PNG Department of Health

Child Morbidity and Mortality

10th Annual Report, 2019

PNG National Department of Health
Paediatric Society of Papua New Guinea

2019 Annual Report on Child Morbidity and Mortality

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

Acknowledgements:
We gratefully acknowledge all paediatricians, nurses and other health care workers in all participating hospitals who reported their hospital's data.

Data compiled by Edilson Yano, Paediatric Surveillance Officer and PHR coordinator
Graphs by Eleanor Neal
Photograph on page 14 by Dr Doreen Panauwe
Edited by Prof Trevor Duke

2019 Annual Report on Child Morbidity and Mortality

Executive summary

This report covers admissions and outcomes for children in 2019 from 20 hospitals: 16 provincial hospitals, 3 rural district hospitals and one urban hospital. This is the highest participation rate since the Paediatric Hospital Reporting (PHR) system began in 2008.

Children and the Covid-19 pandemic

This report has been finalised in the midst of the global COVID-19 pandemic. It is not clear what effect this infection will have on children in the next 12 months, but most likely, based on other countries, the elderly will be most severely affected and cases of severe COVID-19 will be uncommon in children. However the pandemic means new challenges to health workers, and children will be affected greatly by restrictions of movement, interruption to supply chains of vaccines and other treatments.

More than ever it is essential to **maintain routine services for children**, including vaccine services. Guidelines for health care workers on COVID-19 are available at www.pngpaediatricsociety.org scroll down to the bottom of the page. A link to other useful WHO resources on COVID-19 can also be downloaded there.

Report main points

- In 2019 there were 29,901 admissions and 1923 deaths recorded (mortality rate 6.43%). This is significant improvement in mortality rate compared with 5-10 years ago.
- In 2019 there were 1244 post-neonatal deaths out of a total of 21,930 patients (CFR 5.7%) and 679 neonatal deaths out of 7971 patients (neonatal CFR 8.52%).
- Pneumonia was the most common reason for admission (4818, 16.1% of admissions), but a lower proportion of all admissions than in previous years. Pneumonia case fatality rates were significantly lower than in previous years: 3.6% overall (previously 5%), and 7.4% for severe pneumonia (previously more than 10%).
- 27% 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 combinations of neonatal sepsis, birth asphyxia, and very low birth weight.
- Severe malnutrition was present in 2411 admissions (8% of admissions), a reduction on previous years data. Malnutrition caused or contributed to 250 deaths (13% of all deaths and 20% of post-neonatal deaths). Case fatality rates for severe malnutrition are significantly lower than in previous years; 10.4% in 2019. This is a big improvement on previous years and close to the World Health Organization target of under 10%. Many additional children had moderate malnutrition.
- This year there were almost 1000 children admitted with chronic non-communicable illnesses – asthma, bronchiectasis, rheumatic and congenital heart disease, epilepsy and cerebral palsy, and cancer. Death rates for some of these conditions are high. More awareness of how to care for such children in hospitals and in communities is needed.

In response to the PHR results for 2019, the Child Health Advisory Committee of the National Department of Health has made the following recommendations:

To achieve further improvements a **National Paediatric Quality Improvement Program** is needed. Such programs exist in many countries and have been very successful. The components include:

- A quality improvement team in each provincial hospital
- Regular mortality and morbidity audits, and training in how to learn lessons from these and implement changes
- WHO quality standards for the care of children and adolescents in health care facilities
- Training on the care of seriously ill children, through the WHO Hospital Care for Children program
- Continuing professional development for paediatricians and paediatric nurses
- Establishment of intensive care areas in the paediatric wards for the care of the sickest children
- Paediatric monitoring and response charts with early warning indicators and escalation processes
- Infection control and antibiotic stewardship
- Improved systems for managing children with chronic conditions
- Improved diagnostics, especially diagnostics to guide antibiotic use

Further decreases in deaths from **severe pneumonia** will require prevention and treatment. Prevention includes the use of *Haemophilus* and pneumococcal conjugate vaccines, improving breast-feeding and complementary feeding, hygiene, 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 triage, and pulse oximetry for identification of the sickest children, giving appropriate antibiotics, and oxygen therapy to those with hypoxaemia, using paediatric monitoring and response charts, and supportive care. Treating co-morbidities including malnutrition and anaemia and identifying children early who may have tuberculosis are also important for reducing pneumonia deaths.

Reducing **neonatal deaths** further 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* reduces the risk of anaemia 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, newborns should have 4% chlorhexidine applied to the umbilical cord.

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, and careful use of IV fluids, using paediatric monitoring and response charts, audit, and ward organisation. In many hospitals nosocomial infections are common, and some of these are resistant to multiple antibiotics. To prevent hospital-acquired infections, it

is very important to adhere to hand hygiene and other infection control practices, and reduce the use of unnecessary antibiotics.

Improved obstetric care is needed to reduce deaths from birth asphyxia. Improved use of partography during labour is needed. Family planning would reduce many unwanted pregnancies.

Malnutrition also needs both prevention and treatment. Prevention of malnutrition at the community level is the best way to avoid children dying from malnutrition. Timely treatment of children with malnutrition is also essential and often poorly done in hospitals. Increased use of Mid Upper Arm Circumference (MUAC) measurement and plotting weights on a growth chart would identify children at highest risk. 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. By addressing these steps the CFR for severe malnutrition has come down from 18-24% to just over 12%, a big improvement in the last 6 years.

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. Third-generation cephalosporins - ceftriaxone or cefotaxime - are effective antibiotic to treat meningitis.

Tuberculosis caused 7.1% of all admissions. The case fatality rate for pulmonary TB was significantly lower in 2019 (5.3%) than in previous years (7-9%), but the death rate for extra-pulmonary TB, although falling, remains nearly twice that (10.1%). This is because extra-pulmonary TB is often a more complex multi-system disease. Every effort should be made to help children complete TB treatment. 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. Identifying children early who may have multi-drug resistant TB is also very important, and requires input from a paediatrician.

There are more children with **chronic diseases**, including asthma, bronchiectasis, epilepsy, rheumatic and congenital heart diseases, cerebral palsy, and diabetes. These children need a long-term treatment plan, good follow-up by a paediatrician or skilled child health nurse, adherence with medications and a continued supply of essential medicines, addressing comorbidities such as vision and hearing loss, going to school regularly and having education about their condition.

The National Child Health Plan outlines a plan for improving child health up to 2020. The Child Health Advisory Committee recommends that everyone involved in health care for children be familiar with the Plan, 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

2019 Annual Report on Child Morbidity and Mortality

Introduction

The Child Health Advisory Committee of the National Department of Health releases the tenth Annual Report on Child Morbidity and Mortality in Papua New Guinea, for 2019. 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 2019, with some comparisons to data collected in the previous 9 years. The recommendations cover clinical and public health solutions that would result in many more 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 highlight 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.

A note on the method of the graphs in this report: the graphs this year of case fatality rates per year are *weighted averages*, rather than proportions of the aggregate raw data for all hospitals combined for each condition. The use of weighted averages is more valid for looking at time trends in outcomes, as different hospitals report different numbers of cases and deaths, and different numbers of hospitals have reported data each year. Weighted averages takes this into account, and also enables year-on-year comparison as smaller district hospitals or health facilities contribute PHR data in the future.

The current version of PHR (V12) has a maternal component. In future years labour obstetric departments may report summary data from their labour and maternity wards on outcomes for mothers and deliveries.

Mortality rates for common diseases

The overall case fatality rate (CFR) in 2019 was the lowest in 8 years (6.43%), see figure 1 and table 1). Case fatality rates vary widely (from 0.3% in Gerehu to over 8% in Nonga, Modilon, Port Moresby and Wabag). Differences in CFR reflect many factors, including case mix (the types of illnesses seen in the hospitals), the complexity and severity of illness at the time of presentation, referrals, the number of health care workers and other resources available to manage seriously ill children, and serious disease outbreaks. In some hospitals it may also reflect missing data. What matters are broad trends over time, and the falls in overall CFR and the CFRs for pneumonia and malnutrition in 2018 and 2019 are real progress.

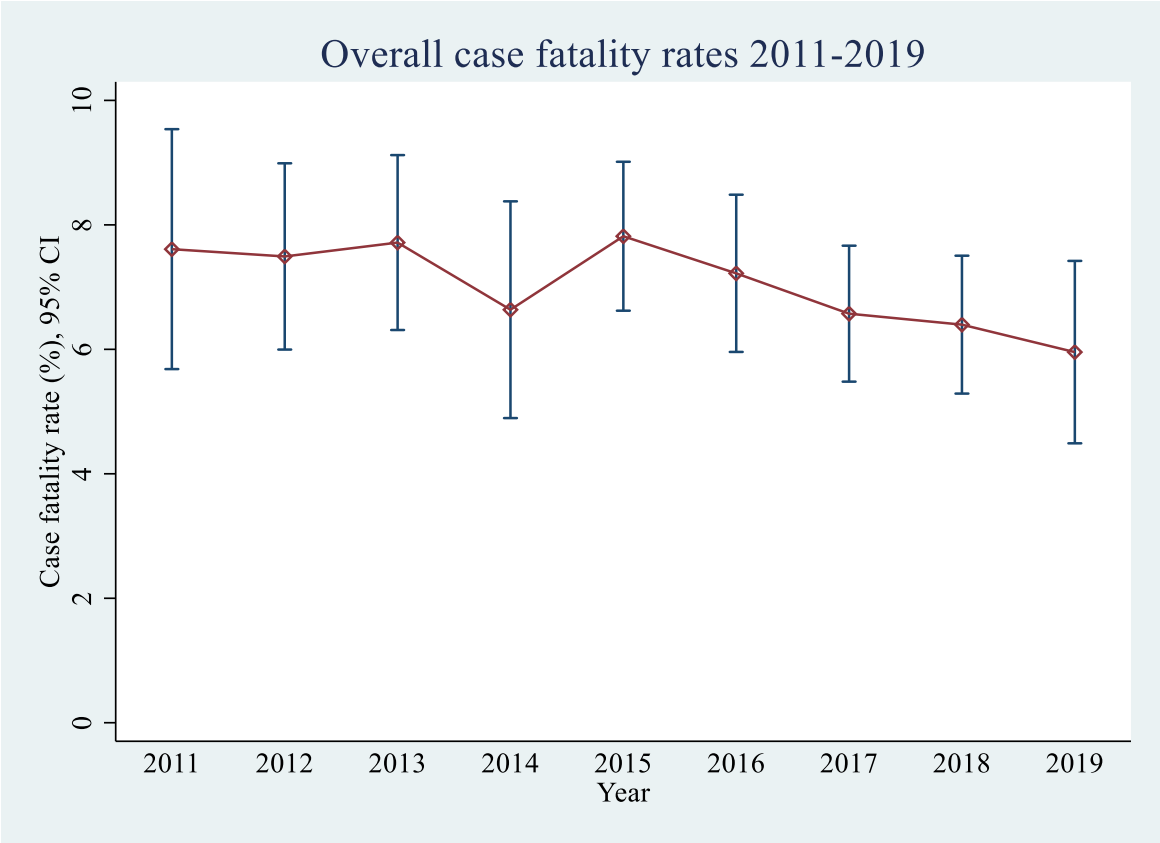


Figure 1. Overall paediatric case fatality rates 2011-2019

Hospital	Admissions	Deaths	Case fatality rate
Alotau			
Angau	3438	248	7.2
Buka	561	33	5.9
Chuave	293	2	7.0
Daru	263	18	6.8
Gerehu	2405	7	0.3
Goroka	2298	172	7.5
Kavieng	592	34	5.7
Kimbe	1637	106	6.5
Kerema			
Kompiam	124	3	2.4
Kundiawa	1652	96	5.8
Mabisanda			
Manus	477	13	2.7
Mendi	1829	134	7.3
Modilon	2189	182	8.3
Mt Hagen	2596	94	3.6
Nonga	1541	168	10.9
Popendetta	995	76	7.6
Port Moresby	4210	340	8.1
Tari	1138	74	6.5
Vanimo			
Wabag	1393	123	8.8
Wewak			
Yampu	270	1	0.4
Total	**29901**	**1923**	**6.43**

Table 1. Summary of admission, death and case fatality rates in participating hospitals in 2019

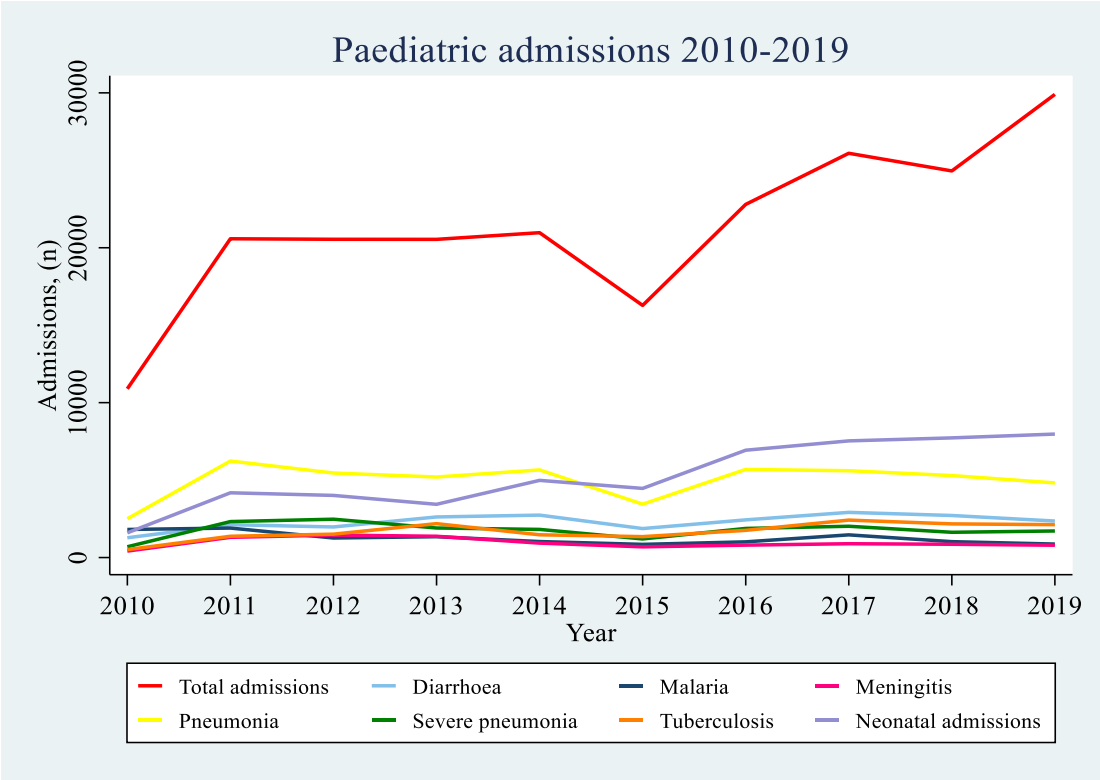


Figure 2. Admissions per year overall and for common acute infections.
Despite more hospitals participating in the PHR and more patients being reported the number of cases of common infections have remained static or in some cases declined. This indicates partly the effectiveness of measures to reduce pneumonia, malaria and diarrhoea, the increased proportion of neonatal admissions, and the increase in chronic conditions.

Diagnoses	Admissions 2019	Deaths 2019	Case fatality rate 2019	Average CFR in previous years of the PHR 2009-2018
Pneumonia	4818	171	3.55	4.70
Severe pneumonia	1716	127	7.40	11.16
Neonatal conditions	7971	679	8.52	9.48
Diarrhoea	2358	124	5.26	4.31
Malaria	872	42	4.82	4.38
Severe malnutrition	2411	250	10.37	17.08
Tuberculosis	2125	173	8.14	10.86
Meningitis	795	115	14.47	17.60
HIV	389	48	12.34	15.22
Anaemia	2310	267	11.56	12.90
Rheumatic heart disease	116	15	12.9	9.17
Congenital heart disease	296	41	13.85	19.02
Measles	5	0	0.0	2.97
Cancer	139	39	28.1	31.87
Tetanus	10	2	20.00	15.13
Acute flaccid paralysis	46	1	2.2	3.49
Whooping cough	18	0	0.0	1.27
Child protection	148	25	16.9	16.82
Trauma and injuries	125	2	1.60	3.13
All paediatric admissions	**29901**	**1923**	**6.43**	**7.31**

Table 2. Most common causes of hospital admission and case fatality rates in children for 2019

Some diagnoses added recently, so CFRs do not reflect the complete 10 years of reporting

Pneumonia

In 2019 as in all years, pneumonia was the most common reason for admission (4918 cases; 16.4% of all admissions), however the number of cases of pneumonia are falling compared with previous years. Pneumonia case fatality rates in 2019 continued the favourable trend of last year: 3.6% overall (Figure 3), and 7.4% for severe pneumonia (Figure 4). Previously the case fatality rate for severe pneumonia was more than 10% and up to 20% or more in many hospitals.

This improvement is due to many things: better clinical care, use of oxygen concentrators and pulse oximetry, vaccines against *Haemophilus influenzae* type b and *Streptococcus pneumoniae*, and changes in epidemiology with more viral bronchiolitis.

Using the current version of the PHR in 2019 many hospitals reported bronchiolitis separate to pneumonia. In 2019 there were 542 cases of bronchiolitis and only 4 deaths reported (CFR 0.74%). So the reduction in pneumonia CFR is even more significant, as previously these low-risk cases would have been included in pneumonia numbers.

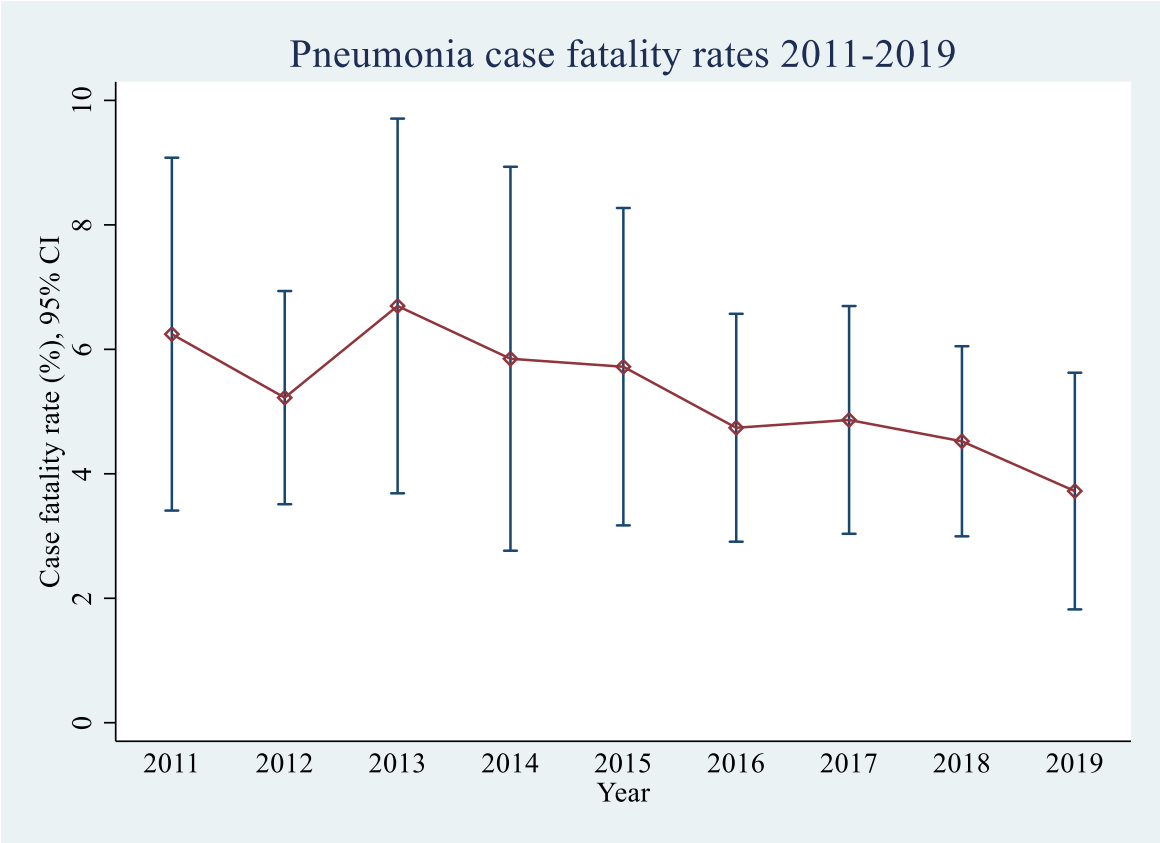


Figure 3. Pneumonia case fatality rates 2011-2019

Severe pneumonia case fatality rates, which 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. In 2019 the case fatality rates for pneumonia were the lowest recorded.

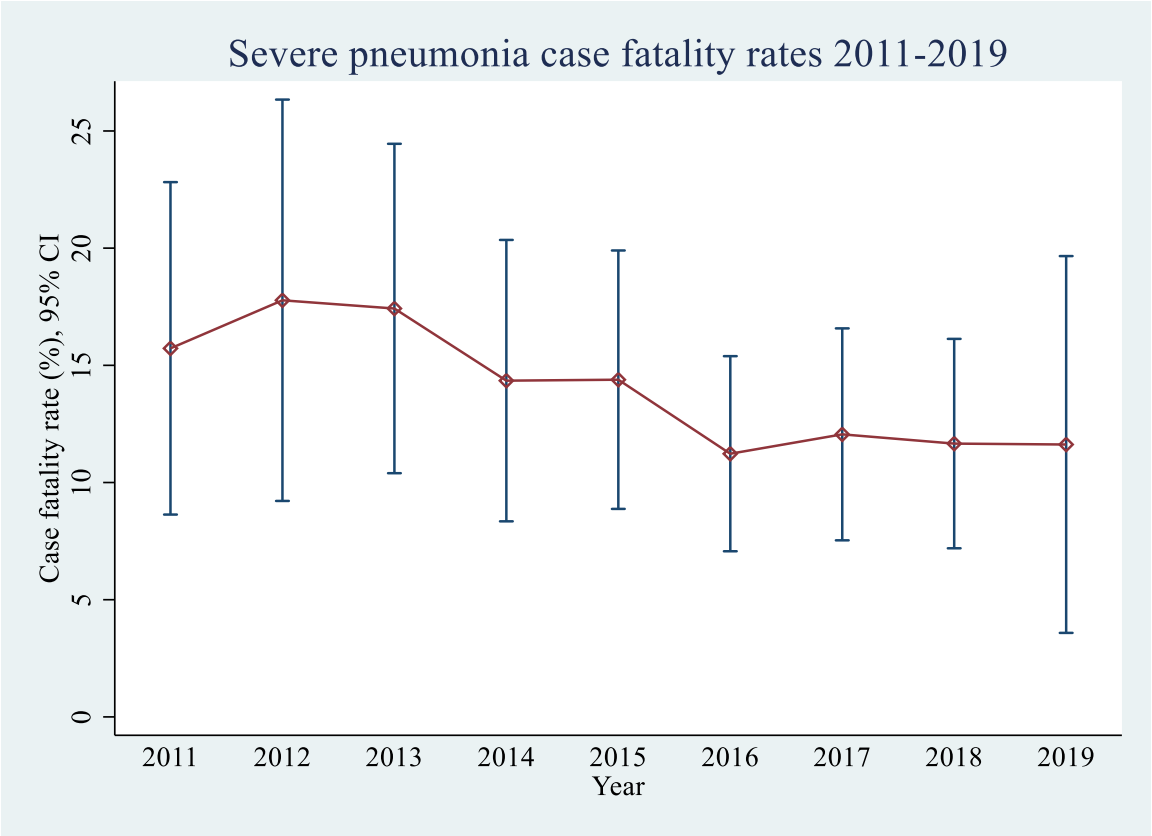


Figure 4. Severe pneumonia case fatality rates 2011-2019

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 intensive care and close monitoring 24 hours a day
- 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
- supervision of nursing and medical care by senior clinicians

Pneumonia (171) and meningitis (115) combined account for 15% of all deaths. The number of deaths from these two infections is lower than previous years, despite increased numbers of hospitals reporting. This emphasises the importance of *Hemophilus influenzae* type b vaccine (Hib) – given as part of Pentavalent vaccine, and the pneumococcal conjugate vaccine (PCV); both vaccines given at 1, 2 and 3

months. These vaccines are preventing deaths and disability from bacterial meningitis, and are reducing cases of pneumonia. So coverage needs to be strengthened. And improving BCG coverage will reduce pneumonia and meningitis from tuberculosis.

However there are other common causes of pneumonia, including viruses (particularly respiratory syncytial virus - RSV, and influenza) and bacteria (such as Group A streptococcus, *Staphylococcus aureus*, Chlamydia, Mycoplasma), and other causes of meningitis (enterovirus, dengue and other mosquito-borne viruses), which are not currently prevented by vaccines.

This means that these pneumonia and meningitis will continue to be a major cause of hospital admission for children in PNG.

The best way to deal with this is a comprehensive approach. The PNG Child Health Plan 2009-2020 outlines a comprehensive approach to acute lower respiratory tract infections (ALRI).

This includes key areas to address:

Prevention

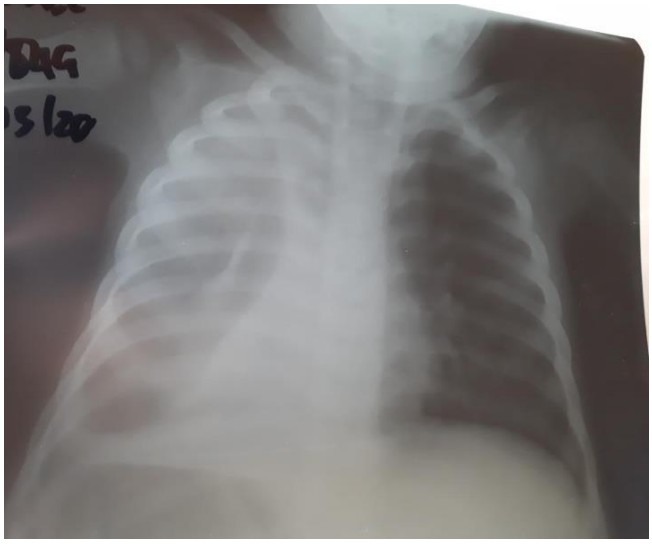
- Breast feeding and good balanced nutrition in the second 6 months of life and beyond, with growth monitoring
- Helping parents be aware of the signs of pneumonia and bronchiolitis and when to seek care
- Reduce indoor air pollution, keeping children away from smoke from cooking stoves, and never smoke in a child's presence
- Hand-washing
- Vaccines: measles, Hib, PCV, BCG

Treatment

- Improving hospital and health centre care of pneumonia through Hospital Care for Children training
- Use of a paediatric monitoring and response chart to identify children who are deteriorating and escalate appropriately
- Oxygen, pulse oximetry, careful monitoring and supportive, intensive care
- Identification and treatment of comorbidities, including anaemia, malnutrition, HIV and tuberculosis if present
- Improved infection control practices, particularly hand hygiene, and reducing unnecessary antibiotic usage
- Outpatient or day-care treatment for moderate bronchiolitis, so that hospitals are not crowded by children who can safely be treated without hospitalisation.

Yampu Health Centre in Enga Province: improvements in survival for children with pneumonia

2019 was the first year for Yampu Health Centre to participate in the PHR. Yampu was involved in the solar-powered oxygen concentrator project, and the staff learned how to use pulse oximetry to assess patients with pneumonia. In 2019 two children were admitted to Yampu and received standard antibiotics, but continued to have signs of respiratory distress and oxygen saturation of 70%, despite oxygen, so HEO Siune (seen above) did a chest x-ray and noted changes of empyema, sent the x-ray images via text-message to the paediatrician at Wabag Hospital, and referred the children. Both children had a chest drain inserted by the surgeons and they did well. It is likely that without pulse oximetry, oxygen concentrators and the skills of the HEO, both children would have died. These examples also demonstrate the value of communication between health centres and paediatricians using mobile phone technology to transmit x-rays and referrals.



Diarrhoea

2358 and 124 deaths (case fatality rate of 5.26%) due to diarrhoea were reported in the 20 hospitals in 2019. 11 hospitals recorded more than 100 cases of diarrhoea for the year, and case fatality rates varied from 2% to 11%. Diarrhoea mortality rates are dependent on factors similar to those that influence severe pneumonia mortality rates (comorbidities, especially malnutrition, HIV, anaemia), late presentation, and outbreaks.

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 in otherwise well children is due to viruses and does not require antibiotics. These children need ORS, zinc and nutrition (breast feeding in infants). 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 (Septrin) is ineffective, and that 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 2019 malaria accounted for 872 admissions and 42 deaths (case fatality rate of 4.8%).

PNG 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, published in 2016.

Malnutrition

The PHR records malnutrition as either a co-morbidity or a main diagnosis, so even if it is not the main diagnosis it is still recorded. In 2019 in the 20 hospitals that reported using the PHR, 2411 children were admitted with severe malnutrition (weight for age <3 SD below the median), or with severe wasting or kwashiorkor. This represented 8.1% of all admissions, a significant reduction on previous years. The case fatality rate for severe malnutrition was 10.4%, much lower than in earlier years of the PHR reporting where CFR was 15-20% or above (Figure 5 and Table 3). This shows that there has been a consistent and gradual improvement in the management of severe malnutrition over recent years, because of an improved systematic approach based on the WHO/UNICEF and Standard Treatment guidelines.

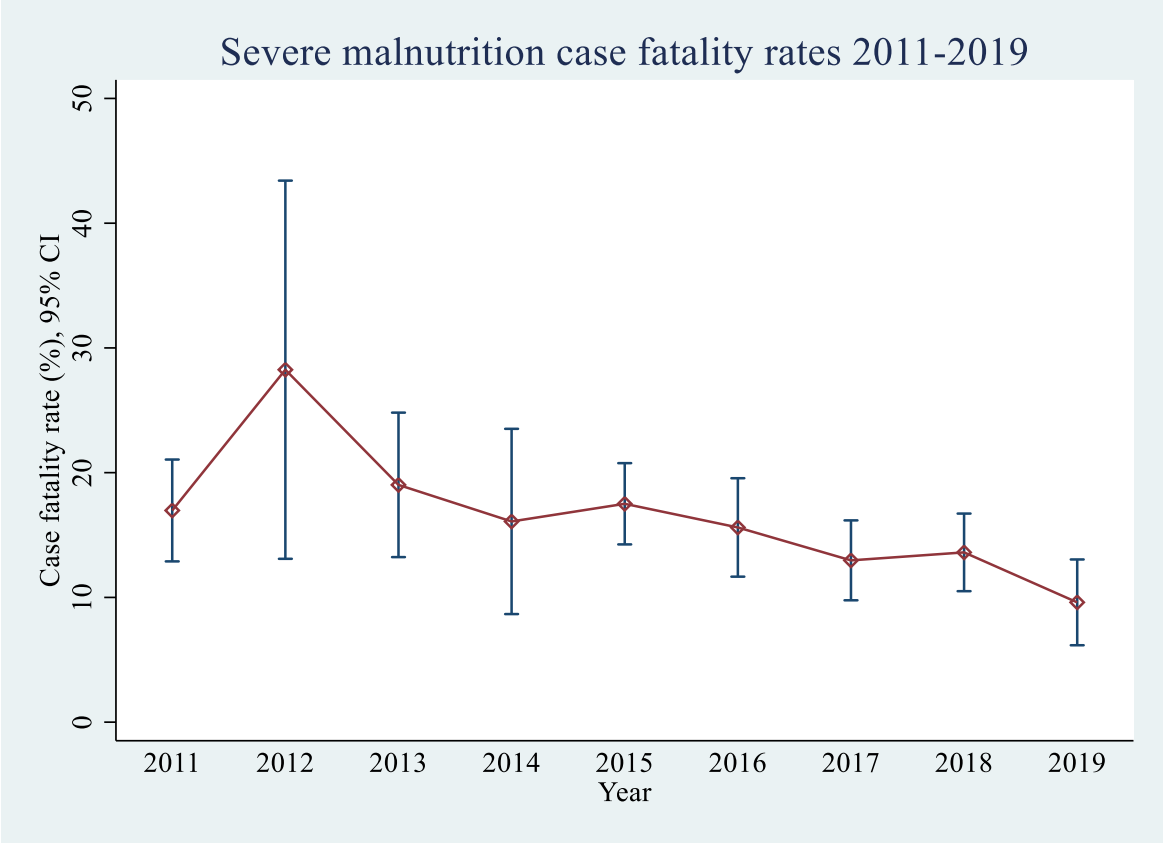


Figure 5. Severe malnutrition case fatality rate 2011-2018

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
2018	2548	315	12.4	3
2019	2411	250	10.4	1

Table 3. Cases and outcomes of children with severe malnutrition 2010-2018

This year we also report moderate malnutrition, because as improvements occur, a greater focus is needed on other types of under-nutrition, including moderate malnutrition, under-nutrition in adolescents, nutritional anaemia.

In 2019 1386 children were reported with moderate malnutrition, and there were 91 deaths (CFR 6.57%), which is just higher than the death rate overall for children outside the neonatal period (5.7%). This will be an underestimate of the numbers of cases of moderate malnutrition, as only 10 of the 20 hospitals were using the PHR version which includes moderate malnutrition, and moderate malnutrition will be an under-recognised condition because it is so common. However recording a problem is a start to improving the recognition of it. Better approaches to children with moderate malnutrition will prevent more children developing severe malnutrition.

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). If F75 and F100 are not available, there are **recipes for making equivalent formula** at https://pngpaediatricsociety.org/treatment/ in the section: **Undernutrition – guidelines and tools for management**.
- The main problems in the management of malnutrition are inadequate feeding (starting feeds too late, not enough milk feeds and not frequent enough feeds).

- Guidelines for the management of malnutrition should be used in all wards. 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 complementary (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 20 hospitals, meningitis accounted for 795 admissions and 115 deaths. The case fatality rate for meningitis was 14.5%. This is the first year that meningitis mortality rates have been less than 15%, and is likely the effect of Hib and Pneumococcal vaccine, and improvements in quality of care.

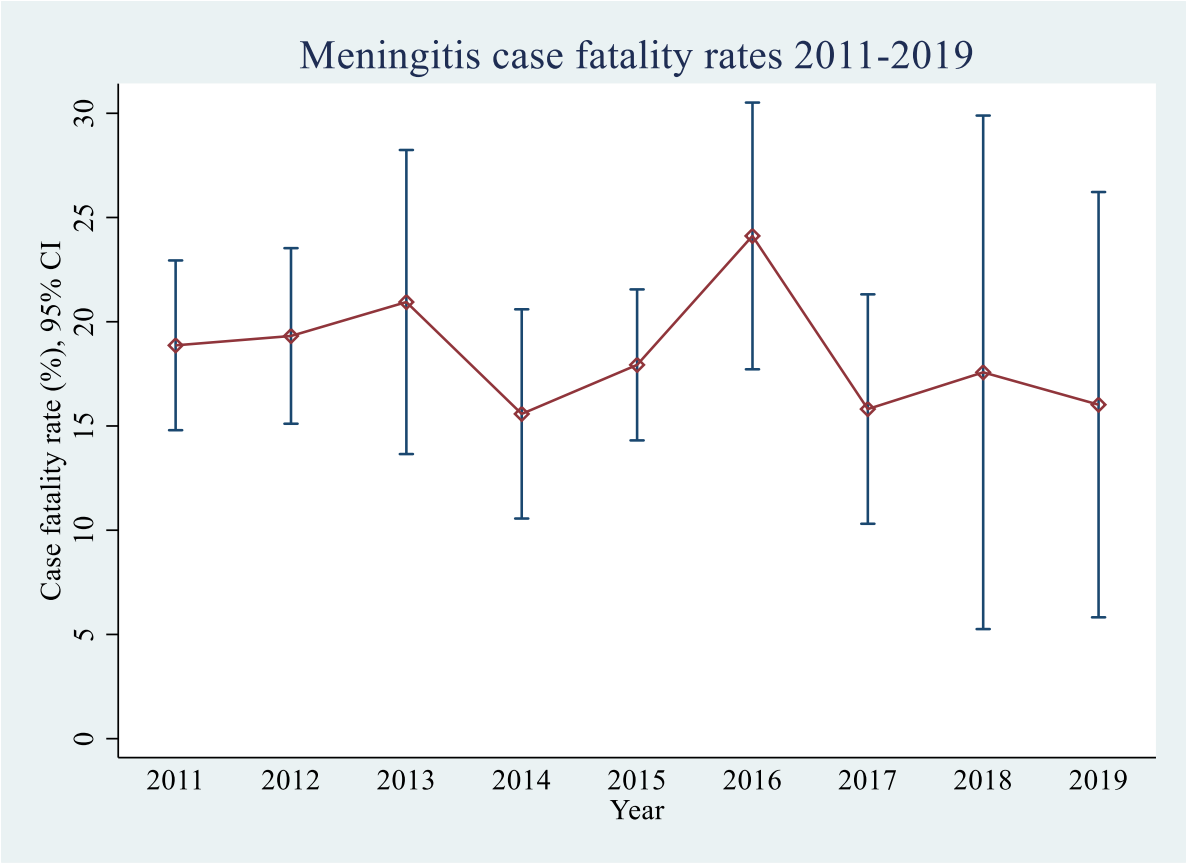


Figure 6. Meningitis case fatality rates

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 (Pentavalent) and pneumococcal (PCV) vaccines. Cases of Haemophilus influenza and pneumococcal meningitis are still being reported in 2019, which indicates that the vaccines is not yet reaching all children.

Most Hib and *Streptococcus pneumoniae* 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 enterovirus, dengue, Japanese encephalitis, herpes viruses, and 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 occurs 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, pertussis (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, treat 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 to 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 children with meningitis. 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
- Slow 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 Hartmann solution, 20ml/kg, then reassess.
- Promptly give IV or IM antibiotics: ceftriaxone plus flucloxacillin
- 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.

Tuberculosis

In the 20 hospitals in 2019 there were 2125 children admitted with tuberculosis, and 173 deaths and a case fatality rate of 8.14%. The number of admissions for TB has steadily declined since 2017, as has the case fatality rate for both pulmonary and extra-pulmonary TB. This numbers represented in this report are probably only a small proportion 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 emphasise that TB causes many childhood deaths.

Pulmonary TB made up 56% of all TB diagnoses. Extra-pulmonary tuberculosis (TB meningitis, lymph node TB, spinal TB, abdominal TB, miliary TB) made up 44% of children diagnosed with TB, and of that there were 316 cases of central nervous system TB. EPTB has a higher hospital mortality rate than PTB, this is consistently seen over years, reflecting the multi-system nature of many cases of EPTB treated as in-patients in hospitals. Case fatality rates for both pulmonary and extra-pulmonary TB are improving over the years (Figure 7).

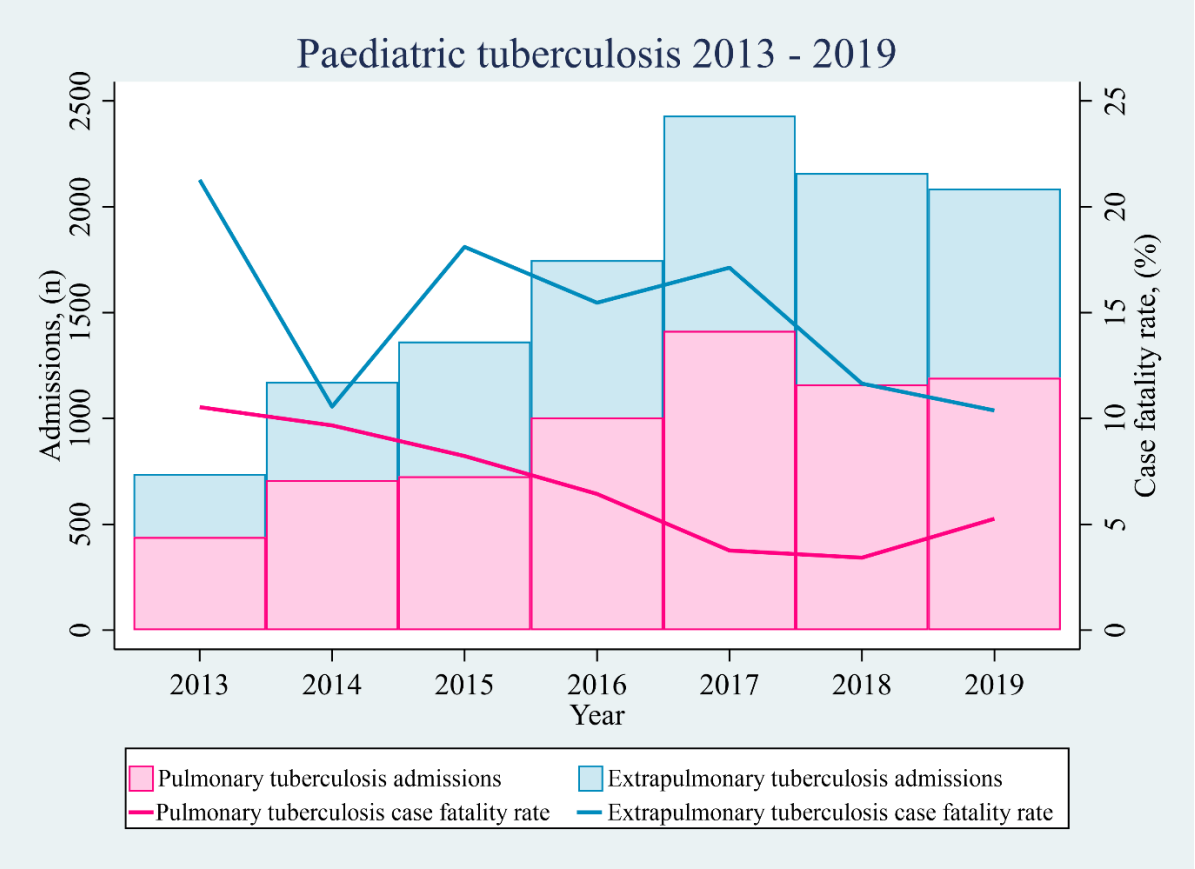


Figure 7. Pulmonary and extra-pulmonary tuberculosis admissions and case fatality rates 2013-2019

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

Recommendations

Every effort should be made to help children complete TB 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 have 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, 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 x-ray 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 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 2019 there were 389 children with HIV admitted to the hospitals, and 48 known HIV-related deaths (case fatality rate of 12.3). This represents only 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

- **Many children with HIV are failing anti-retroviral (ART) therapy because they are still on Nevirapine-Lamivudine-Zidovudine (NVP/3TC/AZT) combination therapy. In PNG as in many countries there are high levels of drug-resistance to non-nucleoside reverse transcriptase inhibitors (NNRTIs), such as Nevirapine. This leads to poor treatment outcomes on NNRTI-based ART among infants and young children. More effective therapy using Lopinavir/ritonavir, Abacavir and Lamivudine, should be available. This is described in the new HIV care and treatment guidelines:** https://pngpaediatricsociety.org/wp-content/uploads/2020/03/PNG-HIV-care-and-treatment-guidelines-2019.pdf
- Mothers who are diagnosed with HIV during or after pregnancy are now treated with three antiretroviral drugs for life, not just for shorter periods to prevent transmission to the baby.
- Early infant diagnosis of HIV with PCR testing is now available. Children who have HIV confirmed by early infant diagnosis and start on effective anti-retroviral therapy (ART) before they become symptomatic have a much better chance of healthy life than children diagnosed later because they have AIDS-defining infections.
- All children diagnosed with HIV should see a paediatrician regularly, for starting on antiretroviral therapy and follow-up.
- **Children on ART need to have their treatment monitored, with regular testing of viral load, or CD4 count.**
- All children with HIV need prophylaxis with cotrimoxazole (Septrin or Bactrim) and isoniazid, treatment of other 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.

Chronic non-communicable diseases in children

There are increasingly children with **chronic diseases**, involving respiratory, cardiac, neurological systems, and cancer. These are under-estimates of the true burden of these conditions, but the PHR has just started reporting these conditions, and more awareness on the care of these patients is needed. Individually the conditions are less common than acute problems, for example, pneumonia, diarrhoea or malaria, but together nearly 1000 patients with these conditions have been admitted to these 20 hospitals in 2019 (Table 4).

Chronic condition	Admissions	Deaths
Asthma	122	1
Bronchiectasis	20	3
Rheumatic heart disease	116	15
Congenital heart disease	296	41
Cerebral palsy	160	150
Epilepsy	94	1
Cancer	139	39

Table 4. Common chronic diseases reported in 2019

Children with chronic diseases, regardless of the type, have some common health care needs, including

- **a long-term treatment plan**
- **good follow-up by a trusted doctor or paediatric nurse**
- **going to school regularly and having schools informed about their condition**
- **a 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. These children are most at risk of dying from acute infections and malnutrition, so preventative measures are vital.

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

assistance is available from Dr Gwenda Anga, oncology paediatrician at Port Moresby General Hospital.

Child protection

Data on child physical, sexual and other forms of abuse are now being collected by the PHR. There were 148 child protection cases and 25 deaths reported in 2018. This under-estimates the true burden of child abuse, maltreatment, and neglect, but it is a start at systematic gathering of data on this problem. Social issues are also a frequent root cause of malnutrition and its disease risks.

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

Vaccine preventable diseases

There were 46 cases of acute flaccid paralysis (AFP) in 2019 (Figure 8) and 1 death. There were 10 cases of tetanus (2 deaths), and 18 cases of whooping cough, and 5 reported case of measles and 1 of rubella in 2019.

Vaccination coverage in PNG is still far too low, and it is inevitable that there will be another measles epidemic in the next few years unless action is taken.

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.

Report any suspected case of acute flaccid paralysis, acute fever and rash, tetanus or whooping cough to the Provincial or National Disease Control Officer for evaluation and specimen collection for laboratory confirmation.

Neonatal admissions

Neonatal admissions made up 7971 (26.7%) of all 29,901 paediatric admissions to the 20 hospitals in 2019. There were 679 neonatal deaths reported, meaning that 35% of all deaths in children were in the neonatal period.

There has been a steady rise in neonatal admissions reported (Figure 1), and downward trend in neonatal mortality rates in participating hospitals (Figure 8).

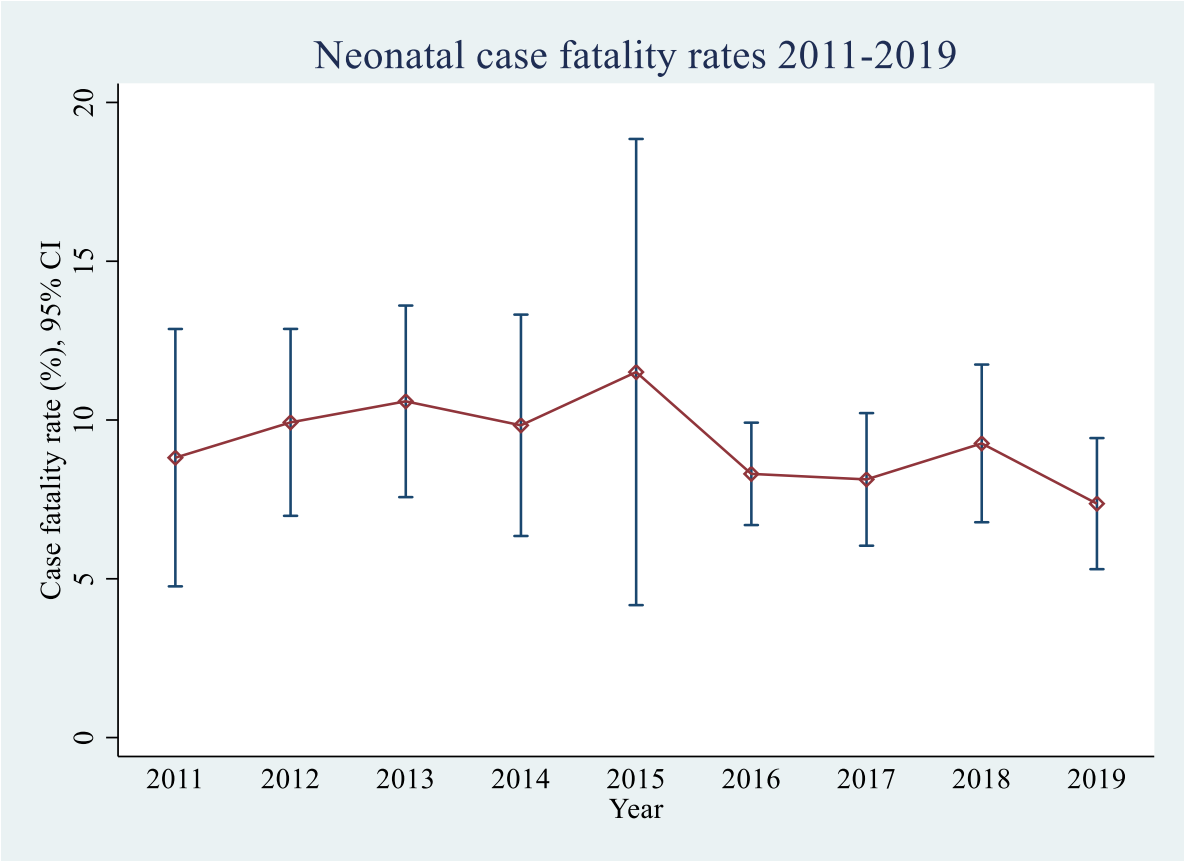


Figure 8. Overall neonatal mortality rates in Special Care Nurseries 2011-2019

Neonatal infections

Fifty-eight percent of all neonatal admissions were associated with infections (n=4624). 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 1473 hospital admissions due to birth asphyxia, and the CFR was 14.8%, similar to previous years. 32% of neonatal deaths were due to perinatal asphyxia or associated with it.

The developmental implications for many surviving children are significant: cerebral palsy, intellectual disability, blindness, and seizures are common. Perinatal asphyxia can be reduced with supervision with supervision by a skilled midwife, identification of delays in labour, active management of labour, and close communication between obstetric / midwifery services and paediatric services. Providing immediate newborn care - described below - can also prevent some cases of asphyxia, as babies are

stimulated to initiate breathing early by drying. Training in neonatal resuscitation for nurses and doctors can also reduce the number of babies with birth asphyxia.

Very low birth weight

Very low birth weight is a birth weight between 1000 and 1499g. There were 419 very low birth weight admissions in the 20 hospitals. In 2019, 140, or 33% of VLBW newborns died in hospital, but more than 60% survived hospitalisation. These surviving babies are at high risk of complications and need close follow-up and care in the first year of life.

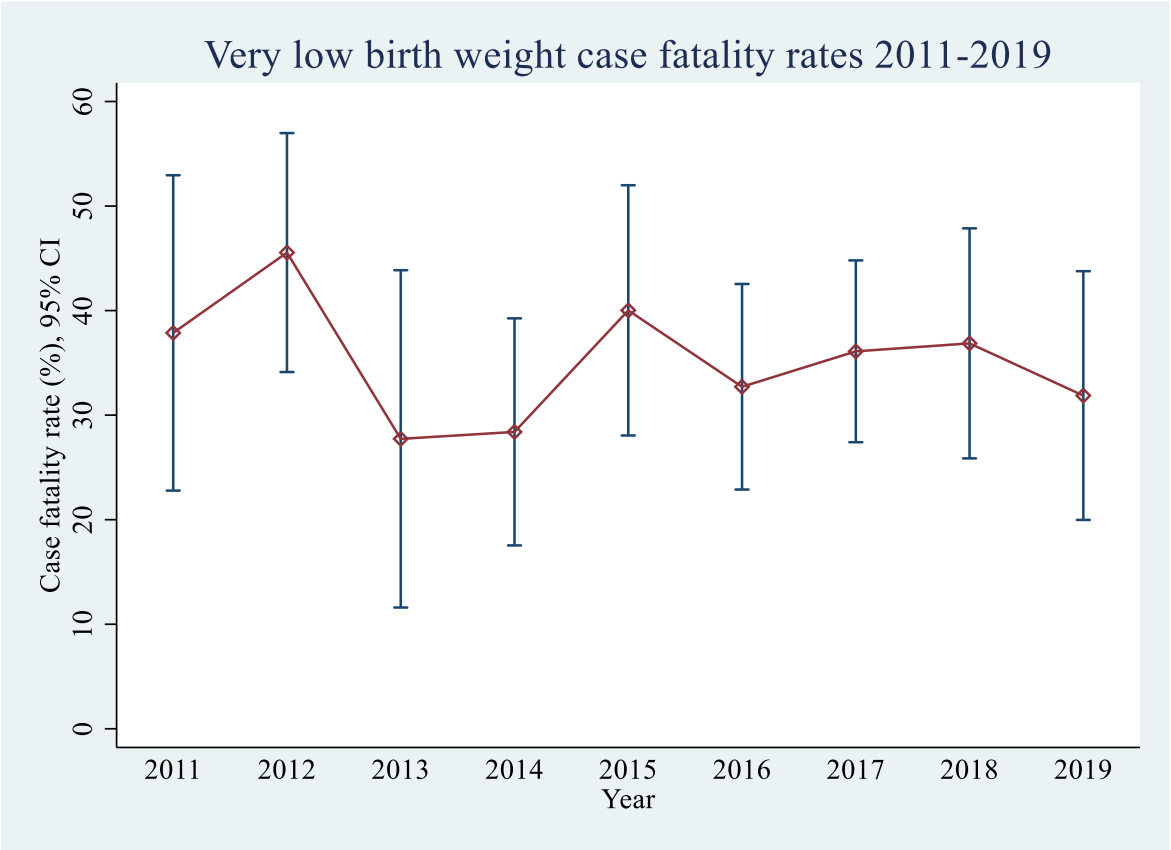


Figure 9. Case fatality rates for very low birthweight newborns

In 2019, prematurity (gestational age <37 weeks) was reported also, with 1207 admissions and 313 deaths (CFR 25.9).

Congenital malformations

275 newborns were reported to have congenital malformations, of which 89 had multiple anomalies. 81 of these newborns died (case fatality rate 29.5%).

Other neonatal conditions

There were 58 cases of congenital syphilis and 13 cases of congenital malaria.

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, hypoglycaemia 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 with the mother*** 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 after birth, reduces the risk of anaemia and the risk of intraventricular haemorrhages in preterm infants.
- ***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 that babies 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 do not breathe at birth. ***Bag and mask resuscitation*** for babies who are not breathing within 1 minute of 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 non-invasive and as 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 many neonates do not have clinical signs of hypoxaemia, 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. Hypoglycaemia occurs because neonates have 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. Ensure 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.
- 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, expressed breast milk by a nasogastric tube is ideal. However large volumes of enteral feeding in the first day or two of life is often not well tolerated. 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 strongly 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 is very important 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 be identified. Clinical audit is essential to reduce neonatal mortality.
- Training of nurses in early essential newborn care and neonatal high-dependency care

Summary

This Annual Report and the Paediatric Hospital Reporting System in 2019 has highlighted significant progress in several areas: overall paediatric mortality rates, and case fatality rates for pneumonia, tuberculosis and neonates. Addressing quality of care will further 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 further in the coming years.

Diagnoses	Admissions 2019	Deaths 2019	CFR 2019	CFR 2009-2018
All paediatric admissions	**29901**	**1923**	**6.43**	**7.31**
Pneumonia	4818	171	3.55	4.70
Severe pneumonia	1716	127	7.40	11.16
Neonatal conditions	7971	679	8.52	9.48
Diarrhoea	2358	124	5.26	4.31
Malaria	872	42	4.82	4.38
Severe malnutrition	2411	250	10.37	17.08
Tuberculosis	2125	173	8.14	10.86
Meningitis	795	115	14.47	17.60
HIV	389	48	12.34	15.22
Anaemia	2310	267	11.56	12.90
Rheumatic heart disease	116	15	12.93	9.17
Congenital heart disease	296	41	13.85	19.02
Measles	5	0	0.00	2.97
Cancer	139	39	28.06	31.87
Tetanus	10	2	20.00	15.13
Acute flaccid paralysis	46	1	2.17	3.49
Whooping cough	18	0	0.00	1.27
Child protection	148	25	16.89	16.82

Table 5: Admissions, deaths and case fatality rates for common diagnoses in 2019, and comparison with 2009-2018

* 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 2018.

Hospital	Admissions	Deaths	Case fatality rate
Alotau			
Angau	3438	248	7.2
Buka	561	33	5.9
Chuave	293	2	7.0
Daru	263	18	6.8
Gerehu	2405	7	0.3
Goroka	2298	172	7.5
Kavieng	592	34	5.7
Kimbe	1637	106	6.5
Kerema			
Kompiam	124	3	2.4
Kundiawa	1652	96	5.8
Mabisanda			
Manus	477	13	2.7
Mendi	1829	134	7.3
Modilon	2189	182	8.3
Mt Hagen	2596	94	3.6
Nonga	1541	168	10.9
Popendetta	995	76	7.6
Port Moresby	4210	340	8.1
Tari	1138	74	6.5
Vanimo			
Wabag	1393	123	8.8
Wewak			
Yampu	270	1	0.4
Total	**29901**	**1923**	**6.43**

Table 6. Total paediatric and neonatal admissions, deaths and case fatality rate for 2019

Hospital	Pneumonia admissions	Pneumonia deaths	Pneumonia case fatality rate
Alotau			
Angau	566	33	5.8
Buka	62	1	1.6
Chuave	132	1	0.8
Daru	38	1	2.6
Gerehu	384	2	0.5
Goroka	604	22	3.6
Kavieng	23	1	4.3
Kimbe	138	3	2.2
Kerema			
Kompiam	18	0	0.0
Kundiawa	288	6	2.1
Mabisanda			
Manus	36	2	5.6
Mendi	300	8	2.7
Modilon	220	9	4.1
Mt Hagen	514	5	1.0
Nonga	141	22	15.6
Popendetta	119	8	6.7
Port Moresby	556	38	6.8
Tari	251	5	2.0
Vanimo			
Wabag	395	4	1.0
Wewak			
Yampu	33	0	0.0
Total	4818	171	3.55

Table 7. Pneumonia admissions and outcomes in 2018

Hospital	Severe pneumonia admissions	Severe pneumonia deaths	Severe pneumonia case fatality rate
Alotau			
Angau	140	26	18.6
Buka	13	0	0.0
Chuave	4	1	25.0
Daru	37	1	2.7
Gerehu	126	0	0.0
Goroka	390	16	4.1
Kavieng	6	1	16.7
Kimbe	34	2	5.9
Kerema			
Kompiam	13	0	0.0
Kundiawa	140	6	4.3
Mabisanda			
Manus	3	2	66.7
Mendi	85	6	7.1
Modilon	76	7	9.2
Mt Hagen	173	3	1.7
Nonga	55	17	30.9
Popendetta	59	6	10.2
Port Moresby	210	29	13.8
Tari			
Vanimo			
Wabag	138	4	2.9
Wewak			
Yampu	14	0	0.0
Total	1716	127	7.40

Table 8. Severe pneumonia admissions and outcomes in 2019

Hospital	Diarrhoea admissions	Diarrhoea deaths	Diarrhoea case fatality rate
Alotau			
Angau	315	15	4.8
Buka	36	3	8.3
Chuave	28	0	0.0
Daru	1	0	0.0
Gerehu	149	3	2.0
Goroka	195	4	2.1
Kavieng	27	2	7.4
Kimbe	98	4	4.1
Kerema			
Kompiam	22	0	0.0
Kundiawa	113	5	4.4
Mabisanda			
Manus	27	1	3.7
Mendi	156	15	9.6
Modilon	143	12	8.4
Mt Hagen	213	2	0.9
Nonga	118	13	11.0
Popendetta	18	2	11.1
Port Moresby	360	17	4.7
Tari	138	12	8.7
Vanimo			
Wabag	151	14	9.3
Wewak			
Yampu	50	0	0.0
Total	2358	124	5.26

Table 9. Diarrhoea admissions and outcomes in 2019

Hospital	Malaria admissions	Malaria deaths	Malaria case fatality rate
Alotau			
Angau	170	5	2.9
Buka	13	1	7.7
Chuave	1	0	0.0
Daru	4	0	0.0
Gerehu	11	0	0.0
Goroka	17	1	5.9
Kavieng	35	2	5.7
Kimbe	89	3	3.4
Kerema			
Kompiam	1	0	0.0
Kundiawa	2	0	0.0
Mabisanda			
Manus	0	11	0.0
Mendi	1	0	0.0
Modilon	309	14	4.5
Mt Hagen	40	0	0.0
Nonga	40	1	2.5
Popendetta	108	2	1.9
Port Moresby	29	2	6.9
Tari			
Vanimo			
Wabag	1	0	0.0
Wewak			
Yampu	1	0	0.0
Total	872	42	4.82

Table 10. Malaria admissions and outcomes in 2019

Hospital	Severe malnutrition admissions	Severe malnutrition deaths	Severe malnutrition case fatality rate
Alotau			
Angau	408	42	10.3
Buka	52	7	13.5
Chuave	60	0	0.0
Daru	43	6	14.0
Gerehu	179	5	2.8
Goroka	188	24	12.8
Kavieng	16	3	18.8
Kimbe			
Kerema			
Kompiam	15	0	0.0
Kundiawa	56	7	12.5
Mabisanda			
Manus	15	0	0.0
Mendi	90	19	21.1
Modilon	232	27	11.6
Mt Hagen	150	4	2.7
Nonga	116	19	16.4
Popendetta	122	6	4.9
Port Moresby	395	44	11.1
Tari	101	17	16.8
Vanimo			
Wabag	147	20	13.6
Wewak			
Yampu	26	0	0.0
Total	2411	250	10.37

Table 11. Severe malnutrition admissions and outcomes in 2019

Hospital	Meningitis admissions	Meningitis deaths	Meningitis case fatality rate
Alotau			
Angau	104	23	22.1
Buka	14	6	42.9
Chuave	0	0	0.0
Daru	8	2	25.0
Gerehu	69	0	0.0
Goroka	91	16	17.6
Kavieng	15	1	6.7
Kimbe	45	8	17.8
Kerema			
Kompiam	2	2	100.0
Kundiawa	45	6	13.3
Mabisanda			
Manus	1	0	0.0
Mendi	56	16	28.6
Modilon	53	5	9.4
Mt Hagen	6	0	0.0
Nonga	26	8	30.8
Popendetta	33	1	3.0
Port Moresby	165	17	10.3
Tari	37	2	5.4
Vanimo			
Wabag	20	1	5.0
Wewak			
Yampu	5	1	20.0
Total	795	115	14.47

Table 12. Meningitis admissions and outcomes in 2019

Hospital	Tuberculosis admissions	Tuberculosis deaths	Tuberculosis case fatality rate
Alotau			
Angau	212	26	12.3
Buka	39	4	10.3
Chuave	6	0	0.0
Daru	7	0	0.0
Gerehu	18	0	0.0
Goroka	229	23	10.0
Kavieng	21	1	4.8
Kimbe	105	14	13.3
Kerema			
Kompiam	5	0	0.0
Kundiawa	120	4	3.3
Mabisanda			
Manus	7	1	14.3
Mendi	96	13	13.5
Modilon	119	16	13.4
Mt Hagen	153	1	0.7
Nonga	70	9	12.9
Popendetta	145	10	6.9
Port Moresby	532	31	5.8
Tari	91	8	8.8
Vanimo			
Wabag	88	12	13.6
Wewak			
Yampu	62	0	0.0
Total	2125	173	8.14

Table 13. TB admissions and outcomes in 2019

Hospital	HIV admissions	HIV deaths	HIV case fatality rate
Alotau			
Angau	33	4	12.1
Buka	1	0	0.0
Chuave	0	0	0.0
Daru	2	0	0.0
Gerehu	17	0	0.0
Goroka	55	8	14.5
Kavieng	1	0	0.0
Kimbe	0	0	0.0
Kerema			
Kompiam	1	0	0.0
Kundiawa	12	4	33.3
Mabisanda			
Manus	1	0	0.0
Mendi	3	2	66.7
Modilon	25	4	16.0
Mt Hagen	67	0	0.0
Nonga	3	2	66.7
Popendetta	6	1	16.7
Port Moresby	118	19	16.1
Tari	3	0	0.0
Vanimo			
Wabag	22	4	18.2
Wewak			
Yampu	19	0	0.0
Total	389	48	12.34

Table 14. HIV admissions and outcomes in 2019

Hospital	Neonatal admissions	Neonatal deaths	Neonatal case fatality rate
Alotau			
Angau	951	74	7.8
Buka	53	12	22.6
Chuave	7	1	14.3
Daru	53	3	5.7
Gerehu	169	0	0.0
Goroka	487	61	12.5
Kavieng	170	8	4.7
Kimbe	449	29	6.5
Kerema			
Kompiam	7	1	14.3
Kundiawa	698	52	7.4
Mabisanda			
Manus	174	3	1.7
Mendi	522	33	6.3
Modilon	563	42	7.5
Mt Hagen	583	31	5.3
Nonga	527	59	11.2
Popendetta	242	18	7.4
Port Moresby	1770	210	11.9
Tari	265	18	6.8
Vanimo			
Wabag	241	24	10.0
Wewak			
Yampu	40	0	0.0
Total	7971	679	8.52

Table 15. Total neonatal admissions and outcomes in 2019

Hospital	Neonatal sepsis admissions	Neonatal sepsis deaths	Neonatal sepsis case fatality rate
Alotau			
Angau	814	40	4.9
Buka	36	4	11.1
Chuave	7	1	14.3
Daru	41	1	2.4
Gerehu	153	0	0.0
Goroka	270	33	12.2
Kavieng	77	1	1.3
Kimbe	240	7	2.9
Kerema			
Kompiam	5	0	0.0
Kundiawa	454	8	1.8
Mabisanda			
Manus	114	1	0.9
Mendi	38	10	26.3
Modilon	290	8	2.8
Mt Hagen	322	8	2.5
Nonga	410	37	9.0
Popendetta	128	10	7.8
Port Moresby	833	83	10.0
Tari	233	12	5.2
Vanimo			
Wabag	124	12	9.7
Wewak			
Yampu	35	0	0.0
Total	4624	276	5.97

Table 16. Neonatal infections in 2019

Hospital	VLBW admissions	VLBW deaths	VLBW case fatality rate
Alotau			
Angau	35	19	54.3
Buka	5	5	100.0
Chuave			
Daru	5	2	40.0
Gerehu	0	0	0.0
Goroka	49	20	40.8
Kavieng	12	5	41.7
Kimbe	18	7	38.9
Kerema			
Kompiam	0	0	0.0
Kundiawa	19	5	26.3
Mabisanda			
Manus	4	1	25.0
Mendi	17	8	47.1
Modilon	43	11	25.6
Mt Hagen	0	0	0.0
Nonga	38	8	21.1
Popendetta	19	4	21.1
Port Moresby	141	36	25.5
Tari			
Vanimo			
Wabag	13	9	69.2
Wewak			
Yampu	1	0	0.0
Total	419	140	33.41

Table 17. Very low birth weight (1000-1499g) admissions and deaths in 2019

Hospital	Perinatal asphyxia admissions	Perinatal asphyxia deaths	Perinatal asphyxia case fatality rate
Alotau			
Angau	135	26	19.3
Buka	13	3	23.1
Chuave			
Daru	10	1	10.0
Gerehu	0	0	0.0
Goroka	212	23	10.8
Kavieng	58	2	3.4
Kimbe	132	15	11.4
Kerema			
Kompiam	1	0	0.0
Kundiawa	92	9	9.8
Mabisanda			
Manus	22	2	9.1
Mendi	59	10	16.9
Modilon	112	28	25.0
Mt Hagen	121	19	15.7
Nonga	117	24	20.5
Popendetta	54	7	13.0
Port Moresby	248	33	13.3
Tari	26	6	23.1
Vanimo			
Wabag	55	10	18.2
Wewak			
Yampu	6	0	0.0
Total	1473	218	14.80

Table 18. Perinatal asphyxia admissions and deaths in 2019

Hospital	Cancer admissions	Cancer deaths	Cancer case fatality rate
Alotau			
Angau	10	1	10.0
Buka	2	1	50.0
Chuave	0	0	0.0
Daru	2	0	0.0
Gerehu	1	0	0.0
Goroka	6	0	0.0
Kavieng	13	0	0.0
Kimbe			
Kerema			
Kompiam	0	0	0.0
Kundiawa	2	2	100.0
Mabisanda			
Manus	1	1	100.0
Mendi	2	0	0.0
Modilon	11	8	72.7
Mt Hagen	2	1	50.0
Nonga	18	7	38.9
Popendetta	1	1	100.0
Port Moresby	65	16	24.6
Tari			
Vanimo			
Wabag	3	1	33.3
Wewak			
Yampu	0	0	0.0
Total	139	39	28.1

Table 19. Cancer admissions and deaths in 2019

Hospital	RHD admissions	RHD deaths	RHD case fatality rate
Alotau			
Angau	2	2	100.0
Buka	3	0	0.0
Chuave	0	0	0.0
Daru	6	0	0.0
Gerehu	3	0	0.0
Goroka	11	1	9.1
Kavieng	1	0	0.0
Kimbe			
Kerema			
Kompiam	0	0	0.0
Kundiawa	10	2	20.0
Mabisanda			
Manus	0	0	0.0
Mendi	10	3	30.0
Modilon	6	0	0.0
Mt Hagen	4	0	0.0
Nonga	10	2	20.0
Popendetta	2	1	50.0
Port Moresby	43	4	9.3
Tari			
Vanimo			
Wabag	5	0	0.0
Wewak			
Yampu	0	0	0.0
Total	116	15	12.9

Table 20. Rheumatic heart admissions and deaths in 2019

Hospital	Congenital heart disease admissions	Congenital heart disease deaths	Congenital heart disease case fatality rate
Alotau			
Angau	39	8	20.5
Buka	6	0	0.0
Chuave	0	0	0.0
Daru	7	0	0.0
Gerehu	8	0	0.0
Goroka	11	4	36.4
Kavieng	0	0	0.0
Kimbe			
Kerema			
Kompiam	0	0	0.0
Kundiawa	17	3	17.6
Mabisanda			
Manus			
Mendi	39	5	12.8
Modilon	0	0	0.0
Mt Hagen	0	0	0.0
Nonga	0	0	0.0
Popendetta	0	0	0.0
Port Moresby	137	19	13.9
Tari	30	2	6.7
Vanimo			
Wabag	0	0	0.0
Wewak			
Yampu	2	0	0.0
Total	296	41	13.85

Table 21. Congenital heart disease admissions and outcomes in 2019

Hospital	Child protection admissions	Child protection deaths	Child protection case fatality rate
Alotau			
Angau	5	5	100.0
Buka	5	0	0.0
Chuave	0	0	0.0
Daru	0	0	0.0
Gerehu	6	1	16.7
Goroka	1	1	100.0
Kavieng	1	0	0.0
Kimbe			
Kerema			
Kompiam	7	0	0.0
Kundiawa	50	1	2.0
Mabisanda			
Manus	0	0	0.0
Mendi	0	0	0.0
Modilon	15	1	6.7
Mt Hagen	3	0	0.0
Nonga	2	2	100.0
Popendetta	5	1	20.0
Port Moresby	10	1	10.0
Tari	2	0	0.0
Vanimo			
Wabag	36	12	33.3
Wewak			
Yampu	0	0	0.0
Total	148	25	16.9

Table 22. Child protection admissions (physical abuse, sexual abuse or neglect) in 2019