PNG Department of Health

Child Morbidity and Mortality

Annual Report 2017

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

Produced by the members of the Paediatric Society of Papua New Guinea

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2017 Annual Report on Child Morbidity and Mortality

Summary

- This report covers admissions and outcomes for children in 2017 from 15 provincial hospitals.
- In 2017 there were 23,272 admissions and 1701 deaths recorded (mortality rate 7.31%), comparable to 2016 of 7.3 and 2015 of 7.7%. There were 1100 post-neonatal deaths and 601 neonatal deaths.
- Pneumonia was the most common reason for admission (5314, 22.8% of admissions).
- 6681 (28.7%) of all admissions were in the neonatal period. Neonatal deaths accounted for just over one third (35.3%) 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 13.5% of admissions, making it in the top 5 most common problem seen in hospitals. Malnutrition either directly caused or contributed to 28.6% of all deaths, and many additional children had moderate malnutrition.
- Anaemia, also a rare *primary* cause of admission, was present in at least 12% of patients, and in 20% of all deaths, including 31% 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.

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 52% of admissions and 51% of deaths in 2017.
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 13% of child deaths. Extra-pulmonary tuberculosis made up over 41% of children diagnosed with TB, and children with EPTB have a higher mortality (13% compared with 7% for pulmonary TB). 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. In 2017 there were 132 reported cases, and 16 deaths from RHD. 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 2017 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.

Introduction

The Child Health Advisory Committee of the National Department of Health releases the 8th 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 2017, with some comparisons throughout to data collected in the previous 7 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.

Mortality rates for hospitals and common diseases

Case fatality rates (CFR) vary: low overall CFR in some smaller hospitals, such as Alotau (4%) to nearly 10% in Kimbe. 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.

Hospitals	Admissions	Deaths	Overall CFR
Alotau	831	36	4.3
Angau			
Buka	817	57	7.0
Daru	175	6	3.4
Goroka	2381	180	7.6
Kavieng	673	42	6.2
Kimbe	2423	240	9.9
Kerema			
Kundiawa	1600	83	5.2
Manus			
Mendi	3658	262	7.2
Modilon	1715	140	8.2
Mt Hagen	1390	55	4.0
Nonga	1110	86	7.7
Oro	635	33	5.2
PMGH	5244	434	8.3
Vanimo	718	27	3.8
Wabag	733	56	7.6
Wewak			
Total	**23,272**	**1701**	**7.31**

Table 1. Summary of admission, death and case fatality rates in participating hospitals in 2017

Diagnoses	Admissions 2017	Deaths 2017	CFR 2017	CFR in previous years: 2009-2016
All paediatric admissions	23,272	1701	7.31	7.39
Pneumonia	5314	265	5.0	4.81
Severe pneumonia	1918	219	11.4	11.29
Neonatal conditions	6681	601	9.0	9.85
Diarrhoea	2707	135	5.0	4.15
Malaria	1251	45	3.6	4.50
Severe malnutrition	3137	486	15.5	18.04
Tuberculosis	2260	218	9.7	11.46
Meningitis	809	136	16.8	17.98
HIV	515	81	15.7	15.06
Anaemia *	2928	343	11.7	14.09
Rheumatic heart disease *	132	16	12.1	8.44
Congenital heart disease *	425	71	16.7	29.45
Measles	3	0	0.0	2.97
Cancer *	167	49	29.3	34.22
Tetanus	11	4	36.4	4.90
Acute flaccid paralysis	28	3	10.7	3.66
Whooping cough	25	0	0.0	0.89
Child protection *	60	15	25	7.78
Trauma and injuries	59	2	3.4	*

Table 2. Most common causes of hospital admission and case fatality rates in children for 2017, and comparative CFR for years 2009-2017

* Diagnoses added recently, so CFRs do not reflect the complete 8 years of reporting

Pneumonia

In 2017 there were 5314 admissions for pneumonia reported through the PHR. Pneumonia makes up 23% of admissions overall.

The overall pneumonia CFR was 5.0% (265 deaths from 5314 cases of pneumonia), largely unchanged from previous years 2009-2016.

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 11.4%.

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 (265) and meningitis (136); 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 (over 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.

EXPERIENCE OF A PROVINCIAL PAEDIATRICIAN

Enga Province is in the northern region of the highlands of Papua New Guinea. It is the highest, and the second most rugged, province after Chimbu; with much of Enga at altitudes above 2000 meters. The majority of the population live in traditional rural settings, and tribal conflicts are still common. The provincial capital is Wabag where Enga Provincial Hospital is located. Since its opening the provincial hospital had not had a paediatrician.

Dr Doreen Panauwe hails from the coastal Island province of East New Britain. She completed her Paediatric training in 2013, and along with her fellow graduates was given a list of the provinces that needed a paediatrician. She chose Enga, making her the first full time clinical paediatrician to practice in the province, and she took up her post in February 2014.

Everyday Dr Panauwe provides high quality care to sick children at the hospital. However she has also been instrumental in organising public health programs that the children in Enga province previous did not have access to. The UNICEF sponsored Severe Acute Malnutrition program was implemented in 2015 and rolled out to the district hospitals. Children with cardiac defects previously travelled by road for 3 hours to the neighbouring Western Highlands Province for their cardiac reviews. Since 2015 the review has been done at Enga provincial hospital.

Dr Panauwe conducted a baseline health facility survey in 2015 prior to the introduction of the solar-powered oxygen project which is funded by the Bill and Melinda Gates Foundation. As a result, 6 important health care facilities in her province now have oxygen concentrators and power to manage seriously ill children and mothers during delivery. In Wabag, the continuous supply of oxygen, and good care of children with pneumonia has seen the case fatality rate fall from 12.1% in 2011 to 1.8% in 2017. A separate and proper special care nursery was also organised with neonatal equipment donated by WHO.

Dr Panauwe is a national facilitator for the IMCI, SAM, and Hospital Care for Children and Oxygen concentrator training. Her experience and that of other paediatricians serving in provincial and district hospitals, shows that there is much a paediatrician can do to reduce the burden of childhood illnesses in these settings. From specialist clinical care, management and program building, to disease prevention and training.

Diarrhoea

2707 admissions and 135 deaths (CFR 5%) due to diarrhoea were reported in the 15 hospitals in 2017. Diarrhoea case mortality rates varied widely, from no deaths among 80 admissions in Alotau to 8.1% among 86 admissions in Modillon and 8.5% from 562 admissions at 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, such as severe malnutrition or immune deficiency.

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 10-15 mg/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 2017 malaria accounted for 1251 admissions and 45 deaths (case fatality rate of 3.6%). The number of reported cases and deaths from malaria *had* fallen in the earlier years of PHR reporting, however in 2017 more admission from malaria were reported than in 2016 (1015) and this was more than in 2015 (852).

PNG now has established malaria treatment guidelines which include:

- 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 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 2017 in the 15 hospitals that reported using the PHR, 3137 children were admitted with severe malnutrition (weight for age <3 SD below the median), or with severe wasting or kwashiorkor. This represented 14% of all admissions. Severe malnutrition in these 15 hospitals was associated with 486 deaths: 28.5% of all deaths, and the case fatality rate for severe malnutrition was 15.5%, again lower than in earlier years of the PHR reporting where CFR was consistently 20% or above. Unlike in previous years, in 2017 case fatality rate for malnutrition were more than 20% in only 2 hospitals (Table 3). This shows that

(i) Severe malnutrition is as large a burden in 2017 as in previous years as the admission numbers continue to be high

(ii) There has been a consistent gradual improvement in the management and outcomes of severe malnutrition management over years, likely because of improved systematic approach based on the WHO/UNICEF and Standard Treatment guidelines.

Year	Number admissions	Deaths	CFR	Number of hospitals with CFR >20%
2010	739	157	21.2	4
2011	1544	287	18.6	3
2012	2590	604	23.3	4
2013	3379	524	15.5	4
2014	2861	455	15.9	4
2015	2338	438	18.7	4
2016	2635	438	16.7	4
2017	3049	483	15.8	2

Table 3. Cases and outcomes of children with severe malnutrition 2010-2017

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 15 hospitals meningitis accounted for 809 admissions and 136 deaths. The case fatality rate for meningitis was 16.8%.

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 2017, 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.

There are many causes of the syndrome of febrile encephalopathy that are not bacterial meningitis. The other causes of febrile encephalopathy include viral encephalitis, including Dengue, Japanese encephalitis, herpes viruses, influenza. TB meningitis also causes febrile encephalopathy. A good history should be taken to determine if the child has been unwell for several weeks prior to presentation: weight loss, chronic fever, chronic cough, and examination finding of wasting, lymphadenopathy, and enlarged liver suggest a more chronic process than with bacterial or viral meningitis, and TB should be considered early.

All patients with febrile encephalopathy or meningitis require very good supportive care and monitoring.

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.

Supportive care of all children with febrile encephalopathy (seizures and / or acute coma) includes attention to the following:

- Nurse all children with meningitis or unconsciousness in a high dependency or intensive care section of the ward
- Nurse the child 30° head up (elevate the head of the bed, or nurse on a pillow) to reduce the risk of aspiration and reduce intracranial pressure
- Monitor with pulse oximetry to detect hypoxaemia, and give oxygen if SpO_2<92%
- Monitor the blood glucose and prevent hypoglycaemia
- Monitor the Glasgow Coma Scale
- Monitor the blood pressure and ensure it is in the normal range (avoid both severe hypertension and hypotension, both are bad for injured brains). Monitor the pulses and peripheral circulation.
- Close observation for convulsions, and prompt treatment with a preventative anticonvulsant if the child has convulsions
- Do not give too much IV fluids, this leads to body and brain swelling and results in poor outcomes, maintain enteral nutrition via a nasogastric tube
- Change position to prevent pressure sores
- Physiotherapy to prevent limb contractures

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 6681 (28.7%) of all 23,272 paediatric admissions to the 15 hospitals in 2017. There were 601 neonatal deaths reported, meaning that 35% of all deaths in children were in the neonatal period.

Neonatal infections

61% of all neonatal admissions were associated with infections (n=4057). 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 1735 hospital admissions due to birth asphyxia, and the CFR was 13.8% (239 of 1735). 40% of neonatal deaths were due to or associated with perinatal asphyxia. On average some hospitals (Goroka, Kimbe, Mendi) had between 3 and 4 cases per week, and PMGH had 8 cases a week.

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 440 very low birth weight admissions in the 15 hospitals. In 2017, 169 (38.4%) of VLBW newborns died while in hospital, but more than 60% survived hospitalisation.

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 15 hospitals in 2017 there were 2260 children admitted with tuberculosis, with 218 known deaths, and a case fatality rate of 9.7%. 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.

Pulmonary TB made up 59% (1341) of all TB diagnoses. Extra-pulmonary tuberculosis (TB meningitis, lymph node TB, spinal TB, abdominal TB, miliary TB) made up over 40% of children diagnosed with TB (933 reported cases). EPTB has a much higher hospital mortality rate than PTB (13.2% compared with 6.8%), this is consistently seen over years, 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 2017 there were 515 new cases of HIV admitted to the 14 hospitals, and 81 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 11 cases of tetanus (4 deaths), 25 cases of whooping cough, 28 cases of acute flaccid paralysis in 2016 (3 deaths), and 3 cases of measles in 2017.

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 2017 there were very few cases of measles (only 3 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 (132 cases and 16 deaths in 2017) and congenital heart diseases (425 cases and 71 deaths in 2017), cerebral palsy, and cancer (167 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 2017, and 15 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	Admissions 2017	Deaths 2017	CFR 2017	**Admissions 2009-2016**	**Deaths 2009-2016**	**CFR 2009-2016**
All paediatric admissions	23,272	1701	7.31	136,075	10054	7.39
Pneumonia	5314	265	5.0	35121	1691	4.81
Severe pneumonia	1918	219	11.4	12625	1425	11.29
Neonatal conditions	6681	601	9.0	30434	2999	9.85
Diarrhoea	2707	135	5.0	15323	636	4.15
Malaria	1251	45	3.6	9605	432	4.50
Severe malnutrition	3137	486	15.5	16430	2964	18.04
Tuberculosis	2260	218	9.7	10333	1184	11.46
Meningitis	809	136	16.8	7248	1303	17.98
HIV	515	81	15.7	2543	383	15.06
Anaemia *	2928	343	11.7	6892	971	14.09
Rheumatic heart disease *	132	16	12.1	237	20	8.44
Congenital heart disease *	425	71	16.7	309	91	29.45
Measles	3	0	0.0	2155	64	2.97
Cancer *	167	49	29.3	339	116	34.22
Tetanus	11	4	36.4	102	5	4.90
Acute flaccid paralysis	28	3	10.7	82	3	3.66
Whooping cough	25	0	0.0	112	1	0.89
Child protection *	60	15	25	167	13	7.78

Table 2: Admissions, deaths and case fatality rates for common diagnoses in 2017, and comparison with 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 2017.

Pneumonia admissions and outcomes in 2017

Hospital	Pneumonia admissions	Pneumonia deaths	Pneumonia CFR		Severe pneumonia admissions	Severe pneumonia deaths	Severe pneumonia CFR
Alotau	137	3	2.2		17	3	17.6
Angau							
Buka	251	9	3.6		134	8	6.0
Daru	14	0	0.0		13	0	0.0
Goroka	643	19	3.0		273	15	5.5
Kavieng	62	7	11.3		28	7	25.0
Kimbe	380	42	11.1		125	34	27.2
Kerema							
Kundiawa	305	8	2.2		107	8	7.5
Manus							
Mendi	1214	46	3.8		260	38	14.6
Modilon	262	10	3.8		79	9	11.4
Mt Hagen	537	23	4.3		348	18	5.2
Nonga	184	15	8.2		54	13	24.1
Oro	144	8	5.6		36	5	13.9
PMGH	813	70	8.6		338	57	16.9
Vanimo	142	1	0.7		40	1	2.5
Wabag	226	4	1.8		66	3	4.5
Wewak							
Total	5314	265	4.99		1918	219	11.42

Diarrhoea admissions and outcomes in 2017

Hospital	Diarrhoea admissions	Diarrhoea deaths	Diarrhoea CFR
Alotau	88	0	0.0
Angau			
Buka	94	6	6.4
Daru	2	0	0.0
Goroka	307	12	3.9
Kavieng	35	3	8.6
Kimbe	213	11	5.2
Kerema			
Kundiawa	282	3	1.1
Manus			
Mendi	559	24	4.3
Modilon	86	7	8.1
Mt Hagen	160	7	4.4
Nonga	134	2	1.5
Oro	36	1	2.8
PMGH	562	48	8.5
Vanimo	53	2	3.8
Wabag	96	9	9.4
Wewak			
Total	2707	135	4.99

Malaria admissions and outcomes in 2017

Hospital	Malaria admissions	Malaria Deaths	Malaria CFR
Alotau	27	1	3.7
Angau			
Buka	7	0	0.0
Daru	2	0	0.0
Goroka	44	4	9.1
Kavieng	144	2	1.4
Kimbe	278	15	5.4
Kerema			
Kundiawa	16	0	0
Manus			
Mendi	9	0	0.0
Modilon	412	19	4.6
Mt Hagen	38	2	5.3
Nonga	48	0	0.0
Oro	48	1	2.1
PMGH	40	1	2.5
Vanimo	138	0	0.0
Wabag	0	0	0.0
Wewak			
Total	**1251**	**45**	**3.60**

Severe malnutrition admissions and outcomes in 2017

Hospital	Severe malnutrition admission	Severe malnutrition deaths	Malnutrition CFR
Alotau	37	6	16.2
Angau			
Buka	113	10	8.8
Daru	39	5	12.8
Goroka	559	96	17.2
Kavieng	33	5	15.2
Kimbe	438	93	21.2
Kerema			
Kundiawa	88	3	3.4
Manus			
Mendi	318	72	22.6
Modilon	239	32	13.4
Mt Hagen	128	15	11.7
Nonga	96	13	13.5
Oro	122	8	6.6
PMGH	756	110	14.5
Vanimo	94	4	4.3
Wabag	77	14	18.2
Wewak			
Total	3137	486	15.49

Meningitis admissions and outcomes in 2017

Hospital	Meningitis admissions	Meningitis deaths	Meningitis CFR
Alotau	7	0	0.0
Angau			
Buka	21	6	28.6
Daru	5	0	0.0
Goroka	71	13	18.3
Kavieng	14	3	21.4
Kimbe	93	25	26.9
Kerema			
Kundiawa	36	9	25.0
Manus			
Mendi	127	22	17.3
Modilon	64	17	26.6
Mt Hagen	48	1	2.1
Nonga	0	0	0.0
Oro	26	1	3.8
PMGH	263	34	12.9
Vanimo	11	3	27.3
Wabag	23	2	8.7
Wewak			
Total	809	136	16.81

TB admissions and outcomes in 2017

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	23	3	13.0		15	1	6.7		8	2	25.0
Angau											
Buka	82	7	8.5		49	6	12.2		33	1	3.0
Daru	16	0	0.0		15	0	0.0		11	0	0.0
Goroka	135	14	10.4		41	5	12.2		94	9	9.6
Kavieng	27	1	3.7		12	0	0.0		15	1	6.7
Kimbe	432	44	10.2		317	22	6.9		115	22	19.1
Kerema											
Kundiawa	155	4	2.6		76	0	0		83	0	0
Manus											
Mendi	200	22	11.0		118	11	9.3		82	11	13.4
Modilon	163	18	11.0		76	1	1.3		87	17	19.5
Mt Hagen	73	7	9.6		42	0	0.0		31	7	22.6
Nonga	68	6	8.8		37	2	5.4		31	4	12.9
Oro	87	5	5.7		33	0	0.0		54	5	9.3
PMGH	678	74	10.9		429	42	9.8		249	32	12.9
Vanimo	55	7	12.7		40	1	2.5		15	6	40.0
Wabag	66	6	9.1		41	0	0.0		25	6	24.0
Wewak											
Total	2260	218	9.65		1341	91	6.79		933	123	13.18

PTB = Pulmonary tuberculosis EPTB = Extra-pulmonary tuberculosis

HIV admissions and outcomes in 2017

Hospital	HIV admissions	HIV deaths	HIV CFR
Alotau	9	1	11.1
Angau			
Buka	8	2	25.0
Daru	1	0	0.0
Goroka	98	11	11.2
Kavieng	0	0	0.0
Kimbe	11	2	18.2
Kerema			
Kundiawa	5	3	69.0
Manus			
Mendi	29	5	17.2
Modilon	28	4	14.3
Mt Hagen	102	7	6.9
Nonga	9	0	0.0
Oro	7	0	0.0
PMGH	182	38	20.9
Vanimo	2	0	0.0
Wabag	24	8	33.3
Wewak			
Total	515	81	15.73

Total neonatal admissions and outcomes in 2017

Hospital	Neonatal admissions	Neonatal deaths	Neonatal CFR
Alotau	211	15	7.1
Angau			
Buka	118	12	10.2
Daru	23	1	4.3
Goroka	652	61	9.4
Kavieng	230	12	5.2
Kimbe	931	101	10.8
Kerema			
Kundiawa	500	41	8.2
Manus			
Mendi	917	94	10.3
Modilon	452	36	8.0
Mt Hagen	204	4	2.0
Nonga	354	37	10.5
Oro	209	9	4.3
PMGH	1557	154	9.9
Vanimo	223	9	4.0
Wabag	100	15	15.0
Wewak			
Total	6681	601	9.00

Neonatal infections in 2017

* Probable error in data from Kimbe on neonatal sepsis deaths and CFR

Hospital	Neonatal Infections Admissions	Neonatal Infections Deaths	Neonatal Infection CFR
Alotau	153	6	3.9
Angau			
Buka	85	50	58.1
Daru	18	6	33.3
Goroka	287	24	8.4
Kavieng	156	7	4.5
Kimbe	113	9	8.0
Kerema			
Kundiawa	297	9	3.0
Manus			
Mendi	737	50	6.8
Modilon	324	11	3.4
Mt Hagen	134	16	11.9
Nonga	244	13	5.3
Oro	183	7	3.8
PMGH	1068	74	6.9
Vanimo	192	11	11.5
Wabag	66	5	7.6
Wewak			
Total	4057	298	7.35

Very low birth weight (1000-1499g) admissions and deaths in 2017

Hospital	VLBW admissions	VLBW deaths	VLBW CFR
Alotau	8	3	37.5
Angau			
Buka	12	5	41.7
Daru	10	3	30.0
Goroka	48	21	43.8
Kavieng	24	5	20.8
Kimbe	45	29	64.4
Kerema			
Kundiawa	26	9	35.0
Manus			
Mendi	50	14	28.0
Modilon	32	5	15.6
Mt Hagen	17	0	0.0
Nonga	29	13	44.8
Oro	5	2	40.0
PMGH	114	51	44.7
Vanimo	8	4	50.0
Wabag	12	5	41.7
Wewak			
Total	440	169	38.41

Perinatal asphyxia admissions and deaths in 2017

Hospital	Asphyxia admissions	Asphyxia deaths	Asphyxia CFR
Alotau	44	6	13.6
Angau			
Buka	30	6	20.0
Daru	4	1	25.0
Goroka	351	35	10.0
Kavieng	66	2	3.0
Kimbe	240	41	17.1
Kerema			
Kundiawa	87	13	14.9
Manus			
Mendi	142	40	28.2
Modilon	117	20	17.1
Mt Hagen	66	1	1.5
Nonga	78	17	21.8
Oro	37	3	8.1
PMGH	431	46	10.7
Vanimo	15	2	13.3
Wabag	27	6	22.2
Wewak			
Total	1735	239	13.78

Cancer admissions and deaths in 2017

Hospital	Cancer admissions	Cancer deaths	Cancer CFR
Alotau	5	0	0.0
Angau			
Buka	12	3	25.0
Daru	3	0	0.0
Goroka	13	3	25.0
Kavieng	10	4	40.0
Kimbe	22	8	36.4
Kerema			
Kundiawa	5	1	20.0
Manus			
Mendi	5	2	40.0
Modilon	5	3	60.0
Mt Hagen	1	0	0.0
Nonga	14	6	42.9
Oro	5	2	40.0
PMGH	59	15	25.4
Vanimo	3	0	0.0
Wabag	5	2	40.0
Wewak			
Total	167	49	29.3

Rheumatic and congenital heart admissions and deaths in 2017

Hospital	Rheumatic heart admissions	Rheumatic heart deaths	RHD CFR		Congenital Heart Disease Admissions	Congenital Heart Disease Deaths	Congenital Heart Disease CFR
Alotau	5	3	60.0		20	5	25.0
Angau							
Buka	6	1	16.7		22	3	13.6
Daru	0	0	0.0		2	0	0.0
Goroka	7	1	14.3		11	1	9.1
Kavieng	1	0	0.0		25	5	20.0
Kimbe	4	1	25.0		36	10	27.8
Kerema							
Kundiawa	3	0	0		11	4	36.4
Manus							
Mendi	20	4	20.0		0	0	0.0
Modilon	2	1	50.0		6	4	66.7
Mt Hagen	7	0	0.0		24	1	4.2
Nonga	1	0	0.0		4	1	25.0
Oro	2	0	0.0		11	2	18.2
PMGH	68	4	5.9		194	26	13.4
Vanimo	0	0	0.0		10	2	20.0
Wabag	6	1	16.7		49	7	14.3
Wewak							
Total	**132**	**16**	**12.1**		425	71	16.71

Child protection admissions (child physical or sexual abuse or neglect)

Hospital	Child Protection Admissions	Child Protection Death	Child Protection CFR
Alotau	0	0	0.0
Angau			
Buka	1	0	0.0
Daru	0	0	0.0
Goroka	3	2	66.7
Kavieng	0	0	0.0
Kimbe	8	1	12.5
Kerema			
Kundiawa			
Manus			
Mendi	4	1	25.0
Modilon	3	0	0.0
Mt Hagen	0	0	0.0
Nonga	0	0	0.0
Oro	16	2	12.5
PMGH	7	2	28.6
Vanimo	1	0	0.0
Wabag	17	7	41.2
Wewak			
Total	**60**	**15**	**25.0**

Summaries of paediatric registrar research projects 2017

In Popendetta, antibiotic prescribing for children with a common cold or minor upper respiratory tract infection was common, occurring in 82% of 108 cases. Children under the age of 1 year, and those with symptoms longer than 5 days were more likely to be inappropriately prescribed antibiotics. When health workers prescribed antibiotics for the common cold they were less likely to give basic symptomatic advice. (Dr Andree Zamunu)

In Vanuatu, 212 children with congenital (166) and rheumatic heart disease (44) were identified between 2010 and 2016. Through a collaboration with New Zealand 61 children underwent surgery in Auckland, with 60 survivors. 20% of the 212 children were on conservative care, many because of inoperable severe pulmonary hypertension from left to right shunts. 12% of the 212 had been lost to follow-up. (Dr Annette Garae)

In a qualitative study of children and adolescents with Rheumatic Heart Disease, the understanding of RDH was explored. Many adolescents knew that RHD affected their heart, and that they needed regular injections, but knowledge among affected patients was often limited. Parents of these children knew they had some sort heart problem, and thought that treatment would make their child better. They showed a sense of trust in doctors, and had a fear of their child missing injections. Because of recent adverse events related to benzathine penicillin injection, and difficulties with syringes being obstructed by powder if not shaken adequately, some clinic health workers were reluctant to give injections. This is a challenge for the RHD program in Solomon. (Dr Bardley Ludawane)

In Kimbe, the parents of 20 children with severe malnutrition were interviewed to explore the diversity of the diet given to their children. While most children ate carbohydrates and vitamin A containing food daily, more than half of these children did not have a daily source of protein or other vitamins, and more than half did not have a weekly source of calcium in their diets. (Rachel Masta)

At the National Referral Hospital in Honiara, 62 of 144 children admitted in a 3 month period had some degree of malnutrition. Of the 62, 27% had severe acute malnutrition, 30% had moderate acute malnutrition, 18% had chronic severe malnutrition and 16% had moderate chronic malnutrition. Only 4 children with malnutrition died (CFR 6.5%), after a major campaign to improve the management of malnutrition at NRH, with training, guidelines, monitoring and audit. (Dr Janella Solomon)

In Mendi Hospital and rural health facilities in Southern Highlands, 85 adopted children were identified. 61 were subject of customary adoption, 24 infants were bought, and there were no legal adoptions. Most mothers had no knowledge of legal adoption practices, or of appropriate infant feeding practices, and 53 (62%) were adopted in the neonatal period. Nearly half of the adoptive mothers had no formal education. (Justin Kali)

Among 97 children with febrile encephalopathy at Port Moresby General Hospital, 5 had Japanese encephalitis, 5 had Dengue, 6 had meningitis due to Streptococcus pneumonia, 1 had meningitis due to Haemophilus influenzae, 6 had malaria, and 19 had suspected tuberculous meningitis. Many aspects of supportive care for children with febrile encephalopathy were frequently not done, including monitoring of blood pressure, blood glucose, anticonvulsant therapy, pupillary assessment and recording, and head elevation to reduce intracranial pressure and prevent aspiration. Other aspects of supportive care were done in more than half the cases, but there was still scope to improve on oxygen administration, Glasgow Coma Score monitoring, recording weight, basic vital signs and providing enteral nutrition. (Dr Kunera Kiromat)

Among 129 children with gastroenteritis and moderate dehydration monitored in the children's emergency department at PMGH, 63 tolerated oral rehydration and zinc well, taking 25ml/kg of ORS over 2¼ hour of observation without vomiting. All these children recovered with home treatment, and 97% of mothers understood how to give ORS. Of the 66 children who did not tolerate ORS under observation in the CED, all improved with half-strength Darrow's solution. Outpatient management of children with gastroenteritis and moderate dehydration is safe as long as appropriate safeguards are in place: particularly that the family can access the hospital 24 hours a day, the child has 2-4 hours of observation in ED and tolerates 25-40ml/kg ORS and oral zinc without vomiting, parent education is provided on danger signs and when to return, and the child can be reviewed on day 2. (Dr Rhondi Kauna)

Among 120 children assessed as having moderate pneumonia at PMGH, outpatient treatment was successful in 92%. 3 patients were recognised as having clinical signs of severe pneumonia on day 1, and admitted. 117 were treated as outpatients with a single dose of benzylpenicillin, followed by oral amoxicillin for 5 days. Three children were admitted on day 2 with signs of severe pneumonia, and on day 6, 2 children were admitted for non-pneumonia causes. In total 15 children were lost to follow-up. 97 children were cured by day 6. There were no deaths. This study shows that outpatient treatment of moderate pneumonia is safe and effective, as long as safeguards are in place. These include: excluding high risk patients (HIV, neonates), checking for danger signs and hypoxaemia using pulse oximetry, a protocol for education of mothers, including teaching about danger signs and when to return (use structured teaching materials and video), and follow-up and reassessment if a child is not improving to detect undiagnosed conditions which may look like moderate pneumonia (TB, congenital heart disease, HIV). (Dr Rose Morre)

Among 133 well babies born at term after prolonged rupture of membranes, with a minimal or no antibiotic treatment approach, any signs of sepsis occurred in only 10 (7.5%) in the first week of life, and an additional 3 between 8 and 28 days. There was only one case of proven bacteraemia, and no deaths. Most of the suspected sepsis cases were a transient fever or skin pustules. Minimal use of antibiotics in PROM in well term babies is safe as long as safeguards are in place to monitor for signs of sepsis. In this study nearly 90% of newborns avoided antibiotic exposure and went home at 48-72 hours. This approach can protect against adverse consequences of antibiotics, including overgrowth with resistant organisms and wheezing. (Dr Diana Olita'a)

In a retrospective study describing 5 years of neonatal admissions at Goroka General Hospital, there were over 5176 admissions, of which 82% were born in hospital, 4% in health centres and 14% at home. The overall neonatal mortality rates was 9.7%, and annual CFRs were 8.07% to 13.1%. The highest causes of mortality were low birth weight, birth asphyxia and meconium aspiration syndrome, and neonatal sepsis. In a multivariate regression the significant independent predictors of neonatal death were LBW, health centre birth and village birth. Babies born in HCs and in villages who are referred to EHPH have higher mortality rates than hospital delivered babies who are admitted to NNU, partly because of referral bias (sicker babies are referred). (Dr Temane Korowi)

In Goroka over 6 months 52 babies with birth asphyxia were identified, with an incidence of 2.4%. They had a case fatality rate of 23%. 67% were delivered by midwives and in 58% of cases no partograph was used. The major predictor of death was a low Apgar score at 5 minutes (Apgar of 5 or less). (Dr Merlisa Kuama)

Among 97 low birth weight babies monitored with the new Bempu wrist bracelet, which is designed to detect neonatal hypothermia, 6 hourly temperatures were taken by thermometer 1491 times. On 124 occasions the babies temperature was measured by thermometer as <36 C. On 102 of these 124 occasions that the neonate had hypothermia the Bempu bracelet had an orange alarm, with a sensitivity (true positive) rate of 82%. All the Bempu bracelets lasted the expected life of 4 weeks, there was a high alert for hypothermia and prompt actions, including swaddling and skin-to-skin warming. Illiterate mothers were able to recognise hypothermia with use of band. The study is ongoing. (Dr Venao Seta)

Using the Paediatric Hospital Reporting Program as a tool, the case mix and epidemiology of children admitted to Honiara National Referral Hospital was identified. The study identified the more complex diagnoses not summarised in the summary sheet of the PHR, including the different types of TB, the types of cancer, the different types of neonatal sepsis and congenital malformations, and the comorbidities associated with severe malnutrition (anaemia, infectious complications, and underlying chronic conditions). Key findings included: 25% of all admissions were readmissions, suggesting many children have chronic conditions; the highest CFR was for sepsis in older children (63% died); and just over half the childhood cancers did not receive a proper diagnosis of the cancer type. (Dr Steven Lumasa)