HIV admissions and outcomes in 2016

Hospital	HIV admissions	HIV deaths	HIV CFR
Alotau	12	3	25.0
Angau			
Buka	0	0	0.0
Daru			
Goroka	113	9	8.0
Kavieng	0	0	0.0
Kimbe	8	1	12.5
Kerema			
Kundiawa	16	6	37.5
Manus			
Mendi	11	1	9.1
Modilon	42	4	9.5
Mt Hagen	152	21	13.8
Nonga	7	1	14.3
Oro	12	4	33.3
PMGH	134	28	21.1
Vanimo	0	0	0.0
Wabag	25	8	32.0
Wewak			
Total	532	86	

Total neonatal admissions and outcomes in 2016

Hospital	Neonatal admissions	Neonatal deaths	Neonatal CFR
Alotau	732	18	2.5
Angau			
Buka	139	22	15.8
Daru			
Goroka	489	68	13.9
Kavieng	164	10	6.1
Kimbe	422	57	13.5
Kerema			
Kundiawa	495	45	9.1
Manus			
Mendi	410	33	8.0
Modilon	532	36	6.8
Mt Hagen	909	64	7.0
Nonga	765	34	4.4
Oro	344	27	7.8
PMGH	1355	127	9.4
Vanimo	174	15	8.6
Wabag	0	0	0.0
Wewak			
Total	6930	556	

Neonatal infections in 2016

* Probable error

Hospital	Neonatal Infections Admissions	Neonatal Infections Deaths	Neonatal Infection CFR
Alotau	517	7	1.4
Angau			
Buka	80	57	71.3
Daru			
Goroka	257	38	14.8
Kavieng	112	7	6.3
Kimbe	362	9	2.5
Kerema			
Kundiawa	290	10	3.4
Manus			
Mendi	327	18	5.5
Modilon	384	17	4.4
Mt Hagen	632	33	5.2
Nonga	300	9	3.0
Oro	243	12	4.9
PMGH	943	50	5.3
Vanimo	30	6	20.0
Wabag	0	0	0.0
Wewak			
Total	4477	273	6.1

Very low birth weight (1000-1499g) admissions and deaths in 2016

Hospital	VLBW admissions	VLBW deaths	VLBW CFR
Alotau	24	5	20.8
Angau			
Buka	13	6	46.2
Daru			
Goroka	0	0	0.0
Kavieng	17	4	23.5
Kimbe	27	16	59.3
Kerema			
Kundiawa	24	11	45.8
Manus			
Mendi	20	5	25.0
Modilon	35	5	14.3
Mt Hagen	46	16	34.8
Nonga	22	2	9.1
Oro	17	9	62.9
PMGH	101	38	37.6
Vanimo	10	3	30.0
Wabag	0	0	0.0
Wewak			
Total	356	120	

Perinatal asphyxia admissions and deaths in 2016

Hospital	Asphyxia admissions	Asphyxia deaths	Asphyxia CFR
Alotau	135	10	7.4
Angau			
Buka	60	15	25.0
Daru			
Goroka	0	0	0.0
Kavieng	49	1	2.0
Kimbe	95	23	24.2
Kerema			
Kundiawa	61	14	23.0
Manus			
Mendi	58	12	20.7
Modilon	134	17	12.7
Mt Hagen	263	27	10.3
Nonga	54	7	13.0
Oro	97	11	11.3
PMGH	331	53	16.0
Vanimo	141	95	67.4
Wabag	0	0	0.0
Wewak			
Total	1478	285	

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Cancer and Rheumatic heart disease admissions and deaths in 2015

Hospital	Cancer admissions	Cancer deaths	Cancer CFR		Rheumatic heart admissions	Rheumatic heart deaths	RHD CFR
Alotau	7	2	28.6		3	0	0.0
Angau							
Buka	11	6	54.5		0	0	0.0
Daru							
Goroka	14	5	35.7		8	0	0.0
Kavieng	9	3	33.3		1	0	0.0
Kimbe	8	2	25.0		2	0	0.0
Kerema							
Kundiawa	3	3	100.0		5	0	0.0
Manus							
Mendi	3	1	33.3		3	1	33.3
Modilon	6	4	66.7		8	2	25.0
Mt Hagen	3	2	66.7		9	0	0.0
Nonga	4	2	50.0		2	1	50.0
Oro	15	3	20.0		1	0	0.0
PMGH	37	16	43.2		23	3	13.0
Vanimo	0	0	0.0		1	0	0.0
Wabag	0	0	0.0		0	0	0.0
Wewak							
Total	120	49			66	7	