PNG Department of Health

Child Morbidity and Mortality

14th Annual Report, 2023

PNG National Department of Health

Paediatric Society of Papua New Guinea

2023 Annual Report on Child Morbidity and Mortality

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

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August 2024

2023 Annual Report on Child Morbidity and Mortality

FORWORD by the Chief Paediatrician

It gives me great pleasure to write the forward for this excellent Annual Report for 2023.

The Annual Reports on Child Morbidity and Mortality have been produced since 2010 and this report marks 14 years of this reporting through many versions to what we are up to now.

Fourteen years gives a lot of useful data of trends in morbidity and mortality and helps us in planning for areas for improvement.

We have improved over these years in reporting, with a handful of Provincial Hospitals reporting in 2009, this year with 17 health facilities participating. Some years we have been as high as 24 participating health centres, so it remains to try to increase this reporting.

Overall, our admissions have been increasing and our mortality rates have decreased gradually. Our case fatality rates for most diseases have generally improved, however this year showed some concerning trends – increase in CFR for neonates, the rise in deaths from septic shock, increase in typhoid cases in highlands provinces, ongoing deaths from birth asphyxia, a significant rise in congenital syphilis, ongoing cases and deaths from severe malnutrition, and deaths from child protection issues.

Over the years, our plans for improvement have been guided by this data and the results in this report show that. The Paediatric Society of PNG has initiated programs to improve our outcomes, and many are proving successful. But there is much work to be done.

As a way forward, the Paediatric Society will achieve further improvement in our outcomes with a **Paediatric Quality Improvement Program** and the many initiatives described in the **Child and Adolescent Health Policy and Plan 2021-2030**. As a Society, we want to ensure that quality care is given even in resource limited settings to all children of this country.

Let me acknowledge all my fellow Paediatricians and colleague health workers who contribute to the data collection. Edilson Yano has been our constant worker supporting the PHR program and helping to put together the data yearly. And thanks to Prof Trevor Duke who edits and produces this report.

I hope this report gives useful information to all health workers and administrators both in the province and nationally to improve child health services together with our second and revised Child Health Plan 2021-2030, that we launched in June last year. In our last CAHPP 2011-2020 and in the National Health Plan KRA 4 (Child Health), I believe we have achieved much and as we go forward with the new NHP 2021-2030 that the recommendations from this report can be the cornerstone for child health services in PNG.

Dr Cornelia Kilalang
Chief Paediatrician
National Department of Health

Executive summary

This report covers admissions and outcomes for children in 2023 from 18 hospitals. We gratefully acknowledge the paediatricians, nurses, medical officers, and HEOs in charge of wards who record these data and submit it annually.

Report key points:

- In 2023 overall, there were 32,741 admissions and 2154 deaths recorded (mortality rate 6.58%). The children's ward case fatality rate remained at 4.92 (20,204 admissions and 994 deaths).
- After a concerning few years where case fatality rates increased, in 2023 there was a stabilisation, with case fatality rates for children over the age of 1 month, and those with pneumonia being lower than in 2022. The improvement in pneumonia outcomes is the biggest improvement.
- Neonatal case fatality rates, which had also risen in 2022 fell slightly in 2023 to 9.3%, but still remains higher than the 10-year average.
- Malnutrition: The crude case fatality rate for severe malnutrition was 9.4%, the first time this was less than 10%, the WHO benchmark. This is likely because of a systematic approach, based on the WHO/UNICEF and Standard Treatment guidelines.
- In 2023 there were 213 children > 1 month of age with severe sepsis or septic shock, and 144 deaths, making septic shock the illnesses with the highest death rate (68%). Improvements in recognition of septic shock, emergency care, quality of care including having an intensive care area in each paediatric ward with monitoring and supportive care, and increases in immunization are needed to reduce deaths from septic shock.
- This year there were 1616 children admitted with chronic non-communicable illnesses – asthma, chronic lung disease, rheumatic and congenital heart disease, epilepsy and cerebral palsy, and cancer. There were 159 deaths: these conditions make up over 8% of hospital admissions of children >1 month, and 16% of all paediatric deaths. More awareness of how to care for such children in hospitals and in communities is needed.

In response to the PHR results for 2023, the Paediatric Society of PNG has made the following recommendations:

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

- Regular mortality and morbidity audits
- A quality improvement team in each provincial hospital
- More paediatric nurses being trained
- Training on the care of seriously ill children, through the WHO Hospital Care for Children courses
- 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 (see Appendix)
- Infection control and antibiotic stewardship
- Improved systems for managing children with chronic conditions
- Continuing medical education (CME) for paediatricians and paediatric nurses

Tools for Quality Improvement are available at:
https://pngpaediatricsociety.org/quality-improvement/

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, those with 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 partographs 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. 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 under 10% in 2023, an overall improvement in the last decade.

Tuberculosis caused 7.6% of all admissions in 2023. Every effort should be made to help children complete TB treatment. For many children this requires keeping them under careful supervision 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.

Children with **chronic diseases**, including asthma, chronic lung disease, epilepsy, rheumatic and congenital heart diseases, cerebral palsy and neurodevelopmental problems, thalassaemia, and diabetes need ongoing holistic care. They 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. Increasingly important is adolescent health, including preventative and mental health issues.

The National Child Health Plan outlines a plan for improving child health for 2021-2030. Everyone involved in health care for children be familiar with the Plan, and Provincial and District Health officials should use it to formulate their Annual Activity Plans. This plan can be downloaded at http://pngpaediatricsociety.org/png-child-health

Introduction

The Paediatric Society of Papua New Guinea releases the 14th Annual Report on Child Morbidity and Mortality for 2023. The Society 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 2023, with some comparisons to data collected in the previous 14 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.

There have been several versions of the PHR, we are now up to V12.5, but not all hospitals were using the latest version in 2023. That is not a problem as the data for the common diagnoses are consistent between versions and therefore comparable. However, some less-common diagnoses only included in V12.5 are not reported by all hospitals. Version 12.5 is downloadable at: https://pngpaediatricsociety.org/hospital-reporting-program/

Version 12.5 has a maternal component. In future years we hope labour wards and obstetric departments will report summary data on outcomes for mothers and deliveries.

A note on the method of the graphs in this report: the graphs 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 take this into account and enables year-on-year comparison as smaller district hospitals or health facilities contribute PHR data in the future.

Mortality rates for common diseases

In 2023 overall, there were 32,741 admissions and 2154 deaths recorded (mortality rate 6.58%). This is influenced strongly by high newborn death rate (case fatality rate 9.3%). The children's ward case fatality rate remained at 4.9%. see figure 1 and table 1.

Case fatality rates vary widely, often related to the level of the health facility (smaller rural hospitals have much lower CFR, larger referral hospitals have higher CFR, related to referral bias and complexity). Differences in CFR can reflect many factors, including case mix (the types of illnesses seen in different hospitals), the severity of illness at the time of presentation (if children with severe illness present

late, they have a higher risk of death), 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 looking for signals where they may be problems.

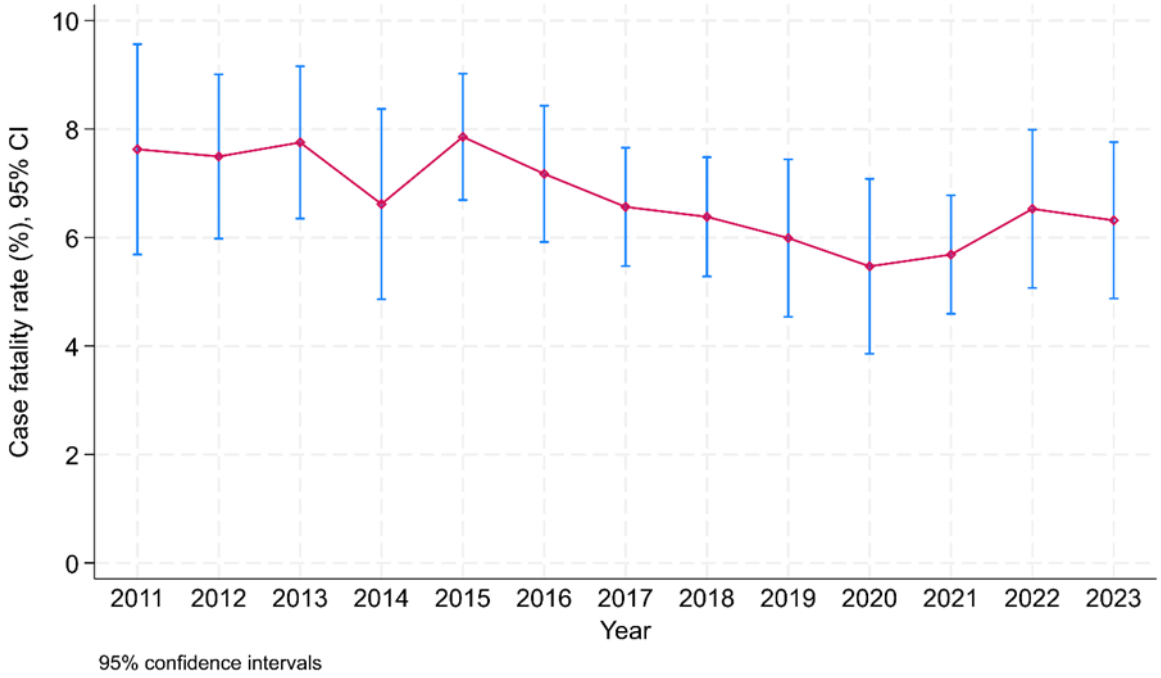

Figure 1. Overall paediatric (children's ward and special care nurseries combined) case fatality rates 2011-2023 (weighted averages)

2020	**Paediatric admissions**	**Paediatric deaths**	**Case fatality rate 2023**	**CFR 2009-2023**
Alotau	2418	75	**3.10**	3.26
Angau *	3993	303	**7.59**	9.52
Buka				8.59
Chuave				0.81
Daru				4.81
Gembogl				0.00
Gerehu	856	11	**1.29**	0.61
Goroka	2027	190	**9.37**	6.65
Kainantu				6.20
Gumine				0.73
Kavieng	680	35	**5.15**	5.55
Kimbe	1282	74	**5.77**	8.96
Kerema				
Kerowagi				0.52
Koge				0.00
Kompiam				5.22
Kundiawa	1315	74	**5.63**	5.93
Kudjip				3.17
Mabisanda				4.70
Lorengau	621	35	**5.64**	3.57
Mendi	1559	103	6.61	6.25
Mingendi				1.02
Modilon	2070	134	**6.47**	8.33
Mt Hagen	6164	213	**3.46**	5.03
Nonga	820	76	**9.27**	7.98
Popendetta *	249	6	**2.41 ***	7.40
Port Moresby	5121	576	**11.25**	8.45
Rumginae	295	8	**2.71**	2.89
Tari	1361	108	**7.94**	6.31
Vanimo	445	38	**8.54**	5.33
Wabag				7.77
Wewak	1465	95	**6.48**	7.06
Yampu				0.37
Total	32,741	2154	**6.58**	6.85

Table 1. Summary of admission, death, and case fatality rates in participating hospitals in 2023, and historical CFR 2009-2023

* Popendetta Hospital reported 4 months of data from paediatric ward only.

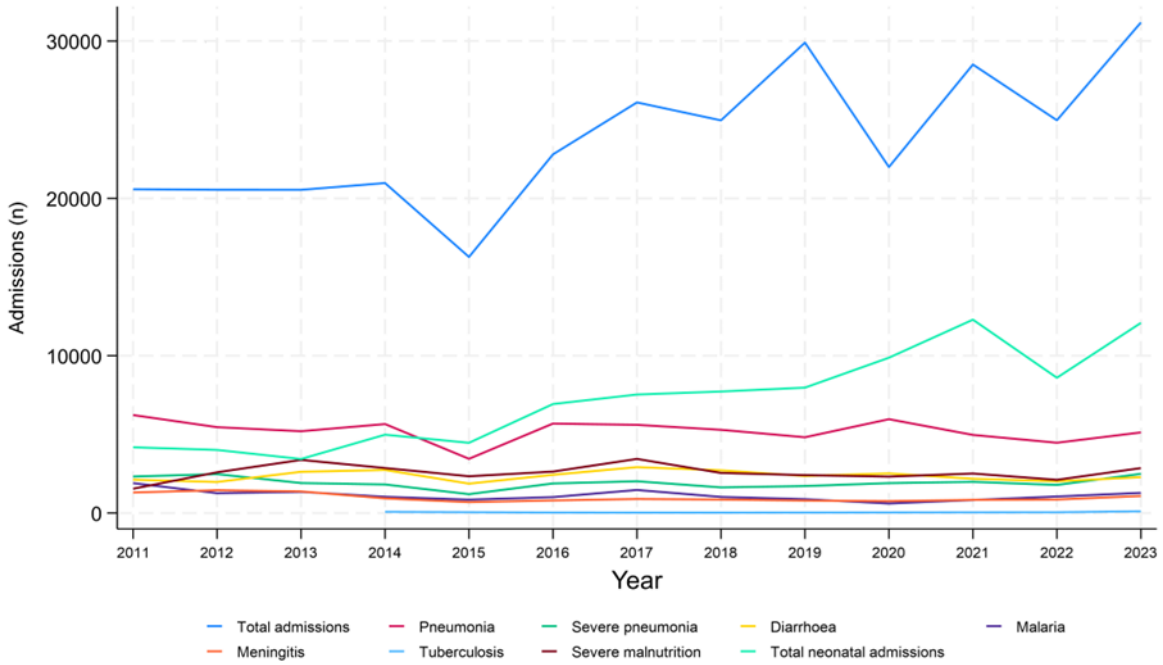

Figure 2. Admissions per year overall and for common conditions 2011-2023

Although the total number of admissions reported in the PHR has increased over the years, the number of cases of common conditions has remained relatively static; pneumonia, diarrhoea, malaria remain the common reasons for admissions to children's wards. The increased number of *other* conditions (thus the much higher total admissions) reflect the increased proportion of neonatal admissions over the last 10 years, the rise in chronic non-communicable paediatric conditions, and increased cases of severe sepsis.

Diagnoses	Admissions 2023	Deaths 2023	Case fatality rate 2023	CFR 10-year average
All paediatric admissions	**32,741**	**2154**	**6.58**	6.59
Neonatal conditions	12537	1160	**9.25**	8.1
Children's wards	20204	994	4.92	
Pneumonia	5680	200	3.52	4.10
Severe pneumonia	2493	157	6.30	9.26
Diarrhoea	2444	84	3.44	4.52
Dysentery	386	1	**0.26**	
Malaria	1283	51	**3.98**	4.52
Severe malnutrition	2976	281	9.44	13.26
Moderate malnutrition	1500	84	5.60	
Anaemia	3030	268	8.84	11.95
Typhoid	953	6	0.63	
Tuberculosis	2574	223	8.66	9.92
Meningitis	1107	134	12.10	15.27
Severe sepsis	213	144	67.61	
Epilepsy	149	3	2.01	
Dengue	34	1	**2.94**	
Developmental disability	167	9	5.39	
HIV	455	76	16.70	15.87
Rheumatic heart disease	203	21	10.34	10.51
Congenital heart disease	518	57	11.00	15.63
Cancer	187	44	23.53	29.13
Measles	0	0	**0**	2.86
Tetanus	13	4	**30.77**	30.91
Acute flaccid paralysis	28	0	**0.00**	5.57
Whooping cough	31	1	**3.22**	1.85
Child protection	168	21	**12.50**	16.71
Trauma and injuries	163	1	**0.61**	1.05

Table 2. Most common causes of hospital admission and case fatality rates in children for 2023, compared to 10-year average (2014-2023)

Note: some diagnoses added recently, so CFRs do not reflect the complete 10 years of reporting. Paediatric admissions = neonatal conditions admitted to special care nurseries plus children's ward admissions. In hospitals where sick newborns were admitted to children's wards, or general wards, these are separated according to age (neonates <1 months; or children older than 1 month).

Pneumonia

In 2023 as in all years, pneumonia was the most common reason for admission (5680 cases: 17.3% of all admissions overall).

Pneumonia case fatality rates in 2023 were 3.5% overall (Figure 3), and 6.3% for severe pneumonia (Figure 4, showing weighted averages over time). A decade

ago, the case fatality rate for severe pneumonia in most hospitals was higher than 10%.

The improvement in pneumonia outcomes is due to many things: better clinical care, increased awareness of the need for oxygen with pulse oximetry, use of oxygen concentrators and newer methods of giving oxygen, vaccines against *Haemophilus influenzae* type b and *Streptococcus pneumoniae*, and changes in epidemiology of pneumonia with more viral bronchiolitis. Most hospitals now have high dependency or intensive care areas in their children's ward with oxygen and monitors and are using color-coded monitoring charts.

Bronchiolitis

Using the current version of the PHR in 2023 many hospitals reported bronchiolitis separate to pneumonia. In 2023 there were 878 cases of bronchiolitis, 5 deaths, for a CFR of 0.6%. An increased number of bronchiolitis cases on previous years. So, the reduction in pneumonia CFR over the last decade remains very significant, as previously these cases of bronchiolitis would have been included in pneumonia numbers.

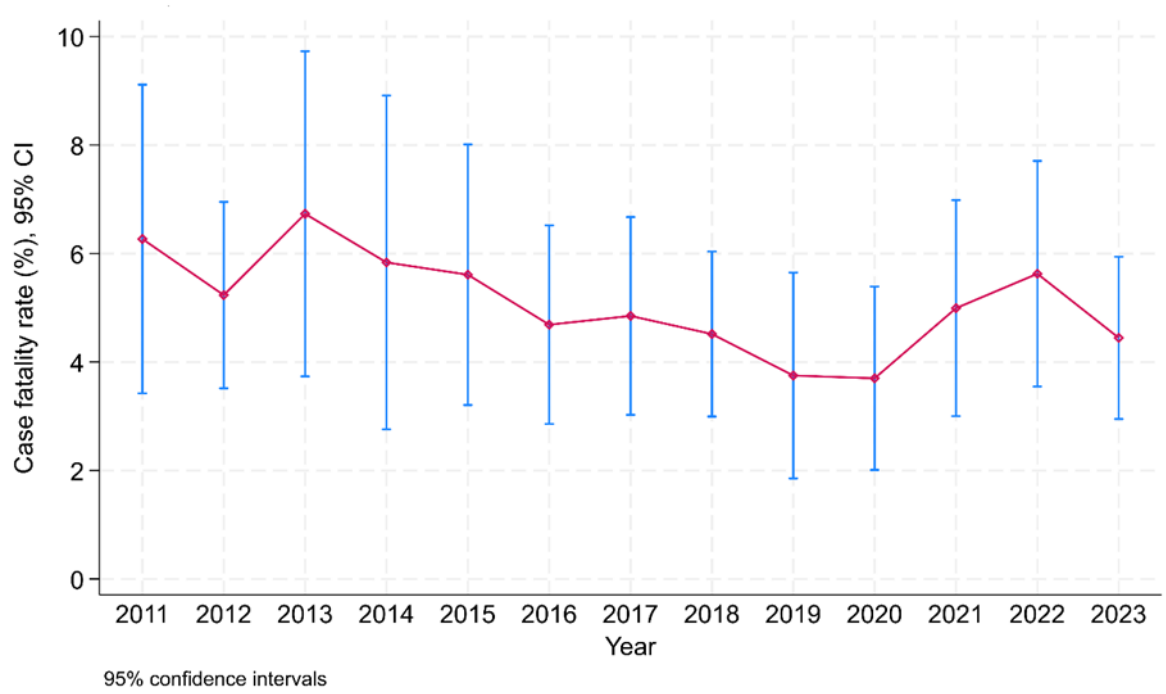

Figure 3. Pneumonia case fatality rates 2011-2023

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.

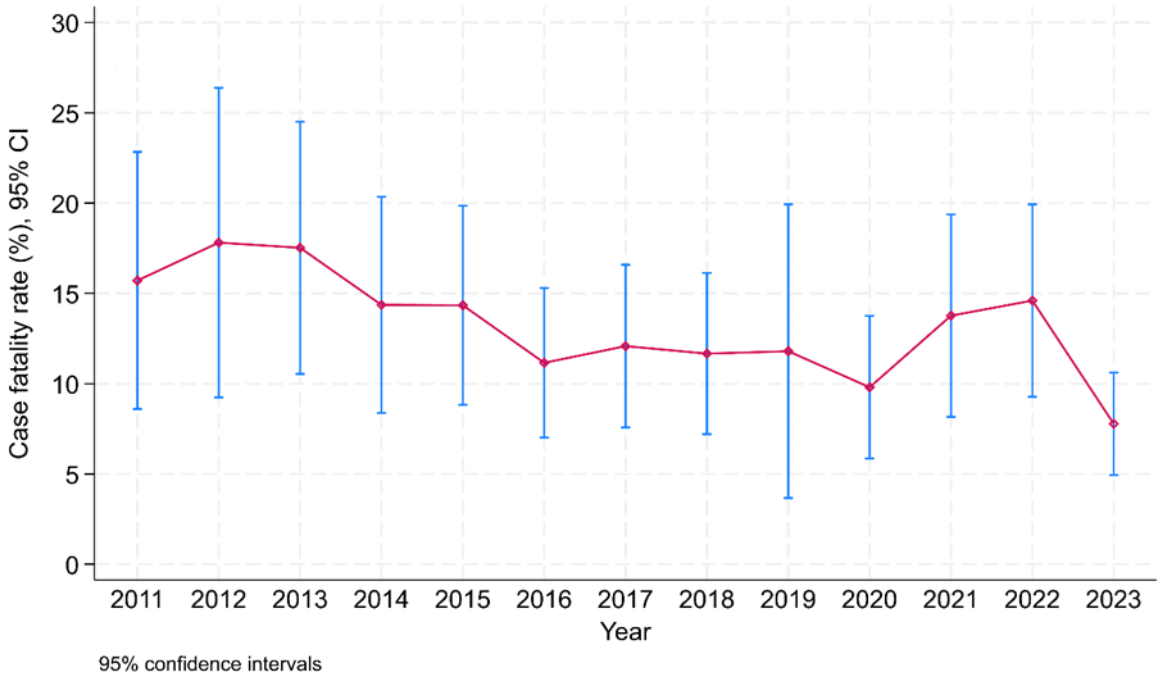

Figure 4. Severe pneumonia case fatality rates 2011-2023

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 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.
- colour-coded paediatric monitoring and response charts.
- training for staff in the care of seriously ill children
- sufficient nursing and medical staff to always provide clinical care
- supervision of nursing and medical care by senior clinicians

Deaths from pneumonia (200), meningitis (134) and severe sepsis (144) = 478 deaths from likely serious bacterial infection: and combined account for 48% of all children's ward deaths and 22% of all paediatric deaths (children's ward and neonatal deaths combined).

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 of all vaccines needs to be strengthened. And improving BCG coverage will reduce pneumonia and meningitis from tuberculosis.

There are other common causes of pneumonia, including viruses (particularly respiratory syncytial virus - RSV, influenza, and COVID-19) and bacteria (such as Group A streptococcus, *Staphylococcus aureus*, Chlamydia, Mycoplasma), and other causes of viral meningitis (enterovirus, and dengue and other mosquito-borne viruses), which are not all currently prevented by vaccines.

Pneumonia, meningitis and sepsis will continue to be major causes of presentation to health facilities and deaths in children in hospitals and in communities in Papua New Guinea.

The best way to address this with a comprehensive approach. The National Child Health Plan 2021-2030 outlines a comprehensive approach to preventing and treating pneumonia and other acute lower respiratory infections.

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 severe infection 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.
- Handwashing
- Vaccines: measles, Hib (Pentavalent), PCV, BCG, and other vaccines.
- Vector control measures will reduce the number of causes of mosquito-borne viral meningitis, such as Japanese encephalitis, dengue, as well as malaria.

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 that increase the risk of death from infections, especially anaemia, malnutrition, HIV and tuberculosis.
- 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.

Diarrhoea

2444 cases and 84 deaths (case fatality rate of 3.4%) due to diarrhoea were reported in the 18 hospitals in 2023.

Deaths from diarrhoea occur if (i) 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 solution (ORS) in the community and in primary care, by parents bringing their child to a health facility early if they have diarrhoea and signs of being sick, by improved assessment of the severity of dehydration, the use of zinc as additional treatment, the appropriate use of antibiotics in bloody diarrhoea, and by reducing malnutrition.

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 acute 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 no longer effective, and that ciprofloxacin is needed to treat dysentery. **Oral ciprofloxacin is currently recommended treatment by WHO for children with dysentery** in a dose of 10-15 mg/kg twice daily for 5 days.

If children have dysentery and are too sick to take oral medications, give ceftriaxone intravenously (IV) or intramuscularly (IM), and refer if you can.

In 2022 there were 365 children were admitted with dysentery, with only 1 reported death. So with the right treatment children with dysentery can recover.

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, they often have underlying problems or comorbidity (anaemia, malnutrition, immune deficiency, adoption), and need referral for assessment.

Typhoid

In 2023 there was a significant increase in reported cases of typhoid: 953 in total, with 6 reported deaths from typhoid. Most were from major highlands hospitals: Mt Hagen (638 cases) reported by far the most paediatric typhoid cases, followed by Goroka (108) and Kundiawa (69).

Multi-drug resistant typhoid has increased in countries throughout Asia in the last 10 years. Although there is limited resistance data from PNG, the recommended

treatment for proven or suspected typhoid is fluroquinolones (ciprofloxacin). Third generation cephalosporins, and azithromycin are also options.

The rising incidence of typhoid being seen in the PHR data especially in highlands provinces is concerning. Typhoid is often under-recognised in children because of lack of culture facilities and widespread availability of antibiotics means blood cultures are often negative – so the typhoid burden in other areas of PNG may be similar to that of the highland.

There is a new WHO approved Typhoid conjugate vaccine, which has longer-lasting immunity than the older typhoid vaccines and can be given as a single dose to children from the age of 6 months.[1] WHO recommends putting all the typhoid data for a country together in order to put in an application to introduce the vaccine.

Malaria

In 2023 malaria accounted for 1281 admissions and 51 deaths (case fatality rate of 4.0%). The number of cases of malaria have increased in the last 2 years, after a reduction in reported malaria cases in 2019-2020. The case fatality rate has not changed (around 4% most years).

Cases of malaria may be increasing again because of lack of use of insecticide-treated bed nets and other public health protective measures.

Year	Cases	Deaths	CFR
2023	1283	51	4.0
2022	1053	40	3.8
2021	829	34	4.1
2020	617	32	5.2
2019	872	42	4.8
2018	1026	43	4.2
2017	1465	56	3.8
2016	1015	46	4.5
2015	852	44	5.2
2014	1033	67	6.5
2013	1347	70	5.2
2012	1263	69	5.5
2011	1904	61	3.2
2010	1814	50	2.8

Table 3. Malaria admissions and case fatality rates 2010-2023

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.

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 2023 in the 18 hospitals that reported using the PHR, 2976 children were admitted with severe malnutrition (weight for age <3 SD below the median), or with severe wasting or kwashiorkor. This represented 9.1% of all admissions, like previous years from 2018 onwards.

The case fatality rate for severe malnutrition was 9.4%, lower than previous years (Figure 5 and Table 3).

Malnutrition is a social condition, and only improved social and economic conditions will reduce the numbers of children with malnutrition.

Many children with severe malnutrition have comorbidities such as tuberculosis (based on studies in Africa, about 17%).

There is a need for ongoing supply of essential commodities for managing severe malnutrition, but the best way to prevent deaths from malnutrition is prevention at a community level.

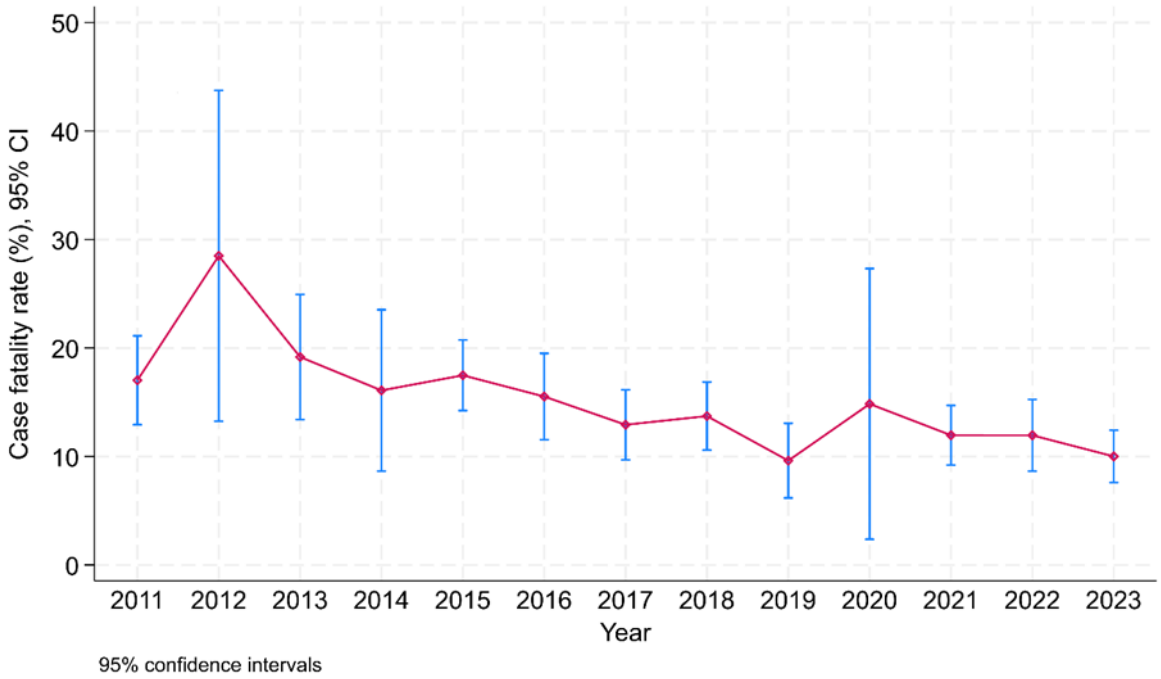

Figure 5. Severe malnutrition case fatality rate 2011-2022

Year	Number admissions	Percentage of all admissions	Deaths	CFR	Number of hospitals with CFR >20%
2011	1544	7.50	287	18.6	3
2012	2590	12.61	604	23.3	4
2013	3379	16.50	524	15.5	4
2014	2861	13.64	455	15.9	4
2015	2338	14.36	438	18.7	4
2016	2635	11.56	438	16.7	4
2017	3049	14.0	483	15.8	2
2018	2548	10.21	315	12.4	3
2019	2411	8.06	250	10.4	1
2020	2377	7.27	257	10.8	1
2021	2514	8.52	256	10.1	0
2022	2111	8.45	244	11.6	4
2023	**2976**	**9.0**	**273**	**9.44**	**0**

Table 4. Cases and outcomes of children with severe malnutrition 2011-2022

In the last 4 years 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 2023 1500 children were reported with moderate malnutrition, and there were 84 deaths (CFR 5.6%), which is just higher than the death rate overall for children >1 month of age (4.9%).

This will be an underestimate of the numbers of cases of moderate malnutrition, as 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.
- Check all children with severe malnutrition for tuberculosis, as it is likely that 17% of such children will have tuberculosis. They should all have a thorough clinical examination, chest x-ray, GeneXpert test, and TB score. If children with severe malnutrition have a positive family history of a household contact with sputum smear positive, the risk is even higher, and starting TB treatment can be lifesaving.
- Zinc and vitamin A should be available and given to children with severe malnutrition, as per Standard Treatment guidelines.
- Staff should be trained in the management of malnutrition.

The *prevention* of malnutrition should 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, the PNG Guidelines on Management of Severe Malnutrition, and the WHO Pocket Book of Hospital Care for Children, all available at: https://pngpaediatricsociety.org/treatment/

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 18 hospitals, meningitis accounted for 1107 admissions and 134 deaths. The case fatality rate for meningitis was 12.1%.

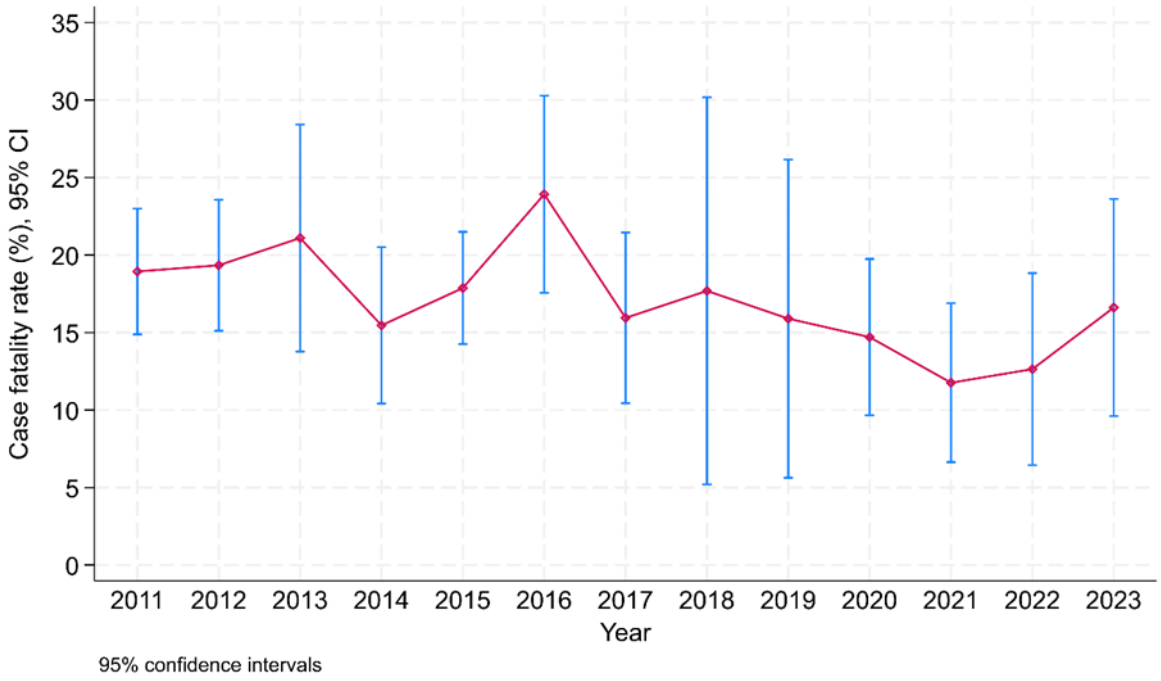

Figure 6. Meningitis case fatality rates 2011-2023

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 2023, which indicates that the vaccines are 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 bacterial 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 careful 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 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 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 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 upper normal range to optimise cerebral perfusion. 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 fluid, this leads to body and brain swelling and results in poor outcomes, maintain enteral nutrition via a nasogastric tube.
- Check electrolytes and correct if sodium <130mmol/L or >150mmol/L.
- Change position to prevent pressure sores.
- Physiotherapy to prevent limb contractures.
- **Consider the diagnosis of TB meningitis if a child is not improving, or if the history is suggestive (prolonged history, malnutrition, contact with a case of active TB). If uncertain, refer, or commence TB treatment.**
- Do a CT scan if you can if the child remains poorly conscious after 48 hours of treatment for bacterial meningitis.

Severe sepsis and septic shock

In 2022 there were 213 children outside the neonatal period reported with severe sepsis or septic shock, and 144 deaths, making septic shock the illness with the highest death rate (68%). This is a large increase in cases of septic shock on previous years.

It is very important that health workers recognise the signs of septic shock, and know how to give emergency management.

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

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

- High or persistent fever
- Vomiting or diarrhoea
- Severe pallor
- Lethargy or unconsciousness
- Fast breathing and respiratory distress
- Heart rate >160 with pulses that are difficult to feel.
- Cold skin of arms and legs
- Slow capillary refill (>3 seconds)
- Low blood pressure

There may be **localising signs** suggesting meningitis:

- Severe headache
- Neck stiffness
- Repeated convulsions
- Bulging fontanelle
- Extreme irritability or high-pitched cry

There may be localising signs suggesting **bowel sepsis**.

- Severe vomiting and abdominal distension
- Blood in vomit or dysentery (blood in stools)

There may be a rash, different types of rashes suggests different causes:

Purpura (red or black spots on the skin) – suggests a Gram-negative septic shock (Neisseria meningitidis, E. coli, Klebsiella)

Scarlet fever-like red rash (widespread red rash on face, trunk, limbs) – suggests a Gram positive septic shock (Group A Streptococcus, Staphylococcus aureus).

There may be other **signs of Staphylococcal infection:**

- Skin sepsis: boils, pustules, abscess, infected scabies or infected skin sores, cellulitis.

- Swollen red, hot, tender, and painful joint.
- Empyema or pleural effusion

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

- If the child is unconscious or convulsing, nurse on the side, 30° head up, keep the airway clear.
- Give oxygen if there is severe respiratory distress, cyanosis, poor conscious state, or the oxygen saturation is <94%
- Measure blood pressure if you can, and assess the circulation for signs of shock (are the limbs cold, are the pulses hard to feel, is the capillary refill very prolonged?)
- **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.**
- Give antibiotics urgently: **ceftriaxone 50mg/kg *plus* flucloxacillin 50mg/kg intravenously (IV) or IM.**
- Monitor in the ICU section of the ward. Monitor with pulse oximetry to detect hypoxaemia.
- Check blood glucose. Give a bolus of glucose if the blood sugar level (BSL) is low.
- Seek assistance from an experienced doctor. If you cannot insert an IV, give IM antibiotics and refer urgently if you can.
- Look up further treatment recommendations in the PNG Standard Treatment Book for Children, and the WHO Pocketbook of Hospital Care for Children.

Tuberculosis

Tuberculosis made up 7.8% of admissions. In the 18 hospitals in 2023 there were 2574 children admitted with tuberculosis, and 223 deaths and a case fatality rate of 8.7%. (Figure 7).

Year	Cases of TB	Total admissions	TB cases as a percentage of admissions
2017	2417	23272	10.4%
2018	2175	24960	8.7%
2019	2125	29901	7.1%
2020	1819	32755	5.6%
2021	1953	29485	6.6%

2022	1840	24967	7.4%
2023	**2574**	**32,741**	**7.8%**

Table 5. Cases of TB as a proportion of all admissions 2017-2023

The case fatality rates for paediatric pulmonary TB was 5.9%, and extrapulmonary TB (8.5%), lower than in 2022 (Figure 7).

442 children had central nervous system TB, which has the highest case fatality rate (95 deaths, 21.5%).

There were 38 cases of MDR TB reported, again an underestimate as not all hospitals are testing or reporting, but it is important in the future we record this accurately. There were only 6 deaths from the 38 cases reported of MDR TB, which shows that it can be treated successfully if identified and the resources are available to treat.

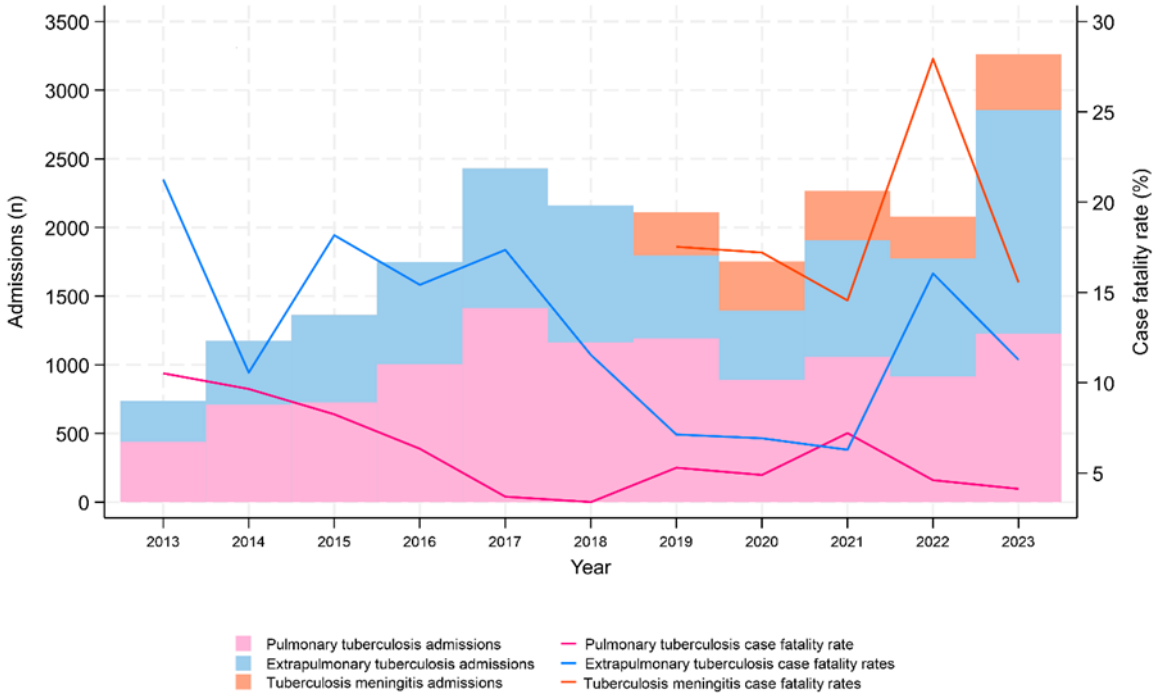

Figure 7. Pulmonary and extra-pulmonary tuberculosis admissions and case fatality rates 2013-2023

The numbers represented in this report may be 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.

Recommendations

Every effort should be made to help children complete TB therapy, and for many children this will require up to 2 months of hospitalisation to ensure adherence, adequate education of the family, and arrange 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 GeneXpert test can help diagnose TB and 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 also 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 who are seriously ill with TB 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 2022 there were 455 children with HIV admitted to the hospitals, and 76 known HIV-related deaths (case fatality rate of 16.7%).

Year	Admission of children with HIV	Deaths in children with HIV
2016	532	86
2017	545	89
2018	547	87
2019	389	48
2020	479	82
2021	384	61
2022	281	64
2023	**455**	**76**

Table 6. Cases and deaths of paediatric HIV 2016-2023

The numbers represent only cases that were admitted to hospitals 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.

In the past children living with HIV were 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.

Recommendations

- **Early infant diagnosis (EID) of HIV with PCR testing is now available (including rapid point-of-care testing using GeneXpert in some hospitals).** In Western Highlands Province EID with GeneXpert for HIV is being done successfully at birth, and this is helping identify babies who have HIV before they become sick.
- **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.**
- **Effective therapy using Dolutegravir (DGV)-based therapy is available, and other recommended drugs Lopinavir (LPV)/ritonavir, Abacavir and Lamivudine are now also available.** If these are not available in your province, contact the Chief Paediatrician.

- **All children living with HIV should be on DGV-based or LPV-based regimens. 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.
- All children living 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.**
- All children living with HIV need prophylaxis with cotrimoxazole (Septrin or Bactrim) and isoniazid, treatment of other infections and good nutrition.
- **Teach children who are living 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, endocrine problems, and cancer. 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, however together they are increasingly common. In 2022, 1616 patients with these chronic conditions were admitted to these 18 hospitals (Table 4), making up 8.5% of all admissions in children over 1 month of age, and 16.9% of all deaths.

Chronic condition	Admissions	Deaths
Asthma	261	0
Rheumatic heart disease	203	21
Congenital heart disease	596	85
Cerebral palsy / developmental disability	167	9
Epilepsy	149	3
Diabetes and endocrine disorders	148	6
Cancer	187	44
Total	1711	168 (9.8%)

Table 7. Common chronic diseases reported in 2023

* Includes paediatric admissions plus babies born with congenital heart disease.

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 must 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 and Dr Benjamin Daur, oncology paediatricians at Port Moresby General Hospital.

Child protection

Data on child physical, sexual, and other forms of abuse are gathered by the PHR. There were 168 child protection cases and 21 deaths reported in 2023. These under-estimates the true burden of child abuse, maltreatment, and neglect, as many children do not present to hospitals.

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.

There are other conditions that children present with that represent child protection issues: social issues are also a frequent root cause of malnutrition, and a proportion of children with severe malnutrition have also been subject to neglect.

In many families where a child has been abused or neglected, there will also be gender-based violence against the mother.

For resources on child Protection see: https://pngpaediatricsociety.org/treatment/, scroll down to **Child protection, maltreatment and gender-based violence.**

Vaccine preventable diseases

There were fewer cases of vaccine preventable diseases reported in 2023 than in 2022. In 2023, there were 31 cases of whooping cough, 28 cases of acute acute flaccid paralysis (AFP), 13 cases of tetanus (4 deaths). There were no cases of measles or rubella reported in 2023 (Figure 8).

Vaccination coverage in PNG is still far too low, and even without reported cases in 2023 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 do not come to get vaccines, so we have to go to communities to immunise them. Routine and outreach immunisation programs are the highest priority.

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.

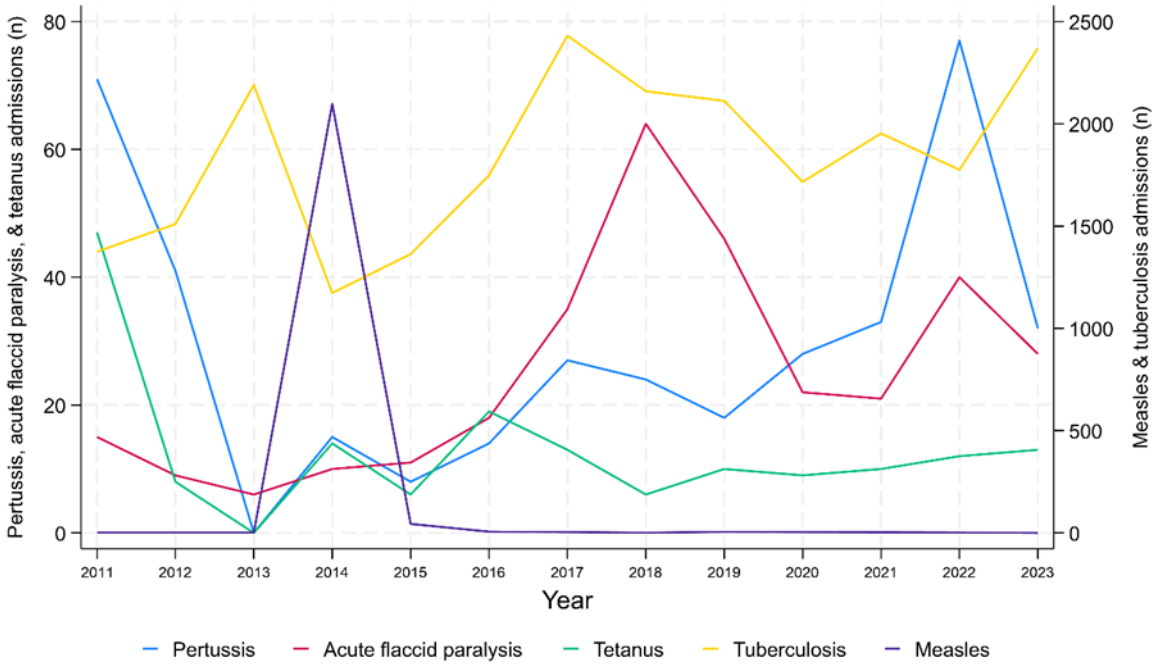

Figure 8. Cases of vaccine preventable diseases reported in 2011-2023

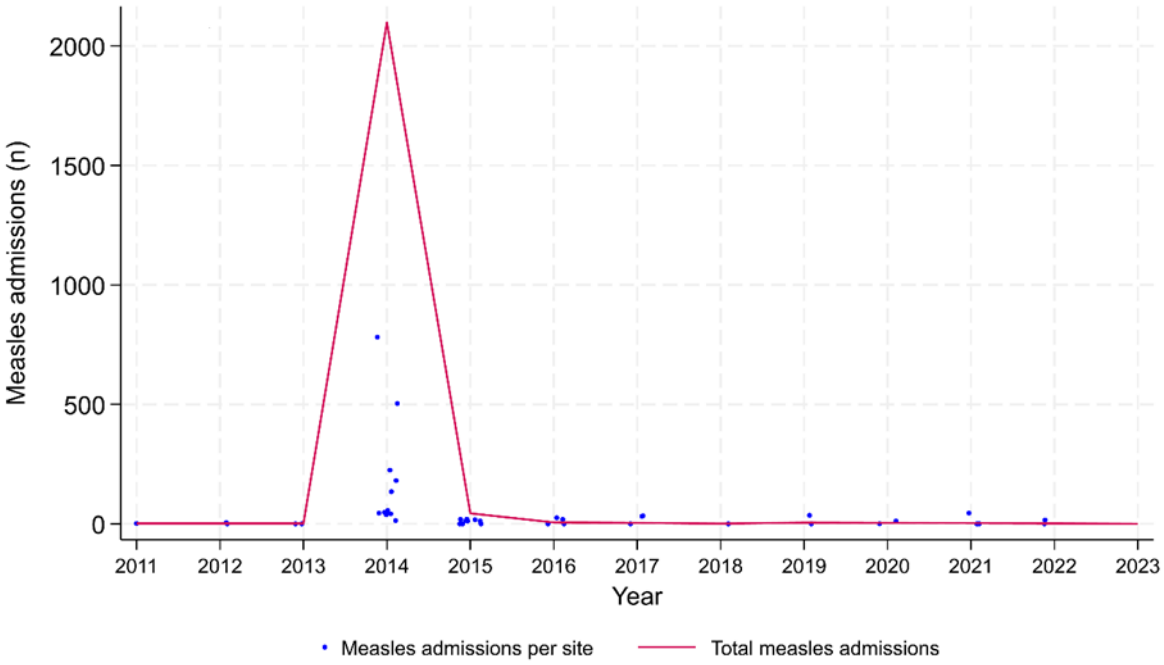

Figure 9. Measles cases 2011-2023

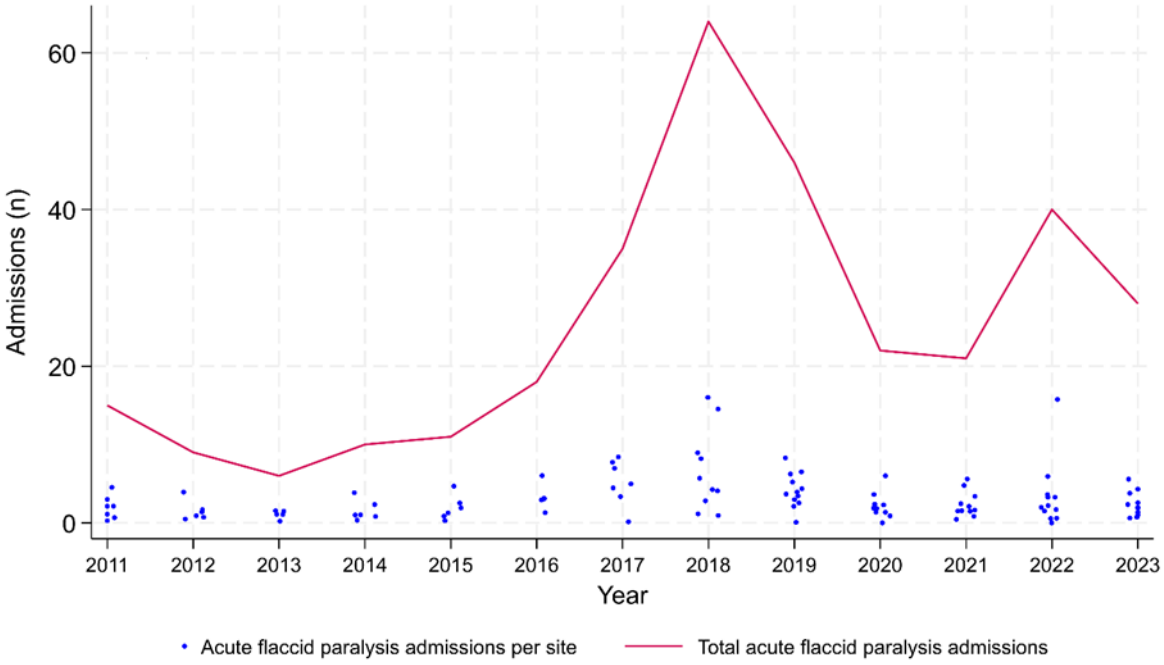

Figure 10. Acute flaccid paralysis cases 2011-2023

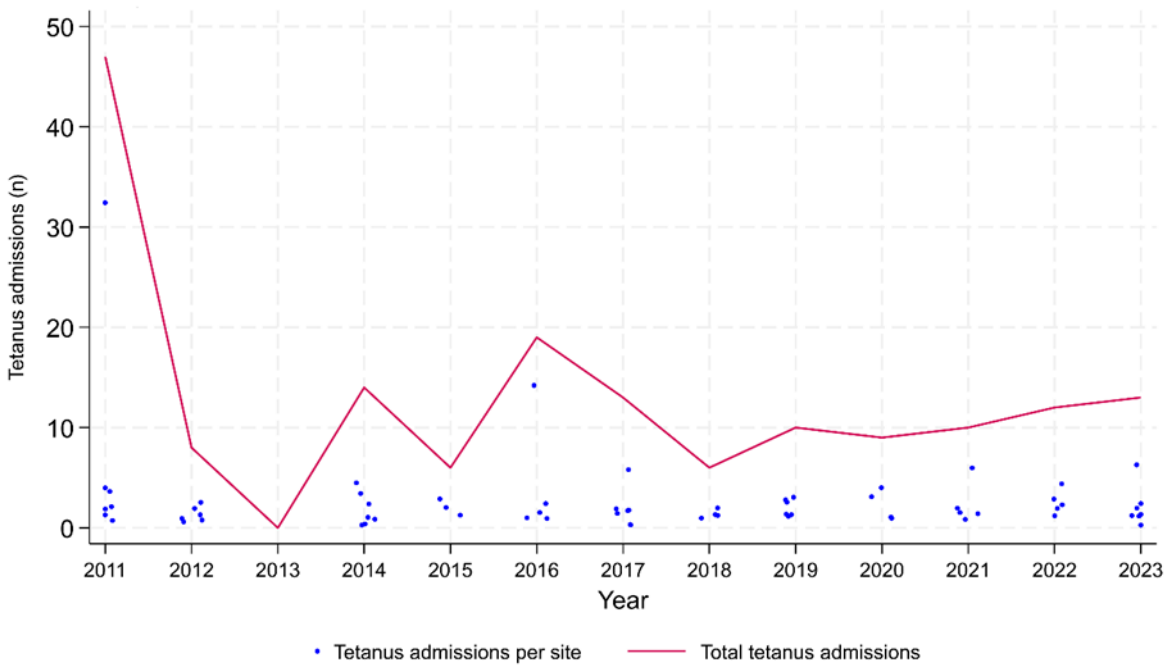

Figure 11. Tetanus cases 2011-2023

Neonatal care

Neonatal admissions made up 12,537 (38.3%) of all 32,741 paediatric admissions to the 18 hospitals in 2023.

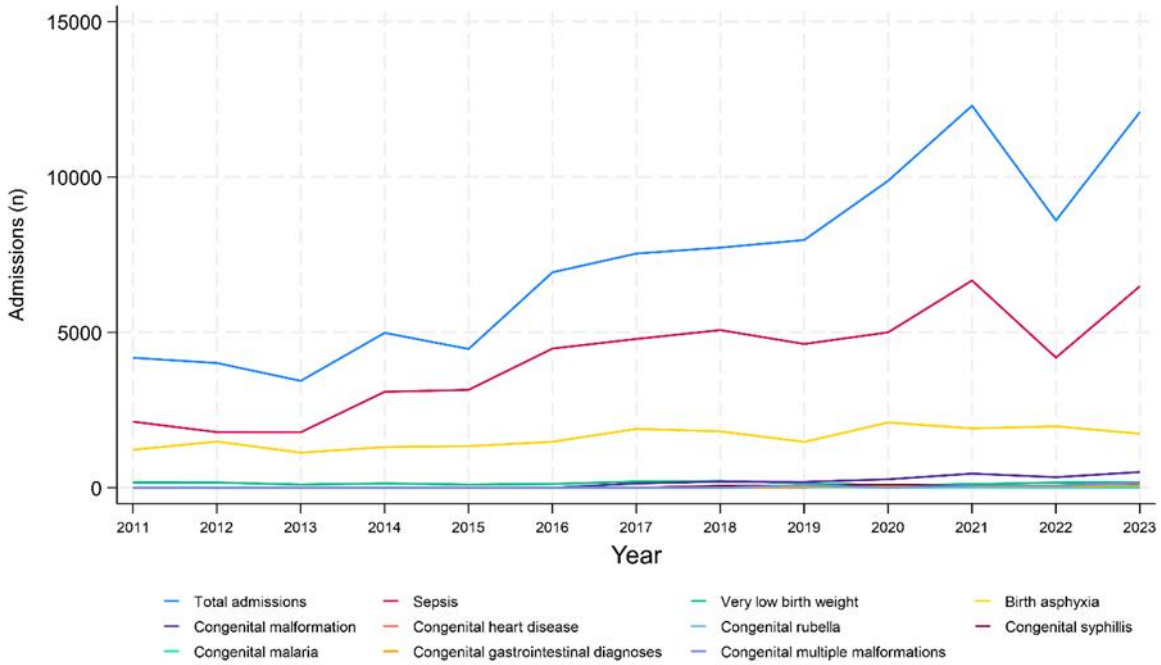

Figure 12. Common neonatal diagnoses 2011-2023

Note infection (sepsis) the most common reason for admission, but lower overall CFR (5.6%), while birth asphyxia is the second most common reason for admission, but has a much higher CFR (17.1%), and very low birth weight which is less frequent but has a high CFR (35.3%).

There were 1109 neonatal deaths reported (mortality rate 9.17): (Table 8, Figure 13).

Year	Neonates admitted	Neonatal deaths	Mortality rate
2015	4461	394	8.8
2016	6930	556	8.0
2017	7534	687	9.1
2018	7725	643	8.3
2019	7971	679	8.5
2020	10024	534	5.3
2021	12292	726	5.9
2022	8600	928	10.8
2023	12537	1160	9.25

Table 8. Neonatal admissions and deaths 2015-2023

The ongoing high neonatal mortality rate (Figure 13) in Special Care Nurseries is concerning. The major causes of neonatal deaths are infection, birth asphyxia, and very low birth weight.

There are many possible reasons for high newborn mortality: out-of-hospital deliveries, delays in accessing obstetric care, parents not bringing their newborns to be assessed until they were very unwell, overcrowding of special care nurseries, and insufficient beds and other resources to admit the number of unwell neonates.

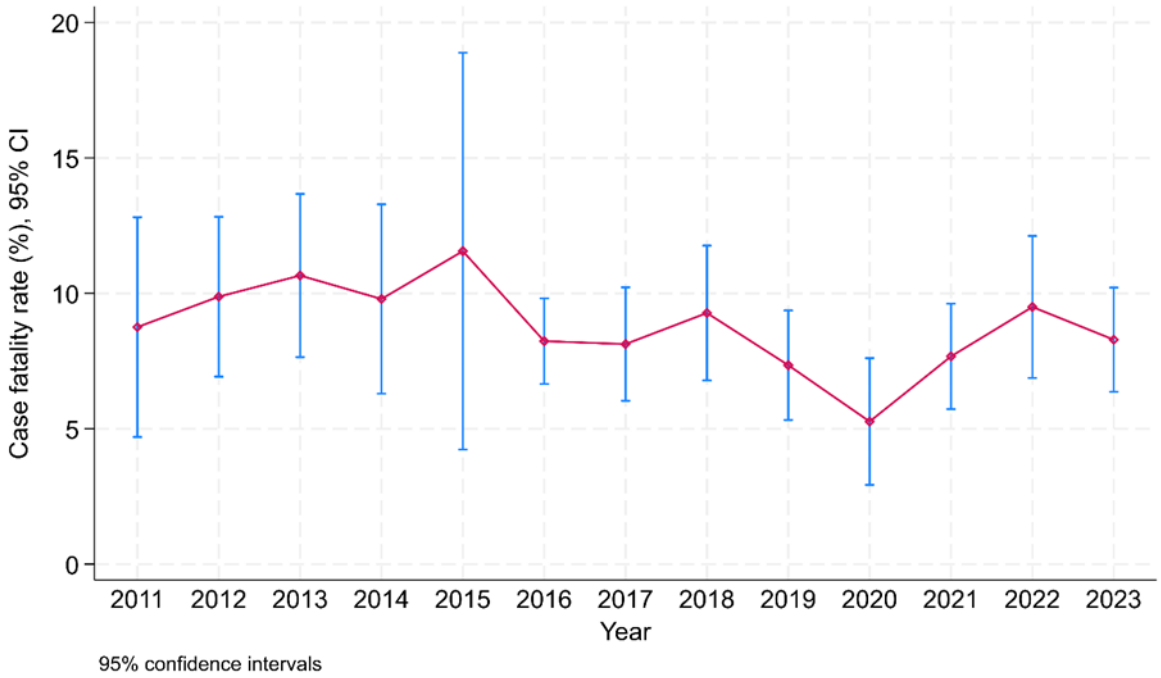

Figure 13. Overall neonatal mortality rates in Special Care Nurseries 2011-2023

Neonatal infections

6861 of all 12,537 neonatal admissions were associated with infections (54%), and there were 386 deaths (CFR 5.6%).

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.

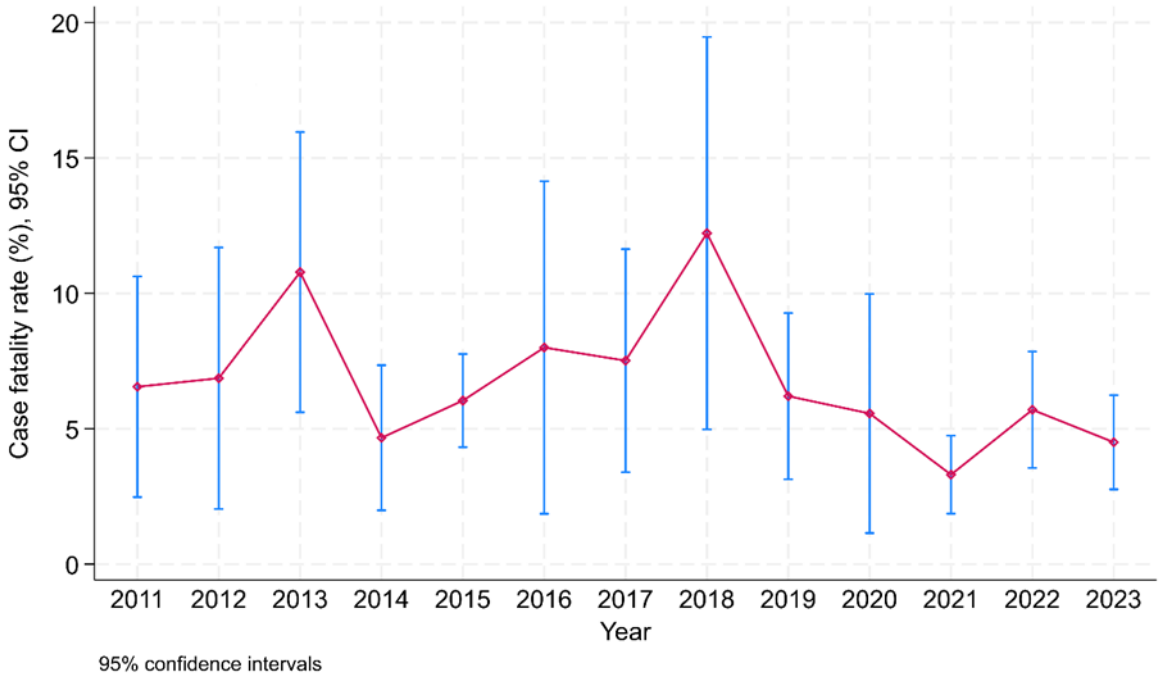

Figure 10. Neonatal infection case fatality rates in Special Care Nurseries 2011-2023

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. In 2023 there were 1822 cases reported of birth asphyxia, and 311 babies died (case fatality rate 17.1%). 28% of neonatal deaths were due to perinatal asphyxia or associated with it. The number of deaths from birth asphyxia (more than 5 per week) has increased over the last 8 years suggesting that the problem is not adequately addressed by current interventions.

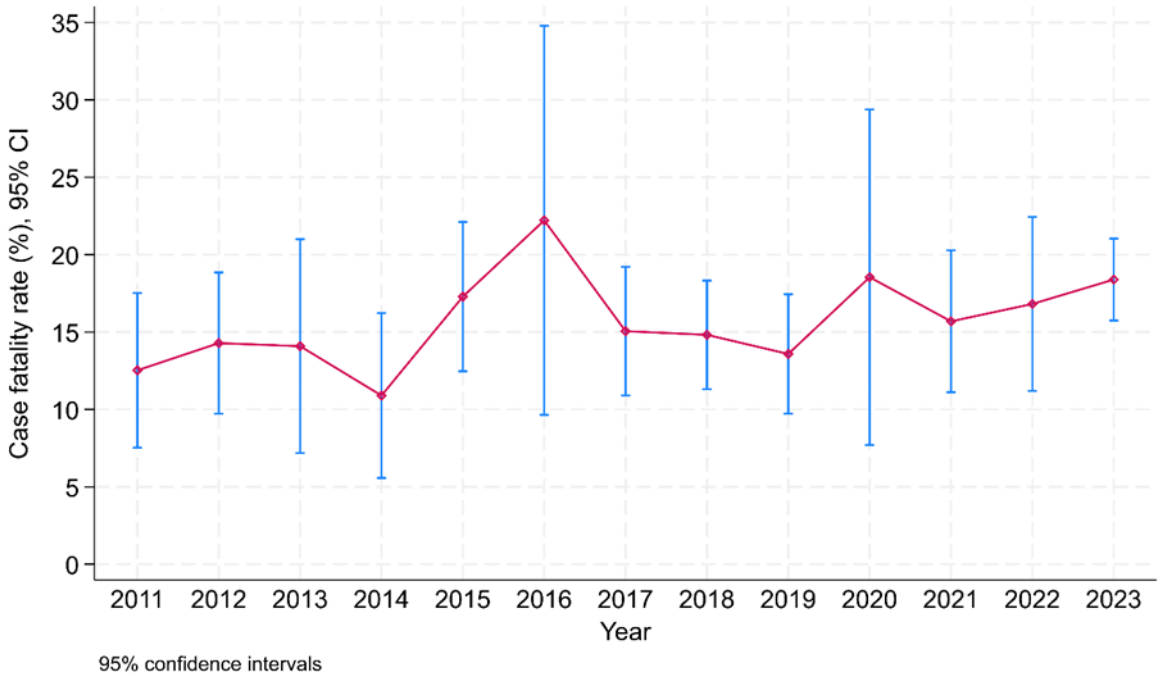

Figure 11. Case fatality rates for newborns with birth asphyxia 2011-2023

Year	Birth asphyxia cases	Birth asphyxia as a percentage of all newborn SCN admissions	Deaths caused by birth asphyxia (% of all newborn deaths)	Case fatality rate
2015	1335	29.9%	198 (50%)	14.8%
2016	1478	21.3	285 (51%)	19.2%
2017	1892	25.15	280 (41%)	14.8%
2018	1812	23.5%	245 (38.1%)	13.5%
2019	1473	18.5%	218 (32.1)	14.8%
2020	2134	21.3%	204 (38.2%)	9.5%
2021	1909	15.5%	240 (33.1%)	12.6%
2022	1973	22.9%	231 (24.9%)	11.7%
2023	**1822**	**14.5%**	**311 (26.8%)**	**17.1%**

Table 9. Birth asphyxia cases as a proportion of all newborn admissions and deaths 2015-2023

The developmental implications for many surviving children are significant: cerebral palsy, intellectual disability, blindness, and seizures are common. Even mild or moderate forms of birth asphyxia can have long-term developmental consequences.

Birth asphyxia can be reduced 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 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 527 very low birth weight admissions in the 18 hospitals. In 2023, 186, or 35% of VLBW newborns died, a concerning increase on recent years.

Year	VLBW cases	VLBW deaths	Case fatality rate
2015	267	100	37.5%
2016	356	120	33.7%
2017	491	198	40.3%
2018	536	217	40.5%
2019	419	140	33.4%
2020	262	79	30.2%
2021	459	113	24.6%
2022	464	167	36.0%
2023	**527**	**186**	**35.3%**

Table 10. Very low birth weight cases and deaths 2015-2023

These surviving babies are at high risk of complications and need close follow-up and care in the first year of life.

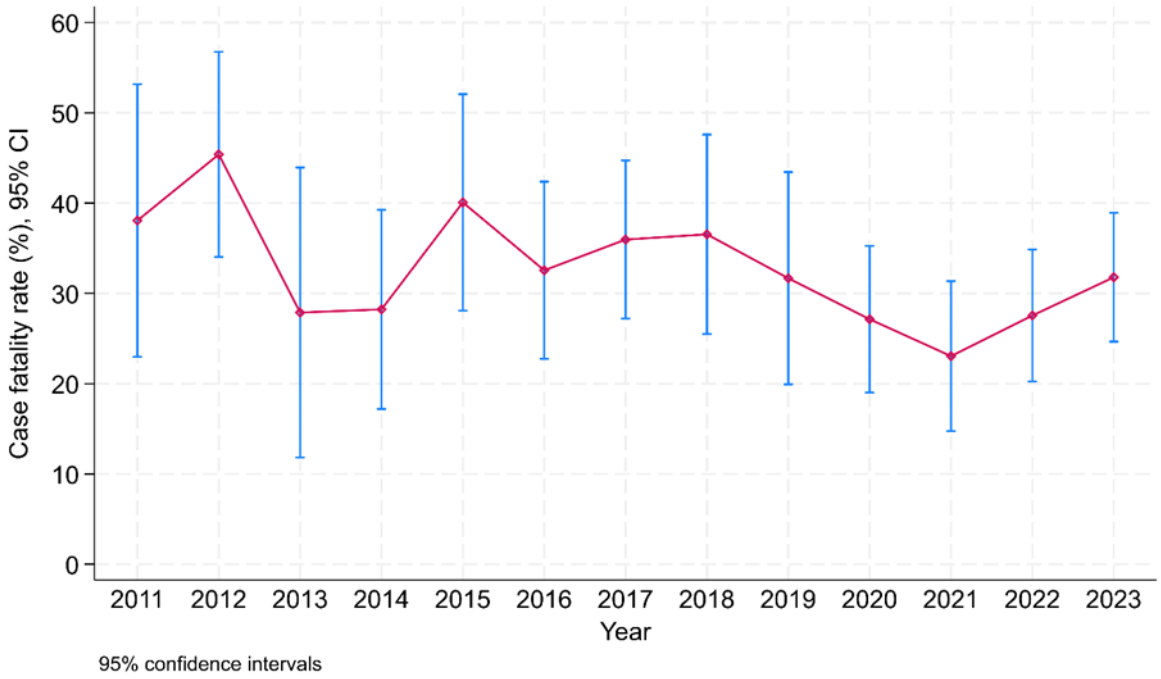

Figure 12. Case fatality rates for very low birthweight newborns 2011-2023

Congenital malformations

516 newborns were reported to have congenital malformations, of 126 died (case fatality rate 24.4%). Cases included 78 newborns with congenital heart disease, 87 with congenital gastrointestinal anomalies (including anorectal malformations / imperforate anus, diaphragmatic hernia, and gastroschisis), 6 newborns were reported with microcephaly, and 159 newborns with multiple congenital anomalies.

Congenital or intrauterine infections

There were 140 cases of congenital syphilis (7 deaths) and 21 cases of congenital malaria (4 deaths). 2 cases of congenital rubella were identified in 2023.

Recommendations for improving neonatal care

Provision of early essential newborn care and keeping newborns with their mothers has 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 the first minute of life 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 are not separated from 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 pulse oximetry is recommended. In very low birth weight babies, keep SpO_2 90-95%, but do not give oxygen to make the SpO_2 higher than 95%, as it can cause eye damage (retinopathy of prematurity: ROP).
- 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.
- Organisation of the SCN 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.
- Birthing facilities, nurseries, and post-natal wards can be involved in educating mothers on warning signs for newborns e.g. poor feeding, fits or twitching, yellow discoloration, fever, too sleepy, wet cord, etc. Such education on warning signs can help improve health seeking for sepsis, where it is not uncommon for symptoms to have been present for a couple of days.

- 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 2023 has highlighted sustained progress in several areas, but also some signals where the outcomes in 2023 show where there can be improvements.

The Paediatric Society asks that all health workers and hospital administrators play their part to address ongoing problems, adopt the recommendations in this report, and see these results improve in the coming years.

Appendix table 1. Pneumonia (all types of severity)

Hospitals	Pneumonia admissions	Pneumonia deaths	Pneumonia CFR
Alotau	623	10	1.61
Angau	467	45	9.64
Buka			
Chuave			
Daru			
Gembogl			
Gerehu	223	6	2.69
Goroka	415	23	5.54
Kainantu			
Gumine			
Kavieng	50	4	8.00
Kimbe	131	6	4.58
Kerema			
Kerowagi			
Koge			
Kompiam			
Kundiawa	276	12	4.35
Kudjip			
Mabisanda			
Lorengau	67	3	4.48
Mendi	556	8	1.44
Mingendi			
Modilon	298	6	2.01
Mt Hagen	1157	0	0.00
Nonga	178	9	5.06
Popendetta	55	1	1.82
Port Moresby	569	37	6.50
Rumginae	60	1	1.67
Tari	411	15	3.65
Vanimo	58	3	5.17
Wabag			
Wewak	86	9	10.47
Yampu			
TOTAL	5680	200	3.52

Appendix table 2. Severe pneumonia

2020	Severe pneumonia admissions	Severe pneumonia deaths	Severe pneumonia CFR
Alotau	38	8	21.05
Angau	467	43	9.21
Buka			
Chuave			
Daru			
Gembogl			
Gerehu	96	5	5.21
Goroka	273	21	7.69
Kainantu			
Gumine			
Kavieng	19	4	21.05
Kimbe	25	4	16.00
Kerema			
Kerowagi			
Koge			
Kompiam			
Kundiawa	276	12	4.35
Kudjip			
Mabisanda			
Lorengau	18	3	16.67
Mendi			
Mingendi			
Modilon	75	5	6.67
Mt Hagen	678	15	2.21
Nonga	72	9	12.50
Popendetta	33	1	3.03
Port Moresby			
Rumginae	22	1	4.55
Tari	257	15	5.84
Vanimo	58	2	3.45
Wabag			
Wewak	86	9	10.47
Yampu			
TOTAL	2493	157	6.30

Appendix table 3. Diarrhoea

Hospital	Diarrhoea admissions	Diarrhoea deaths	Diarrhoea CFR
Alotau	77	1	1.30
Angau	334	12	3.59
Buka			
Chuave			
Daru			
Gembogl			
Gerehu	174	4	2.30
Goroka	200	4	2.00
Kainantu			
Gumine			
Kavieng	29	0	0.00
Kimbe	84	5	5.95
Kerema			
Kerowagi			
Koge			
Kompiam			
Kundiawa	125	4	3.20
Kudjip			
Mabisanda			
Lorengau	27	3	11.11
Mendi	162	7	4.32
Mingendi			
Modilon	161	6	3.73
Mt Hagen	393	2	0.51
Nonga	54	3	5.56
Popendetta	16	0	0.00
Port Moresby	352	14	3.98
Rumginae	23	2	8.70
Tari	151	15	9.93
Vanimo	16	0	0.00
Wabag			
Wewak	66	2	3.03
Yampu			
TOTAL	2444	84	3.44

Appendix table 4. Malaria

Hospitals	Malaria admissions	Malaria deaths	Malaria CFR
Alotau	95	2	2.11
Angau	225	9	4.00
Buka			
Chuave			
Daru			
Gembogl			
Gerehu	15	1	6.67
Goroka	24	0	0.00
Kainantu			
Gumine			
Kavieng	44	2	4.55
Kimbe	132	7	5.30
Kerema			
Kerowagi			
Koge			
Kompiam			
Kundiawa	4	0	0.00
Kudjip			
Mabisanda			
Lorengau	64	2	3.13
Mendi	2	0	0
Mingendi			
Modilon	411	9	2.19
Mt Hagen	15	0	0.00
Nonga	50	4	8.00
Popendetta	27	1	3.70
Port Moresby	41	3	7.32
Rumginae	18	1	5.56
Tari	1	0	0.00
Vanimo	34	6	17.65
Wabag			
Wewak	81	4	4.94
Yampu			
TOTAL	1283	51	3.98

Appendix table 5. Severe malnutrition

Hospitals	Severe malnutrition admission	Severe malnutrition deaths	Severe malnutrition CFR
Alotau	134	17	12.69
Angau	504	60	11.90
Buka			
Chuave			
Daru			
Gembogl			
Gerehu	245	8	3.27
Goroka	213	20	9.39
Kainantu			
Gumine			
Kavieng	24	2	8.33
Kimbe	163	9	5.52
Kerema			
Kerowagi			
Koge			
Kompiam			
Kundiawa	120	13	10.83
Kudjip			
Mabisanda			
Lorengau	46	6	13.04
Mendi	118	8	6.78
Mingendi			
Modilon	337	25	7.42
Mt Hagen	390	32	8.21
Nonga	89	9	10.11
Popendetta	23	0	0.00
Port Moresby	203	20	9.85
Rumginae	23	2	8.70
Tari	98	18	18.37
Vanimo	62	9	14.52
Wabag			
Wewak	184	23	12.50
Yampu			
TOTAL	2976	281	9.44

Appendix table 6. Meningitis

Hospitals	Meningitis admissions	Meningitis deaths	Meningitis CFR
Alotau	21	2	9.52
Angau	116	28	24.14
Buka			
Chuave			
Daru			
Gembogl			
Gerehu	37	0	0.00
Goroka	121	13	10.74
Kainantu			
Gumine			
Kavieng	11	4	36.36
Kimbe	33	7	21.21
Kerema			
Kerowagi			
Koge			
Kompiam			
Kundiawa	58	5	8.62
Kudjip			
Mabisanda			
Lorengau	3	1	33.33
Mendi	24	3	12.50
Mingendi			
Modilon	80	10	12.50
Mt Hagen	181	17	9.39
Nonga	28	10	35.71
Popendetta	15	2	13.33
Port Moresby	261	11	4.21
Rumginae	7	0	0.00
Tari	62	10	16.13
Vanimo	22	9	40.91
Wabag			
Wewak	27	2	7.41
Yampu			
TOTAL	1107	134	12.10

Appendix table 7. Tuberculosis

Hospitals	TB admissions	TB deaths	TB CFR
Alotau	112	11	9.82
Angau	459	54	11.76
Buka			
Chuave			
Daru			
Gembogl			
Gerehu	59	2	3.39
Goroka	148	15	10.14
Kainantu			
Gumine			
Kavieng	14	1	7.14
Kimbe	210	7	3.33
Kerema			
Kerowagi			
Koge			
Kompiam			
Kundiawa	150	11	7.33
Kudjip			
Mabisanda			
Lorengau	30	2	6.67
Mendi	204	20	9.80
Mingendi			
Modilon	205	15	7.32
Mt Hagen	117	14	11.97
Nonga	52	5	9.62
Popendetta	44	0	0.00
Port Moresby	282	21	7.45
Rumginae	77	0	0.00
Tari	131	10	7.63
Vanimo	26	7	26.92
Wabag			
Wewak	254	28	11.02
Yampu			
TOTAL	2574	223	8.66

Appendix table 8. HIV

Hospitals	HIV admissions	HIV deaths	HIV CFR
Alotau	14	1	7.14
Angau	49	12	24.49
Buka			
Chuave			
Daru			
Gembogl			
Gerehu	1	0	0.00
Goroka	55	8	14.55
Kainantu			
Gumine			
Kavieng	4	2	50.00
Kimbe	5	1	20.00
Kerema			
Kerowagi			
Koge			
Kompiam			
Kundiawa	26	4	15.38
Kudjip			
Mabisanda			
Lorengau	3	1	33.33
Mendi	11	0	0
Mingendi			
Modilon	21	2	9.52
Mt Hagen	47	2	4.26
Nonga	16	1	6.25
Popendetta	2	0	0.00
Port Moresby	70	26	37.14
Rumginae	2	0	0.00
Tari	0	0	0.00
Vanimo	105	11	10.48
Wabag			
Wewak	24	5	20.83
Yampu			
TOTAL	455	76	16.70

Appendix table 9. Total neonatal admissions

Hospitals	Neonatal admissions	Neonatal deaths	Neonatal CFR
Alotau	967	38	3.93
Angau *	1971	144	7.31
Buka			
Chuave			
Daru			
Gembogl			
Gerehu			
Goroka	558	98	17.56
Kainantu			
Gumine			
Kavieng	365	23	6.30
Kimbe	551	45	8.17
Kerema			
Kerowagi			
Koge			
Kompiam			
Kundiawa	469	38	8.10
Kudjip			
Mabisanda			
Lorengau	242	16	6.61
Mendi	449	51	11.36
Mingendi			
Modilon	837	64	7.65
Mt Hagen	1839	126	6.85
Nonga	369	45	12.20
Popendetta	63	2	3.17
Port Moresby	2575	378	14.68
Rumginae			
Tari	403	34	8.44
Vanimo	215	15	6.98
Wabag			
Wewak	664	43	6.48
Yampu			
TOTAL	12537	1160	9.25

* Initially Angau reported only 6 months of data without neonatal data, which the remainder of this report reflects, this table shows the entire years data for Angau (table revised June 13, 2023).

Appendix table 10. Neonatal infections

Hospitals	Neonatal sepsis admissions	Neonatal sepsis deaths	Neonatal sepsis CFR
Alotau	476	17	3.57
Angau	1691	104	6.15
Buka			
Chuave			
Daru			
Gembogl			
Gerehu			
Goroka	340	62	18.24
Kainantu			
Gumine			
Kavieng	250	9	3.60
Kimbe	343	12	3.50
Kerema			
Kerowagi			
Koge			
Kompiam			
Kundiawa	139	5	3.60
Kudjip			
Mabisanda			
Lorengau	127	5	3.94
Mendi	379	37	9.76
Mingendi			
Modilon	536	20	3.73
Mt Hagen	882	27	3.06
Nonga	284	22	7.75
Popendetta	30	0	0.00
Port Moresby	510	26	5.10
Rumginae			
Tari	330	22	6.67
Vanimo	114	5	4.39
Wabag			
Wewak	430	13	3.02
Yampu			
TOTAL	6861	386	5.63

Appendix Table 11. Very low birth weight (1000-1499g)

Hospitals	Very low birth weight admissions	Very low birth weight deaths	Very low birth weight CFR
Alotau	22	7	31.82
Angau	50	26	52.00
Buka			
Chuave			
Daru			
Gembogl			
Gerehu			
Goroka	50	19	38.00
Kainantu			
Gumine			
Kavieng	15	3	20.00
Kimbe	25	7	28.00
Kerema			
Kerowagi			
Koge			
Kompiam			
Kundiawa	12	6	50.00
Kudjip			
Mabisanda			
Lorengau	5	2	40.00
Mendi	25	8	32.00
Mingendi			
Modilon	49	13	26.53
Mt Hagen	48	28	58.33
Nonga	21	5	23.81
Popendetta	1	0	0.00
Port Moresby	150	50	33.33
Rumginae			
Tari	10	3	30.00
Vanimo	4	1	25.00
Wabag			
Wewak	41	7	17.07
Yampu			
TOTAL	527	186	35.29

Appendix table 13. Perinatal asphyxia

Hospitals	Birth asphyxia admission	Birth asphyxia death	Birth asphyxia CFR
Alotau	149	11	7.38
Angau	344	64	18.60
Buka			
Chuave			
Daru			
Gembogl			
Gerehu			
Goroka	172	28	16.28
Kainantu			
Gumine			
Kavieng	53	6	11.32
Kimbe	82	10	12.20
Kerema			
Kerowagi			
Koge			
Kompiam			
Kundiawa	67	9	13.43
Kudjip			
Mabisanda			
Lorengau	23	5	21.74
Mendi	83	19	22.89
Mingendi			
Modilon	143	24	16.78
Mt Hagen	158	35	22.15
Nonga	78	18	23.08
Popendetta	2		0.00
Port Moresby	240	45	18.75
Rumginae			
Tari	74	14	18.92
Vanimo	24	6	25.00
Wabag			
Wewak	130	17	13.08
Yampu			
TOTAL	1822	311	17.07

Appendix table 14. Paediatric cancer

Hospitals	Cancer admission	Cancer death	Cancer CFR
Alotau	2	1	50.00
Angau	9	3	33.33
Buka			
Chuave			
Daru			
Gembogl			
Gerehu	2	0	0.00
Goroka	23	3	13.04
Kainantu			
Gumine			
Kavieng	5	3	60.00
Kimbe	12	2	16.67
Kerema			
Kerowagi			
Koge			
Kompiam			
Kundiawa	3	1	33.33
Kudjip			
Mabisanda			
Lorengau	0	0	0.00
Mendi	2	1	50.0
Mingendi			
Modilon	4	1	25.00
Mt Hagen	15	2	13.33
Nonga	17	1	5.88
Popendetta	0	0	0.00
Port Moresby	65	21	32.31
Rumginae	0	0	0.00
Tari	4	1	25.00
Vanimo	3	0	0.00
Wabag			
Wewak	21	4	19.05
Yampu			
TOTAL	187	44	23.53

Appendix table 15. Acute rheumatic fever / Rheumatic heart disease

Hospitals	Rheumatic heart disease admissions	Rheumatic heart disease deaths	Rheumatic heart disease CFR
Alotau	10	1	10.00
Angau	4	1	25.00
Buka			
Chuave			
Daru			
Gembogl			
Gerehu	2	0	0.00
Goroka	7	1	14.29
Kainantu			
Gumine			
Kavieng	5	0	0.00
Kimbe	5	0	0.00
Kerema			
Kerowagi			
Koge			
Kompiam			
Kundiawa	9	0	0.00
Kudjip			
Mabisanda			
Lorengau	2	1	50.00
Mendi	12	2	16.67
Mingendi			
Modilon	7	0	0.00
Mt Hagen	12	0	0.00
Nonga	3	0	0.00
Popendetta	1	0	0.00
Port Moresby	110	13	11.82
Rumginae	0	0	0.00
Tari	3	0	0.00
Vanimo	4	0	0.00
Wabag			
Wewak	7	2	28.57
Yampu			
TOTAL	203	21	10.34

Appendix Table 16. Congenital heart disease (admissions outside the newborn period)

Hospitals	Congenital heart disease admissions	Congenital heart disease deaths	Congenital heart disease CFR
Alotau	42	4	9.52
Angau	37	6	16.22
Buka			
Chuave			
Daru			
Gembogl			
Gerehu	11	0	0.00
Goroka	135	13	9.63
Kainantu			
Gumine			
Kavieng	13	1	7.69
Kimbe	24	4	16.67
Kerema			
Kerowagi			
Koge			
Kompiam			
Kundiawa	40	6	15.00
Kudjip			
Mabisanda			
Lorengau	12	3	25.00
Mendi	73	6	8.22
Mingendi			
Modilon	36	3	8.33
Mt Hagen	51	2	3.92
Nonga	13	3	23.08
Popendetta	3	1	33.33
Port Moresby			
Rumginae	1	0	0.00
Tari	0	0	0.00
Vanimo	13	2	15.38
Wabag			
Wewak	14	3	21.43
Yampu			
TOTAL	518	57	11.00

Appendix table 17. Child protection admissions (physical abuse, neglect, or sexual abuse)

Hospitals	Child protection admission	Child protection death	Child protection CFR
Alotau	17	1	5.88
Angau	8	1	12.50
Buka			
Chuave			
Daru			
Gembogl			
Gerehu	0	0	
Goroka	5	0	0.00
Kainantu			
Gumine			
Kavieng	9	1	11.11
Kimbe	0	0	0.00
Kerema			
Kerowagi			
Koge			
Kompiam			
Kundiawa	14	3	21.43
Kudjip			
Mabisanda			
Lorengau	3	1	33.33
Mendi	0	0	0
Mingendi			
Modilon	64	9	14.06
Mt Hagen	4	0	0.00
Nonga	33	5	15.15
Popendetta	0	0	0.00
Port Moresby			
Rumginae	0	0	0.00
Tari			
Vanimo	3	0	0.00
Wabag			
Wewak	8	0	0.00
Yampu			
TOTAL	168	21	12.50

Paediatric monitoring and response chart

Name

UR Number | Age: | Weight: | Length / height

Diagnoses: | Frequency of observations:

Date																										
Time																										
	Temp °C	≥ 39																								>39
		38-38.9																								38-38.9
		36-37.9																								36-37.9
		<36																								<36
AIRWAY / BREATHING	Respiratory Rate (bpm)	≥ 80																								≥ 80
		70																								70
		60																								60
		50																								50
		40																								40
		30																								30
		20																								20
		10																								10
		0																								0
	SpO_2 (%)	95-100																								95-100
		90-94																								90-95
		85-89																								80-90
		80-84																								
		70-79																								70-80
		<70																								<70
	Oxygen	L/min																								L/min
	Respirat distress	Severe																								Severe
		Mod.																								Mod.
		Mild																								Mild
		Normal																								Normal
CIRCULATION	Heart rate (bpm)	≥ 200																								≥ 200
		190																								190
		180																								180
		170																								170
		160																								160
		150																								150
		140																								140
		130																								130
		120																								120
		100																								100
		90																								90
		80																								80
		70																								70
		60																								60
		<60																								<60
	Cap refill	≥ 3 secs																								≥ 3 secs
		< 3 secs																								< 3 secs
	BP	Systolic																								Systolic
		Diastolic																								Diastolic
		Mean																								Mean
DISABILITY	AVPU response to stimuli	Alert																								Alert
		Verbal																								Verbal
		Pain																								Pain
		None																								None
	Pain score (/10)																									Pain
Blood sugar level																										
Treatments given Actions taken																										

References

1. John J, Bavdekar A, Rongsen-Chandola T, et al. Burden of Typhoid and Paratyphoid Fever in India. N Engl J Med 2023;388:1491-500.