PNG Department of Health

Child Morbidity and Mortality

Annual Report 2013

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

2013 Annual Report on Child Morbidity and Mortality

Summary

- This report covers data on child admissions and outcomes in 2013 from 10 provincial hospitals
- In 2013 there were 26,571 admissions and 1957 deaths recorded (mortality rate 7.4%). There were 1431 post-neonatal deaths and 526 neonatal deaths.
- Pneumonia was the most common reason for admission (30% of admissions)
- Neonatal conditions were the second most common cause for admission (17% of admissions).
- Although malnutrition is often not the primary reason children present, severe malnutrition was present in 15% of admissions, making it the third most common problem seen in hospitals. Malnutrition either directly caused or contributed to 33% of all deaths.
- Diarrhoeal disease (12% of admissions) and malaria (7% of admissions) were the 4th and 5th most common illness.
- In the post-neonatal period, pneumonia (29% of deaths) and meningitis (23% of deaths) were the leading causes of death.
- Neonatal deaths accounted for 27% of all deaths. The leading causes of death in neonates were: birth asphyxia (45% of neonatal deaths), neonatal infections (39% of neonatal deaths) and very low birth weight (22% of neonatal deaths).
- In the post-neonatal period, children presenting with HIV (17.6% case fatality rate), malnutrition (16.2% case fatality rate), meningitis (16.6% case fatality rate), tuberculosis (10.9% case fatality rate), and severe pneumonia (9.5% case fatality rate) had the highest risks of death
- Among neonates case fatality rates were very low birth weight (40.8%), birth asphyxia (16.3%) and neonatal sepsis (8.1%).

Summary of major recommendations

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

1. Addressing unnecessary child deaths will depend to a large extent on reducing deaths from pneumonia and neonatal conditions, which combined made up 47% of admissions and 48% of deaths in 2013.
2. Reducing deaths from severe pneumonia require a comprehensive approach, including prevention with vaccines, improving breast-feeding and nutrition (including vitamin A and zinc), and reducing indoor air pollution. Reducing pneumonia deaths also requires improved access to early diagnosis and treatment: with better education of mothers on the signs of pneumonia, timely management in health centres or aid posts, and improved hospital care: triage for identification of the most seriously ill children, giving appropriate antibiotics, close monitoring for respiratory distress and with pulse oximetry, and oxygen therapy.

3. Reducing neonatal deaths requires access to improved access to skilled birth attendants, access to obstetric care and early essential newborn care. Essential newborn care includes *immediate and thorough drying*, which stimulates breathing and prevents hypothermia. *Sustained skin-to-skin contact* prevents hypothermia, reduces infection, calms the baby and facilitates successful intake of colostrum and sustained breastfeeding. *Delaying cord clamping until cord pulsations stop* - typically around one to three minutes from birth - reduces the risk of anaemia and in preterm infants and other complications. *Exclusive breastfeeding and elimination of formula* can prevent a large proportion of neonatal sepsis deaths. *Avoiding 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, the application of 4% chlorhexidine to the umbilical cord should be done for all newborns.
4. Achieving minimal standard for care of seriously ill neonates in health facilities is also essential to addressing neonatal deaths. Improvements in care for very low birth weight babies, neonatal sepsis and birth asphyxia are needed. This includes the increased use of Kangaroo Mother Care (skin-to-skin contact), prevention and treatment of hypoxaemia, apnoea, hypoglycaemia, improved feeding with breast milk, more rational use of antibiotics, more careful use of IV fluids, audit and ward organisation. Models of neonatal care should be introduced in all hospitals.
5. Improving obstetric care is necessary to reduce deaths from birth asphyxia. Improved use of partographs during labour is needed. Family planning would reduce many unwanted pregnancies.
6. Malnutrition also needs greater emphasis. Prevention of malnutrition at the community level is the best way to avoid children dying from malnutrition. However identification and timely treatment of children with severe malnutrition is also essential and often poorly done in hospitals. Children with severe malnutrition have a very high risk of death. They 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. The main problems in the management of malnutrition are inadequate feeding (starting feeds to late, not enough milk feeds and not frequent enough feeds).
7. Children with meningitis have a high risk of death, and survivors are at risk of disability. Meningitis deaths can be prevented by more widespread use of the Hib vaccine (contained within the Pentavalent vaccine given at 1, 2 and 3 months), and by use of the pneumococcal conjugate vaccine (PCV) starting in 2014. Children presenting with meningitis need to be recognised and treated early, and monitored closely in a high dependency area of the ward. Resistance to chloramphenicol among the common causes of meningitis means that third-generation cephalosporins (such as ceftriaxone or cefotaxime) are the only effective antibiotic to treat meningitis.
8. This year the PHR program has gathered more data on tuberculosis, which causes 14% of child deaths. Extra-pulmonary tuberculosis makes up over 40% of children diagnosed with TB, and that children with EPTB have a higher

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

9. There are very major human resource gaps in neonatal and child health at all levels of the health service. Addressing these requires increasing the number and quality of community, health workers, nurses and post-basic child health nurses. This will require ensuring that the child health content of these courses is in line with national strategies, such as IMCI, Hospital Care for Children, Infant and Young Child Feeding, and EPI training. Increased investment is also needed, especially to increase the number of general nurses, CHWs and post-graduate paediatric nurses.
10. The National Child Health Plan outlines a plan for improving child health until 2020. The Child Health Advisory Committee recommends that everyone involved in health care for children be familiar with this, and that Provincial and District Health officials use it to formulate their Annual Activity Plans.

2013 Annual Report on Child Morbidity and Mortality

Introduction

The Child Health Advisory Committee of the National Department of Health releases the fourth Annual Report on Child Morbidity and Mortality in Papua New Guinea. The Committee believes the data and recommendations contained in this report should be read by all health workers and health administrators. It is only by critically examining health outcomes that we can improve our services. The data are current, covering all of 2013, with some comparisons throughout to data collected in 2010-2012. The recommendations cover clinical and public health issues that if taken on board by all, would result in many children's lives being saved in the coming years.

Paediatric Hospital Reporting System (PHR)

The Paediatric Hospital Reporting System enables hospitals to record admissions, calculate mortality rates and monitor trends in diseases burdens and outcomes over time. When the data are compiled from all hospitals, this can focus on disease or geographical 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.

In each of 2010-12, 10-11 hospitals participated, providing data for the entire 12 months. However these represented some different hospitals (see Table 1). In 2012 10 hospitals contributed data.

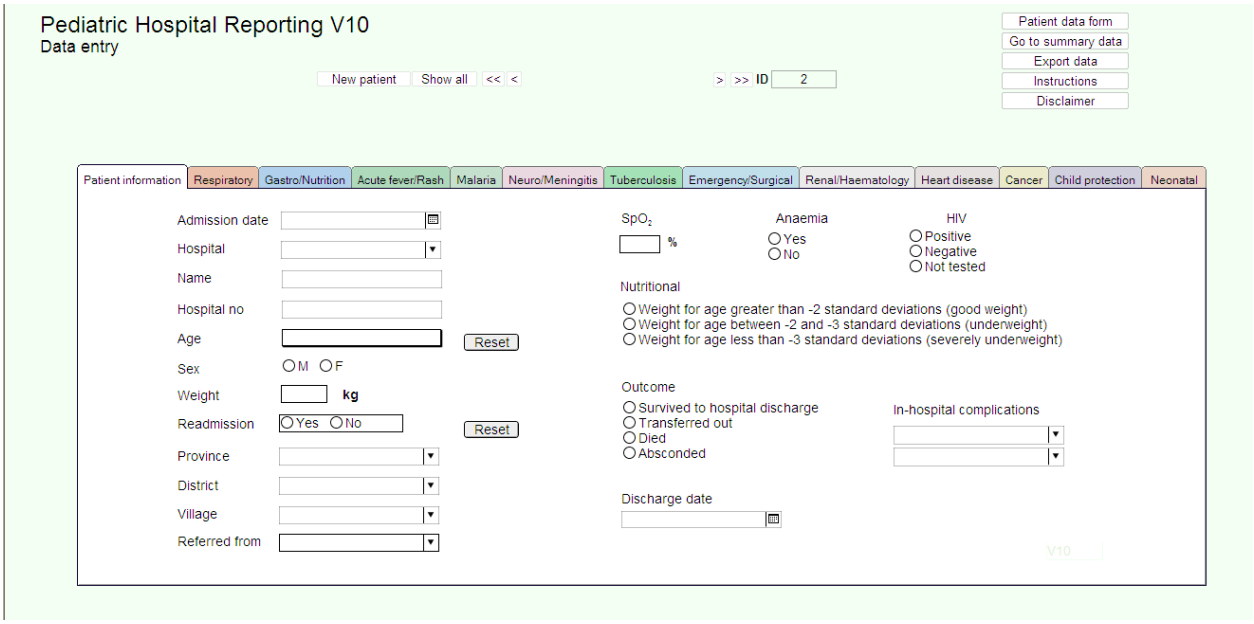
Case fatality rates varied up to twofold: from 5.2% in Goroka Hospital to 13% in Angau and 10.8% in Modilon Hospital. Seven hospitals reported data for 2010 to 2012, and case fatality rates between these two years were consistent in most hospitals.

Differences in case fatality rates reflect many things: these include case mix, severity of illness at the time of presentation, human and other resources available to manage seriously ill children, and disease outbreaks.

Table 1 summarises the data for the 8 most common causes of hospital admission in children and case fatality rates, outside the neonatal period. A comparison is made with 2010-2012 data, but it must be realised that the hospitals contributing data were not all the same in the 4 years. However there was remarkable consistency in the case fatality rates, suggesting the data are robust.

The Appendices contain summaries of data for each major diagnostic group at each hospital.

In the last three years there have been 78,596 admissions reported through the PHR system, and 5808 deaths (case fatality rate 7.4%). This has been consistent over the 4 years of PHR data reporting.



The Paediatric Hospital Reporting program

Diagnoses	Admissions	Deaths	CFR	Admissions	Deaths	CFR
	2010-2012			2013		
All admissions	**52,025**	**3851**	**7.4**	**26571**	**1957**	**7.4**
Pneumonia	14292	731	**5.1**	7893	412	**5.2**
Neonatal conditions	9788	1103	**11.3**	4517	526	**11.6**
Diarrhoea	5374	159	**3.0**	3072	135	**4.4**
Malaria	4851	180	**3.7**	1813	87	**4.8**
Severe malnutrition	4873	1048	**21.5**	4092	653	**16.2**
Tuberculosis	3399	402	**11.8**	2455	268	**10.9**
Meningitis	3174	601	**18.9**	1962	326	**16.6**
HIV	719	107	**14.9**	575	101	**17.6**

Table 1. Most common causes of hospital admission and case fatality rates in children for 2010-2012 and in 2013

Pneumonia

There were 7893 admissions for pneumonia. Pneumonia makes up 30% of admissions overall.

The overall pneumonia CFR was 5.2% (412 deaths from 7893 cases of pneumonia), comparable with the pneumonia case fatality rate for 2010-12 (5.1%). Pneumonia case fatality rates vary considerably, from 31 deaths among 1276 admissions in Goroka (2.4%), to three hospitals (Angau, Kimbe) which had case fatality rates for pneumonia of more than 10%.

The PHR system enables the calculation of mortality rates for both total cases of pneumonia overall and for cases of *severe* pneumonia. The overall case fatality rate for severe pneumonia was 9.5%. Seven hospitals had case fatality rates in excess of 10% in 2012.

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

Recommendations

It is recommended that hospitals ensure that there is:

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

Chloramphenicol may be becoming less effective in the treatment of very severe pneumonia, and this may be one factor that explains the high case fatality rates in some hospitals. Treatment options include penicillin (or ampicillin) and gentamicin, or ceftriaxone for the seriously ill, septic or deteriorating child with pneumonia.

The high numbers of deaths from pneumonia and meningitis (738 or 38% of all deaths) underline the importance of the more widespread use of the *Hemophilus influenzae* type b (Hib) vaccine, which was introduced in 2008, and the pneumococcal conjugate vaccine, which is being introduced in 2014.

While these vaccines are the only real solution to deaths and disability from bacterial meningitis (see below) in other countries these two vaccines have made a modest

difference to pneumonia presentations to hospitals. This is because there are other common causes of pneumonia, including viruses (particularly respiratory syncitial virus, influenza) and bacteria that are not prevented by these two vaccines (such as Group A streptococcus, *Staphylococcus aureus*, enteric gram negative bacilli, Chlamydia and Mycoplasma). This means that even with these important vaccines, pneumonia will continue to be a major cause of hospitalisation and death in children in PNG. Therefore improving systems for clinical care and preventative measures to reduce pneumonia are also essential.

The PNG Child Health Plan 2009-2020 outlines a comprehensive approach to pneumonia. This includes key areas to address:

Prevention

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

Curative

- Improving quality of hospital and health centre of pneumonia through IMCI, Standard Treatment Guidelines and Hospital Care for Children training
- Models of community care for pneumonia
- Focus on pneumonia in high risk patients (malnourished, HIV-affected, neonates)
- Oxygen and other methods of respiratory support, including CPAP
- Addressing rising rates of bacterial resistance and trying to improve rational antibiotic prescribing
- Exploring the role of zinc sulphate in pneumonia treatment

Diarrhoea

3072 admissions and 135 deaths (CFR 4.4%) due to diarrhoea were reported in the 10 hospitals in 2013.

Deaths from diarrhoea can be due to severe dehydration where the child does not have access to effective rehydration, from sepsis from bacillary dysentery, or other co-morbidity. Severe diarrhoea can be prevented by timely use of oral rehydration in the community, by parents bringing their child to a health facility if they have diarrhoea, by improved assessment of the severity of dehydration, the use of zinc as additional treatment, and the appropriate use of antibiotics in bloody diarrhoea.

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

Dysentery is bloody diarrhoea, and is commonly due to a bacterium called *Shigella flexneri*. Studies in PNG found very high levels of resistance to amoxicillin and

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

Recommendations

- Give ORS and zinc to all children with diarrhoea
- Treat bloody diarrhoea (dysentery) with ciprofloxacin

Malaria

In 2013 malaria accounted for 1813 admissions and 87 deaths (case fatality rate of 4.8%). Malaria case fatality rates vary between hospitals: from 1-2% in Port Moresby and Kimbe to 8% in Modilon, Angau and Buka

PNG has changed malaria guidelines to:

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

It is important that health workers are familiar with these new treatments. They are described in the 9th Edition of the Standard Treatment Book for Common Illnesses in Children, published in 2011.

Malnutrition

The PHR records malnutrition as a co-morbidity, so even if it is not the primary diagnosis it is still recorded. In 2013 in the 10 hospitals that reported useing the PHR, 4029 children were admitted with severe malnutrition (weight for age <3 SD below the median), or with clinical marasmus or kwashiorkor. This represented 15% of all admissions. Severe malnutrition in these 10 hospitals was associated with 653 deaths: 33% of all deaths, and the case fatality rate for severe malnutrition was 16.2%. Case fatality rate for malnutrition was more than 20% in 4 hospitals.

Recommendations

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

- staff need to be trained in Infant and Young Child Feeding
- all staff should promote breast feeding
- hospitals should adopt the Baby Friendly Hospital Initiative
- growth monitoring should be a regular part of child health care

- There should be ready access in the health centre or hospital to adequate volumes formulas, nutritious food and ready-to-use therapeutic food (RUTF) for the management of children with malnutrition
- The main problems in the management of malnutrition are inadequate feeding (starting feeds to late, not enough milk feeds and not frequent enough feeds).
- Guidelines for the management of malnutrition should be in place and used. These include prevention and treatment of fatal complications such as sepsis, hypothermia and hypoglycaemia
- Children with acute severe 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 prevention and management of malnutrition

The *prevention* of malnutrition must have the highest priority. This requires improved rates of breast feeding and complimentary (weaning) feeding. This will be helped by increased participation in education by girls and by greater economic empowerment 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 10 hospitals meningitis accounted for 1962 admissions. There were 362 deaths (case fatality rate 16.6%.

With a high percentage of all children admitted to hospital dying from meningitis there is an urgent need to address this. This is just part of the tragedy, for every death more 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.

There were 265 cases of meningitis due to S. pneumoniae and 197 cases due to H. influenzae type b recorded through clinical reporting. Therefore an aetiology was identified for around 20% of cases of meningitis. Many hospitals cannot do bacterial culture of blood or CSF. Latex antigen testing has been available in some of the hospital laboratories.

The best method of preventing meningitis is the universal use of conjugate Hib and pneumococcal vaccines. Hib vaccine was introduced in PNG in 2008. Cases of Hib meningitis are still being reported, suggesting that the vaccine is not yet reaching all children. Meningitis due to *S. pneumoniae*, one of the two commonest causes, can only be effectively addressed by the introduction of the conjugate pneumococcal vaccine, which is scheduled for introduction in 2014.

Most Hib and some pneumococci causing meningitis are now resistant to chloramphenicol, so this is now no longer effective treatment for bacterial meningitis. If children receive chloramphenicol for meningitis, rates of death and brain injury will be very high.

Recommendations

All children should receive Pentavalent vaccine, which contains the Hib vaccine at 1, 2 and 3 months of age. The Pentavalent vaccine also protects against diphtheria (a throat infection), tetanus, pertussus (whooping cough) and hepatitis B (a liver infection which eventually may cause liver cancer in adults).

All children with suspected meningitis should have a lumbar puncture if it is safe to do so. They should be treated with ceftriaxone 50mg/kg twice daily IV or IM for 10 days.

Acute complications can lead to high case fatality rates, and may be minimised by

- Nursing all children with meningitis in a high dependency unit
- Monitoring with pulse oximetry to detect hypoxaemia
- Monitoring the blood glucose and treatment of hypoglycaemia
- Close observation for convulsions
- Avoid use of too much IV fluids in children with meningitis, body and brain swelling can occur and this results in poor outcomes

Recommendations on identification and treatment of severe infections

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

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

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

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

- lethargy or unconsciousness

There may be **localising signs suggesting meningitis**

- severe headache
- neck stiffness
- severe vomiting
- repeated convulsions
- bulging fontanelle

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

There may be **signs of Staph infection**

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

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

- If the child is unconscious or convulsing, nurse on the side and keep the airway clear
- Give oxygen if there is severe respiratory distress, cyanosis or the oxygen saturation is <90%
- If the child has signs of shock (several signs: lethargy or drowsiness, low volume pulses, heart rate >160, cold skin or low blood pressure), give an IV bolus of Normal Saline or Hartmanns, 20ml/kg, then reassess.
- Give appropriate parenteral (IV or IM) antibiotics: ceftriaxone +/- flucloxacillin (if Staph infection is present) or flucloxacillin & gentamicin if there is no ceftriaxone
- Monitor for signs of sepsis in a high dependency area in the ward or in the ICU. Monitor with pulse oximetry to detect hypoxaemia
- Check blood glucose. Give a bolus of glucose if the BSL is low
- Seek assistance from an experienced doctor
- Look up treatment recommendations in the PNG Standard Treatment Book for Children, and the WHO Pocketbook of Hospital Care for Children.

Neonatal admissions

Neonatal admissions made up 4517 (17%) of all 20,546 paediatric admissions to the 10 hospitals in 2013. There were 526 neonatal deaths reported, meaning that 27% of all deaths in children were in the neonatal period.

Neonatal infections

56% of all neonatal admissions were due to infections (n=2530). Neonatal infections included pneumonia, meningitis, cord sepsis, skin sepsis and diarrhoea. The case fatality rate for neonatal infections in the 10 hospitals was 8.1%, consistent with previous years. This is very likely to be an under-estimate, as some hospitals reported few cases (e.g. Modilon Hospital reported only 19 case of neonatal sepsis).

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 1463 hospital admissions due to birth asphyxia, and the CFR was 16.3% (239 of 1463). 45% of neonatal deaths were due to perinatal asphyxia. Seven of 10 hospitals had more than 50 cases of birth asphyxia for the year, the largest hospitals (Mt Hagen, Goroka and Angau) had between 4 and 10 cases per week on average.

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

Very low birth weight

Very low birth weight is a birth weight between 1000 and 1499g. There were 283 very low birth weight admissions in the 10 hospitals. The case fatality rate for these babies is very high, with 41% of VLBW newborns dying while in hospital.

	2010-2012			2013		
Diagnoses	**Admissions**	**Deaths**	**CFR**	**Admissions**	**Deaths**	**CFR**
All neonatal	10944	1288	**11.8**	4517	526	**11.6**
Neonatal sepsis	4505	317	**7.0**	2530	206	**8.1**
Asphyxia	3171	472	**14.9**	1463	239	**16.3**
VLBW (1000-1500g)	978	367	**37.5**	284	116	**40.8**

Table 4. The most common causes of neonatal admissions and deaths for 2010 and 2011

Recommendations for improving neonatal care

Early essential newborn care is often neglected, and potentially harmful practices are too common. These reduce the access for babies to basic protective care. Provision of early essential newborn care can have a big impact on reducing neonatal sepsis, birth asphyxia and other complications. All newborns need the following:

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

Babies who require a higher level of care

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

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

MAINTAIN SKIN-TO-SKIN CONTACT WITH THE MOTHER TO PROTECT BABIES FROM HYPOTHERMIA, HYPOGLYCAEMIA, APNOEA AND SEPSIS

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

- Keeping babies warm, best done using Kangaroo Mother Care (KMC). KMC is even safe for many very low birth weight babies, unless they are also very sick with danger signs such as apnoea, cyanosis or severe hypoxaemia.

- Supplemental oxygen administration and pulse oximetry. Because clinical signs predicting hypoxaemia in neonates are relatively insensitive, use of protocols for supplemental oxygen administration based on monitoring of pulse oximetry is recommended.
- Detecting and treating apnea. 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, aminophyline 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 contactr and KMC. In neonates hypoglycaemia occurs because of insufficient glycogen stores in the liver, inability to feed or separation from the mother, and increased glucose metabolism during illness. The clinical signs are non-specific, and regular blood glucose monitoring of high-risk ill neonates is required. Contact with the mother is essential for most sick babies. Careful correction of hypoglycaemia using breast feeds in babies who can suck, or nasogastric expressed breast milk feeding or IV glucose in babies too sick to feed should be started.
- Ward organisation to ensure close observation of the most seriously ill and highest risk ill babies
- Safe use of intravenous fluids in seriously ill neonates. In very low birth weight neonates, large volumes of enteral feeding in the first day or two of life is not well tolerated and may increase the risk of necrotising enterocolitis. The use of any artificial formula feeding is not recommended at any time in low birth weight babies. For babies less than 1.5 kg, slow increases in expressed breast milk with cautious intravenous fluids to maintain hydration and prevent hypoglycaemia in the first few days of life is recommended. Babies on IV fluids are at risk of overhydration and nosocomial infection through the IV drip site.
- Antibiotics. Although many seriously ill neonates have bacterial infections, the inappropriate use of broad-spectrum antibiotics will lead to colonization of babies, and of neonatal units, with bacteria that are resistant to standard antibiotics. Standard treatment of neonatal sepsis is benzylpenicillin (or ampicillin or amoxicillin) and gentamicin, which are effective against most bacteria causing sepsis. *Staphylococcus aureus* is another common cause of infection in young infants in some hospitals, and resistant enteric gram negative bacilli are a common cause of neonatal death. Flucloxacillin or cloxacillin should be used if there are signs Staphylococcal infection, such as purulent umbilical cord, skin pustules or purulent conjunctivitis.
- Prevention of neonatal sepsis. Strict hand washing and other basic infection control measures are recommended. There is good evidence now that prolonged antibiotics lead to colonisation of the newborns gastrointestinal tract with pathogenic bacteria that are likely to be invasive, rather than the protective bacteria that comes from the mother. So avoiding antibiotics in babies who do not have serious infections also helps to protect them against

infection. Ceasing antibiotics after 24 or 48 hours if the baby is well will also reduce colonisation with pathogenic or highly-resistance bacteria, and reduce infections in babies.

- Auditing of practice. It is only by keeping accurate records of all admissions and outcomes that patterns of adverse events will become identified. Clinical audit is essential to reduce neonatal mortality.
- Training of nurses in early essential newborn care and neonatal high-dependency care

Tuberculosis

In the 10 hospitals in 2013 there were 2455 children admitted with tuberculosis, with 268 known deaths, and a case fatality rate of 10.9%. This may represent only a fraction of the children with TB in PNG, given that many cases are diagnosed by other hospitals or health facilities or remain undiagnosed in the community. However these data underlines that in its severest forms TB cause many childhood deaths.

This year the PHR program has started gathering more data on tuberculosis. We know that extra-pulmonary tuberculosis (TB meningitis, lymph node TB, spinal TB, abdominal TB, military TB) makes up over 40% of children diagnosed with TB, and that children with EPTB have a higher mortality.

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

Recommendations

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

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

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

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

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

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

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

HIV

In 2012 there were 575 new cases of HIV admitted to the 10 hospitals, and 101 known HIV-related deaths. Port Moresby General (111 cases), Mt Hagen (277 cases) and Goroka (110 cases) reported the majority. This only represents cases that were reported in hospitals, based on admissions, and may be an underestimate of new cases in the population, as some children are diagnosed as outpatients, or through Prevention of Parent to Child Transmission (PPTCT) programs.

Recommendations

- Mothers who are diagnosed with HIV during or after pregnancy are now treated with three anti-retroviral drugs for life, not just for shorter periods to prevent transmission to the baby. The ongoing care of the mother is paramount, and what is good for the mother is good for her children.
- Early infant diagnosis of HIV with PCR testing is now available. Children who have HIV confirmed by early infant diagnosis and start on ante-retroviral therapy (ART) before they become symptomatic have a much better chance of healthy life than children diagnosed in late stages because of AIDS-defining infections.
- All children diagnosed with HIV should see a paediatrician, for starting on antiretroviral therapy.
- All children with HIV need prophylaxis with cotrimoxazole and INAH, treatment of intercurrent infections and good nutrition.

Other vaccine preventable diseases

In 2013 in 10 hospitals there were 6 cases of measles, but a major outbreak has occurred in early 2014 affecting hundreds of children and causing tens of deaths so far. Young infants are especially vulnerable to severe complications from measles, particularly pneumonia. Provinces should mount mass campaigns in 2014 with active visits to villages and homes to immunise all children against measles.

There were 13 cases of acute flaccid paralysis.

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

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Summary

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

Chronic diseases in children

The PHR now gathers data on some chronic or non-communicable diseases. These are of increasing importance. In 2013 there were 49 cases of Rheumatic Heart Disease (RHD) reported. This is a major under-estimate, but in subsequent years we should better understand the national disease burden. Guidelines for the management of RHD and acute rheumatic fever are in the PNG Standard Treatment Manual and the WHO Hospital Care for Children Pocket book.

In 2013 there were 35 reported cases of childhood cancer, again an under-estimate but a start at national reporting. Guidelines for the management of common cancers are available at www.pngpaediatricsociety.org (under Treatment Guidelines, Cancer Protocols)

Child protection

Data on child physical, sexual and other forms of abuse are now being collected by the PHR. There were only 6 cases reported from the 5 hospitals which used the updated version of the program in 2013. This is a gross under-estimate of the burden of child abuse and maltreatment, but it is a start at systematic gathering of data on this problem. In 2014 every hospital will be reporting cases of child abuse or children requiring social protection through the PHR. A study from Goroka in 2013 showed that child sexual abuse was a common reason for children presenting. Many will be managed as outpatients. More emphasis on child protection is needed, and more resources, including a child social worker in each provincial hospital to deal with a range of common social issues. Social issues are the most frequent root causes of malnutrition and its disease risks.

Total admissions and outcomes for each hospital in 2013

Hospital	Total Admissions 2013	Total Deaths 2013	Overall CFR 2013
Alotau			
Angau	2013	261	13.0
Buka	519	43	8.3
Daru			
Goroka	3916	205	5.2
Kavieng			
Kimbe	999	109	10.9
Kerema			
Kundiawa	1868	132	7.1
Manus			
Mendi			
Modilon	1272	137	10.8
Mt Hagen	9435	653	6.9
Nonga			
Oro	2198	163	7.4
PMGH	4121	238	5.8
Vanimo			
Wabag	230	16	7.0
Wewak			
Total	**26571**	**1957**	**7.4**

Total admissions and outcomes for each hospital 2010-2012

Hospital	Total Admissions 2010	Total Deaths 2010	Overall CFR 2010	Total Admissions 2011	Total Deaths 2011	Overall CFR 2011	Total Admissions 2012	Total Deaths 2012	Overall CFR 2012
Alotau	1002	28	2.8						
Angau				2457	244	9.9	2161	270	12.5
Buka	659	46	7.0	574	42	7.3	632	53	8.4
Daru									
Goroka	1517	90	5.9	3125	114	3.6	3618	279	7.7
Kavieng	378	14	3.7				326	13	4.0
Kimbe	1013	72	7.1	881	102	11.6	1145	103	9.0
Kerema									
Kundiawa									
Manus	494	9	1.8						
Mendi	2262	112	5.0				2143	123	5.7
Modilon	977	109	11.2	1342	143	10.7	1533	171	11.2
Mt Hagen				4198	303	7.2	4232	298	7.0
Nonga	720	46	6.4	833	61	7.3			
Oro				612	53	8.7			
PMGH	5180	431	8.3	4901	373	7.6	3954	300	7.6
Vanimo	820	31	3.8	668	15	2.2	802	50	6.2
Wabag	1055	89	8.4	991	95	9.6			
Wewak									
Total	**16077**	**1277**		**20582**	**1545**	**7.5**	**20546**	**1660**	**8.1**

Pneumonia admissions and outcomes in 2013

Hospital	Pneumonia admissions	Pneumonia deaths	Pneumonia CFR	Severe pneumonia admissions	Severe pneumonia deaths	Severe pneumonia CFR
Alotau						
Angau	281	34	12.1	170	33	19.4
Buka	111	7	6.3	30	6	20.0
Daru						
Goroka	1276	31	2.4	517	24	4.6
Kavieng						
Kimbe	83	16	19.3	36	16	44.4
Kerema						
Kundiawa	404	24	5.9	142	20	14.1
Manus						
Mendi						
Modilon	214	12	5.6	72	12	16.7
Mt Hagen	3914	211	5.4	2292	178	7.8
Nonga						
Oro	488	35	7.2	164	29	17.7
PMGH	1050	37	3.5	307	33	10.7
Vanimo						
Wabag	72	5	6.9	22	5	22.7
Wewak						
Total	7893	412	5.2	3752	356	9.5

Diarrhoea admissions and outcomes in 2013

Hospital	Diarrhoea admissions	Diarrhoea deaths	Diarrhoea CFR
Alotau			
Angau	155	21	13.5
Buka	49	2	4.1
Daru			
Goroka	456	12	2.6
Kavieng			
Kimbe	112	6	5.4
Kerema			
Kundiawa	373	14	3.8
Manus			
Mendi			
Modilon	86	2	2.3
Mt Hagen	1020	40	3.9
Nonga			
Oro	148	7	4.7
PMGH	671	30	4.5
Vanimo			
Wabag	2	1	50.0
Wewak			
Total	3072	135	4.4

Malaria admissions and outcomes in 2013

Hospital	Malaria admissions 2013	Malaria Deaths 2013	Malaria CFR 2013
Alotau			
Angau	201	16	8.0
Buka	62	5	8.1
Daru			
Goroka	95	6	6.3
Kavieng			
Kimbe	183	2	1.1
Kerema			
Kundiawa	26	1	3.8
Manus			
Mendi			
Modilon	159	14	8.8
Mt Hagen	534	21	3.9
Nonga			
Oro	417	20	4.8
PMGH	136	2	1.5
Vanimo			
Wabag	0	0	0
Wewak			
Total	**1813**	**87**	**4.8**

Malaria admissions and outcomes in 2010-12

Hospital	Malaria admissions 2010	Malaria Deaths 2010	Malaria CFR 2010	Malaria Admissions 2011	Malaria deaths 2011	Malaria CFR 2011	Malaria admissions 2012	Malaria deaths 2012	Malaria CFR 2012
Alotau	284	7	2.5						
Angau				373	17	4.6	240	10	4.2
Buka	233	5	2.1	127	4	3.1	106	2	1.9
Daru									
Goroka	20	2	10.0	20	0	0.0	104	18	17.3
Kavieng	128	4	3.1				29	0	0.0
Kimbe	467	15	3.2	169	8	4.7	154	1	0.7
Kerema									
Kundiawa									
Manus	52	1	1.9						
Mendi	150	3	2.0				44	4	9.1
Modilon	130	3	2.3	174	8	4.6	174	17	9.8
Mt Hagen				294	10	3.4	209	9	4.3
Nonga	170	5	2.9	160	9	5.6			
Oro				127	3	2.4			
PMGH	270	1	0.3	140	1	0.7	97	4	4.1
Vanimo	175	4	2.3	190	1	0.5	106	4	3.8
Wabag	5	1	20.0	0	0	0			
Wewak									
Total	**2084**	**51**	**2.4**	**1774**	**61**	**3.4**	**1263**	**69**	**5.5**

Severe malnutrition admissions and outcomes in 2013

Hospital	Severe malnutrition admission	Severe malnutrition deaths	Malnutrition CFR
Alotau			
Angau	389.0	102.0	26.2
Buka	28.0	1.0	3.6
Daru			
Goroka	1178.0	125.0	10.6
Kavieng			
Kimbe	90.0	29.0	32.2
Kerema			
Kundiawa	200.0	48.0	24.0
Manus			
Mendi			
Modilon	117.0	17.0	14.5
Mt Hagen	1170.0	199.0	17.0
Nonga			
Oro	312.0	45.0	14.4
PMGH	491.0	71.0	14.5
Vanimo			
Wabag	54	16	29.6
Wewak			
Total	**4029**	**653**	**16.2**

Meningitis admissions and outcomes in 2013

Hospital	Meningitis admissions	Meningitis deaths	Meningitis CFR	Meningitis admissions due to S. pneumoniae	Meningitis admissions due to H. influenzae
Alotau					
Angau	96	16	16.7	22	27
Buka	30	2	6.7	4	1
Daru					
Goroka	230	34	14.8	0	3
Kavieng					
Kimbe	51	15	29.4	14	23
Kerema					
Kundiawa	51	6	11.8	8	33
Manus					
Mendi					
Modilon	80	25	31.3	0	2
Mt Hagen	804	134	16.7	111	90
Nonga					
Oro	243	37	15.2	2	3
PMGH	363	52	14.3	104	15
Vanimo					
Wabag	14	5	35.7	0	0
Wewak					
Total	**1962**	**326**	**16.6**	**265**	**197**

TB admissions and outcomes in 2013

Hospital	TB admissions	TB deaths	TB CFR	PTB admissions	PTB deaths	PTB CFR	EPTB admissions	EPTB deaths	EPTB CFR
Alotau									
Angau	266	33	12.4	142	19	13.4	124	14	11.3
Buka	48	2	4.2						
Daru									
Goroka	333	18	5.4						
Kavieng									
Kimbe	114	14	12.3	69	6	8.7	45	8	17.8
Kerema									
Kundiawa	191	22	11.5	120	10	8.3	71	12	16.9
Manus									
Mendi									
Modilon	116	20	17.2						
Mt Hagen	432	57	13.2						
Nonga									
Oro	324	42	13.0						
PMGH	622	58	9.3						
Vanimo									
Wabag	9	2	22.2						
Wewak									
Total	**2455**	**268**	**10.9**	**331**	**35**	**10.6**	**240**	**34**	**14.2**

PTB = Pulmonary tuberculosis EPTB = Extra-pulmonary tuberculosis

Note only 3 hospitals used the newest version of the PHR in 2013, so only 3 reported TB cases disaggregated for PTB and EPTB. All will do so in 2014

HIV admissions and outcomes in 2013

Hospital	HIV admissions	HIV deaths	HIV CFR
Alotau			
Angau	12	6	50
Buka	2	0	0
Daru			
Goroka	110	9	8.2
Kavieng			
Kimbe	2	1	50.0
Kerema			
Kundiawa	21	6	28.6
Manus			
Mendi			
Modilon	15	5	33.3
Mt Hagen	277	50	18.1
Nonga			
Oro	20	5	25
PMGH	111	16	14.4
Vanimo			
Wabag	5	3	60.0
Wewak			
Total	575	101	17.6

Total neonatal admissions and outcomes in 2013

Hospital	Neonatal admissions 2013	Neonatal deaths 2013	Neonatal CFR 2013
Alotau			
Angau	596	85	14.3
Buka	84	10	11.9
Daru			
Goroka	550	52	9.5
Kavieng			
Kimbe	171	31	18.1
Kerema			
Kundiawa	161	25	15.5
Manus			
Mendi			
Modilon	440	56	12.7
Mt Hagen	1878	216	11.5
Nonga			
Oro	376	40	10.6
PMGH	248	10	4.0
Vanimo			
Wabag	13	1	7.7
Wewak			
Total	4517	526	11.6

Total neonatal admissions and outcomes in 2010-2012

Hospital	Neonatal admissions 2010	Neonatal deaths 2010	Neonatal CFR 2010	Neonatal admissions 2011	Neonatal deaths 2011	Neonatal CFR 2011	Neonatal admissions 2012	Neonatal deaths 2012	Neonatal CFR 2012
Alotau	212	10	4.7						
Angau				665	72	10.8	571	75	13.1
Buka	30	10	33.3	54	9	16.7	79	12	15.2
Daru									
Goroka	188	7	3.7	420	19	4.5	546	71	13.0
Kavieng	61	6	9.8				67	2	3.0
Kimbe	40	7	17.5	217	34	15.7	226	33	14.6
Kerema									
Kundiawa									
Manus	165	4	2.4						
Mendi	248	21	8.5				117	4	3.4
Modilon	271	56	20.7	417	45	10.8	551	78	14.2
Mt Hagen				827	103	12.5	852	96.0	10.88
Nonga	217	21	9.7	256	21	8.2			
Oro				94	13	13.8			
PMGH	1156	185	16.0	1102	162	14.7	801	86	10.7
Vanimo	159	8	5.0	126	2	1.6	202	16	7.9
Wabag	5	0	0.0	2	0	0.0			
Wewak									
Total	**2752**	**335**	**12.3**	**4180**	**480**	**11.5**	**4012**	**473**	**11.8**

Neonatal infections in 2013

Hospital	Neonatal Infections Admissions 2013	Neonatal Infections Deaths 2013	Neonatal Infection CFR 2013
Alotau			
Angau	276	21	7.6
Buka	50	0	0.0
Daru			
Goroka	300	11	3.7
Kavieng			
Kimbe	58	6	10.3
Kerema			
Kundiawa	66	10	15.2
Manus			
Mendi			
Modilon	19	5	26.3
Mt Hagen	1346	130	9.7
Nonga			
Oro	167	13	7.8
PMGH	238	9	3.8
Vanimo			
Wabag	10	1	10.0
Wewak			
Total	2530	206	8.1

Neonatal infections in 2010-2012

Hospital	Neonatal Infections Admissions 2010	Neonatal Infections Deaths 2010	Neonatal Infection CFR 2010	Neonatal Infections Admissions 2011	Neonatal Infections Deaths 2011	Neonatal Infection CFR 2011	Neonatal Infections Admissions 2012	Neonatal Infections Deaths 2012	Neonatal Infection CFR 2012
Alotau	129	3	2.3						
Angau				334	21	6.3	258	24	9.3
Buka	15	4	26.7	40	5	12.5	41	3	7.3
Daru									
Goroka	128	3	2.3	223	3	1.3	249	13	5.2
Kavieng	30	3	10.0				1	0	0.0
Kimbe	40	7	17.5	87	14	16.1	70	7	10.0
Kerema									
Kundiawa									
Manus	16	0	0.0						
Mendi	123	5	4.1				51	0	0.0
Modilon	34	3	8.8	62	10	16.1	29	6	20.7
Mt Hagen				577	63	10.9	682	61.0	8.94
Nonga	12	8	66.7	124	11	8.9			
Oro				47	3	6.4			
PMGH							310	10	3.2
Vanimo	61	1	1.6	59	0	0.0	98	4	4.1
Wabag	4	0	0.0	2	0	0.0			
Wewak									
Total	**592**	**37**	**6.3**	**1555**	**130**	**8.4**	**1789**	**128**	**7.2**

Very low birth weight (1000-1499g) admissions and deaths in 2013

Hospital	VLBW admissions 2013	VLBW deaths 2013	VLBW CFR 2013
Alotau			
Angau	44	23	52.3
Buka	11	5	45.5
Daru			
Goroka	41	23	56.1
Kavieng			
Kimbe	23	6	26.1
Kerema			
Kundiawa	24	15	62.5
Manus			
Mendi			
Modilon	35	12	34.3
Mt Hagen	58	25	43.1
Nonga			
Oro	47	7	14.9
PMGH	1	0	0.0
Vanimo			
Wabag	0	0	0
Wewak			
Total	**284**	**116**	**40.8**

Very low birth weight (1000-1499g) admissions and deaths in 2010-2012

Hospital	VLBW admissions 2010	VLBW deaths 2010	VLBW CFR 2010	VLBW admissions 2011	VLBW deaths 2011	VLBW CFR 2011	VLBW admissions 2012	VLBW deaths 2012	VLBW CFR 2012
Alotau	8	2	25.0						
Angau				46	25	54.3	37	15	40.5
Buka	11	2	18.2	3	1	33.3	9	4	44.4
Daru									
Goroka	13	6	46.2	29	15	51.7	51	35	68.6
Kavieng	5	0	0.0				3	0	0.0
Kimbe				22	7	31.8	33	17	51.5
Kerema									
Kundiawa									
Manus	10	1	10.0						
Mendi	19	8	42.1				26	15	57.7
Modilon	19	7	36.8	39	14	35.9	58	19	32.8
Mt Hagen				33	14	42.4	21	10.0	47.6
Nonga	17	5	29.4	10	5	50.0			
Oro				4	0	0.0			
PMGH							105	45	42.9
Vanimo	4	1	25.0	3	2	66.7	11	6	54.6
Wabag									
Wewak									
Total	**106**	**32**	**30.2**	**189**	**83**	**43.9**	**354**	**166**	**46.9**

Perinatal asphyxia admissions and deaths in 2010-2012

Hospital	Asphyxia admissions 2013	Asphyxia deaths 2013	Asphyxia CFR 2013
Alotau			
Angau	224	45	20.1
Buka	14	4	28.6
Daru			
Goroka	230	37	16.1
Kavieng			
Kimbe	85	18	21.2
Kerema			
Kundiawa	71	8	11.3
Manus			
Mendi			
Modilon	103	24	23.3
Mt Hagen	550	79	14.4
Nonga			
Oro	183	24	13.1
PMGH			
Vanimo			
Wabag	3	0	0.0
Wewak			
Total	1463	239	16.3

Perinatal asphyxia admissions and deaths in 2010-2012

Hospital	Asphyxia admissions 2010	Asphyxia deaths 2010	Asphyxia CFR 2010	Asphyxia admissions 2011	Asphyxia deaths 2011	Asphyxia CFR 2011	Asphyxia admissions 2011	Asphyxia deaths 2012	Asphyxia CFR 2012
Alotau	79	5	6.3						
Angau				263	43	16.3	256	46	18.0
Buka	6	2	33.3	10	2	20.0	26	3	11.5
Daru									
Goroka	53	3	5.7	169	13	7.7	285	52	18.3
Kavieng	18	1	5.6				2	0	0.0
Kimbe				94	12	12.8	124	20	16.1
Kerema									
Kundiawa									
Manus	7	2	28.6						
Mendi	101	12	11.9				59	4	6.8
Modilon	55	18	32.7	102	19	18.6	95	21	22.1
Mt Hagen				246	35	14.2	230	34.0	14.78
Nonga	58	5	8.6	84	5	6.0			
Oro				41	8	19.5			
PMGH							315	62	19.7
Vanimo	90	6	6.7	58	1	1.7	93	11	11.8
Wabag									
Wewak									
Total	467	54	11.6	1067	138	12.9	**1485**	**253**	**17.0**

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Cancer and Rheumatic heart disease admissions and deaths in 2013

Hospital	Cancer admissions	Cancer deaths	Cancer CFR	Rheumatic heart admissions	Rheumatic heart deaths	RHD CFR
Alotau						
Angau	8	4	50	1	0	0
Buka	0	0		0	0	
Daru						
Goroka	0	0		0	0	
Kavieng						
Kimbe	9	3	33.3	0	0	
Kerema						
Kundiawa	0	0		9	1	11.1
Manus						
Mendi						
Modilon	0	0		0	0	
Mt Hagen	0	0		0	0	
Nonga						
Oro	0	0		0	0	
PMGH	18	8	44.4	39	1	2.6
Vanimo						
Wabag	0	0		0	0	
Wewak						
Total	35	15	42.8	49	2	4.1