

**RCH Global**

The Royal Children's Hospital Melbourne  
50 Flemington Road Parkville  
Victoria 3052 Australia  
EMAIL [rch.global@rch.org.au](mailto:rch.global@rch.org.au)  
TELEPHONE +61 3 9345 6709  
[www.rch.org.au/global](http://www.rch.org.au/global)

<p><b>Melbourne Children's</b> A world leader in child and adolescent health</p>	
	



# Global Health Report

Leading global approaches to caring for sick children



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# Introduction

Sujan Sarkar, Courtesy of Photoshare, 2012

The Royal Children's Hospital (RCH), Melbourne is one of Australia's biggest and busiest paediatric hospitals. With a proud 147-year history the RCH cares for children from across Victoria; and, through its nationally funded centres for complex cardiac surgery and transplantation, for Australia's sickest children and adolescents.

But the RCH is more than just a great children's hospital.

With our campus partners, Murdoch Childrens Research Institute (MCRI) and the University of Melbourne Department of Paediatrics, we are Melbourne Children's. And it is this integration of research, education and clinical care here, on a single site, that has positioned us as a global leader in child and adolescent healthcare delivery.

Melbourne Children's has led developments in clinical care and research, including the discovery of the major worldwide causes of viral diarrhoea and bacterial pneumonia, that are now saving the lives of children across the world.

We are leading research and global policy in newborn care, vaccines and child-sized medicines. With more children surviving beyond the age of five years, we are leading a shift in the focus of global health to include children with disabilities, early childhood development and adolescent health.

Our work with United Nations agencies, donors, governments and with doctors, nurses, allied health professionals in developing countries is a small part of the global effort that has seen child deaths reduce by half.

But just half a day's flying time away, in Asia and the Pacific, children still die from preventable diseases. In some of these countries, children are 10 to 15 times more likely than Victorian children to die before their fifth birthday.

This report documents the contributions made by over 100 Melbourne Children's staff in an effort to reduce this inequality in global health. Global health focuses on the needs of the poorest countries by working toward the prevention and treatment of common illness. Global health programs should be equitable, sustainable, affordable, based on best practice and evidence and

driven by the priorities of our developing country partners. Our global health programs combine practical collaboration with research, training and advocacy.

The projects described in this report have collectively raised over \$40 million to improve the health of children in low- and middle-income countries. Other stories told in this report acknowledge the generosity and dedication of our staff involved in volunteer work.

The contributions of our staff are amplified by the work of around 100 international medical graduates who train in clinical departments of the RCH annually, and over 30 partnerships with hospitals, universities, research institutes and ministries of health in low- and middle-income countries. Some of our international colleagues tell their own stories in this report.

**It is inspiring.**

Professor Christine Kilpatrick, Chief Executive Officer  
The Royal Children's Hospital

Professor Kathryn North AM, Director  
Murdoch Childrens Research Institute

Professor Paul Monagle, Stevenson Chair, Head of Department  
of Paediatrics, The University of Melbourne

We have contributed to the training of over 1,500 health workers to provide a high standard of hospital care for children.

Our anaesthetists have helped train health workers to use 10,000 low-cost machines to make surgery safer in our region. Our heart surgeons have trained surgeons in Vietnam who operate on around 600 children and adolescents each year.

We have been involved in screening over 15,000 children and adolescents for rheumatic heart disease in Fiji.

Our Emergency Department doctors and nurses have been part of Australia's emergency response teams who treated over 2,500 people and performed 200 surgeries in the weeks following natural disasters in Samoa (2009) and the Philippines (2013).

We have trained the only childhood cancer specialist in any Pacific Island country.

We are working with countries in our region to show how vaccines could protect almost 6.5 million children each year.





# Survive beyond five

Preventing three common causes of child deaths: pneumonia, diarrhoea and newborn conditions

Each year throughout the world, six million children die before their fifth birthday. Almost half of these deaths are due to diseases such as pneumonia, diarrhoea or other infections that can be prevented or treated through simple and affordable health care measures.

Children are most vulnerable in their first month of life; and especially in the first 24 hours after birth. Forty percent of all the deaths in children under the age of five occur in the first month of life.

Pneumonia and diarrhoea account for a third of all child deaths, causing the loss each year of about two million children before their fifth birthday. Pneumonia and diarrhoea can be prevented by vaccines as well as by improving breastfeeding and childhood nutrition, reducing exposure to indoor smoke and environmental pollution, improving hand hygiene and ensuring access to clean drinking water and toilets.

## How do we know this?

Staff from the Melbourne Children's were part of an international team of 486 researchers from 50 countries who produced estimates of global disease, disability and death in children and adolescents using surveys and available information from national health systems.

## Essential care for newborns

A baby's chance of surviving complications during birth increases significantly if they are delivered by a skilled birth attendant in a health facility. In countries where most births occur in hospitals or health centres, quality care in these facilities is essential for newborn survival.

In communities where there are still high levels of newborn deaths, the focus should be on improving community based services for disadvantaged populations and increasing essential newborn care, which includes breastfeeding and keeping the baby warm.

## Seven steps to identify very sick newborns

In communities without local hospitals, intensive care units or even doctors, most of the care for sick newborns is provided by nurses and community health workers. It is essential that health workers recognise when a sick newborn should be referred to hospital. A simple checklist to assist community health workers has been developed through the Young Infants Clinical Signs Study.

Health workers in Bangladesh, Bolivia, Ghana, India, Pakistan and South Africa collected information on sick babies. The information was analysed by Professor John Carlin to narrow the checklist to seven key signs. Sick newborns with any one of the following signs should be referred to hospital:

- difficulty feeding;
- movement only when stimulated;
- temperature below 35.5°C or above 37.5°C;
- rapid breathing;
- severe chest indrawing; or
- convulsions.

This simple checklist is an important tool to reduce disability and death in the first two months of life. It has also been used to update the WHO's Integrated Management of Childhood Illness (IMCI), the standard checklist for first-line health workers.

## Small measures to save newborn lives

Babies born weighing less than 2,500g need extra care and attention. However, without scales to weigh newborns it is difficult for health workers to identify those babies who need extra attention. In communities in Ethiopia and Hòa Bình Province in Vietnam, the Melbourne Children's is working to identify other measures to save newborn lives. A simple screening tool that measures babies' feet is being evaluated so that, in the future, community health workers can identify at-risk newborns and then deliver the extra care and follow up they need. Ethiopia currently has a neonatal death rate above the average for African countries and 90% of babies there are born at home without the assistance of a midwife or doctor. Home births are also common in the ethnic minorities of the Hòa Bình Province, a mountainous region in northern Vietnam. Newborns from remote areas like Hòa Bình Province are over three times more likely to die in the first few days of life than babies born in urban areas.

To evaluate these measures, Associate Professor Fiona Russell is working with paediatricians from Jimma University in Ethiopia and the National Children's Hospital and Hòa Bình Province, Vietnam.

## Getting priorities right for healthy mothers and healthy newborns

In some areas of the Philippines, more than 90% of children are born in facilities that are inadequately staffed and ill equipped to provide care should any complications occur. Many health care workers have not yet received training in new strategies, including how to support new mothers to provide early and exclusive breastfeeding. Inadequate equipment and supplies often mean that families must purchase these items themselves. With a number of issues to be addressed, how do local governments prioritise limited resources for health programs?

Health planners and policymakers from the Philippines explored these service provision challenges and developed solutions. They were supported by Dr Sophie La Vincente from the Melbourne Children's, along with a team from the University of Queensland. These locally developed solutions were then costed, providing governments with a rationale to prioritise health care spending for mothers and newborns.



**PROFILE: Dr Hoang Tran, Da Nang Hospital for Women and Children, Vietnam**

'To improve care for sick newborns, we need to begin with accurate information on a newborn's first month of life. We reviewed available information in South East Asia, where it is estimated that 200,000 newborn deaths occur each year. The review included studies from neonatal intensive care units as well as community settings where verbal surveys were used to determine the cause of death. The need for more information is critical.

“To build the house from the base” by improving the available information, we began to review the care given to sick newborns and babies who were born too soon at the hospital where I work as Director of the Department of Paediatrics, Da Nang Hospital for Women and Children, Vietnam. We found that approximately 40% of deaths were caused by infections or lack of oxygen. Many of these deaths can be prevented by simple, low-cost techniques such as resuscitation, keeping newborns warm, promoting early and exclusive breastfeeding and improving health worker's hygiene. I am now working with doctors, nurses and many supporters to implement these simple, low-cost techniques.'

*Dr Hoang Tran completed these studies as part of a Doctor of Philosophy at the Melbourne Children's, supervised by Professor Steve Graham.*

**Early essential newborn care in the Solomon Islands**

The Solomon Islands is one of 23 countries in the Western Pacific Region where out of every 1,000 babies born, more than ten newborns will die within their first month of life. A newborn dies every two minutes in this region. Access to care can be challenging in the Solomon Islands, where 80% of the population lives in rural or remote areas. To improve care during the first month of life Melbourne Children's is working with the Ministry of Health and Medical Services (MHMS), Solomon Islands and UNICEF to upgrade equipment in special care nurseries, and train health workers at all levels in newborn care.

Dr Shidan Tosif will implement training in neonatal resuscitation, standard clinical guidelines for managing sick newborns and other strategies as part of WHO and UNICEF's Action Plan for Healthy Newborn Infants in the Western Pacific Region. This features the Early Essential Newborn Care (EENC) program, a package of interventions aimed at improving care at birth and the first few days of life. Essential care includes interventions for babies born too soon or too small and the 'first embrace'.

Training will be run at a national and provincial level for health care workers, nurses and doctors. The aim is to eventually train all health workers in the country. Support will be given to include essential newborn care in the Bachelor of Child Health Nursing, which has been developed by MHMS and Solomon Islands National University.

Alongside this, UNICEF will support new equipment and improved infrastructure for special care nurseries at health centres and hospitals.

As part of a comprehensive approach, these infrastructure upgrades and training will be guided by an assessment of available health care for newborns, strengthened health information and updated national policy. By improving access to essential newborn care, this project aims to contribute to reach the Solomon Islands' national goal of reducing newborn deaths.

**How do we know this?**

Since 2013, the WHO Western Pacific Region has aimed to reduce preventable newborn deaths through an Early Essential Newborn Care Plan. The target is to reduce newborn mortality to 10 per 1,000 births or less, by 2020 by increasing access to doctors, midwives or nurses at the time of birth and through improving neonatal care. Twenty-three countries in the Western Pacific region have neonatal death rates currently above this target.



## Preventing child deaths from pneumonia

Pneumonia is the leading cause of death in children under five years of age. Pneumonia can be caused by a variety of micro-organisms including two common bacteria, *Streptococcus pneumoniae* and *Haemophilus influenzae*, that are in part preventable with vaccines.

Bacterial pneumonia can be treated with antibiotics and, if severe, with oxygen. Severe viral respiratory infections also need oxygen and good supportive care. The Melbourne Children's has developed a comprehensive program across each of these areas.

The number of children who die from pneumonia and diarrhoea before their fifth birthday

# 2 million



### How do we know this?

- Professor Frank Shann conducted some of the earliest research to identify the causes of childhood pneumonia.
- Professor Kim Mulholland conducted the first trials to demonstrate that bacterial pneumonia can be prevented by vaccines, as well as a range of studies on the causes and treatment of pneumonia.
- Professor Steve Graham showed the value of preventative antibiotics for pneumonia in HIV positive children in Africa.
- Professor Trevor Duke and colleagues in PNG conducted the largest field trial of oxygen concentrators and pulse oximeters, which showed that deaths from pneumonia could be reduced by up to 35%.

### Life saving vaccines for pneumonia

At least one third of pneumonia deaths are attributable to *Streptococcus pneumoniae*. The pneumococcal conjugate vaccine (PCV) is a life-saving vaccine that can protect infants and young children against pneumonia, meningitis and middle ear infections caused by this bacteria. Kim Mulholland, Fiona Russell and a team from the Melbourne Children's conducted pivotal trials of PCV schedules in Fiji and Vietnam (ongoing) and are working with governments in Fiji, Gambia, Lao PDR, Mongolia and Papua New Guinea to evaluate the impact of delivering the vaccine in national programs. They are also working on a new type of vaccine which will be trialed in Indonesia.

PCV13 protects against the 13 most common strains of *S. pneumoniae*. However, there are more than 90 different recognised strains. There is a chance that the introduction of PCV will result in more infections due to less common strains not included in the vaccine. To determine how effective PCV is and whether children need broader protection, the Melbourne Children's is working with hospital clinicians and laboratory technicians to test which

strains of *S. pneumoniae* are causing disease. Our teams will also identify the strains of *S. pneumoniae* bacteria that live in the nose and throat of healthy people – nasal carriage – to show if the availability of the vaccine has decreased the circulation of the most common strains in these communities.

### How do we know this?

To determine the most effective test to identify the different strains of the *Streptococcus pneumoniae* bacteria, a team led by Kim Mulholland and Dr Catherine Satzke, supported by the Bill & Melinda Gates Foundation, have compared 20 different methods. Their work has contributed to updated WHO guidelines for collecting, storing and transporting nasopharyngeal samples; and culture and non-culture methods for the identification and serotyping of pneumococci.

While vaccination is cost-effective, it is still a significant investment for developing countries. One dose of PCV13 can cost US\$3.30 per child. Vaccine manufacturers recommend a course of four doses of PCV. WHO currently recommends that infants receive either three doses of PCV starting at six weeks of age or two doses starting at six weeks and a booster dose between nine and 15 months of age.

When choosing between the two recommended schedules, national immunisation programs should consider the age group with the largest burden of pneumonia and the proportion of children who receive routine vaccinations on time. There is little information currently available to guide this decision.

The Melbourne Children's is evaluating different pneumococcal immunisation schedules.

Vietnam does not currently include PCV10 or PCV13 in their national immunisation schedule. The Melbourne Children's is working with a team in Vietnam to compare potential schedules for these vaccines. They are looking at nasal carriage and antigen levels in children to show the strength of their immune response.



This information will help to determine the most efficient schedule. A new study commencing next year will compare the effectiveness of one and two dose schedules following catch-up campaigns. This team are hopeful that the results of this study will prove the most efficient way to use the vaccines.

### How do we know this?

- WHO recommendations for the PCV vaccine schedule are based largely on work that a Melbourne Children's team has completed in Fiji. In Fiji, the team demonstrated that a two-dose schedule (with a booster) may be the most efficient. In the same project, the team found that a booster dose of the 23-valent pneumococcal polysaccharide (PPS) vaccine has a stronger immune response in infants given a single dose of PCV, compared with children who have received two or three doses of the PCV.
- Kim Mulholland trialed one of the first pneumonia vaccines that was effective in children and has been involved in most of the pneumonia vaccine trials with Hib or pneumococcal vaccines in the developing world over the past 20 years.
- Fiona Russell studied the PCV among children in Fiji as a PhD, and was awarded the 2012 Chancellor's prize from the University of Melbourne. She has subsequently reviewed the age distribution of pneumococcal disease, contributing to a revision of the WHO PCV position paper.

Conjugate vaccines are complex and relatively expensive to manufacture. They are manufactured using the parts of the cell walls of *Streptococcus pneumoniae* that our immune system recognises. Kim Mulholland and Dr Eileen Dunne are working to develop a low-cost vaccine that can provide broader protection by using the entire cell. The Melbourne Children's is involved in early clinical trials in Indonesia, where PATH is funding production of this low-cost vaccine by the Indonesian manufacturer Bio Farma.



**PROFILE: Dr Mohammed Chisti, International Centre for Diarrhoeal Disease Research, Bangladesh**

'Pneumonia makes breathing more difficult for children, and can lead to critically low levels of oxygen in the blood (hypoxemia). I completed a Master of Medicine at the Melbourne Children's to identify signs that health workers can use to determine if a child is hypoxic. This is important in district hospitals in Bangladesh, where equipment to monitor oxygen levels is not always available.

'Oxygen supplies are limited and the cost of oxygen is often charged to families. Families from the lowest socio-economic backgrounds find it almost impossible to meet this cost. Oxygen concentrators are machines which can concentrate oxygen using room air, and can produce oxygen cheaply. In a study in hospitals in Papua New Guinea the use of oxygen concentrators reduced the death rate from pneumonia by up to 35%. But even with oxygen, in many hospitals in developing countries the death rate from severe pneumonia can be as high as 10-15%.

'For my PhD I completed another study to evaluate a low-cost technology - bubble-continuous positive airway pressure - CPAP. This showed improved survival in children with severe pneumonia and hypoxaemia who were treated with CPAP compared with those treated with standard oxygen.'

*Dr Mohammed Chisti completed a Master of Medicine and a Doctor of Philosophy at the University of Melbourne; he was supervised by staff at the Melbourne Children's, including Professor Colin Robertson, Trevor Duke and Steve Graham.*

The percentage of all cases of diarrhoea worldwide caused by rotavirus virus

40%



## Preventing child deaths from diarrhoea

Diarrhoea can be caused by a variety of viruses, bacteria (and their toxins) and parasites. The Melbourne Children's is targeting rotavirus, the most common cause of diarrhoea in children, with vaccines.

### How do we know this?

Professor Roy Robins-Browne was part of a team that studied around 10,000 children with diarrhoea in seven countries in sub-Saharan Africa and South Asia. They identified the four most common causes of diarrhoea in these children as rotavirus, *Escherichia coli*, *Cryptosporidium* and *Shigella*. Their results confirmed that existing rotavirus vaccines and prevention with zinc dietary supplements should be made more widely available and that new methods must be developed to diagnose, treat and prevent other infections.

### Life saving vaccines for rotavirus

In Indonesia, rotavirus remains a leading cause of death in children under age five and a significant cause of childhood hospitalisation. A recent survey showed that 60% of diarrhoea-related hospitalisations in children across six Indonesian provinces were due to rotavirus.

As part of the clinical trials of the RV3-BB vaccine, Professor Julie Bines, Associate Professor Carl Kirkwood and their team are working with the Universitas Gadjah Mada and the Indonesian vaccine manufacturer Bio Farma. Two hospitals, 23 primary healthcare clinics and more than 35 doctors and 400 midwives are participating in the trial. Through the trial, primary health workers, including midwives and nurses, have been trained to strengthen care for common childhood illnesses. The health care workers administering the vaccine are proud of the part they are playing in the trial. Indonesian health care worker Bu Kartini says, 'we are ready to share in this research in order to be successful and potentially save [the lives of] babies and toddlers'.

RV3-BB is an oral vaccine. There are two other commercial rotavirus vaccines globally available, but RV3-BB would provide earlier protection as it is administered soon after a baby's birth. Additionally, administering the first vaccine dose shortly after birth when a woman and her baby may already be in a health care setting, could help reach those infants whose families do not have easy access to health centres.

So far, over 1,000 infants in Indonesia have received the vaccine. With 4.2 million babies born each year in Indonesia, if RV3-BB is included in the national immunisation schedule an estimated 9,000 deaths could be prevented each year.

### How do we know this?

Rotavirus was discovered by a team from the Melbourne Children's, led by Professor Ruth Bishop. This virus has subsequently been shown to cause 40% of all cases of diarrhoea worldwide. A strain of rotavirus that specifically infects newborns but does not cause disease was discovered at Melbourne's Royal Women's Hospital. This unique strain of rotavirus (RV3) is the basis of the RV3 vaccine developed at the Melbourne Children's. Professor Graeme Barnes led the early safety and efficacy trials of RV3 in Melbourne. The next generation of the vaccine RV3-BB, has completed phase I and II safety trials in Australia and New Zealand. Phase II trials are currently being undertaken in Indonesia.

The Melbourne Children's has collaborated with the Universitas Gadjah Mada and Sardjito Hospital in Indonesia over the past 40 years.

Collaborating with Indonesian government vaccine manufacturer, Bio Farma, to produce RV3 allows for technology transfer to an emerging vaccine manufacturer and is hoped will result in the manufacture of an affordable rotavirus vaccine for developing countries.

## Getting the benefits of breastfeeding and vaccines

Rotavirus vaccines are highly effective in countries like Australia, where studies show evidence of protection from severe rotavirus disease in 95-100% of infants. These vaccines are proving less effective where they are most needed, with a reduction in severe disease in less than 50% of infants in Bangladesh, Vietnam and Malawi. There are a number of factors that could explain why oral vaccines are less effective in these settings, including the high load of micro-organisms within the environment, malnutrition or high-levels of maternal and breastmilk antibodies.

A team from Universitas Gadjah Mada and the Melbourne Children's is examining the role of maternal antibodies, the antibodies that are passed to newborns from their mothers during pregnancy and breastfeeding. Mothers in resource-poor settings are exposed to more rotavirus disease and develop higher levels of antibodies. These antibodies are concentrated in early breastmilk, or colostrum, and have the potential to protect the infant from natural rotavirus disease but also to inhibit the immune response to rotavirus vaccines.

A rotavirus vaccine for newborns developed by MCRI, RV3-BB, is being trialled in Indonesia (as described above), with the first of three doses given at birth. To examine the effect of maternal antibodies on oral vaccines, Dr Vicka Oktaria and Dr Margie Danchin will look at rotavirus antibodies in umbilical cord blood, colostrum and breastmilk and their association with the immune response to RV3-BB rotavirus vaccine, alongside the trial. Results from this study may suggest that RV3 should be given before the initiation of breastfeeding so that infants in resource-poor settings can get an optimal immune response to the vaccine very early in life and the enormous benefit of breastfeeding.

## Rotavirus surveillance

The safety and efficacy of the current rotavirus vaccine has been proven in extensive clinical trials. When the rotavirus vaccine is introduced into national immunisation schedules, vaccine effectiveness and adverse events can be monitored through national health information systems or disease surveillance

program. However, many low and middle-income countries do not have adequate systems or laboratory capacity to monitor disease trends, vaccine safety or effectiveness.

As part of the WHO Global Rotavirus Surveillance Network, Carl Kirkwood leads the Rotavirus Regional Reference Laboratory based at the Melbourne Children's. The Regional Reference Laboratory provides expertise in rotavirus detection and genetic sequencing and supports laboratories in developing countries to introduce standardised procedures. The Regional Reference Laboratory has provided training to laboratories in Vietnam, Mongolia, Phillipines, Lao PDR, Myanmar and Cambodia.

### How do we know this?

Safety evaluations showed that the first rotavirus vaccine was associated with a small increase in the risk of intussusception, the most common cause of intestinal obstruction in infants and young children. This vaccine was withdrawn and subsequent vaccines have been rigorously evaluated for risk of intussusception.

Professor Julie Bines compiled data from 70 countries on intussusception for the Steering Committee on Diarrhoeal Disease Vaccines, Vaccine Development, Vaccines and Biologicals, World Health Organization, to contribute to rotavirus vaccine safety guidelines and developed the Brighton Collaboration Clinical Case Definition for intussusception and the WHO generic protocol for post-licensure surveillance for rotavirus vaccines.

In 2012, Fiji introduced the rotavirus vaccine for infants into the national immunisation schedule. To show how effective the vaccine is, a team from the Melbourne Children's is working with the Fiji Centre for Communicable Disease Control (FCCDC), Ministry of Health, the Colonial War Memorial Hospital and Savusavu Hospital to build disease surveillance capacity. The Ministry of Health has now met the requirements to participate

in the WHO Global Rotavirus Surveillance Network and is the WHO Regional Reference Laboratory for the Pacific.

Vaccine safety monitoring was also introduced through this project.

## Lifesaving vaccines for *Escherichia coli*

Most strains of *Escherichia coli* are harmless, but some can cause diarrhoea and other diseases. Roy Robins-Browne and a team at the Melbourne Children's and the University of Melbourne are developing tools to distinguish the disease-causing varieties of *E. coli* and developing a vaccine to target these varieties. There is currently no effective vaccine for *E. coli*.

The Melbourne Children's and the University of Melbourne are in the early stages of developing a vaccine based on molecules produced by *E. coli* joined to synthetic lipopeptides which can be given as a nasal spray. Lipopeptides can stimulate immune cells directly and should generate a comprehensive immune response without the need to use toxic adjuvants such as aluminium.

...many low and middle-income countries do not have adequate systems or laboratory capacity to monitor disease trends, vaccine safety or effectiveness.





## Nutrition and common childhood illness

Globally, more than one third of children do not receive adequate nutrition. This has serious consequences for their health, development and learning.

Poor nutrition is a factor in almost half of all deaths of children under five years of age.

### An essential micronutrient to reduce diarrhoea

Zinc sulphate, when given with oral rehydration solution (ORS), reduces the severity and duration of diarrhoea. It is highly cost-effective; a two week supply of zinc and ORS costs less than 50 cents. However, in many developing countries, zinc and ORS are not yet routinely given to children with diarrhoea. This is often due to issues with the supply and distribution of essential medicines or the promotion of new treatments.

Pharmacist Michael Nunan is working with the Pharmacy Services Division in the Solomon Islands to improve the availability of zinc by introducing electronic management and simple changes in the supply system for over 300 clinics, health centres and provincial hospitals. This project has also developed educational radio program and patient information cards to improve health worker and community knowledge of the effectiveness of zinc.

### Can vitamin D prevent severe pneumonia?

Despite being close to the equator, vitamin D deficiency is still common in South-East Asia. Vitamin D plays a role in ensuring healthy immune function and there is evidence to suggest that deficiency can contribute to the severity of lower respiratory tract illness, particularly pneumonia, in young children.

To examine the relation between vitamin D deficiency and the severity of pneumonia in Indonesian children, Vicka Oktaria, Sardjito Hospital, Yogyakarta, and Gadjah Mada University, Indonesia, and a team of local health care providers are working with Steve Graham and Margie Danchin, at the Melbourne Children's.

The team will test newborns for vitamin D deficiency at birth and at other time points during the first two years of life to record vitamin D levels and incidence of respiratory infections in the

community. The team will also test the vitamin D levels of children with pneumonia admitted to Sardjito Hospital over one year to look for an association with more severe respiratory illness.

This is the first step towards testing whether Vitamin D supplementation could prevent severe pneumonia in young children in resource-poor settings in South-East Asia, where around half of global pneumonia cases currently occur.

### Treating malnutrition and common childhood illness in hospital

Hospital based nutritionists are a key part of a health care team working to reduce complications and promote faster recovery from disease through improved nutrition. Judith Myers is working with the Ministry of Health, Timor Leste to define the role of hospital-based nutritionists and to write the *Hospital Nutrition Manual for Timor Leste*. She is also working to ensure that the skills needed in a hospital context are incorporated into local nutrition training. Over 50% of children in Timor Leste are chronically undernourished.

This program has received support from the Royal Darwin Hospital, Alice Springs Hospital, Menzies School of Health Research, the Australian Government and the WHO South East Asian Regional Office (SEARO).

The number of children globally who do not receive adequate nutrition

one third



Vitamin D plays a role in ensuring healthy immune function and there is evidence to suggest that deficiency can contribute to the severity of lower respiratory tract illness, particularly pneumonia, in young children.



# Child tuberculosis

The WHO estimates that there are around 500,000 cases of tuberculosis in children and up to 74,000 deaths annually. The actual numbers could be much higher. The impact of this neglected disease in children has gained recognition since the launch of the global plan to eliminate child tuberculosis in late 2013.

Steve Graham led the development of the global plan *Roadmap for childhood tuberculosis: towards zero deaths* with WHO, Stop TB Partnership, US Centers for Disease Control and Prevention (CDC), International Union Against Tuberculosis and Lung Disease and the US Agency for International Development.

The Roadmap outlines critical research to end child tuberculosis and provides advice for national health programs about the tools to prevent tuberculosis that already exist. The Melbourne Children's works in several of the key areas identified in the Roadmap, including research to develop child-friendly diagnostic tests, medicines and more effective vaccines; and by supporting national tuberculosis programs to work with families and communities.

## Testing for tuberculosis in children

The lack of an accurate test for tuberculosis in children is a major challenge. Professor Nigel Curtis and Dr Tom Connell have compared some of the available tests (tuberculin skin testing, QuantiFERON-TB gold and T-SPOT.TB). Their studies in South Africa and Australia found that new tests developed for use in adults do not perform as well in children. This has led doctors worldwide to review how these tests are used in children. Nigel Curtis' team has gone on to investigate other new methods for obtaining more accurate results. They are involved in ongoing studies of potential new diagnostic indicators of tuberculosis, including a pilot study in children in Lima, Peru.

It is also difficult to know whether tuberculosis is a factor in many child deaths, because in young children the signs and symptoms overlap with other common diseases such as pneumonia, malnutrition and HIV/AIDS. Dr Mohammad Chisti from the International Centre for Diarrhoeal Disease Research (icddr'b) in Dhaka, Bangladesh and Steve Graham from the Melbourne Children's have evaluated a recently developed diagnostic test (Xpert assay) that can be used in children with pneumonia and severe malnutrition, a group at high risk of death in hospital and after discharge, to test for tuberculosis.

Steve Graham and Nigel Curtis are investigators on the National Health and Medical Research Council (NHMRC) Centre of Research Excellence in Tuberculosis Control, which also has a focus on developing new diagnostic tests.

## Community care of children and families with tuberculosis

The story of Mavuto, a nine month old Malawian infant whose name means 'trouble' in the local language, shows what community initiated care of children and families with tuberculosis could achieve.

When Mavuto's father was diagnosed with tuberculosis, Mavuto was only three months old. Young children living with a family member who has tuberculosis are at high risk of infection. However,

when an adult is diagnosed there is often no attempt to test children in the household for tuberculosis. Mavuto wasn't tested.

Six months later Mavuto was hospitalised with seizures from tuberculosis meningitis.

If screening of family members was routine, Mavuto could have taken preventive medicine or been treated earlier, before he developed seizures. Mavuto survived hospital to return home; sadly, many children with tuberculosis meningitis do not.

Preventive medicines are safe and cost effective for children under five years old who don't have any tuberculosis symptoms. Prevention requires daily medication for six months. While acknowledging it can be difficult to convince parents that children without symptoms should take daily medication, community health workers can help educate and encourage parents to continue preventive medicines for their children.

Many countries are now adopting this type of screening for children.

### How do we know this?

In recognition of the challenges and possibilities in places with limited resources, Steve Graham was instrumental in publishing a symptom based screening approach to child TB contact management in WHO's first edition of child tuberculosis guidelines. This opened the possibility for screening to be decentralised from the hospital to the community.

In 2013, Steve Graham and Dr Rina Trisih completed a collaborative project with Gadjah Mada University, Indonesia, that evaluated symptom based screening and provision of preventive therapy by community health workers for children who are tuberculosis contacts. This project has shown that community screening using WHO guidelines can be effective in case detection of children with tuberculosis as well as providing preventive therapy to at-risk children.

## Life saving vaccines for tuberculosis

The Bacille Calmette-Guérin (BCG) vaccine is given to over 120 million infants born each year worldwide. The BCG vaccine offers protection against some forms of tuberculosis, but we don't yet fully understand the immune response to the vaccine. Understanding the immune response to BCG vaccines can help us to develop new tuberculosis vaccines.

A team led by Nigel Curtis at the Melbourne Children's compared the immune response to BCG vaccines made from three different strains to determine which provides the most effective protection.

### Heterologous effects of BCG vaccine

A number of studies suggest that BCG also protects against diseases *other than* tuberculosis, including other infections and allergies. Nigel Curtis' team is investigating these broader heterologous effects of BCG vaccine. Because tuberculosis is uncommon in Australia and BCG vaccine is not routinely recommended, a Melbourne Children's team is conducting a study here to determine if BCG vaccination reduces the incidence of allergy (food allergy, eczema) and infections in newborns. They will also investigate the underlying immune mechanisms that may account for these heterologous effects of BCG. Harnessing these effects of BCG could significantly reduce neonatal and infant morbidity and mortality worldwide, and have implications for the design of new vaccines and global BCG vaccine policy.

Frank Shann has been working in Guinea-Bissau on this issue with Professor Peter Aaby from the Bandim Health Project, Statens Serum Institut, Denmark. Frank Shann and Dr Siva Namachivayam are also doing research in India on the role of the heterologous effects of BCG in reducing deaths in newborn babies from conditions other than tuberculosis.

Professor Katie Allen has worked with the Indepth Network, Guinea-Bissau, to explore whether BCG vaccination affects immune response to allergens.



The number of children screened so far in Fiji for rheumatic heart disease. Globally 15 million children are affected by rheumatic fever

# 15,000



# Take heart



The Melbourne Children's is working to understand rheumatic heart disease, which typically begins with a persistent fever in early childhood. Rheumatic fever, caused by the common infection Group A Streptococcus, affects 15 million children in developing regions of the world, including the Pacific, and in Indigenous communities in Australia. If rheumatic fever is prevented or treated early, we can prevent heart inflammation and the need for surgery during later childhood or adolescence.

### Step by Step to understand rheumatic heart disease

Associate Professor Andrew Steer and Professor Pierre Smeesters are working to understand how various types of Group A streptococcus bacteria cause acute rheumatic fever and heart disease. Group A streptococcus is a common infection that also causes sore throats, scarlet fever and impetigo (a skin infection). Understanding how infection occurs will contribute to the development of an effective vaccine for the spectrum of diseases caused by streptococcal A bacteria.

There are several potential vaccines currently being trialled by groups worldwide.

### Echo every heart beat

Rheumatic heart disease is difficult to detect early. The stethoscope has long been the primary tool available for doctors in low-income countries to detect heart murmurs that could indicate damage to heart valves. Now, ultrasound of the heart - echocardiography, or 'echo'- is becoming more widely available and more portable. Echo can be ten times more effective at detecting damage to heart valves than a doctor listening with a stethoscope.

Dr Daniel Engelman is working with Dr Joseph Kado from the Ministry of Health in Fiji to train school health nurses to use echo. Portable echo machines make it possible to test children in remote villages. Children can then be referred to the Fiji rheumatic heart disease control program. The program provides antibiotics to prevent the recurrence of rheumatic fever and further damage to the heart. Children are followed up in the divisional hospitals, such as the Colonial War Memorial Hospital, Suva.

Over 15,000 children have been screened so far in Fiji. At least 800 children who would have gone undiagnosed have received treatment through this program.

Continuing work will follow up many of these children to understand their health care needs, and inform policy regarding screening and prevention in Fiji and other Pacific Island nations.

### Understanding Kawasaki disease in developing countries

In developing countries where fever is a common symptom, less common causes of fever such as Kawasaki disease may go undiagnosed. In many resource limited settings, Kawasaki disease is increasingly recognised but management is particularly difficult. Professor David Burgner is working to understand the causes of and changes that occur in Kawasaki disease to improve diagnosis and treatment worldwide. There is no simple test for Kawasaki disease but it is effectively treated with immunoglobulin, the antibodies used in the immune system to neutralise bacteria and viruses. If Kawasaki disease goes undetected in childhood, it can lead to ongoing inflammation of the arteries in a child's heart and heart disease in adulthood.

If rheumatic fever is prevented or treated early, we can prevent heart inflammation and the need for surgery during later childhood or adolescence.

# Preventing and treating cancer



Each year around the world, 175,000 children and adolescents are diagnosed with cancer. The majority live in developing countries where survival rates can be as low as one in ten. If a child develops cancer in Australia, their chances of survival are usually in excess of 85%. To give children and adolescents with cancer the best chance of survival, the Melbourne Children's is working with paediatricians and pathologists in developing countries to improve prevention, early detection, specialist cancer care and the availability of cancer medicines and treatment.

## Putting children's cancer under the microscope

Cancer causes cells to grow in an uncontrolled way. Some tumours grow and spread quickly, some slowly and in other cases tumours simply disappear. Accurate diagnosis, including identifying the type of cancer and severity and progression of the disease, in conjunction with the use of accessory investigations such as molecular genetics, assists paediatricians to provide the best care for children with cancers. Professor CW Chow has trained paediatric pathologists in China in the diagnosis of childhood cancers and other diseases and encouraged collaboration between specialists.

## Setting new standards of care for children with cancer in the Pacific

With the improved treatment of infection and undernutrition in Pacific children, cancer is beginning to emerge as a major cause of premature death. However, the resources to treat children with cancer in Pacific Island countries are very limited: there is just one paediatrician with specialist training in cancer, one medical oncologist and only a single radiotherapy machine for a population of nearly 9 million.

Associate Professor Michael Sullivan is working with the International Society of Paediatric Oncology (SIOP) to support the development of child cancer services in Fiji. More recently he has begun working with Dr Gwenda Anga in Port Moresby, Papua New Guinea to support direct patient care and assist with improving access to cancer treatment (see profile).

Through SIOP and the New Zealand Pacific Islands Program, Michael Sullivan has adapted standards of care for managing specific childhood cancers in resource-poor settings. These adapted treatment regimens provide treatment within the resources available, so a condition like Burkitt Lymphoma that might cost \$200,000 to treat in Australia can be treated for as little as \$500 in Papua New Guinea. By adopting these guidelines and with weekly teleconference support to discuss patient care, survival rates from childhood leukaemia in Fiji have already improved to above 45%.

## Life saving vaccines for cervical cancer

Human papillomavirus (HPV) vaccine, recommended for children and young adolescents aged nine to 13 years, is highly effective in preventing cervical cancer. Cervical cancer is one of the leading causes of death for women, causing an estimated 50,000 deaths in the western Pacific each year. HPV vaccines are especially important in low-income countries, where access to testing and treatment for cervical cancer is limited.

HPV vaccines could reduce cervical cancer by more than 80% in Fiji, where on average two women each week are diagnosed with cervical cancer and only 8% of women have regular Pap tests. The Melbourne Children's is working to support the Ministry of Health, Fiji to evaluate the value of receiving less than the recommended three doses of HPV vaccine and measure HPV infection rates following the introduction of the vaccine. The Ministry of Health has already vaccinated more than 17,000 girls.

The Melbourne Children's is also working with the National Institute of Hygiene and Epidemiology and the Pasteur Institute in Vietnam on a national HPV research program before the vaccine is introduced.

Fiona Russell from the Melbourne Children's has also supported Jimma University, Ethiopia to understand the socio-cultural impact of cervical cancer. Many communities believe the disease is due to a failure to adhere to traditional beliefs and practices, rather than due to a common infection. Women suffering from cervical cancer are commonly stigmatised, blamed and ostracised from their communities.

## PROFILE: Dr Gwenda Anga, International Fellow, Children's Cancer Centre

'Cancer is one of the top ten causes of hospital admissions for children in Papua New Guinea, and it has a survival rate of less than 20%. But we don't have accurate figures for how many children have cancer and how many survive. This is for two main reasons; some cancer patients are wrongly diagnosed so they are not recognised as having cancer. And we don't have a national registry for childhood cancers. I have two diaries that I have handwritten for Port Moresby General Hospital but we don't have this record for other provinces in PNG.'

'Cancer care in PNG is very basic, from the diagnosis to the care we can offer patients, because our health system is overwhelmed by more common diseases.'

'After caring for most of the children with cancer in Port Moresby General Hospital for two years, I worked as a fellow training with Professor Françoise Mechinaud and Michael Sullivan to learn more about cancer diagnosis and treatment. I am the first paediatrician in Papua New Guinea to specialise in oncology.'

'I had an all-round experience so I could go back and provide comprehensive care for our children. At the Melbourne Children's I did consultations, assisted with lumbar punctures and bone marrow aspirates, gave chemotherapy, learned how to identify cancerous cells under the microscope and how to provide the best palliative care for children who won't survive cancer. Unfortunately in PNG, many cancer patients come to the hospital in the later stages of the disease. These patients need quality palliative care, and their families need care also. Nutritional support is important for patients receiving cancer therapy, and this is another one of the things we can improve in PNG.'

'From this experience, I designed protocols modelled on the basic supportive care provided for patients at the Melbourne Children's and have taken them back home to improve our care of children with cancer.'

*Dr Gwenda Anga was supported through the RE Ross Trust.*



# Making surgery safer

The number of children globally born with some form of heart disease

# Almost one in 100



## Simple tools to make surgery safer

We picture operating rooms filled with steady beeps, screens and specialist monitoring equipment to make anaesthesia and surgery safe. Without adequate monitoring a routine operation poses huge risks.

One essential piece of equipment is a pulse oximeter, a small box that clips to a child's finger to monitor the level of oxygen in their blood. The World Federation of Societies of Anaesthesiologists (WFSA) and WHO's *Safe Surgery Checklist* recommend that every patient undergoing surgery should be monitored with an oximeter. The *Safe Surgery Checklist* is a simple tool to eliminate errors before and during surgery. Together, the checklist and the pulse oximeter could save half the lives lost during surgery in developing countries.

However, pulse oximeters are still not available in over 70,000 operating rooms throughout the world.

Since 2011, Dr Rob McDougall from the Melbourne Children's has worked with UK charity Lifebox, supported by the Australian Society of Anaesthetists, to deliver 10,000 low cost oximeters and training covering the *Safe Surgery Checklist* to anaesthetists, surgeons and nurses in South East Asia and Pacific Island countries. Now nearly every operating theatre and recovery room in the Pacific has an oximeter. More recently, Lifebox has been working in Cambodia, Lao PDR, Mongolia, Timor Leste, Indonesia and Myanmar.

## Teaching the ABC of trauma care

Serious injuries from road accidents, violence and landmines are a significant cause of death and disability for children and adolescents in developing countries.

The immediate care that seriously injured children and adolescents receive is critical. Rob McDougall works with the Primary Trauma Care Foundation (PTCF) to train doctors, nurses and ambulance officers to assess and treat serious injuries in a systematic way by using a more complex version of the airway-breathing-circulation (ABC) mnemonics used in first aid courses. This training has been delivered in over 60 countries worldwide, including the Cook Islands, Fiji, Indonesia, China, Mongolia, the Solomon Islands, Tonga and Vietnam.

In addition, the PTCF supports local instructors to develop training skills. This has been remarkably successful in China where 30,000 doctors have been trained in PTC. The Melbourne Children's has provided technical advice to the Ministry of Health in China on the establishment of trauma centres that can provide comprehensive emergency medical services.

## Learning by heart in Vietnam

Almost one child in 100 is born with some form of heart disease. In Vietnam, there are currently around 16,000 children on the waiting list for heart surgery. An estimated 600 paediatric surgeries are performed each year in Huế Central Hospital, Vietnam by surgeons trained at the Melbourne Children's by Associate Professor Christian Brizard, Associate Professor Michael Cheung and the previous Director of Cardiology, Professor Dan Penny.

The training focuses on relatively common heart conditions, for example, where children are born with a 'hole in the heart' or where their arteries are transposed and oxygenated blood is not efficiently circulated throughout the body. These children need just one simple surgery either within the first week or first six months of life. The focus of the program means that surgery can be undertaken safely and at low cost.

Melbourne Children's managed a five-year project training staff in the cardiovascular centre at Huế Central Hospital, Vietnam, supported by Atlantic Philanthropies. Professor Garry Warne was instrumental in establishing this program. More than 100 staff from a range of medical, surgical, nursing and management disciplines were trained at the Heart Institute in Ho Chi Minh City, The Royal Children's Hospital Melbourne (RCH), adult hospitals in Melbourne, Sydney Royal North Shore and at Huế Central Hospital itself. Training for hospital management was provided at the Heart Institute, Ho Chi Minh City and the Pontchaillou Hospital in Rennes, France. This collaboration between training centres around the globe was truly unique.

Melbourne Children's work in Vietnam developed following a collaboration between Dr Duong Quang Trung, the late director of the health authorities in Ho Chi Minh City and Professor Alain Carpentier of the Hôpital Européen Georges-Pompidou, France,

to establish the Heart Institute in Ho Chi Minh City, Vietnam. The Heart Institute has since become a training centre for most surgeons in Vietnam.

## Supporting life-saving surgery for children from Pacific Island countries

Where a particular life saving or life changing surgery is not yet accessible for children living in Pacific Island countries, Rotary Oceania Medical Aid for Children (ROMAC) facilitates surgery in Australia and New Zealand. ROMAC has facilitated procedures for over 350 children and adolescents from our region, including children with heart or neurological conditions, severe disability, burns and cancers. In 2014, ROMAC signed a memorandum of understanding with the RCH to provide medical treatment. The RCH will care for children supported through ROMAC in our award-winning facility.



Le Nhan Phuong / The Atlantic Philanthropies, 2010

**PROFILE: Janine Evans, Clinical Nurse Consultant, Rosella Ward – Paediatric Intensive Care Unit, The Royal Children's Hospital Melbourne**

'As a clinical nurse consultant, I aim for the highest possible standard of care for children in the Rosella – Paediatric Intensive Care Unit at The Royal Children's Hospital Melbourne. Over the last twelve months I took those aims to Benghazi, Libya where I coordinated nurse education programs for the International Children's Heart Foundation (ICHF). The ICHF trains developing country surgeons and nurses to care for children born with imperfect hearts.'

'In Libya, about 2,000 children each year are born with congenital heart disease. For most of these children, one simple surgery can mean a long and healthy life.'

'Currently only 300 children per year receive surgery because there aren't enough trained health care workers.'

'In Libya, almost two-thirds of nurses are from overseas. And while the University of Benghazi now offers a three year nursing program, most local nurses have received only one year of training. Because cutting edge equipment isn't always available in Libya, nurses can't rely on technology, so caring for children requires strong clinical skills.'

'A specialist team from the ICHF has started training local staff in simple surgery for children with congenital heart disease and over several years will train staff to perform more complex surgery independently.'

'I started volunteering in Libya a few months after the Libyan Revolution in 2011, and I have developed good relationships with the staff because I keep coming back. It's been a privilege to get to know these nurses and while life is very different in Libya the same things are important – it's about children and their families.'



Janine Evans, 2012

**'In Libya, about 2,000 children each year are born with congenital heart disease. For most of these children, one simple surgery can mean a long and healthy life.'**

Janine Evans, Clinical Nurse Consultant, Rosella Ward – Paediatric Intensive Care Unit, The Royal Children's Hospital Melbourne



**PROFILE: Associate Professor Choong Yi Fong, Consultant Paediatric Neurologist, University Malaya Medical Centre, Kuala Lumpur, Malaysia**

'The Melbourne Children's has one of the leading epilepsy centres in the world. It was a privilege to continue my training as a fellow in Paediatric Epilepsy and Paediatric Electroencephalography (EEG) after completing paediatric neurology training in the United Kingdom, and an epilepsy fellowship at the Mater Children's Hospital and Royal Children's Hospital Brisbane, Australia.'

'The experience of seeing how a comprehensive epilepsy centre at the Melbourne Children's can transform the lives of children with refractory epilepsy, where medicines don't work well (or at all) to control the seizures, was remarkable.'

'Since returning to Malaysia, I have been involved in developing our paediatric epilepsy centre in the University of Malaya. We conducted our first paediatric epilepsy surgery in January 2014.'

'We have also completed building our inpatient video EEG monitoring (VEM) unit in our paediatric wing. VEM is a way of recording a child's behaviour and brain electrical activity during a seizure to assist in diagnosing the type of seizures the child is experiencing and the appropriate treatment.'

'The Melbourne Children's has continued to support me in Malaysia. Dr Simon Harvey and I have conducted a study to follow up babies with low blood sugar, to determine if they are at risk of epilepsy.'

'Associate Professor Andrew Kornberg and Simon Harvey were invited international speakers for two day postgraduate paediatric neurology course organised by the University of Malaya in 2013. The course was attended by over 160 participants from Malaysia and neighbouring countries.'

# Making medicine child sized



## A pocket-sized book to improve paediatric hospital care

Hospitals play an essential role in reducing child deaths, disability and disease. It is estimated that better quality hospital care could improve child survival by up to 40% in low-income countries. The Melbourne Children's is working with the WHO, national ministries of health and paediatric professional associations to improve the quality of care for children.

A pocket-sized book is changing how doctors in low-income countries diagnose and treat patients. The WHO *Pocket Book of Hospital Care for Children: Guidelines for the Management of Common Illnesses with Limited Resources* was first published in 2005 and revised in 2013. The book includes contributions from over 100 paediatricians worldwide, and constitutes a set of clinical guidelines for common causes of child deaths and ill health including pneumonia, diarrhoea, newborn health problems, tuberculosis, HIV and malnutrition.

The Melbourne Children's have supported the training of over 1,500 health care workers in the Solomon Islands, Lao PDR, Papua New Guinea, Fiji, Samoa, Tonga, Vanuatu, Indonesia, Kazakhstan and Uzbekistan. The book has been translated into more than 16 languages and used in more than 40% of low- and middle-income countries.

## Making medicines for children

Children need specific medicines in dose, size and taste. Professor Noel Cranswick is part of the team who initiated the WHO Essential Medicines List for children. The children's list currently includes over 300 medicines for priority conditions including malaria, tuberculosis and HIV. To inform the committee as to what medicines should be recommended for the list, Professor Cranswick and a team from the Melbourne Children's have conducted reviews of the growing evidence available.

Many developing countries rely on the WHO children's list to guide national procurement of medicines. To support pharmacists, doctors, nurses and community health workers to use medicines on the children's list, a team from WHO and the Melbourne Children's produced a more detailed guide, the WHO Model Formulary for Children, which provides information on prescribing and the different dosages that are needed for children as they grow.

### A pocket-sized book improving care in Lao Peoples Democratic Republic

To improve the quality of care for children in Lao PDR, local paediatricians worked with Dr Amy Gray to translate the *Pocket Book* and train staff to use the clinical guidelines it contains. It is the first comprehensive Lao language resource for children's hospital care. Previously, if hospitals owned a medical textbook in Thai, English or French, it was kept under lock and key. Now there is a copy of the WHO *Pocket Book* in the hands of 2,000 paediatricians, nurses and health workers.





Conor Ashleigh / AusAID 2012

### Education and training in child health

Global estimates suggest that 10.3 million more doctors, nurses, midwives and other health professionals are urgently needed. However, it's not simply a matter of numbers. The skills, clinical experience and approaches of health care workers must keep up with increasingly complex developments in technology, services and procedures. To cope with this complexity and play a leadership role in child and adolescent health, paediatricians and nurses need continuing professional development. This is often unavailable in developing countries.

The number of doctors, nurses and other health professionals estimated to be needed globally

# 10.3 million



### PROFILE: Paulini Qica and Merewairita Valu, Nurse Practitioners, Midwives and Lecturers at Fiji National University

'In many Pacific Island countries nurses provide most of the care for sick children.

'In a single shift in a typical healthcare centre in Fiji, a nurse would be looking at about sixty to seventy children. You would need to assess all these children – like triaging, having to tease out the emergencies – at the same time providing care for these children. That's a handful!

'Our nursing staff often have overwhelming workloads that can include managing children's wards, training junior staff and coordinating care for children in remote area clinics and nursing stations.

'But in our undergraduate nursing program at Fiji National University there is little that is covered in paediatrics and we have limited opportunities for continuing professional development. Samantha Colquhoun is supporting us at the Fiji National University and our colleagues in the Solomon Islands Ministry of Health to develop postgraduate training for child health nurses. We also visited the Melbourne Children's to talk to staff about curriculum design and resources for a postgraduate diploma in paediatric nursing. This course, administered by Fiji National University and the Ministry of Health, will start in 2016.

'We see this work with the Melbourne Children's as a great partnership.'



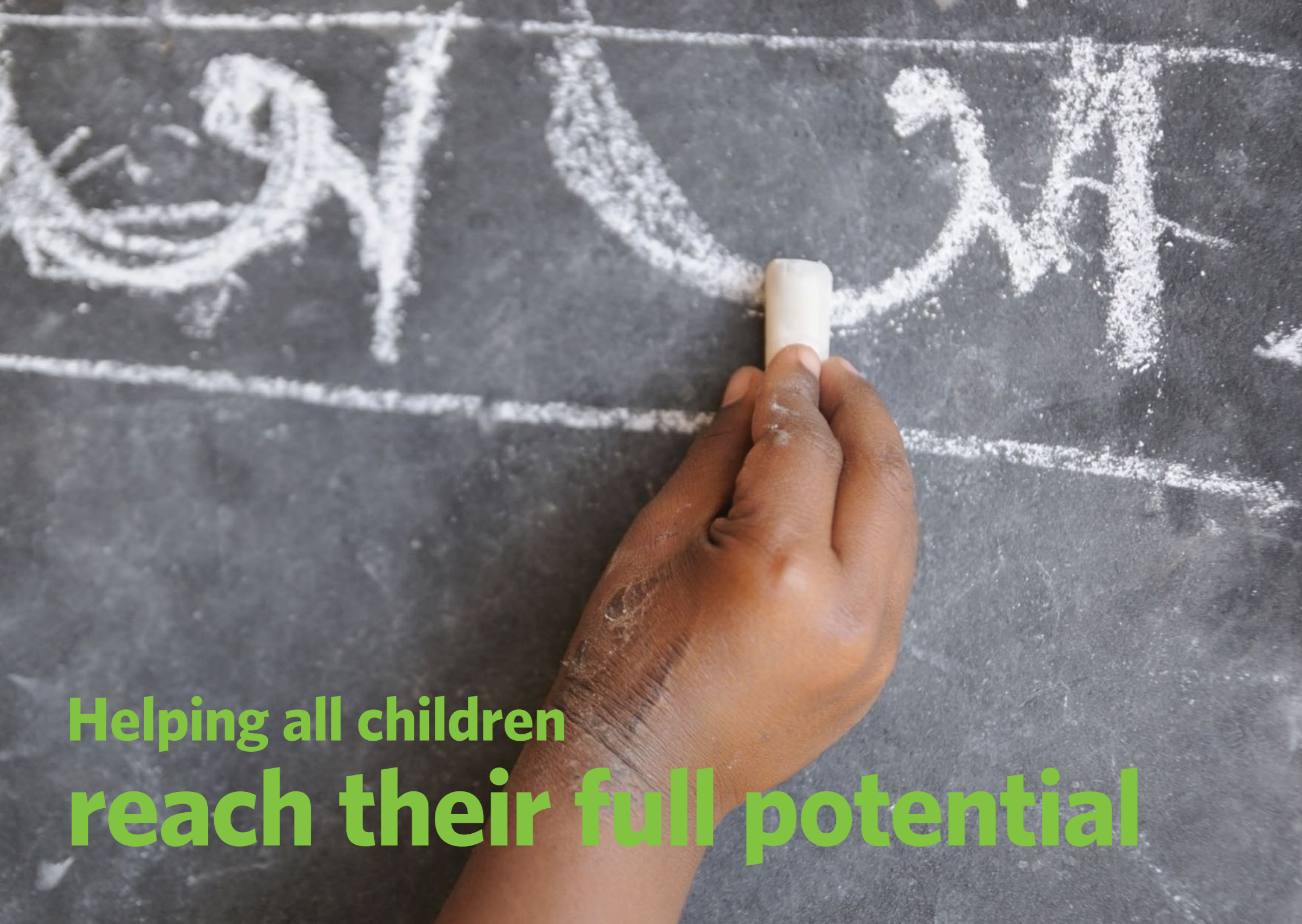
### PROFILE: Dr Monica Brook, International Medical Graduate, The Royal Children's Hospital Melbourne

'I have been fortunate to come to the Melbourne Children's through their collaboration with the Ministry of Health in Fiji. Through this collaboration we've already started to improve the care of sick children in hospitals with the training and use of standard paediatric treatment guidelines in the WHO *Pocket Book*. Further improvements can be achieved through specialist training. I've come to the Melbourne Children's to further my training to care for critically ill children in the paediatric intensive care unit (PICU).

'While there are many resources available for critically ill children at the Melbourne Children's that are not available yet in Fiji, there are also basic techniques and technologies that we could adopt. It's about improving what we have, so that it works more efficiently. For example, in Fiji, for a common chest infection like bronchiolitis, if the child is having severe difficulty breathing we would need to intubate them while administering supplementary oxygen. At the Melbourne Children's we've got the option to use mild air pressure instead of a tube to keep their airway open, making it easier for the child to breathe. This is something that I hope to take back home.

'I was one of ten paediatricians based at the Colonial War Memorial Hospital, Suva. On my return to Fiji, I will coordinate the paediatric intensive care units in the country but also hope to assist the neighbouring smaller Pacific islands. We are also planning to train specialist intensive care nurses to further improve care for the sickest children.'





# Helping all children reach their full potential

To reach their full potential, children need opportunities to play and learn in early childhood. Parents and other caregivers want to provide these opportunities but need support from community and governments to do so. Health care systems can provide some early childhood services and also act as a point of contact between parents and other services. It is estimated that at least 200 million children in developing countries are not realising their full potential.

## How do we know this?

Contributing to the influential work of the WHO's Commission on the Social Determinants of Health, Professor Frank Oberklaid has worked with the Knowledge Network for Early Childhood Development to show how the social and economic environment where children grow, play and learn determines their health during early childhood and throughout their lives.

## Giving pre-term newborn babies the best chance

Fifteen million babies are born too soon every year, but little is known about the long-term health and development of preterm and other seriously ill babies in low-or middle-income countries. The best estimates suggest that almost 40% of these children live with long-term developmental disabilities.

In Fiji, approximately 500 newborns are admitted to the hospital's main paediatric intensive care unit at the Colonial War Memorial Hospital (CWMH) in Suva every year. After discharge, keeping track of these children's progress is challenging and follow-up services are limited. Dr Kate Milner is working with the Ministry of Health, Fiji to develop systems of follow-up for these children that are feasible and appropriate in the local context. This project has received invaluable support from a team at the Melbourne Children's including Dr Anne Miller, Linda Zraika and Jo Butchart, who has been working with the physiotherapy team at CWMH.

## Coordinated care for cerebral palsy

Cerebral palsy affects a child's ability to move. It can affect muscle control, coordination, reflexes, balance and posture. Although cerebral palsy is a lifelong condition, coordinated care including physiotherapy, medication and surgery can greatly assist these children and adolescents in their day-to-day activities and in their ability to fully participate in their communities. Teams from the Melbourne Children's, including Dr Adam Scheinberg, Abhay Khot, Associate Professor Barry Rawicki, Rod Lawlor, Nicole Galea, Anna Noisette, Jane Galvin and Dr Adrienne Harvey, have trained teams of physiotherapists, orthotists, occupational therapists, physicians and orthopaedic surgeons to work with children and adolescent with cerebral palsy in Indonesia and Cambodia. In Indonesia, it is estimated that nearly 500,000 people are affected by cerebral palsy; in Cambodia the number is unknown.

## Listening and learning for children's hearing

In many Pacific Island countries children are not routinely screened for developmental progress, and hearing loss might not be identified until parents have concerns or a child's speech is delayed.

However, early identification of hearing loss is important because early childhood is a critical time for the development of speech and language. Most of the children that ENT surgeons Dr Markus Dahm and Dr Elizabeth Rose have seen in visits to clinics through the Royal Australasian College of Surgeons' Global Health Program suffer from chronic ear disease, perforated eardrums and infections. Although infections are relatively easy to treat, safe topical antibiotic preparations are not always available and a child who has persistent infections may develop permanent hearing loss. Some of these children will benefit from surgery to remove disease and to repair the perforations.

While an ENT team can only treat a few hundred patients with each visit, the training they provide to health workers can improve care for more of the 3.4 million children who have hearing loss across Asia and the Pacific.

The RACS Pacific Islands Program is supported by the Australian Government, Rotary and other partners and includes programs

in the Cook Islands, Fiji, Kiribati, Micronesia, the Marshall Islands, Nauru, Samoa, the Solomon Islands, Timor Leste, Tonga, Tuvalu and Vanuatu.

These visits continue the Melbourne Children's commitment to train health workers to improve children's hearing, begun through The Royal Children's Hospital International (RCHI). Elizabeth Rose and Sowmya Rao from the Melbourne Children's, along with Carina Law from Australian Hearing, developed a program with doctors and nurses in Hanoi to test hearing for infants and younger children. Behavioural and objective hearing tests had not been available before, and the health workers in Hanoi are now able to perform these tests themselves.

## Making links to protect children

All children have the right to grow up in a safe, healthy and positive environment. These rights are assured through the United Nations Convention on the Rights of the Child (CRC). Dr Anne Smith and Garry Warne have worked with Children's Rights International in Vietnam and Cambodia to promote political support to address issues affecting children and to ensure their basic rights under the convention. Anne Smith continues to provide advice and support for doctors working in child protection at the National Hospital of Paediatrics, Hanoi.

...at least 200 million children in developing countries are not realising their full potential.



The estimated number of adolescents globally in 2032

# 2 billion

## Healthy adolescence is a path to a better future

Conor Ashleigh, 2012

Adolescents are central to major health challenges, because risky behaviours such as tobacco and alcohol use, poor diet and physical inactivity commonly start or intensify during adolescence.

Most mental disorders begin before age 25 years.

Injuries account for a higher proportion of deaths in adolescents than in any other age group.

Unintended pregnancy, unsafe abortions, HIV infection and other sexually transmitted infections continue to present challenges. There is growing recognition of the potential to promote a healthy start to life for the following generation by addressing health and nutritional risks in adolescents before pregnancy and parenthood.

Adult cancer and cardiovascular disease can be prevented by healthy choices in made during adolescence.

And adolescents are at the centre of emerging global unemployment, civic unrest and conflict, urbanisation, and migration, each of which pose threats to health and wellbeing.

**How do we know this?**

Two decades of calls to action have brought attention to adolescent health. The Melbourne Children's has led international teams that have compiled the first systematic studies of disease, disability and death among adolescents throughout the world. Building on these first systematic studies, Professor George Patton is the Chair of the Lancet Commission on Adolescent Health and Wellbeing, which brings together academics and clinicians from across the globe to determine the most important investments to be made on the health of adolescents around the world.

The Lancet has partnered with Professor George Patton and Professor Susan Sawyer at the Melbourne Children's and other leading universities to undertake the Lancet Commission on Adolescent Health and Wellbeing.

Health programs for adolescents have typically focused on sexual and reproductive health, including HIV and pregnancy. But with more information now available about the causes of disability and death during adolescence, there is increasing recognition of other health issues that young people face, including injury, violence, poor nutrition, mental health, substance abuse and risks for non-communicable diseases.

Through the Commission, the Melbourne Children's will produce national profiles of adolescent and young adult health from available information and compile 'report cards' with recommendations for youth-friendly policy and programs.

These 'report cards' will provide indicators for adolescent and young adult health. But measurement against these indicators requires accurate information about the lives of adolescents and young adults, which isn't currently available in many countries. The Melbourne Children's will assess the available data and information systems and provide potential solutions to ensure that adolescent health counts.

**'Young people want substantial opportunities to engage longer-term...'**

Kikelomo Taiwo and Dakshitha Wickremarathne  
The Lancet Commission on Adolescent Health and Wellbeing

### **PROFILE: Kikelomo Taiwo and Dakshitha Wickremarathne** **The Lancet Commission on Adolescent Health and Wellbeing**

'Over the past decade, the UN and other agencies have developed initiatives to engage young people and promote programs and ideas that young people matter. World leaders are listening and we at the Lancet Commission on the Adolescent Health and Wellbeing, are amplifying the voices of adolescents and young adults.

'Our role in the Commission is to co-lead work around youth engagement and to meaningfully represent the voices of young people around the world. Young people are keenly interested in being a part of decision-making processes and policies that affect their health.

'We've seen this interest demonstrated in a global survey we've conducted with almost 500 youth advocates. The survey gathered evidence around what young people believe health and wellbeing means. Youth advocates identified what key messages strongly resonate for them and represent their needs and expectations for their wellbeing and development.

'There are several ways we can engage adolescents and young adults – for example, through social media platforms – but the question should be "How do young people want to be engaged?". And that's what we asked in the survey. The desire for young people to contribute meaningfully is about being recognised as equal stakeholders, partners and as experts in their own experiences.

'For example, no one can tell you what a youth-friendly health centre should look like better than a young person. They are the ones who will use it and encourage their peers to use it.

'Young people want substantial opportunities to engage longer-term, but there is a need for effective systems and mechanisms to support their participation. Because adolescents and young adults face a number of competing priorities in their lives – peer-pressure, parental pressure,

there could be pressure coming from educational institutions, or pressure from earning an income. Health underscores the ability to engage in community, education or professional activities.

'Adolescent health research, policy and programs need to involve all these areas. For this reason, the Lancet Commission on Adolescent Health and Wellbeing, brings together experts from different disciplines including education, economics, political and social sciences and is forming partnerships with young people.

'Young people are passionate and effective advocates for public health generally and for adolescent health specifically, but too often they are not given a place in discussions about their own health. Engaging young people in the issues that can potentially affect their health and development builds their sense of responsibility, confidence, and awareness of themselves and community. If young people have experience in contributing to policy-level discussions, like that offered by 'The Lancet Youth', they will be better equipped for future challenges.'

*Kikelomo Taiwo and Dakshitha Wickremarathne are experienced youth advocates. Kikelomo Taiwo is involved in the Education as a Vaccine' (EVA) Youth Advocates Group and has contributed to the UN Post 2015 Development Agenda. Dakshitha Wickremarathne is the co-founder of the Youth Advocacy Network Sri Lanka and serves as an advisor to UNWOMEN Global Civil Society Advisory Group.*

### **Investing in adolescent health**

Addressing health problems in the adolescent years is vital, and it is now understood that health risks arising in adolescents are major contributors to non-communicable diseases, such as cancer, diabetes and cardiovascular disease in later life. Good adolescent health can improve maternal and child health for the next generation. The central place of adolescents has been recognised in the *Global Strategy for Women's, Children's and Adolescents Health* that will run until 2020.

George Patton and Susan Sawyer are working the World Health Organisation, the World Bank, the United Nations Population Fund, UNICEF and the Partnership for Maternal Newborn and Child Health to provide governments in low- and middle-income countries with the best policy choices for investing in adolescent health.

Susan Sawyer currently chairs the WHO Technical Steering Committee to the Department of Maternal, Newborn, Child and Adolescent Health. George Patton and Frank Oberklaid had previously served on this committee, which sets the agenda for developing global recommendations and assisting countries to implement programs to improve the health of women, children and adolescents.

**The desire for young people to contribute meaningfully is about being recognised as equal stakeholders, partners and as experts in their own experiences.**



# Responding to emergencies

'I use my paediatric nursing experience in different ways, whether it's planning, educating and implementing protocols or caring for patients.'

Monica Burns, Médecins Sans Frontières and The Royal Children's Hospital Melbourne

Mathew Li, Courtesy of Photoshare, 2008

## Caring for children after Typhoon Haiyan, the Philippines

Almost five million children were affected by the catastrophic damage of Typhoon Haiyan in November 2013. The city of Tacloban in the Philippines was one of the worst hit areas. All of the hospitals in Tacloban were damaged. At Tacloban City Hospital, although three quarters of the doctors, nurses and other staff were directly affected by the typhoon, the majority returned to work to provide care for over 25,000 people injured in the region. To support the staff in Tacloban City Hospital and other local medical facilities, Dr Joanne Grindlay, Dr Peter Archer, Dianne Crellin and Cindy Sheers were part of an Australian Medical Assistance Team (AusMAT), providing acute surgical and emergency care in a temporary field hospital.

In just under a month, Australian teams assisted by Filipino nurses performed 200 surgeries and treated around 2,500 patients with serious injury and trauma. After the devastation of the typhoon, immediate concerns including food, shelter and the whereabouts

of family members meant that people were presenting at the field hospital with serious injuries weeks after the typhoon. This meant those injured often had infections and other complications. The Australian team worked with local hospitals and Médecins Sans Frontières (MSF) to support those people with other acute or chronic illnesses.



National Critical Care and Trauma Response Centre, 2013

## Be prepared: training to assist in an emergency

Working as part of an AusMAT is a commitment that involves advanced training to provide care for mass casualties in some of the most challenging situations. Around twenty staff at Melbourne Children's are trained to work as part of an Australian team and many of these staff were part of the teams that responded in Samoa (2009) and the Philippines (2013).

At the Melbourne Children's the RCH Emergency Department liaises with the National Critical Care and Trauma Response Centre (NCCTRC) who coordinate teams of Australian doctors, nurses, paramedics and other emergency services to provide medical care after overseas disasters and emergencies.

## PROFILE: Monica Burns, Médecins Sans Frontières and The Royal Children's Hospital Melbourne

'On the surface there are not a lot of similarities that can be drawn between working in a refugee camp in a muddy tent with gumboots on, and working in a tertiary facility like The Royal Children's Hospital Melbourne. But every day in my work with Médecins Sans Frontières (MSF) I use my paediatric nursing experience in different ways, whether it's planning, educating and implementing protocols or caring for patients.'

'I have just returned from co-ordinating a project with MSF in Ethiopia. The Gambella Region in Ethiopia has received the majority of the refugees from a civil war in South Sudan, almost 190,000 people have crossed the border. Most live in extremely basic conditions in three refugee camps.'

'I worked with a small team to co-ordinate the recruitment and training of around 600 refugees and local community members to deliver a vaccination campaign against cholera.'

'Cholera is a severe diarrhoeal disease that can kill within hours. When I arrived in July 2014, it was already present on the other side of the border in South Sudan. Experts agreed that a cholera outbreak that would devastate the refugee population was imminent. The rainy season was just beginning, we knew that it would flood the camps, and the conditions would continue to deteriorate. This forced us to act quickly.'

'Within two months, our team educated and immunised the communities at risk. As the rains progressed, the river rose and the camps flooded. The roads were blocked and our vaccines had to be delivered by UN helicopters. In spite of these difficulties, we successfully vaccinated over 90% of the refugee population. The dedication of our team meant that the wet season has now passed without a major cholera outbreak.'

'I have worked with MSF and other international NGOs in several countries. In Malawi, we responded to a measles epidemic. In Pakistan, we ran a cholera hospital for adults and children affected by the floods. In Yemen, we helped those affected by civil conflict. In 2012, I went to South Sudan to work with Sudanese refugees. In 2013, I again returned to South Sudan working as a Head Nurse for maternal and child services in a state referral hospital as the civil war broke out.'

'While the contexts are always different, using the skills and knowledge I gained from working at The Royal Children's Hospital Melbourne has allowed me to give the best care possible in difficult circumstances.'

# For more information

## Survive beyond five

Preventing three common causes of child deaths: pneumonia, diarrhoea and newborn conditions

**How do we know this?** Lozano R, et al. Global and regional mortality from 235 causes of death for 20 age groups in 1990 and 2010: a systematic analysis for the Global Burden of Disease Study 2010. *The Lancet*. 2012 Dec 15;380(9859):2095-128.

## Essential care for newborns

**How do we know this?** Milner K et al. Reducing newborn mortality in the Asia Pacific region: an urgent need to address quality of care. *Journal of Paediatrics and Child Health*. May 2013.

## Seven steps to identify very sick newborns

**The Melbourne Children's:** Professor John Carlin and Professor Kim Mulholland.  
**Partners:** Boston University, USA; John Snow, Inc.; Komfe Anokye Hospital, Ghana; Kwame Nkrumah University of Science and Technology, Kumasi, Ghana; University of Kwazulu Natal; Dhaka Shishu Hospital, Dhaka, Bangladesh; All India Institute of Medical Sciences, Delhi, India; Post Graduate Institute of Medical Education and Research, Chandigarh, India; Aga Khan University, Karachi, Pakistan; Hospital Materno-Infantil, La Paz, Bolivia; and World Health Organization.  
**Support:** WHO, Save the Children Fund.  
**Learn more:** The Young Infants Clinical Signs Study Group. Clinical Signs that Predict Severe Illness in Children Under Age 2 Months: A Multicentre Study. *The Lancet*. 2008 ; 371:9607.

## Small measures to save newborn lives

**The Melbourne Children's:** Associate Professor Fiona Russell.  
**Partners:** Jimma University, Ethiopia; National Children's Hospital, Vietnam.

## Getting priorities right for healthy mothers and healthy newborns in the Philippines

**The Melbourne Children's:** Dr Sophie La Vincente.  
**Partners:** Gadjah Mada University, Indonesia; London School of Hygiene & Tropical Medicine, United Kingdom; National Institute of Health Research & Development, Indonesia; New ERA, Nepal; Public Health Foundation of India; UNICEF; Nossal Institute for Global Health, The University of Melbourne, Australia; University of the Philippines; The University of Queensland, Australia.  
**Support:** Bill & Melinda Gates Foundation; Department of Foreign Affairs and Trade, Australian Government.  
**Learn more:** La Vincente S, et al. Supporting local planning and budgeting for maternal, neonatal and child health in the Philippines. Health research policy and systems. *BioMed Central*. 2013; 11:3.

## Dr Hoang Tran

**The Melbourne Children's:** Professor Steve Graham and Lex Doyle, Katherine Lee.  
**Partners:** Da Nang Hospital for Women and Children, Vietnam.  
**Support:** Department of Foreign Affairs and Trade, the Australian Government.  
**Learn more:** Tran H, et al. A systematic review of the burden of neonatal mortality and morbidity in the ASEAN Region. *WHO South-East Asia Journal of Public Health*. 2012;1:3.

## Early essential newborn care in the Solomon Islands

**The Melbourne Children's:** Dr Shidan Tosif and Professor Trevor Duke.  
**Partners:** Ministry of Health and Medical Services (MHMS), Solomon Islands; UNICEF.  
**Support:** UNICEF.

**How do we know this?** Duke T. Life-saving embrace: improving newborn survival in the Western Pacific. *The Conversation*. 23 March 2013.

## Ending preventable child deaths from pneumonia

### Life saving vaccines for pneumonia

**The Melbourne Children's:** Professor Kim Mulholland, Associate Professor Fiona Russell, Dr Catherine Satzke, Dr Eileen Dunne, Dr Sophie La Vincente, Dr Grant Mackenzie, Kathryn Bright, Rita Ryeburn, Ahmed Alamrousi, Laura Boelsen, Maha Habib, Edwin Hoe, Jayne Manning, Monica Nation, Eleanor Neal, Frances Oppedisano, Belinda Ortika, Casey Pell, Jenna Smyth, Helen Thomson and Emma Watts.  
**Partners:** Ministry of Health, Fiji; WHO, Western Pacific Regional Office; London School of Hygiene and Tropical Medicine; Pasteur Institute, Vietnam; Lao PDR Ministry of Health; Laos Oxford Mahosot Wellcome Research Unit; Universitas Padjadjaran (UNPAD), Bandung, Indonesia; Papua New Guinea Institute of Medical Research; Mongolian Ministry of Health; University of Western Australia; Otago University, New Zealand; Oxford University; John Hopkins University, USA; Edith Cowan University, Australia; University of Idaho, USA; University of Witswatersrand, South Africa.  
**Support:** Bill & Melinda Gates Foundation; GAVI; National Health and Medical Research Council, Australian Government; PATH.  
**Learn more:** Dunne EM, et al. Effect of pneumococcal vaccination on nasopharyngeal carriage of Streptococcus pneumoniae, Haemophilus influenzae, Moraxella catarrhalis, and Staphylococcus aureus in Fijian children. *Journal of Clinical Microbiology*. 2012; 50:3.

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## Dr Mohammed Chisti

**The Melbourne Children's:** Professor Colin Robertson and Professor Trevor Duke.  
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## Ending preventable child deaths from diarrhoea

### Life saving vaccines for rotavirus

**The Melbourne Children's:** Professor Graeme Barnes, Professor Julie Bines, Professor Ruth Bishop, Gabrielle Byars, Vanessa Clifford, Daniel Cowley, Margaret Danchin, Amanda Handley, Fran Justice, Dr Carl Kirkwood, Nicole Kruger, Karen Lee, Jane Standish and Emma Watts.  
**Partners:** PATH; Bio Farma, Indonesia; Gadjah Mada University, Indonesia; University of Otago, New Zealand; World Health Organization.  
**Support:** National Health and Medical Research Council, Australian Government; Health Research Council of New Zealand; PATH.  
**Learn more:** Danchin M, et al. Phase I trial of RV3-BB rotavirus vaccine: a human neonatal rotavirus vaccine. *Vaccine*. 2013; 31:23.

**How do we know this?** Bishop RF, et al. Virus particles in epithelial cells of duodenal mucosa from children with acute non-bacterial gastroenteritis. *The Lancet*. 1973; 2:7841.

## Getting the benefits of breastfeeding and vaccines

**The Melbourne Children's:** Dr Margie Danchin, Professor Julie Bines, Associate Professor Carl Kirkwood, Dr Katherine Lee, Dr Jim Buttery, Professor Ruth Bishop and Emma, Watts.  
**Partners:** Universitas Gadjah Mada, Indonesia.  
**Support:** Murdoch Childrens Research Institute.  
**Learn more:** Chan J, et al. Maternal antibodies to rotavirus: Could they interfere with live rotavirus vaccines in developing countries?. *Vaccine*. 2011; 29:6.

## Rotavirus surveillance

**The Melbourne Children's:** Dr Carl Kirkwood, Professor Kim Mulholland, Associate Professor Fiona Russell, Kathryn Bright, Rita Ryeburn, Eleanor Neal and Dr Adam Jenney.  
**Partners:** Fiji Centre for Communicable Disease Control (FCCDC); Ministry of Health, Fiji; Colonial War Memorial Hospital, Suva, Fiji; Savusavu Hospital, Fiji.  
**Support:** Department of Foreign Affairs and Trade, the Australian Government; WHO.  
**Learn more:** www.who.int/immunization/monitoring\_surveillance/burden/laboratory/Rotavirus/en/

## Life saving vaccines for Escherichia Coli

**The Melbourne Children's:** Kristy Azzopardi, Dianna Hocking, Professor Roy Robins-Browne and Marija Tauschek.  
**Partners:** Department of Microbiology and Immunology, The Peter Doherty Institute for Infection and Immunity, The University of Melbourne  
**Support:** National Health and Medical Research Council, Australian Government; Bill & Melinda Gates Foundation.

**Learn more:** Zeng W, et al. A totally synthetic lipopeptide-based self-adjuvanting vaccine induces neutralizing antibodies against heat-stable enterotoxin from enterotoxigenic Escherichia coli. *Vaccine*. 2012; 30:32.

## Nutrition and common childhood illness

### An essential micronutrient to reduce diarrhoea

**The Melbourne Children's:** Professor Trevor Duke and Michael Nunan.  
**Partners:** Pharmacy Division, Ministry of Health and Medical Services, Solomon Islands.  
**Support:** Department of Foreign Affairs and Trade, Australian Government.  
**Learn more:** Nunan M, et al. Effectiveness of pharmacy interventions in improving availability of essential medicines at the primary healthcare level. *Tropical Medicine and International Health*: May 2011.

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## Can Vitamin D prevent severe pneumonia?

**The Melbourne Children's:** Professor Steve Graham and Dr Margie Danchin.  
**Partners:** Sardjito Hospital, Indonesia; Gadjah Mada University, Indonesia.  
**Support:** Australia-Indonesia Centre, Monash University.

## Treating malnutrition and common childhood illness in hospital

**The Melbourne Children's:** Judith Myers. Partners have included: Royal Darwin Hospital, Alice Springs Hospital, Menzies School of Health Research, WHO SEARO and the Ministry of Health, Timor-Leste.  
**Support:** Department of Foreign Affairs and Trade, Australian Government.

## Child tuberculosis

**The Melbourne Children's:** Professor Steve Graham.  
**Partners:** Centers for Disease Prevention and Control (CDC), United States of America; International Union Against Tuberculosis and Lung Disease, France; Stop TB Partnership, Switzerland; Treatment Action Group, United States of America; UNICEF; USAID, United States of America; World Health Organization.  
**Learn more:** World Health Organization (2013) Roadmap for childhood tuberculosis towards zero deaths.

## Testing for tuberculosis in children

**The Melbourne Children's:** Professor Nigel Curtis, Associate Professor Sarath Ranganathan, Dr Jim Buttery, Dr Tom Connell, Dr Georgia Paxton and Dr Nicole Ritz.  
**Partners:** NHMRC Center of Research Excellence in Tuberculosis Control; Centenary Institute, University of Sydney, Woolcock Institute of Medical Research, the Children's Hospital at Westmead and the University of Melbourne.  
**Support:** National Health and Medical Research Council, Australian Government.  
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## Community care of children and families with tuberculosis

**The Melbourne Children's:** Professor Steve Graham, Professor Colin Robertson and Dr Rina Triasih.  
**Partners:** Gadjah Mada University, Indonesia; International Union Against Tuberculosis and Lung Disease.  
**Support:** Department of Foreign Affairs and Trade, the Australian Government; TB Operational Research Group, Indonesia.  
**Learn more:** Triasih R, et al. A prospective evaluation of the symptom-based screening approach to the management of children that are contacts of tuberculosis cases Clin Infect Dis. 2014.

## Life saving vaccines for tuberculosis

**The Melbourne Children's:** Professor Karen Allen, Professor Nigel Curtis, Professor Roy Robins-Browne, Associate Professor Susan Donath, Dr Nicholas Kiraly, Dr Nicole Ritz, Dr Marc Tebruegge, Dr Christel Zufferey, Binita Dutta and Susie Germano.  
**Partners:** University of Cape Town, South Africa; Centenary Institute of Cancer Medicine and Cell Biology and Department of Medicine, University of Sydney.  
**Support:** European Society for Pediatric Infectious Diseases; The University of Melbourne; National Health and Medical Research Council; John Burge Trust; Myer Foundation; Aranday Foundation; Murdoch Children's Research Institute.  
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**Learn more:** Kiraly N, et al. Vitamin A supplementation and BCG vaccination at birth may affect atopy in childhood: long-term follow-up of a randomized controlled trial. *Allergy*. 2013; 68:9.

## Take heart

**The Melbourne Children's:** Associate Professor Andrew Steer, Dr Pierre Smeesters, Sam Colquhoun, Dr Daniel Engelman, Ciara Baker, Hannah Frost and Shuki Tsoi.  
**Partners:** Ministry of Health, Fiji.  
**Support:** Cure Kids, New Zealand; Ministry of Health, Fiji; Department of Foreign Affairs and Trade, Australian Government; National Health and Medical Research Council, the Australian Government.  
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## Understanding Kawasaki disease

**The Melbourne Children's:** Professor David Burgner.  
**Partners:** Kawasaki Disease Global Climate Consortium; Rady Children's Hospital San Diego, United States of America; University of California San Diego, United States of America; ICREA and Institut Català de Ciències del Clima (IC3), Spain; Jichi Medical School, Japan; Scripps Institution of Oceanography, UCSD and Water Resources Discipline, United States of America; US Geological Survey, United States of America.  
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## Preventing and treating cancer

### Putting children's cancer under the microscope

**The Melbourne Children's:** Professor CW Chow.  
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### Setting new standards of care for children with cancer in the pacific

**The Melbourne Children's:** Associate Professor Michael Sullivan.  
**Partners:** Associate Professor Michael Sullivan is the Continental President (elect) for Oceania, International Society of Paediatric Oncology (SIOP); New Zealand Children's Cancer Network.  
**Learn more:** www.childcancernetwork.org.nz

## Dr Gwenda Anga

**The Melbourne Children's:** Professor Francoise Mechinaud and Associate Professor Michael Sullivan.  
**Support:** RE Ross Trust.

## Life saving vaccines for cervical cancer

**The Melbourne Children's:** Professor Kim Mulholland, Associate Professor Fiona Russell, Irwin Law, Sepehr Tabrizi, Suzanne Garland, Paul Licciardi and Ryan Toh.  
**Partners:** Regional WHO HPV Reference Laboratory, Royal Women's Hospital, Australia; Australian National University; Menzies School of Health Research, Australia; Ministry of Health, Fiji; London School of Hygiene and Tropical Medicine, United Kingdom.  
**Support:** Australian aid programme, Department of Foreign Affairs and Trade  
**Learn more:** Law I, et al. The high burden of cervical cancer in Fiji, 2004–07. *Sexual Health*. 2013; 10:2.

## Making surgery safer

### Simple tools to make surgery safer

**The Melbourne Children's:** Dr Rob McDougall.

**Support:** Lifebox, Australian Society of Anaesthetists, Australian and New Zealand College of Anaesthetists.

**Learn more:** [www.lifebox.org/](http://www.lifebox.org/)

### Teaching the ABC of trauma care

**The Melbourne Children's:** Dr Rob McDougall.

**Support:** Primary Trauma Care Foundation.

**Learn more:** [www.primarytraumacare.org/](http://www.primarytraumacare.org/)

### Learning by heart in Vietnam

**The Melbourne Children's:** Associate Professor Michael Cheung, Associate Professor Christian Brizard, Jodie Collins, James Goddard, Allison Ellis and Di McKinley and Professor Dan Penny.

**Partners:** Heart Institute, Ho Chi Minh City; Hue Central Hospital, Vietnam; Hôpital Européen Georges-Pompidou, France.

**Support:** Atlantic Philanthropies.

### Supporting life-saving surgery for children from Pacific Island countries

**The Melbourne Children's:** Associate Professor Andrew Kornberg.

**Support:** Rotary Oceania Medical Aid for Children (ROMAC).

**Learn more:** [www.romac.org.au/](http://www.romac.org.au/)

### Janine Evans

**The Melbourne Children's:** Janine Evans.

**Partners:** International Children's Heart Foundation.

**Learn more:** <http://babyheart.org/>

### Associate Professor Choong Yi Fong

**The Melbourne Children's:** Associate Professor Andrew Kornberg and Dr Simon Harvey.

**Partners:** University Malaya Medical Centre, Kuala Lumpur.

## Making medicine child size

### A pocket-sized book to improve paediatric hospital care

**The Melbourne Children's:** Professor Trevor Duke and Dr Amy Gray.

**Partners:** Lao PDR Paediatricians Association, World Health Organization. The Melbourne Children's is part of the International Child Health Review Collaboration that compiles the evidence for the guidelines and have contributed to the development of the WHO Pocket Book.

**Support:** The Wheeler Foundation.

**Learn more:** [www.ichrc.org](http://www.ichrc.org)

### Making medicines for children

**The Melbourne Children's:** Associate Professor Noel Cranswick, Siobhan Andrews, Brian Lilley, Leith Lilley, Dr Kate Milner, Courtney Munro, Christine Plover and David Tickell. A number of the Melbourne Children's staff acted as reviewers of the WHO Model Formulary for Children.

**Partners:** World Health Organization.

**Learn more:** [www.who.int/medicines/publications/essentialmedicines](http://www.who.int/medicines/publications/essentialmedicines)

### Antibiotic resistance a serious threat to public health

**The Melbourne Children's:** Professor Trevor Duke, Lilian Downie, Raffaella Armiento, Dr Rami Subhi, Dr Julian Kelly and Vanessa Clifford.

**Support:** Department of Foreign Affairs and Trade, Australian Government.

**Learn more:** Downie L, et al. Community acquired neonatal and infant sepsis in developing countries: efficacy of WHO's currently recommended antibiotics: a systematic review and meta-analysis. Archives of Disease in Childhood. 2012.

### Paulini Qica and Merewairita Valu

**The Melbourne Children's:** Dr Samantha Colquhoun.

**Partners:** Fiji National University, Fiji.

**Support:** Department of Foreign Affairs and Trade, Australian Government; Fiji National University; Ministry of Health, Fiji; Ministry of Health and Medical Services, Solomon Islands.

**Learn more:** Colquhoun S, et al. Child health nurses in the Solomon Islands: lessons for the Pacific and other developing countries. Human Resources for Health. 2012; 10:1.

### Dr Monica Brook

**The Melbourne Children's:** Professor Trevor Duke.

**Partners:** Ministry of Health, Fiji. **Support:** International Medical Graduate.

## Helping children reach their full potential

**How do we know this?** Early Child Development Knowledge Network, Early Child Development: A Powerful Equalizer. Final Report for the World Health Organization's Commission on the Social Determinants of Health. 2007.

### Giving pre-term newborn babies the best chance

**The Melbourne Children's:** Dr Kate Milner, Professor Trevor Duke, Associate Professor Andrew Steer, Dr Gehan Roberts and Dr Anne Miller, Linda Zrailea and Jo Buchart.

**Partners:** Ministry of Health, Fiji; Colonial War Memorial Hospital, Fiji.

**Support:** Department of Foreign Affairs and Trade, Australian Government; CureKids Fiji.

### Coordinated care for cerebral palsy

**The Melbourne Children's:** Dr Adam Scheinberg, Abhey Khot, Associate Professor Barry Rawicki, Rod Lawlor, Nicole Galea, Anna Noisette, Jane Galvin and Dr Adrienne Harvey.

**Support:** Atlantic Philanthropies.

### Listening and learning for children's hearing

**The Melbourne Children's:** Dr Elizabeth Rose, Dr Markus Dahm and Sowmya Rao.

**Partners:** Australian Hearing.

**Support:** Pacific Islands Program, RACS Global Health, Royal Australasian College of Surgeons; Atlantic Philanthropies.

**Learn more:** [www.surgeons.org/for-the-public/racs-global-health/](http://www.surgeons.org/for-the-public/racs-global-health/)

### Maing links to protect children

**The Melbourne Children's:** Professor Garry Warne and Dr Anne Smith.

**Partner and support:** Children's Rights International.

**Learn more:** [www.childjustice.org/](http://www.childjustice.org/)

## Healthy adolescence is a path to a better future

An edited extract from Patton GC, et al. Next steps for adolescent health: a Lancet Commission. The Lancet. 2014; 383:9915.

**The Melbourne Children's:** Professor George Patton and Professor Susan Sawyer.

**Partners:** University of Washington, Institute of Health Metrics and Evaluation.

**Support:** Bill & Melinda Gates Foundation.

**Learn more:** Patton G, et al. Health of the world's adolescents: a synthesis of internationally comparable data. The Lancet. 2012; 379.

### Earning and learning affects adolescent health

**The Melbourne Children's:** Professor George Patton and Professor Susan Sawyer.

**Partners:** London School of Hygiene and Tropical Medicine, UK; Columbia University, USA; University College London, UK.

**Support:** The Lancet.

**Learn more:** Patton GC, et al. Next steps for adolescent health: a Lancet Commission. The Lancet. 2014; 383:9915.

## Responding to emergencies

### Caring for children after Typhoon Haiyan, the Philippines

**The Melbourne Children's:** Dr Joanne Grindlay, Dr Peter Archer, Dianne Crellin, Cindy Sheers and Kristie Shaw.

**Support:** National Critical Care and Trauma Response Centre (NCCTRC).

**Learn more:** [www.nationaltraumacentre.nt.gov.au/](http://www.nationaltraumacentre.nt.gov.au/)

### Monica Burns

**The Melbourne Children's:** Monica Burns.

**Support:** Médecins Sans Frontières.

**Learn more:** [www.msf.org.au/](http://www.msf.org.au/)

