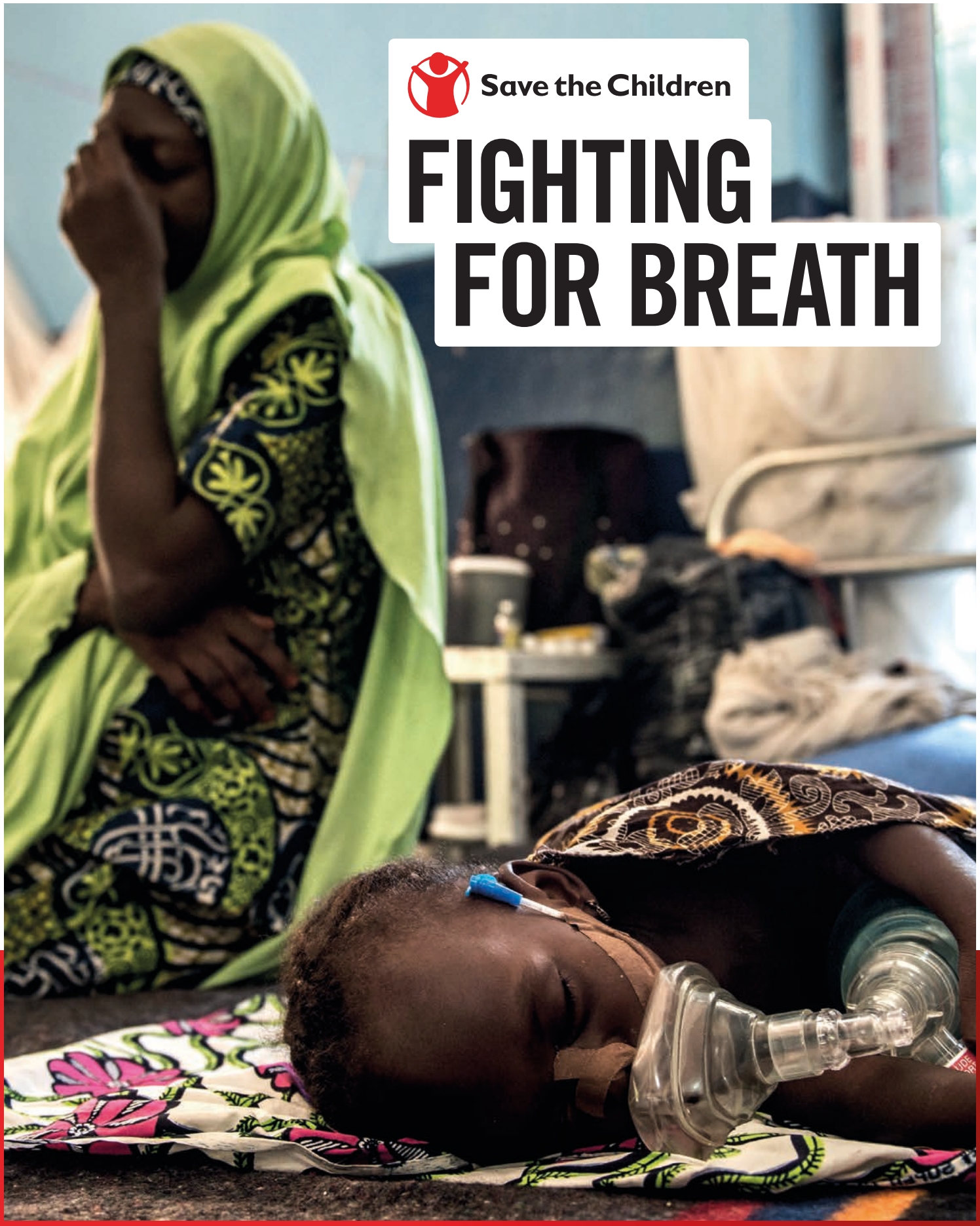

Save the Children

FIGHTING FOR BREATH

A call to action on childhood pneumonia

PHOTO: COLIN CROWLEY/SAVE THE CHILDREN

This report is dedicated to Umi, who lost her life to pneumonia in 2013 in Kenya aged just two and a half.

In 2011, in the midst of the worst drought to hit Kenya in decades, an emergency nutrition programme run by Save the Children helped save the life of a little girl called Umi. Aged just six months, she was malnourished, dehydrated and close to death. Miraculously, she survived.

Umi's case became a global media moment. Having survived Kenya's hunger crisis, and still less than a year old, she became a symbol of recovery – and a testimony to the power of international humanitarian action.

Two years later, Umi's story ended in tragic circumstances. She died on an overcrowded hospital ward from pneumonia and diarrhoea. She was not the victim of a humanitarian disaster. The crops in her village had not failed. Her story did not make media headlines. Umi died because of the interaction of the two most lethal killers of children – pneumonia and diarrhoea. But she also died because she lived in a village lacking access to the trained staff and health facilities that could have saved her.

Cover photo: Bintu, age two, was diagnosed with severe pneumonia and malnutrition at a Save the Children clinic in Nigeria's Borno state. See Bintu's story on page 31.
(Photo: Tommy Trenchard/Save the Children)

FIGHTING FOR BREATH

A call to action on childhood pneumonia

Every Last Child

In 2015 the world's governments came together to issue a solemn pledge. They agreed under the Sustainable Development Goals to work for a world in which no child would suffer a preventable death by 2030. Delivering on the pledge will require an unrelenting focus on the most disadvantaged children – the children born into poverty, living in the hardest-to-reach places, and those facing discrimination because of their gender, ethnicity, skin colour or another characteristic.

Save the Children's 'Every Last Child' campaign is aimed at holding governments to account for the commitments they have made to these children.

This report focuses on what is now the single biggest cause of child deaths through infectious disease. Pneumonia is a disease of poverty. Fatalities are concentrated in the world's poorest countries. Within those countries it is the poorest and most disadvantaged children who face the greatest risks. This report shows how decisive national policies backed by international cooperation could save 5.3 million lives by 2030.

Every child has the right to a future. Save the Children works around the world to give children a healthy start in life, and the chance to learn and to be safe. We do whatever it takes to get children the things they need – every day and in times of crisis.

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Contents

Hanuman, one day old, is treated for pneumonia in a hospital in Rajasthan, India.

PHOTO: CJ CLARKE/SAVE THE CHILDREN

Foreword

By Kofi Annan, former United Nations Secretary-General

"We are confronted with the fierce urgency of now… there *is* such a thing as being too late. This is no time for apathy or complacency. This is a time for vigorous and positive action."

Reading this report prompted me to recall these words, delivered in a speech made 50 years ago by Dr Martin Luther King. We are living in the midst of a pneumonia pandemic. No disease kills more children. Every minute two young lives are lost – and many more are put at risk. It is a disease we have the power to prevent, diagnose and treat, yet the death toll continues to rise. The slow pace of progress in sub-Saharan Africa is a cause for great concern.

The good news is that past trends do not define the future. Practical, achievable and affordable interventions set out in this report provide a roadmap for policies that could save more than 5 million lives between now and 2030.

This is a moment of opportunity for governments around the world to demonstrate their commitment to the Sustainable Development Goal on ending preventable child deaths by 2030. Sustaining progress in the fight against pneumonia will require decisive action. Today, the high cost of vaccines against bacterial pneumonia is one of the factors limiting the power of protection. With 170 million children aged 0–2 unvaccinated, we must step up our efforts to make immunisation affordable. My hope is that pharmaceutical companies, aid donors and UN agencies will come together and negotiate a route to affordable vaccination.

Strengthening health systems is also crucial. We will not win the battle against pneumonia in a world where 400 million people lack access to health care and 100 million are driven into poverty by the cost of treatment. That is why anti-pneumonia strategies have to be integrated into efforts to achieve universal health coverage. The Pneumonia Action Plans advocated in this report provide a vehicle through which political leaders can raise the profile of the disease, signal their intent to combat it, and link bold targets to clear delivery strategies.

Equity is at the very core of the challenge posed by pneumonia. This is a disease that can afflict any child in any country, but the risks of fatality are overwhelmingly skewed towards the poorest children in the poorest countries. Children living in rural areas and urban slums are more likely to contract pneumonia and less likely to have it diagnosed and treated. If governments want to effectively reduce the social disparities in child survival, they must also tackle the inequalities behind the pneumonia crisis. We have the knowledge, financial resources, and tools to save lives. What we are lacking is a powerful coalition to lead the drive against pneumonia. The fight against the number one killer of children currently lacks the leadership and determination it demands and deserves.

Over the course of the day on which you read this Foreword, 2,500 young lives will be lost to pneumonia. My hope is that policy-makers around the world will read this report, reflect on its content and be seized by "the fierce urgency of now".

Kofi A Annan

Pneumonia in numbers

2

children under five die from pneumonia every minute

99%

the share of child deaths from pneumonia in developing countries

735,000

the number of projected deaths in 2030 on current trends

1 MILLION

the lives that could be saved in the next five years from pneumonia prevention and treatment

5.3 MILLION

the lives that could be saved by 2030

4 IN EVERY 5

the share of pneumonia deaths that occur in children under two years

$0.40

the cost of effective antibiotic treatment for pneumonia

43%

increased risk of fatality to South Asian girls with pneumonia, compared with boys

170 MILLION

the number of children not vaccinated against pneumonia

250 MILLION DOSES

the expected vaccine demand from countries eligible for Gavi support in 2026

Executive summary

THE WORLD'S BIGGEST INFECTIOUS KILLER

Writing in 1901, William Osler, one of the founders of modern medicine, described pneumonia as "the captain of the men of death". He was writing about the USA, where the disease was a major killer of children – and a source of fear for their parents. Pneumonia remains a "captain of the men of death". No infectious disease claims the lives of more children. Today, almost all of the victims are in low- and middle-income countries. The vast majority are poor.

The headline statistics on pneumonia point to a global epidemic. **The disease claimed 920,000 young lives in 2015.** That represents two fatalities every minute of every day – more than diarrhoea, malaria and measles combined. Most of the deaths happen in South Asia and sub-Saharan Africa. Over 80% occur among children aged less than two years old, many of them in the first weeks of life.

What the statistics cannot capture is the suffering and distress associated with pneumonia. This is a disease that leaves desperately vulnerable children fighting for breath, and their parents coping with anxiety and, all too often, the distress, grief and trauma that comes with loss.

Pneumonia deaths are falling more slowly than other major causes of child mortality. New research presented in this report shows that, on the current trajectory of progress, **there will still be 735,000 pneumonia deaths in 2030**. This is the target date set for the Sustainable Development Goals (SDGs), which include a collective pledge 'to end preventable child deaths'.

Reducing pneumonia deaths to a level of less than 3/1,000 live births, as envisaged by UNICEF and the World Health Organization (WHO) in their Global Action Plan for Pneumonia and Diarrhoea (GAPPD), would put the world on track for the SDG target.

However, analysis in this report shows only four out of 30 high burden countries are on course to reach this target by 2030. Another 17 – including the Democratic Republic of Congo, Nigeria and Pakistan, which have some of the highest numbers of pneumonia deaths – will not achieve the target until after 2050.

These trends do not define destiny. Other futures are possible. Based on modelling carried out by Johns Hopkins University, we chart a plausible path towards a world where pneumonia deaths are reduced to levels compatible with the SDG commitment. **The '2030 target scenario' trajectory would save a cumulative total of 5.3 million lives from pneumonia over the next 15 years.** Almost 1 million would be saved over the next five years. Many more lives would be saved as a result of benefits in treating diseases that typically accompany pneumonia, including malnutrition and diarrhoea. We estimate the average annual cost of the interventions required at $4.5bn.

WHY ARE CHILDREN DYING?

Every pneumonia death is one too many. The disease is eminently preventable and treatable. Effective vaccines are available for immunisation against the most common bacterial strains, including *Streptococcus pneumoniae* – the deadliest source of pneumonia. Diagnosed accurately and early, pneumonia can be treated with a 3–5 day course of antibiotics costing just $0.40. Severe and complex cases require referral to facilities equipped to deliver more intensive care. But even here the vast majority of lives can be saved, as they are in rich countries.

Children die from pneumonia because they are denied the benefits of prevention, accurate diagnosis and treatment. Support from Gavi, the Vaccine Alliance, has expanded coverage of the pneumococcal conjugate vaccine (PCV), saving

many lives. But 170 million children aged 0–2 years in low- and middle-income countries are not immunised against the world's deadliest disease.

When pneumonia strikes, far too many children are denied access to care. Around 40 million episodes of the disease go untreated each year, placing lives at risk. In sub-Saharan Africa, less than half of children with symptoms are taken to a health care provider.

Reaching a health facility is no guarantee of effective treatment. Inaccurate diagnosis, shortages of frontline antibiotics, and weak referral systems combine to claim lives that could be saved. Surveys of essential medicine availability show that fewer than 60% of facilities in Tanzania, Kenya, the Democratic Republic of Congo and Mauritania have Amoxicillin DT available, the most effective frontline treatment, falling to less than one-quarter in Nepal and Uganda.

One potentially fatal consequence of pneumonia is hypoxaemia, a condition that leaves children with insufficient oxygen in their blood. Some 2 million children are admitted to hospital each year with the condition. These children are left, quite literally, gasping for air. They need basic oxygen therapy that would be taken for granted in any rich country, yet the facilities they are taken to often lack the oxygen that could save their lives.

A DISEASE OF POVERTY

Equity is at the heart of the crisis. Pneumonia today is overwhelmingly a disease of poverty, as it has been throughout history. The risks of contracting the disease are heavily skewed towards the poorest children, while the prospects for receiving accurate diagnosis, effective treatment and appropriate care are skewed towards those who are better off.

Pneumonia powerfully illustrates the lottery of birth that shapes life-chances – including prospects for survival. In rich countries, the disease is a major cause of hospitalisation among children, but fatalities are rare. Being born in a poor country multiplies the risk of pneumonia mortality in the early years. Within countries, social disparities linked to wealth, ethnicity, the rural–urban divide, and gender weigh heavily.

Children who are poor are less likely to be vaccinated, less likely to be taken for treatment when they develop pneumonia symptoms, and more likely to die as a result. A child from a wealthy household in Nigeria is 15 times more likely to be fully immunised than a child from a poor household. Children from the wealthiest households in countries such as Burkina Faso and Chad are twice as likely to be taken by their parents to a health facility if they have pneumonia symptoms as children from the poorest households.

Gender is another powerful marker for disadvantage. Globally, boys are more likely to contract pneumonia for physiological reasons – but in South Asia girls are far less likely to be treated. Fatality rates for girls affected by pneumonia in the region are 43% higher than for boys on one estimate.

A COMPLEX CHALLENGE

Failures of prevention, diagnosis and treatment underscore the critical importance of universal health coverage. Currently, some 400 million people lack access to health care, while 100 million are driven into poverty by unaffordable health costs. Winning the battle against pneumonia will require wider changes that make healthcare accessible and affordable for all.

Pneumonia cannot be treated in isolation. Most fatalities occur because the parents of the children affected are excluded from health systems as a result of cost or distance, or because they see health providers as ineffective, unresponsive and unaccountable. Tackling pneumonia requires a properly financed health system that reaches the most disadvantaged children, delivering effective care through a trained and supported workforce.

Pneumonia presents health planners with a complex challenge because it has such diverse causes – and because it overlaps with other diseases. Prevention is overwhelmingly better than cure, which is why all governments should include pneumococcal conjugate vaccines (PCVs) in their national immunisation schedules. This report highlights the critical importance of building efficient and equitable immunisation infrastructures.

When pneumonia strikes, the first line of defence is the home and community. It is vital that families and carers are equipped with the information they need to recognise symptoms, and that mothers are empowered to make decisions and access care. Community health workers have a vital role to

PHOTO: JONATHAN HYAMS/SAVE THE CHILDREN

Khadija, five months old, was admitted to a Save the Children-supported hospital in Wajir, Kenya with severe pneumonia, severe acute malnutrition and dehydration.

play in diagnosing pneumonia. Countries with a strong track record in cutting deaths – including Bangladesh and Ethiopia – have invested heavily in community-based care systems.

Slow progress in cutting deaths reflects systemic policy failure. Around 17% of pneumonia deaths occur in the first month of life. Many of these deaths could be prevented through early recognition of the warning signs and antibiotic treatment. Yet many women receive no postnatal care, and the health workers caring for them often lack the diagnostic skills they need.

Guidelines for integrated Community Case Management (iCCM) provided by WHO and UNICEF establish clear guidelines for community health workers on pneumonia diagnosis and treatment. However, misdiagnosis is common. Many children are placed at risk because pneumonia symptoms are routinely mistaken for malaria. Moreover, primary health care centres often lack frontline antibiotics, including child-friendly Amoxicillin dispersible tablets (DT). The international aid system may have played an unintended role in weakening iCCM systems by under-investing in anti-pneumonia strategies relative to other major killers. Compounding these diagnostic and treatment challenges, many countries make it illegal for community health workers to dispense life-saving antibiotics. Innovative diagnostic tools such as pulse oximeters, a non-invasive mechanism for measuring oxygen levels in blood, are often unavailable.

PNEUMONIA ACTION PLANS – A HEALTH SYSTEM PRIORITY

National governments have the primary responsibility for tackling pneumonia. Political leaders have neglected the disease for far too long. Ensuring that trained community health workers are available, that clinics are properly supplied, and that referral systems are equipped to ensure a swift transition for children with severe pneumonia should be national health priorities.

Every high-burden country should be aiming to achieve universal PCV immunisation over the next five years. The record to date has been mixed. Some high-burden countries – including Indonesia, Chad and Somalia – are still not using the PCV vaccine in routine immunisation programmes. Nigeria has included PCV in its national schedule, but started only recently and coverage rates are just 13%. More widely, immunisation with PCV is marked

by extreme disparities that follow the contours of inequity in health service provision.

This report calls on governments in every high-burden country to adopt integrated Pneumonia Action Plans geared towards the GAPPD target. These plans would cover costings and delivery strategies for achieving universal PCV vaccination, the provision of antibiotics, and supply of pulse oximeters and oxygen to referral facilities.

The condition for successful implementation of such plans is the strengthening of health systems, with accelerated progress towards universal health coverage. The training of community health workers to correctly diagnose and treat pneumonia is critical. However, anti-pneumonia strategies will only succeed if health system coverage extends to the hardest-to-reach children. Governments should be spending around 5% of GDP on health, with a far greater emphasis on equity in the allocation of resources.

A NEW DEAL ON VACCINES

International cooperation is also critical for achieving a breakthrough on pneumonia. The international community has neglected the disease for far too long. If the 2030 SDG targets are to be achieved, pneumonia must be put at the centre of a renewed effort to eliminate preventable child deaths. That effort has to encompass a new global deal on vaccines and more effective aid.

"The supreme art of war," said Sun Tzu, the Chinese military strategist, "is to subdue the enemy without fighting." That observation is relevant to pneumonia. Subduing the disease through vaccination is infinitely more effective than fighting it through treatment and case management, whether measured in terms of human suffering averted, money saved or the reduced burden on health care. Gavi, the Vaccine Alliance, has supported a total of 59, mainly low-income countries to receive PCVs through the

PHOTO: JONATHAN HYAMS/SAVE THE CHILDREN

Lydia cradles her son Robert, nine months, at their home in Turkana, Kenya. Robert was diagnosed with pneumonia at a Save the Children supported health centre and prescribed antibiotics, paracetamol and antihistamine.

so-called Advance Market Commitment (AMC) facility. Coverage rates in Gavi countries have reached 41% on average.

These very real achievements have been made possible through an extraordinary global partnership. Aid donors have provided $1bn in finance for PCVs since 2009. The two companies producing the vaccine – GSK and Pfizer – have reduced prices for Gavi-supported countries, and for humanitarian charities and UN agencies working with refugee populations. They also committed that low-income countries graduating from Gavi could buy at the Gavi price for ten years after graduation. Gavi has saved lives and demonstrated that multilateralism backed by public–private partnerships delivers results.

Going the next mile on universal PCV coverage will require a concerted effort to deal with three inter-related challenges. The first is linked to price. PCVs are the most costly vaccine in the Gavi portfolio, accounting for 40% of its vaccine procurement spending. Full-course vaccination at Gavi prices costs $9.15. Lower prices, allied to increased national investment in immunisation systems, would enable Gavi to increase coverage and reach more children more quickly. Second, prices for non-Gavi upper middle-income countries, many of which have large unimmunised populations, escalate sharply, reaching $112 in some cases. This represents a barrier to universal access. Third, while the AMC has encouraged investment and increased supply from GSK and Pfizer, it has not led to the emergence of new entrants to the market – one of its primary aims.

With demand for PCV vaccines set to rise sharply, there is a concern that shortfalls in supply could drive up prices and hold back progress towards universal vaccination. Against this backdrop, it is critical that national governments, Gavi and the wider international community develop strategies aimed at increasing supply. Healthy competition is critical, as is the creation of incentives for new market entrants.

This report sets out a range of possible measures to meet the vaccine challenge. Negotiations under Gavi auspices should aim at price reductions. Both GSK and Pfizer should explore opportunities for lowering prices charged to countries eligible for Gavi support and non-Gavi countries with large unimmunised populations. Increasing the volume of guaranteed purchases could create the market conditions for price reductions. These could be financed through bonds – an area in which the World Bank could play a greater role – and risk guarantee instruments to back purchase agreements. Reducing prices to a level consistent with universal coverage will require a degree of burden-sharing and greater transparency with respect to production costs.

Gavi rules could also be amended in some areas. For example, extending support and Gavi prices to regions and provinces of middle-income countries with large unimmunised populations could save lives. Current rules do not allow for such action. Subject to a clear national plan presented by government to reach disadvantaged areas, Gavi's board should remove the barrier created by existing rules.

Creating an enabling environment for new market entrants is critical for healthy competition. More weight should be attached in the AMC and other mechanisms to support accelerated research and development, clinical trials and early market entry, perhaps linked to a target price of around $6 for a full course of PCVs. In the interests of public health, governments should avoid stringent application of patent protection, using compulsory licensing in cases where patent enforcement threatens to delay market entry, raise prices and diminish coverage. Governments have a primary responsibility to ensure universal immunisation for vulnerable children.

There are other areas in which international action is critical. UNICEF, one of the key implementing agencies for iCCM, is currently facing a financing deficit of $73m for the supply of non-malarial interventions, including Amoxicillin DT. While funding for anti-malaria interventions through The Global Fund to Fight AIDS, Tuberculosis and Malaria has unquestionably saved lives, it may also have skewed health priorities towards the anti-malarial drugs, diagnostic kits and training programmes that it finances, reinforcing the neglect of pneumonia. Aid donors could address this imbalance by ensuring that the Global Financing Facility in Support of Women's, Children's and Adolescents' Health, an important new multilateral vehicle, attaches more weight to pneumonia, including in the financing of pneumonia-related iCCM drugs and interventions. It is a matter of concern that the investment plans supported by the Global Financing Facility to date have largely overlooked pneumonia.

PUTTING PNEUMONIA ON THE MAP

Pneumonia presents the international community with both a challenge and an opportunity. Current anti-pneumonia partnerships have much to commend them. These partnerships have produced credible plans of action, targets and guidelines for health planners and led to the development of innovations that, if adopted and used, may help low-income countries to diagnose and treat. They have generated insightful research and provided convening platforms. What has been lacking is the critical mass needed to push the number one infectious killer of children onto the international agenda. The battle against pneumonia remains a cause without the champions needed to save lives.

Therein lies an opportunity. This report calls for a global summit on pneumonia geared towards the sole purpose of saving more than 5 million lives by 2030. Attended by leaders from high-burden country governments, UN agencies, the World Bank, the private sector, donor countries and civil society, such a summit could galvanise the coalitions needed to save lives – and to deliver on the pledge to children undertaken under the Sustainable Development Goals.

Jackson, age three, in a critical condition with severe pneumonia, is fitted with an oxygen mask by a Save the Children emergency health officer at a hospital in Turkana, Kenya.

PHOTO: JONATHAN HYAMS/SAVE THE CHILDREN

Introduction

In the time it takes you to read this paragraph, two children will lose their lives to a killer disease that is readily preventable and easily treatable. This disease preys on its victims' vulnerability. It flourishes in conditions of poverty, social inequality and limited health care. No disease claims the lives of more children. Yet this is a killer that operates in the shadows, neglected by governments and overlooked by the international community.

The killer in question is pneumonia.

100 years ago, pneumonia was a global scourge affecting rich countries as well as poor. The disease was one of the principal causes of death among the children in Europe and the USA. Rising living standards and improved access to health care have dramatically changed this picture. Pneumonia remains a health risk for children in wealthier countries, but the risks of fatality are skewed towards poor children in poorer countries. In 2015, the disease killed 920,000 children, the vast majority under two years of age. For countless millions more children, it is a source of distress, suffering and debilitating long-term health problems.

This report asks a simple question: Why do we as a global community allow so many young lives to be destroyed by a disease we have the knowledge, tools and resources to defeat? The world lacks neither the knowledge nor the financial, technical and medical resources needed to save lives. Yet the fight against pneumonia deaths is being lost – and the children on the frontline are paying with their lives. In this report, we describe the profile of the children at risk. We show their faces and tell their stories.

Above all, though, this report is a call to action. It turns a spotlight on the inequalities, policy failures and indifference holding back progress. And it challenges governments, international agencies, private companies and non-governmental organisations to come together in a coalition committed to saving lives threatened by pneumonia.

Confronted by a challenge of the scale and complexity posed by pneumonia it is easy to become paralysed by pessimism. Such a response would be unjustified. One of the lessons of the past 15 years is that extraordinary progress is possible. There were almost 4 million fewer child deaths in 2015 than in 2000. Many of the world's poorest countries have registered the most dramatic advances. That outcome demonstrates our potential to end the scourge of preventable child deaths. Collectively we have it in our power to make a better, fairer world in which every child can survive and thrive – and we must use that power to end preventable deaths from pneumonia.

We stress throughout the report the urgency of the challenge. Two years ago, the world's governments solemnly committed, through the Sustainable Development Goals (SDGs), to end all preventable child deaths by 2030, with an emphasis on the most disadvantaged. New data presented in this report shows that, on current trends, there will still be 735,000 children dying from pneumonia in the target year. Almost all of these deaths are eminently preventable. Yet pneumonia fatalities are falling more slowly than for any other major killer of children. The disease accounts for more child deaths than diarrhoea, malaria and measles combined.

Failure to change the trajectory on pneumonia will lead to a broken SDG promise – and every year of delayed action will cost lives. The good news is that past trends do not dictate the destiny of nations. The central message of this report is that it is possible to change trajectory and bend the curve on pneumonia deaths, potentially saving some 5 million young lives over the next 15 years.

The health interventions needed to achieve that outcome are well known. Effective vaccines against

bacterial pneumonia are available. The World Health Organization's Integrated Management of Childhood Illness and Integrated Community Case Management guidelines provide health workers with the diagnostic methods and tools needed to determine whether a child has pneumonia. Most cases can be treated with simple antibiotics. The vast majority of severe and complex cases can be dealt with through referral to higher levels of care.

All of which raises the obvious question of why so many lives are being lost. The answer varies across countries, but four self-reinforcing failures stand out.

- **Health system failures**: Identifying the interventions needed to prevent, diagnose and treat pneumonia is the easy part. Ensuring that frontline health workers are in every neighbourhood, adequately trained and supported to deliver these services; that families and communities can demand health services for a sick child; that there is a functioning referral system in place for more severe cases; and that facilities are supplied with the diagnostic equipment, antibiotics and oxygen to provide care is a different matter. Even where facilities and trained staff are in place, parents of the most vulnerable children may lack the knowledge they need to identify early symptoms. They may be unable to afford the costs associated with transport and treatment. The health clinics they attend may lack essential medicines. There may be limited trust between health service providers and the communities they serve.

  Addressing these failures through piecemeal reform and narrowly defined interventions on pneumonia will not work. This is a disease that kills in concert with malaria, diarrhoea, malnutrition and the threats facing children in the first month of life. It cannot be treated in isolation. Ensuring that all children have access to decent quality care is critical. That is why rapid progress towards universal health coverage is a defining condition for sustainable progress on pneumonia.

- **Failures of equity**: Pneumonia is an infectious disease, but fatalities are overwhelmingly linked to the interaction of potentially dangerous microbes with poverty, undernutrition, environmental factors and social disadvantage. The poorest and most marginalised children are more likely to get severe pneumonia – and are less likely to have access to quality care. This helps to explain why pneumonia is among the most powerful drivers of the social disparities that leave children from the poorest households facing death rates two to three times higher than those for children born into the richest households. It is also why progress against pneumonia is a condition for strengthening equity.

  The 2030 SDG commitments included a pledge to 'reach the furthest behind first'. Governments should be held accountable for redeeming that commitment – and tackling the biggest infectious killer of poor children is an obvious starting point.

- **Failures of international cooperation**: Global partnerships in support of strong national policies have achieved powerful changes in health. They have contributed to dramatic cuts in death from malaria, measles, HIV/AIDS and other killers. The global health funds – The Global Fund and Gavi, the Vaccine Alliance – have saved millions of lives. The contrast with pneumonia is striking. UNICEF and the WHO produce consistently high-quality evidence highlighting the effectiveness of known interventions against pneumonia. They have also framed a compelling and practical Global Plan of Action for Pneumonia and Diarrhoea. The World Bank addresses pneumonia as part of its health system portfolio. The UN Secretary-General's Every Woman Every Child initiative and the Global Strategy for Women's, Children's and Adolescents' Health aim to end all preventable child deaths. Yet none of these agencies or initiatives has galvanised action on the scale required. At best, anti-pneumonia efforts are trapped at a low-level equilibrium. The disease is conspicuous by its absence from the global health agenda and international aid priorities. What is needed is a concerted drive to build a coalition for change unified by a commitment to end all preventable pneumonia deaths.

- **Failures of public–private partnership – affordable vaccines**: One of the features of successful health partnerships has been the collaboration between governments, aid agencies and the pharmaceutical sector to make life-saving products more affordable. In the case of pneumonia, the results have been more limited. Current aid efforts are inadequate: less than 2% of development assistance for

Sunil, age two, has been admitted to hospital with pneumonia in Rajasthan, India.

PHOTO: CJ CLARKE/SAVE THE CHILDREN

health is geared specifically towards the disease, even though it accounts for 16% of under-five deaths globally. Gavi has played a critical role in expanding access to anti-pneumonia vaccines. However, prices for the two major pneumococcal conjugate vaccines produced by GSK and Pfizer – $9.15 for a full course for Gavi countries – are still too high to support accelerated progress towards universal immunisation coverage. Moreover, the Gavi arrangements apply only to low-income and some lower middle-income countries. Prices for other countries, including those with large unimmunised populations, are typically well-above Gavi levels.

Price is not the only barrier. Another condition for extending the power of vaccination to vulnerable children is a functioning health infrastructure financed, staffed and equipped to reach marginalised populations. Too many governments are failing to provide that infrastructure. Yet cost does matter, and lower prices would create an enabling environment for more effective anti-pneumonia strategies. While 'fair pricing' is an issue that generates polarised debate, in the absence of deep price reductions for both low-income and middle-income countries, current pricing is a brake on progress. In this report, we make the case for a partnership between companies and aid donors to cut prices, with additional measures to accelerate the market entry of new low-cost vaccines.

THE IMPERATIVE TO ACT

Each of these failures calls into question wider commitments undertaken by the international community. The United Nations Convention on the Rights of the Child – the most widely ratified human rights treaty in history – includes provisions obliging governments to reduce child mortality and protect child health. The provisions include specific responsibilities for national governments and the international community, including the responsibility to develop health systems. Pneumonia is a stark illustration of the failure of governments to uphold the fundamental right of all children to good-quality health care. That is why the strength of efforts to combat pneumonia represents a litmus test of the international community's commitment to child rights.

It is also a litmus test of the commitment to the SDGs. The 2030 commitment to end preventable child deaths is an achievable goal. But the goal will

not be achieved unless governments, the corporate sector, non-government organisations and others come together to translate commitments into the practical actions needed to save lives. As we show in this report, the SDG child survival goal will be missed by a large margin unless we are able to cut pneumonia deaths more rapidly.

The four policy failures we identify also represent an opportunity. For governments in the 'high-burden' pneumonia countries accounting for the bulk of deaths, there is an opportunity to save lives through simple, low-cost and proven interventions. The Pneumonia Action Plans we advocate in this report provide an opportunity for governments to build fairer, more inclusive societies by tackling the deep inequalities in health care and wider social disparities that consign so many children to an early grave. For the international community, this is an opportunity to demonstrate serious intent on the 2030 development goals.

Political leadership is at the heart of the challenge. For millions of the world's poorest and most vulnerable children, pneumonia represents a real and immediate threat. The parents of these children have to deal with the stress and anxiety of watching a loved one suffer. They often also have to pay health care costs that reinforce their poverty. Yet, with a few notable exceptions, governments of low- and middle-income countries have failed to rise to rise to the pneumonia challenge, and aid donors, UN agencies, the World Bank and campaigners have failed to build the partnership needed to save lives.

Children at risk of pneumonia death and illness lack effective advocates. Their cause has not lent itself to a ribbon or a symbol that the public recognises. It does not prompt large numbers of people to participate in fundraising events or lobby their governments. Pneumonia, the greatest infectious child killer, has never appeared on a communiqué of the G8 or the G20. The disease does not get the attention it needs from aid donors, researchers or the pharmaceutical industry. Sadly, political leaders in some of the most affected countries appear either to be unaware of, or indifferent to, the magnitude of the suffering it causes vulnerable children.

Almost one hundred years ago Eglantyne Jebb, the founder of Save the Children, called on governments around the world to act on the ethical imperative to protect children. "Humanity," she said, "owes the child the best it has to give." When it comes to pneumonia, national governments and the international community are falling far short of this standard.

The current trajectory for child pneumonia deaths is not set in stone. It is possible to bend the curve – and because it is possible there is an ethical imperative to act. Collectively we have it in our power to save 5 million lives. This report sets out how we can do it.

PHOTO: CJ CLARKE/SAVE THE CHILDREN

Mohit, nine months old, suffering from pneumonia and malnutrition, is treated in hospital in Rajasthan, India.

1 Pneumonia – the forgotten child killer

KEY POINTS

- Pneumonia killed 920,000 children in 2015 – two children every minute.
- Four in every five deaths occur in children under two – 17% of them in the first month of life.
- Pneumonia deaths are falling more slowly than other major killers, with high-burden countries in sub-Saharan Africa registering the slowest progress.
- On current trends, there could still be 735,000 child deaths from pneumonia in 2030, breaking the Sustainable Development Goal pledge to end preventable child deaths.
- Scaling up proven interventions under a 'target 2030' scenario – to lower the pneumonia death rate to 3/1,000 live births – could save 5.3 million young lives over the next 15 years.

THE MOST LETHAL KILLER OF CHILDREN

Pneumonia is one of the world's most common infectious diseases. It affects millions of people around the world every day. For young children in the poorest countries, it constitutes a real and immediate threat of fatality.

Clinical description does not capture the horror of pneumonia deaths. The disease kills young children by overwhelming their immune systems and starving them of oxygen. It leaves its victims fighting for breath, exhausted by the effort of trying to stay alive. For the children involved, pneumonia is a source of great suffering. For parents, witnessing a child trying to cope with severe pneumonia, the disease creates fear, anxiety and profound distress.

In all but name and recognition, pneumonia represents a global child health epidemic. It is the single biggest infectious cause of death for children under the age of five. Estimates from UNICEF and WHO put the number of deaths at 920,000 – or around 16% of child deaths in 2015.[1] That figure translates into 2,500 deaths a day, or two deaths every minute. More children now die from pneumonia than diarrhoea, malaria and measles *combined* (Figure 1).

The data sources underpinning these figures have to be treated with caution – and there are credible grounds to suggest the real numbers may be far higher. Global estimates for pneumonia deaths in developing countries are derived overwhelmingly from extrapolation, not clinical observation. Post-mortems are seldom conducted. Many deaths in remote areas go unrecorded. While cases reaching hospitals are more likely to be documented, the poorest children facing the greatest risks are the least likely to receive hospital care. Another complicating factor is the interaction between pneumonia and other major killers, including diarrhoea and severe malnutrition. It is often difficult to determine with any precision a single cause of death.

BOX 1 WHAT IS PNEUMONIA?

Pneumonia is a form of acute lower respiratory tract infection that occurs when viruses, bacteria or other micro-organisms cause inflammation of the lungs. Most severe or fatal pneumonia is caused by bacteria. However, viral and bacterial pneumonia often interact, with the former creating conditions that make bacterial infection more likely, or more severe. The most common types of pneumonia are:

- *Streptococcus pneumoniae (pneumococcus)*: This is the single most significant cause of pneumonia, probably accounting for around 40% of pneumonia deaths. It can also cause other serious infections, such as meningitis. There are more than 90 types of pneumococcus.
- *Haemophilus influenza type b*: Typically referred to as Hib, was the second most important cause of pneumonia deaths but has reduced substantially due to widespread vaccination.
- *Respiratory syncytial virus* (RSV) is the most common cause of childhood lung infections in the first six months of life, and the most common cause of hospitalisation from pneumonia in this age group. Recent estimates suggest that there were 33 million cases of RSV in 2015, around 10% of which resulted in hospitalisation – and 118,200 cases led to death. Around half of hospital admissions and deaths occurred in children aged less than six months old.

Effective vaccines are available for *Streptococcus pneumoniae* and Hib. There is currently no vaccine for RSV, although candidate vaccines have been developed and are now in clinical trials. Some viral and bacterial pathogens strike at a very young age and kill young infants before they can be immunised. These include RSV, *Staphylococcus aureus*, *Klebsiella*, pertussis and group B streptococcus. Maternal immunisation may be an important future approach to protect mothers and newborn babies from some of the major pathogens.

Pneumococcal bacteria are already present in most children in developing countries by the first few months of life, living in nasal or throat mucus. In healthy children, the body's defence mechanisms render the bacteria harmless. These mechanisms include reflex coughing, which eject mucus from the lower airways and lung tissue, antibodies in the blood stream, and the immune system. Children are born with a mucosal immune system and their immune system adapts to bacterial and viral threats. The bacteria become dangerous under conditions that compromise the body's defence systems (see Chapter 2).

Pneumonia can also be caused by other bacteria and a range of viruses. For example, measles can act both as a cause of pneumonia and a predisposing factor. Early onset pneumonia can be acquired from the mother during labour or delivery, with respiratory distress beginning at, or soon after, birth. When a child develops pneumonia, the symptoms result from the body's response to infection. Indications include fever and chest pain.

Respiratory distress is a critical clinical indicator. Infection causes the lungs to fill with fluid, making breathing difficult and causing the child to take smaller, faster breaths. In severe cases, reduced lung capacity is associated with contraction of the lower chest wall as the child's body tries to generate negative pressure so that the lungs inflate properly to fill with air. This occurs because the lungs stiffen and become difficult to expand. The restricted flow of oxygen into the blood and body organs can cause hypoxia, an often fatal condition associated with impaired consciousness, inability to feed and convulsions.

Pneumonia is closely related to the most severe forms of acute respiratory infections, or ARIs. Most of these infections are limited to the nose and throat (the upper-respiratory tract). Acute lower respiratory tract infections, the most widely used classification in health surveys, refer to all infections extending into the chest, including bronchiolitis and pneumonia cases, where infection extends into the lung tissue.

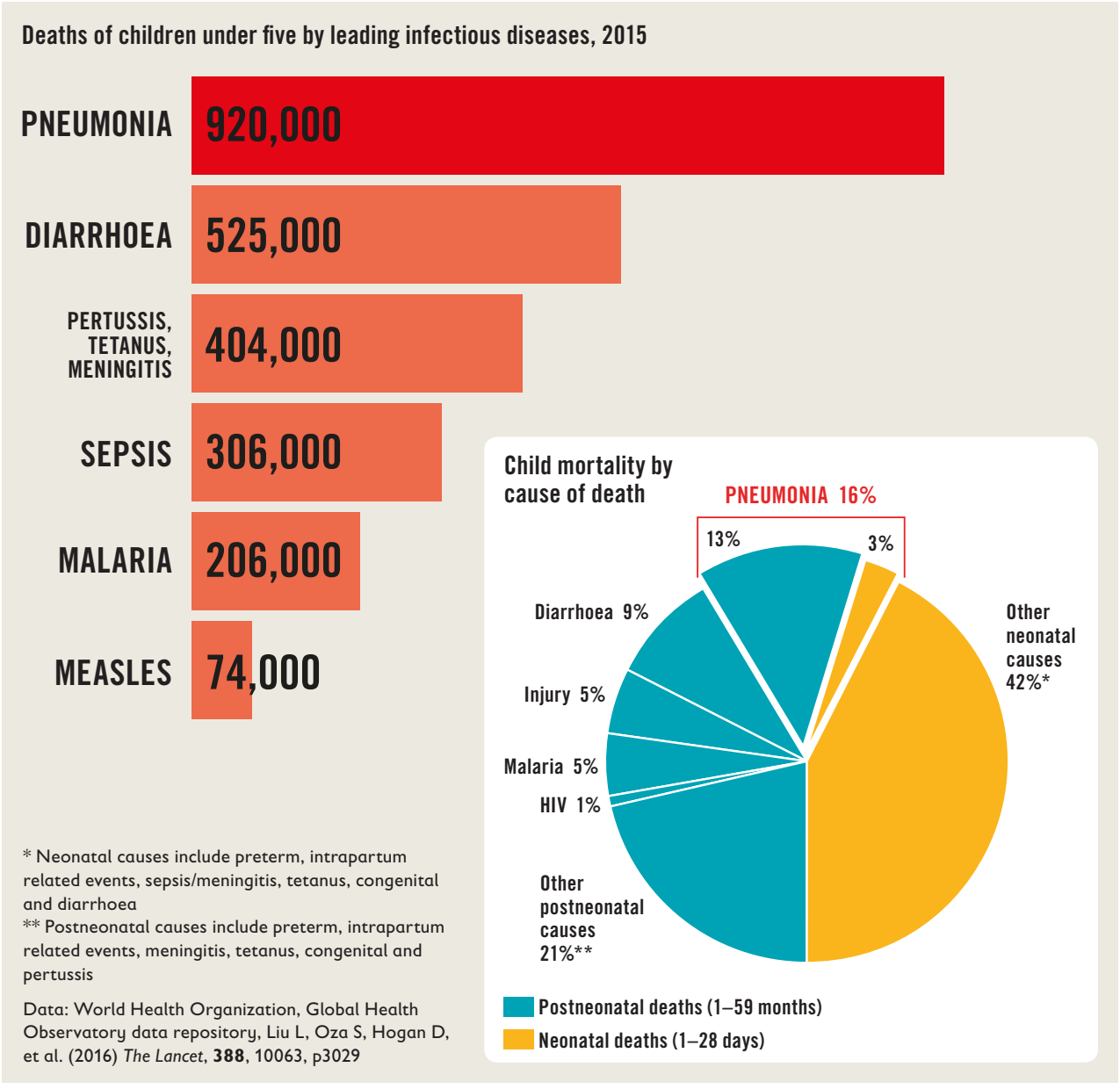
Sources: Mulholland K and Weber MW, (2016) *Pneumonia in Children: Epidemiology, prevention and treatment*, Pinter & Martin TALC; Ting Shi et al., 'Global, regional and national burden estimates of acute lower respiratory infections due to respiratory syncytial virus in young children in 2015: a systemic review and modelling study', *The Lancet*, 390, 2017, pp 946–958; Igor Rudan et al., 'Epidemiology and aetiology of childhood pneumonia in 2010: estimates of incidence, severe morbidity, mortality, underlying risk factors and causative pathogen for 192 countries', *Journal of Global Health*, 3, 1, 2013, pp 1–14

The age profile of children dying reflects the underlying vulnerabilities. It is estimated that children under the age of two account for over 80% of deaths.[2] The immune system of these children, especially when weakened by malnutrition or insufficient breastfeeding, is less able to respond to pneumonia infections.

Pneumonia in the first month of life carries a greatly elevated risk of fatality. In 2015, neo-natal mortality accounted for 17% of pneumonia deaths (Figure 1). Once again, the data has to be treated with some caution. Severe bacterial infection in the neonatal period includes sepsis and meningitis – and pneumonia can contribute to both conditions. On one estimate, there are around 7 million cases of possible severe bacterial infection in neonates annually, with South Asia (3.5 million cases) and sub-Saharan Africa (2.6 million) dominating.[3]

Because of their immature immune systems, small airways, and inability to confine bacterial infections to any one organ, such as the lung, newborn children are acutely vulnerable to pneumonia. Infection can be acquired during pregnancy, delivery or in the postnatal period as a result of exposure to harmful bacteria and viruses. Inability to retain body warmth can be an aggravating factor. As infections

FIGURE 1 PNEUMONIA IS THE SINGLE BIGGEST INFECTIOUS KILLER OF CHILDREN: CHILD MORTALITY BY MAJOR CHILDHOOD INFECTIOUS ILLNESSES



* Neonatal causes include preterm, intrapartum related events, sepsis/meningitis, tetanus, congenital and diarrhoea

** Postneonatal causes include preterm, intrapartum related events, meningitis, tetanus, congenital and pertussis

Data: World Health Organization, Global Health Observatory data repository, Liu L, Oza S, Hogan D, et al. (2016) *The Lancet*, **388**, 10063, p3029

can take time to develop, children born without any symptoms of pneumonia can be asymptomatic after birth but then deteriorate very rapidly.

The risks weigh more heavily for children born with a low birthweight or those born prematurely. Up to 3% of infants with very low birthweights become infected with pneumonia. Mortality rates for these infants can be as high as 30%.[4] However, most low birthweight babies will respond to antibiotic treatment.[5]

The mortality data tells only part of the story. For every child death that results from pneumonia there are many more potentially fatal cases. Best estimates suggest that there are around 120 million episodes of pneumonia among children under five annually – and that 14 million of these episodes progress to become severe cases.[6] In many cases the children affected are left weakened and more vulnerable to future health issues, including chronic lung diseases.

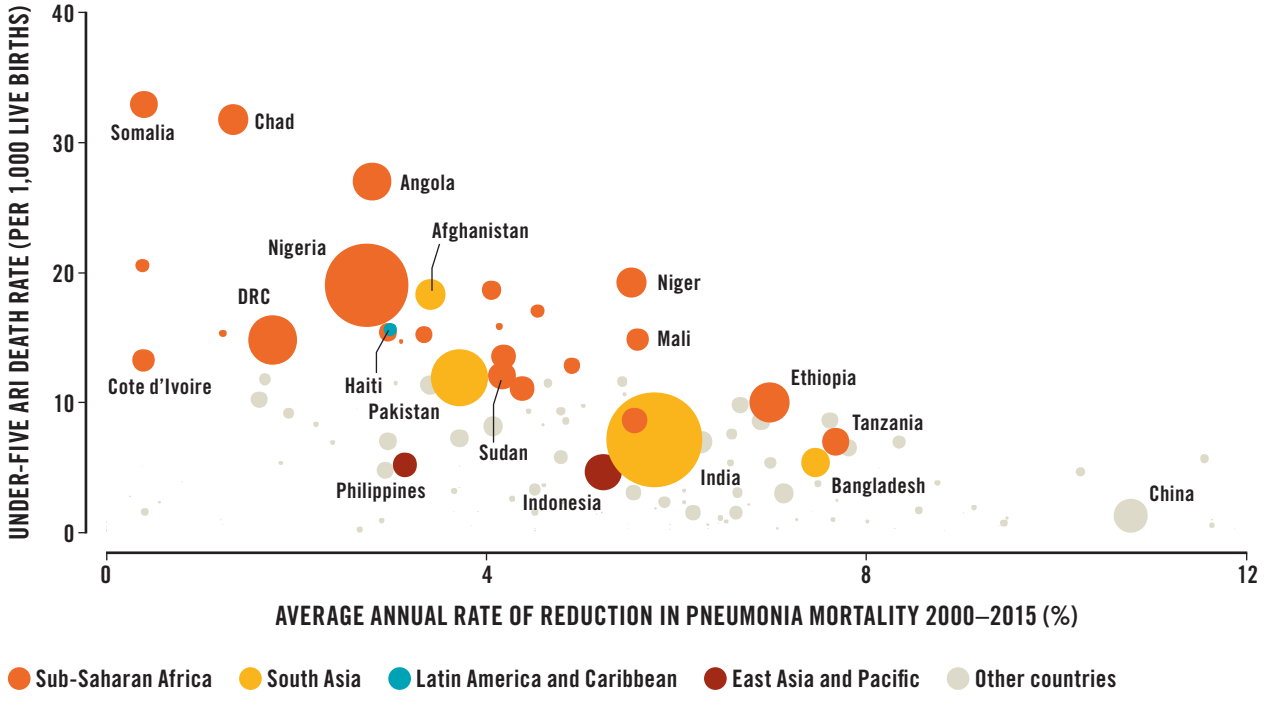
THE GEOGRAPHIC DISTRIBUTION OF PNEUMONIA DEATHS

While pneumonia occurs in children across the world, nearly all the deaths occur in developing countries, particularly in South Asia and sub-Saharan Africa. Fatalities are heavily concentrated in a small number of countries. Just five – India, Nigeria, Pakistan, the Democratic Republic of Congo and Ethiopia – are home to almost half of the children who lose their lives to pneumonia. The top twenty account for three-quarters of all of deaths. For a diverse group of countries, ranging from India and Nigeria to the Democratic Republic of Congo and Indonesia, it is the number one killer of children (Table 1).

Figure 2 looks beyond the static snapshot to a moving picture of pneumonia deaths. The vertical axis charts the death rate and the size of the country bubble captures the number of deaths, while the horizontal axis measures the pace of decline (see Table 1 for the underlying data). Countries towards the right of the graph are reducing pneumonia deaths at an impressive

FIGURE 2 PNEUMONIA DEATHS ARE FALLING AT A VARIABLE RATE: UNDER-FIVE MORTALITY FROM ACUTE RESPIRATORY INFECTION (ARI) VS. ANNUAL RATE OF CHANGE 2000–15

Deaths due to acute respiratory infections in selected low- and middle-income countries in 2015.
Circles proportional to number of under-five mortality due to lower respiratory infections.



Data: WHO

rate. For example, Bangladesh, Ethiopia and Tanzania have registered average annual declines of 7% or more. At the other end of the spectrum, high-mortality countries such as Pakistan, Nigeria and the Democratic Republic of Congo are cutting deaths rates at less than half of this level, with Somalia registering virtually no progress. In India, the country that accounts for the biggest single number of deaths, pneumonia mortality is falling at just under 6% a year.

TABLE 1 PNEUMONIA PROFILE: THE 30 HIGHEST-BURDEN COUNTRIES[7]

	Country	Number of under-five deaths from ARI	Rate of under-five ARI deaths per 1,000 births	Share of deaths from ARI in under-five mortality	Average annual rate of reduction in ARI mortality 2000–15	Year country is expected to reach the 2025 GAPPD target at current rate of progress
1	India	178,717	7.1	14.9%	-5.76%	2030
2	Nigeria	132,556	19.0	17.8%	-2.73%	2075*
3	Pakistan	63,844	11.9	14.8%	-3.72%	2052
4	DRC	45,812	14.8	15.2%	-1.75%	2075*
5	Ethiopia	31,456	10.0	17.1%	-6.98%	2032
6	Angola	29,367	27.0	17.4%	-2.79%	2075*
7	Indonesia	25,481	4.6	17.0%	-5.23%	2023
8	Chad	19,235	31.8	23.3%	-1.33%	2075*
9	Afghanistan	18,671	18.3	19.8%	-3.41%	2068
10	Niger	18,247	19.2	20.8%	-5.53%	2048
11	Bangladesh	17,410	5.4	14.5%	-7.47%	2023
12	Sudan	15,497	12.0	17.4%	-4.16%	2048
13	Somalia	14,561	32.9	24.2%	-0.39%	2075*
14	Tanzania	14,270	7.0	14.6%	-7.68%	2026
15	Uganda	13,566	8.6	16.0%	-5.56%	2034
16	Philippines	12,212	5.2	18.6%	-3.15%	2033
17	Mozambique	11,337	11.1	14.3%	-4.37%	2045
18	Cameroon	11,046	13.5	15.5%	-4.18%	2051
19	Côte d'Ivoire	10,913	13.2	14.5%	-0.39%	2075*
20	Mali	10,717	14.8	13.0%	-5.59%	2043
21	South Sudan	8,268	18.6	20.4%	-4.05%	2060
22	Guinea	6,993	15.4	16.7%	-2.97%	2070
23	Burundi	5,888	12.8	16.0%	-4.90%	2044
24	Benin	5,689	15.2	15.4%	-3.34%	2063
25	Haiti	4,007	15.6	22.5%	-2.99%	2070
26	Sierra Leone	3,705	17.0	14.0%	-4.53%	2053
27	Central African Republic	3,355	20.5	16.0%	-0.38%	2075*
28	Guinea-Bissau	1,019	15.8	17.5%	-4.14%	2055
29	Lesotho	954	15.3	17.2%	-1.22%	2075*
30	Equatorial Guinea	416	14.7	15.8%	-3.11%	2066

* Countries where the projected year for achieving the GAPPD target of 3/1,000 under-five deaths from pneumonia exceeds 2075

There is a strong inverse association between national income and pneumonia deaths. On average, pneumonia fatality declines as rising living standards translate into improved nutrition, less poverty and a stronger health system. However, averages mask some marked variations.

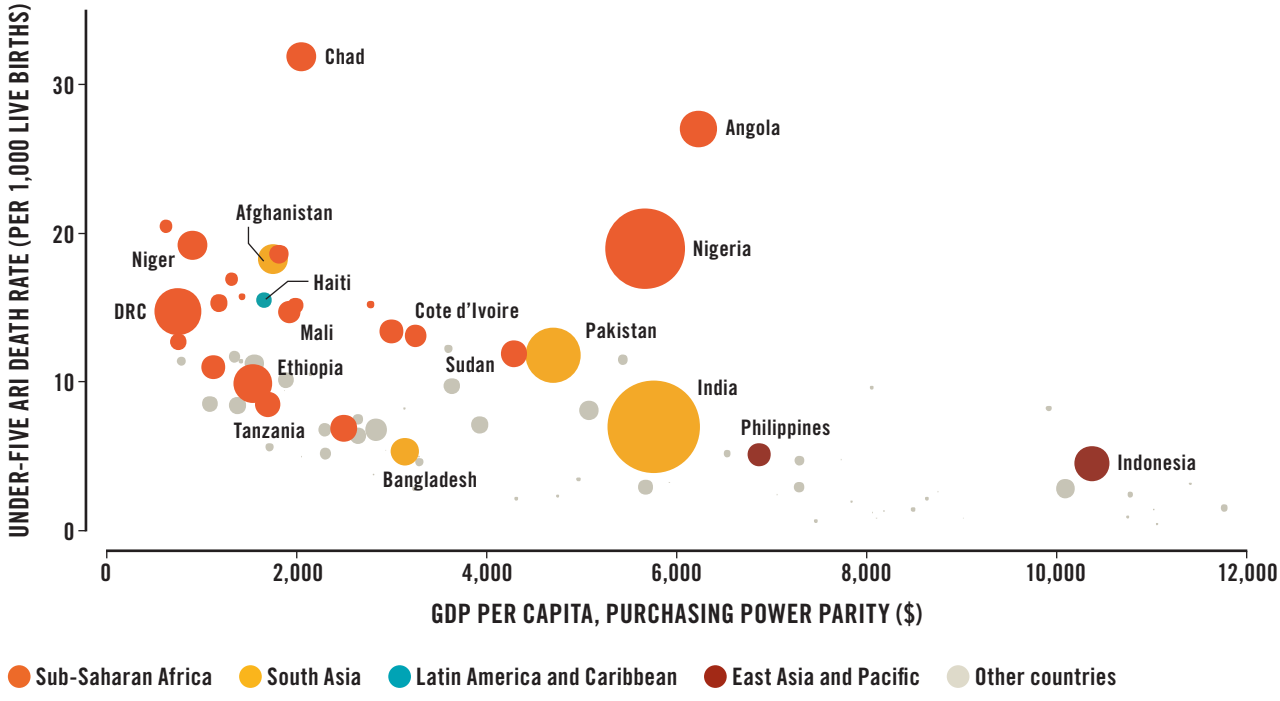
Consider some simple comparisons in Figure 3. Average incomes in Indonesia are four times higher than in Tanzania, but the two countries have comparable death rates for pneumonia – and Tanzania is cutting deaths more rapidly. Incomes in India are almost twice the level in Bangladesh, but India has a higher death rate for child pneumonia – and lags behind Bangladesh in bringing it down. Nigeria is far richer than Mali but has a higher death rate.

Many factors contribute to these differences, but the comparisons highlight the critical importance of policy and equity. Countries vary in the degree to which they convert rising income into lower pneumonia death rates. This may reflect patterns of economic growth and inequality in the distribution of benefits from that growth, which have a bearing on poverty and undernutrition. It may also reflect differences in the degree to which governments have expanded the coverage and quality of health systems to reach vulnerable children. Social and cultural factors affecting treatment may also come into play. For example, ethnic minorities may have more limited access to care, or parents may be less inclined to take girls for treatment. In most cases a combination of factors will be in operation.

Whatever the underlying causes of the differences, Figure 3 raises important questions for policy-makers in a number of countries. Angola and Nigeria stand out as countries that have failed to convert rising wealth into lower pneumonia death rates. While the Philippines and Indonesia have low death rates, comparisons with Bangladesh and Tanzania are hardly favourable given the wealth difference – and the Philippines and Indonesia are reducing pneumonia death more slowly. Contributory factors might include the persistently high rates of stunting and acute malnutrition reported in the Philippines and Indonesia despite their higher average incomes, along with health system inequalities. More than

FIGURE 3 THE LINK FROM HIGHER INCOME TO LOWER PNEUMONIA DEATH RATES IS NOT AUTOMATIC: UNDER-FIVE ARI MORTALITY vs. GDP PER CAPITA

Deaths due to acute respiratory infections in selected low- and middle-income countries in 2015.
Circles proportional to number of under-five mortality due to lower respiratory infections.



Data: WHO and World Bank

3 million children in Indonesia – 14% of the total – are wasted, and one-third are stunted.[8] In the Philippines, rising economic growth has done little to dent undernutrition among children – and recent evidence suggests stunting levels have risen.[9]

Viewed from a different perspective, some very poor countries with high death rates are in the top rank of countries registering progress – Niger is a case in point.

AN UNEQUAL BURDEN

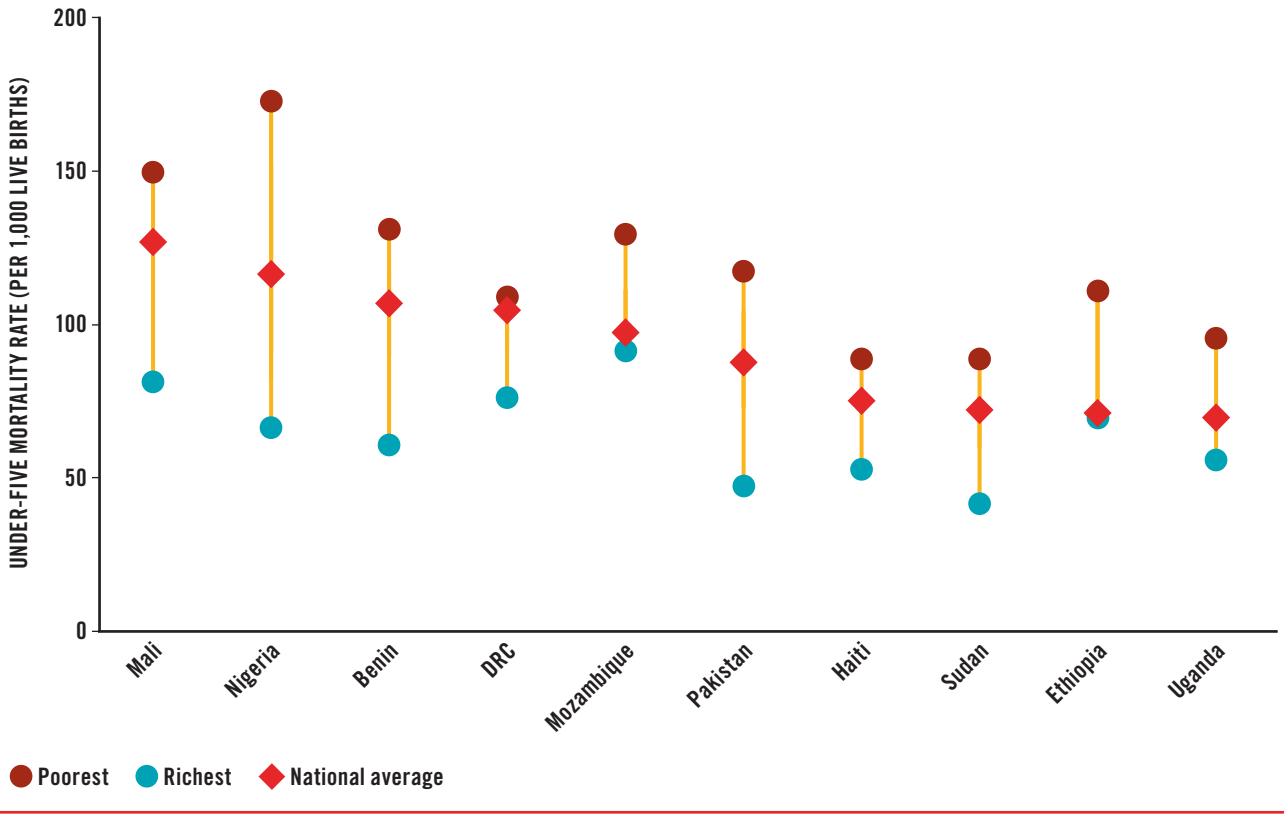
Inequality is at the heart of the pneumonia epidemic. The paucity of the data available makes it difficult to disaggregate the social characteristics of the children dying from the disease. However, pneumonia is overwhelmingly a disease of poverty – and it is a powerful driver of disparities in child survival.

Those disparities have remained intact despite overall progress in reducing child mortality. Being born into the poorest 20% typically multiplies the risk of mortality before the age of five by a factor of two to three.[10] Wealth disparities intersect with, and magnify, wider sources of inequality in child survival, including ethnicity, the urban–rural divide and regional indicators. Figure 4 captures the scale of the disparities for a group of high-burden pneumonia countries.

Pneumonia contributes to the survival gap. One systemic review of evidence from 39 countries found that low socio-economic status among children was associated with a 62% increase in the risk of pneumonia mortality.[11]

Gender disparities are also important. Very young boys are slightly more likely than girls to contract pneumonia, possibly because they have smaller airways. Yet there is disturbing evidence that girls with severe pneumonia cases are far less likely to receive care in South Asia – and that they are more likely to die as a result. Some of that evidence comes from India. Using nationally representative data, one study found that the pneumonia death rate for girls was 43% higher than for boys – a stark illustration of the fact that gender discrimination in health care costs lives.[12]

FIGURE 4 CHILD SURVIVAL PROSPECTS DEPEND ON WEALTH AND CIRCUMSTANCE: SELECTED UNDER-FIVE MORTALITY RATES IN HIGH-BURDEN PNEUMONIA COUNTRIES



DHS or MICS data adjusted for UN Inter-agency Group for Child Mortality Estimation

The transmission mechanisms through which pneumonia fuels social disparities in child survival vary across and within countries. One important mechanism is malnutrition. Children who are stunted (below the appropriate height for age) or, more especially, wasted (below the weight for height) are more vulnerable to life-threatening bouts of pneumonia.

While the risks of contracting severe pneumonia are skewed towards the poorest children, the prospects of receiving quality care are skewed towards the more advantaged. As we show in Chapter 2, disparities in health care provision mean that those facing the greatest risks are the least likely to be vaccinated and the most likely to be misdiagnosed or excluded from the health system. For all of these reasons, pneumonia should figure prominently in efforts to monitor progress towards the 2030 SDG pledge to end preventable child deaths (Box 2).

We illustrate this point in Figure 5, focusing on survival rates for children from the wealthiest and poorest households. In Nigeria, the death rate for the poorest children has to fall at twice the rate for the wealthiest. Survival rates for the children in the wealthiest households in Indonesia are already below the 2030 threshold, implying the need for an overwhelming focus on disadvantaged social groups and areas. Wealth is only one dimension of inequity. However, it intersects with and magnifies wider inequalities linked to ethnicity, the rural–urban divide and gender.

Monitoring the pace of convergence in prospects for survival is important for accountability to children. But it can also serve the wider purpose of turning the spotlight on the investments, policies and targeting needed to reach those who have been left behind. Strengthening the focus on the background risks and health system failures that consign so many children to the risk of pneumonia would be one of the most efficient ways to accelerate convergence in child survival. What is clear from the data is that effective action against pneumonia would both save lives and enhance equity by accelerating the rate of convergence in child survival.

BOX 2 THE SUSTAINABLE DEVELOPMENT GOALS – PROGRESS WITH EQUITY IS CRITICAL

Reporting on the SDGs provides an opportunity to turn the policy spotlight on equity in child survival – and to strengthen monitoring in areas like pneumonia.

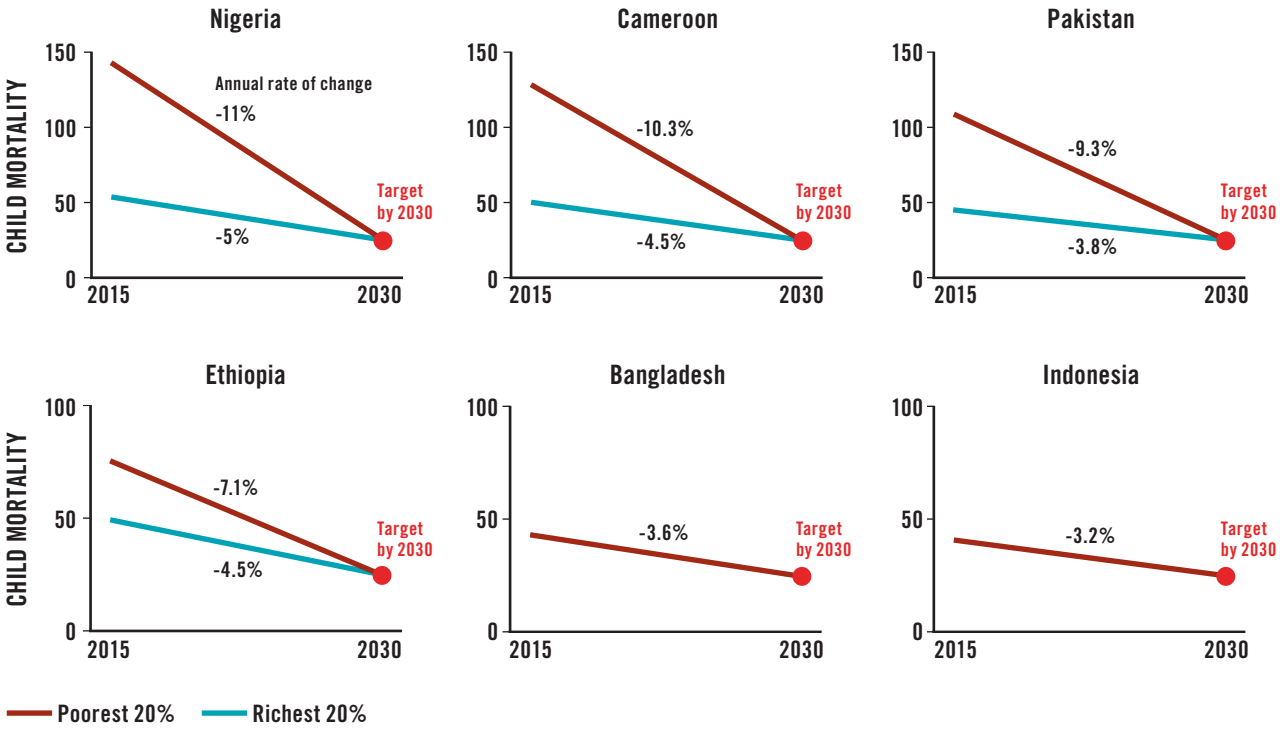
The SDG framework makes an explicit commitment to equity, pledging to leave no one behind, and 'to reach the furthest behind first'. Nowhere does that pledge have a more powerful resonance than with respect to child survival. Working to equalise the opportunity for children to survive, regardless of the wealth of their parents, where they live, their gender or their ethnicity, is an imperative for any strategy grounded in basic principles of fairness, social justice and universal human rights.

The SDG commitment includes a pledge to end preventable child deaths by 2030. Somewhat artificially, a national death rate of 25/1,000 live births was identified as a threshold target. Success in delivering on the SDG ambition depends on achieving the targets set for every last child. Simple equity arithmetic dictates that those starting furthest from the goals have to register faster rates of improvement to arrive at the same destination in 2030 (see main text). This implies a reduction in death rates for the most disadvantaged children greater than for the most advantaged.

The SDGs also include target 3.8 to "Achieve universal health coverage, including financial risk protection, access to quality essential health-care services and access to safe, effective, quality and affordable essential medicines and vaccines for all."

FIGURE 5 DEATH RATES FOR THE POOREST HAVE TO FALL FURTHEST AND FASTEST TO ACHIEVE THE SUSTAINABLE DEVELOPMENT GOALS: CHILD MORTALITY FOR RICH AND POOR

Child mortality per 1,000 births for richest 20% and poorest 20% in 2015 in selected low- and middle-income countries, and rate of progress needed to reach the target of 25 per 1,000 births in 2030.



Data: Save the Children, Groups-based Inequality Database

RICH COUNTRIES – LESSONS AND RESIDUAL RISKS

The time when pneumonia represented an epidemic-level risk to children in rich countries has long passed – and the risk profile has changed. Today, many children in rich countries develop pneumonia, but the disease overwhelmingly threatens the lives of the elderly.

The picture described by William Osler in 1901 changed dramatically over the course of the 20th century. Pneumonia death rates for children in the USA in 1900 were comparable to those in the Democratic Republic of Congo today. By the mid-1930s, before the introduction of antibiotics or vaccines, they had fallen by half. The decade after the introduction of antibiotics saw another steep decline – by 63% for children aged under one year old. Critically, a combination of reduced background risk and health system development drove progress.

What are the policy lessons for developing countries today? The internationally agreed target for pneumonia is a death rate of less than 3/1,000 live births by 2025 (see below). It took the USA half a century to reach that goal, while high-burden pneumonia countries have less than a decade. The difference is that the interventions and resources needed to achieve rapid progress are now widely available – and pneumonia is far better understood. With concerted national and international action, every country should be able to reach the 2025 target.

There is also a wider lesson. In both the USA and Europe the early 20th century saw the start of a concerted drive to reduce child death rates. Catalysed by social movements and political leaders, that drive created the conditions for a breakthrough on pneumonia. One of the central themes of this report is the failure in the 21st century of national governments and the international community to back global commitments on child survival and pneumonia with the partnerships needed to deliver results.

Pneumonia still figures with some prominence as a health concern in rich countries. In the USA, it is the most common reason for children to be hospitalised.[13] However, death rates for children under five are below 0.5/1,000 live births. While around 1 million adults are hospitalised as a result of pneumonia annually in the USA,[14] the 50,000 pneumonia deaths that occurred in 2016 were concentrated overwhelmingly among adults aged over 65.

In the UK, pneumonia remains a major burden on the health system. Around 220,000 people receive a diagnosis for the disease each year, and 29,000 deaths occur – one of the highest death rates in Europe.[15] Child deaths account for less than 1% of the total.[16]

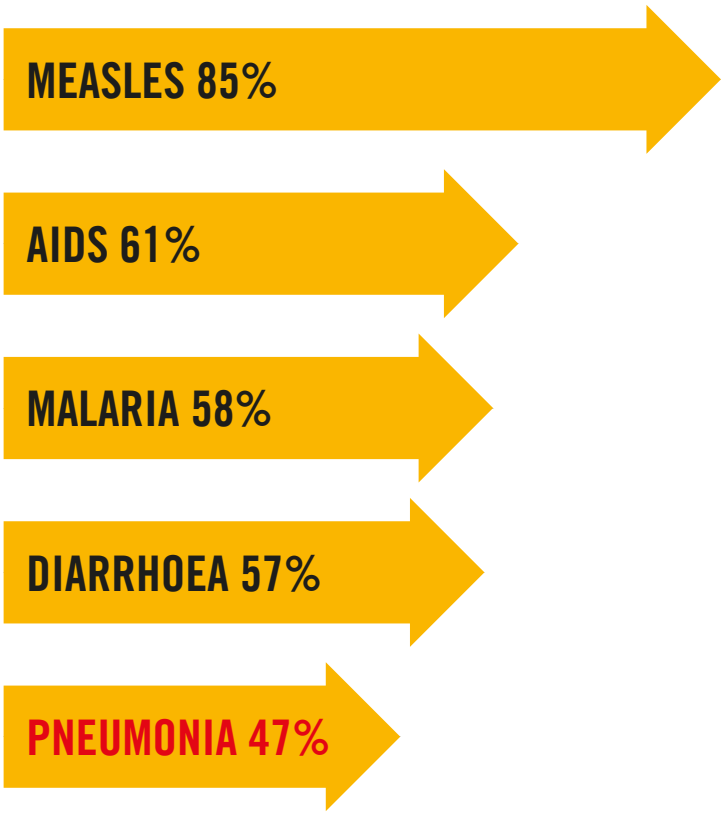
In both the USA and UK there are marked social disparities for pneumonia. In the USA, for example, pneumonia rates are far higher among Hispanic and African-American populations. And in both countries lower income groups are at greater risk than higher income groups. In the UK, pneumonia rates are 45% higher in the most deprived quintile than in the wealthiest quintile – a fact that points to the persistence of social deprivation.

FALLING SHORT – CURRENT PROGRESS WILL LEAVE THE WORLD FAR SHORT OF 2030 SDG TARGETS

The past 15 years have witnessed remarkable progress in child survival. Declining child mortality rates have saved the lives of 48 million children – an extraordinary accomplishment. Pneumonia has been part of the progress.[17] In 2000 there were 1.7 million child deaths from the disease.[18] That figure has been almost halved. The bad news is that pneumonia deaths are falling far too slowly. Failure to change the current trajectory will leave the world far short of the child survival goals set for 2030.

Progress in cutting pneumonia deaths has been partial and unequal. Mortality rates are declining at a slower rate than other major killers, including malaria, measles and HIV (Figure 6). The complexity

FIGURE 6 PNEUMONIA DEATHS ARE FALLING MORE SLOWLY THAN FOR OTHER MAJOR KILLERS: UNDER-FIVE DEATHS BY LEADING INFECTIOUS DISEASES, 2000 AND 2015 (IN MILLIONS)



Source: UNICEF, 2016, *One is Too Many: Ending child deaths from pneumonia and diarrhoea*

associated with prevention, diagnosis and treatment of the disease may be part of the explanation. But the current trajectory for pneumonia is also a symptom of the weakness of national and international partnerships. Unlike many of the other major killers, pneumonia has lacked effective champions, advocates and campaigners – an issue we return to in Chapter 4.

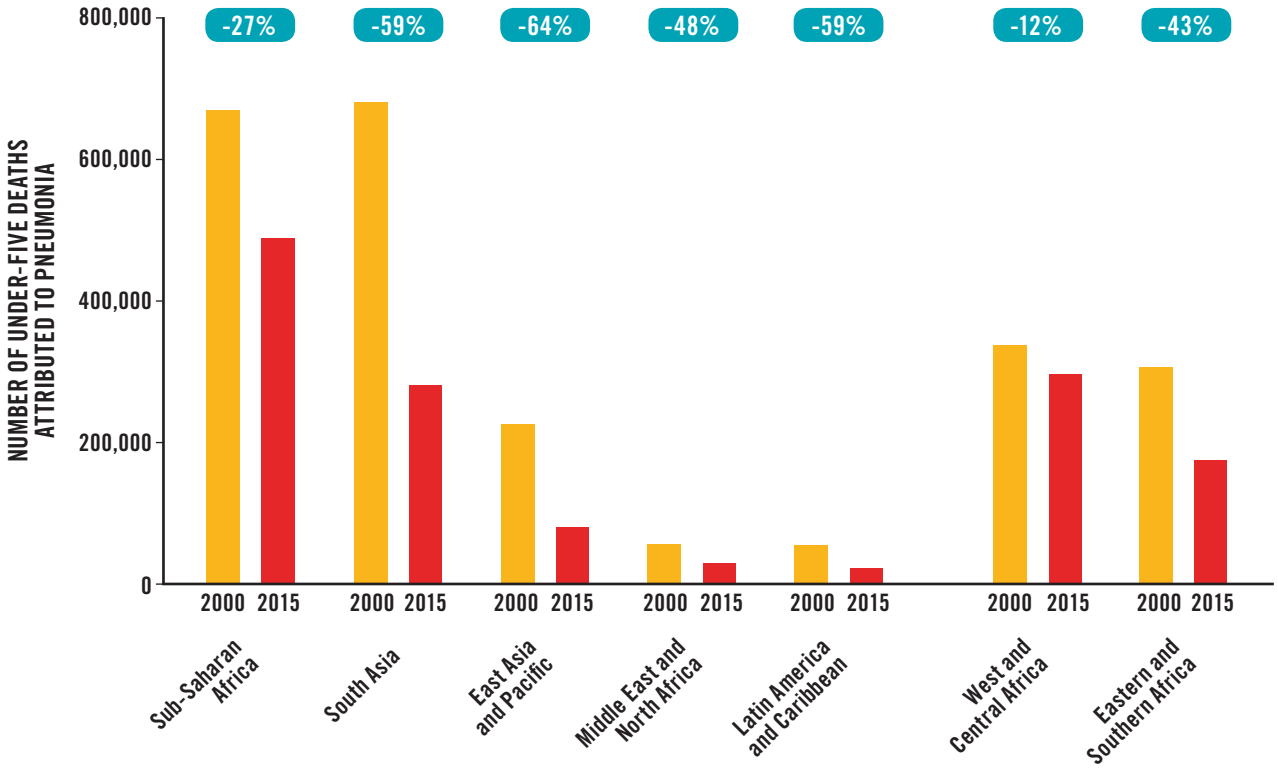
Global averages inevitably mask differences within and across regions. South Asia and East Asia have registered marked gains (Figure 7). Meanwhile, progress in sub-Saharan Africa has been far slower, particularly in West Africa and Central Africa, which has registered a fall in pneumonia deaths of just 12% since 2000. Demography adds to the urgency of accelerating progress. The slow pace of Africa's demographic transition and associated high fertility rates mean it will account for almost all of the increase in the world's under-five population to 2030. One consequence is that 1.13 billion children will be born into the 30 countries where children face the greatest risk of deaths from pneumonia between 2016 and 2030.[19]

Past performance does not dictate future outcomes. One of the lessons of the past 15 years is that dramatic advances in child survival are possible. However, past trends do illustrate one possible future *if* countries continue on a business-as-usual pathway. In the case of pneumonia, one simple conclusion can be safely drawn: if the next 15 years look like the last 15 years, the world will fall far short of the child survival goals adopted by the international community.

On current trends the world will fall far short of the GAPPD target of three deaths per 1,000 live births by 2025. Only three of the 30 countries on our high-burden list – Bangladesh, Indonesia and Tanzania – are on track to achieve the GAPPD target. None of the top ten countries – accounting for more than 550,000 pneumonia deaths in 2015 – are in this group. India is five years off-track. To add to this bleak picture, eight countries are on a trajectory that will see them hit the 3/1,000 target after 2075. This is group that includes Nigeria and the Democratic Republic of Congo. With all of its limitations, the projection points to policy failures on an epic scale.

FIGURE 7 PNEUMONIA DEATH RATES ARE FALLING UNEVENLY – AND SLOWLY IN SUB-SAHARAN AFRICA: NUMBER OF UNDER-FIVE DEATHS FROM ACUTE RESPIRATORY INFECTIONS, 2000 AND 2015 BY REGION

Percentage shows the decline between 2000 and 2015.



Data: WHO

New research carried out for this report at Johns Hopkins University provides a worrying perspective on the gap between current trajectories and international ambition. The research uses a model – the Lives Saved Tool (LiST) – designed to estimate lives saved from maternal and child health interventions. Rather than providing a simple linear projection, it asks what the profile of child pneumonia deaths in 2030 will look like if governments scale-up at the same rate over the next 15 years the measures they have been implementing over the past 15. The prospective results (Figure 8) suggest:

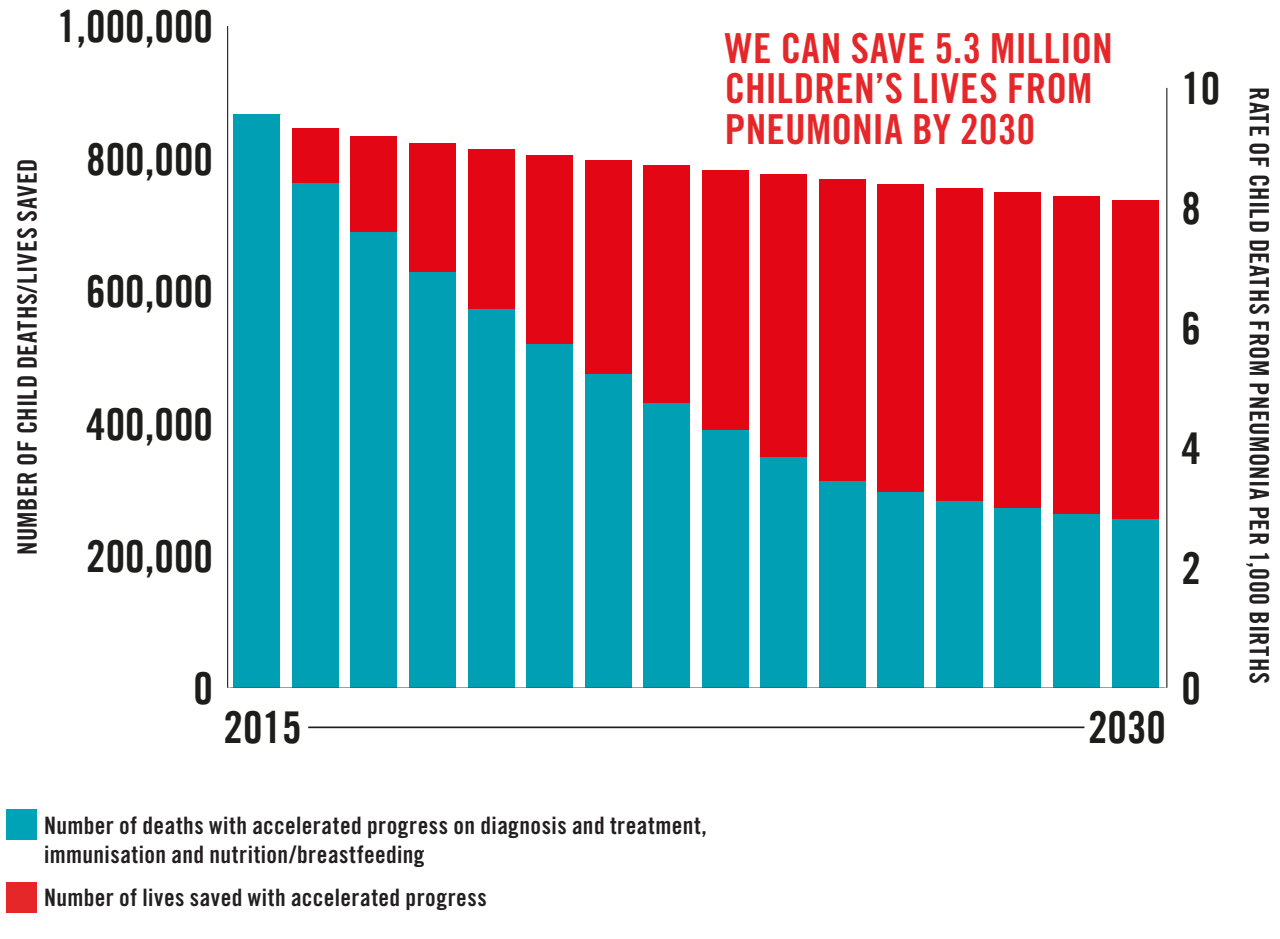
- 735,000 pneumonia-related deaths in 2030
- a pneumonia-specific mortality rate of eight deaths for every 1,000 live births – almost three times the target level in GAPPD.

But other futures are possible. Using the same LiST model, the Johns Hopkins research group examined a '2030 target' scenario in which the pneumonia death rate falls below 3/1,000 live births. Conditions for the scenario to be achieved include universal health coverage for pneumonia treatment, expanded access to immunisation, a 40% reduction in numbers of stunted children, and 50% exclusive breastfeeding coverage in the first six months.

As shown in Figure 8, this scenario dramatically bends the curve for pneumonia deaths. The gap between historic trends and achievable outcomes represents the cumulative saving of 5.2 million lives, with half a million fewer deaths in 2030. Around 1 million lives would be saved over the next five years.

What would it take to finance the investments needed to bend the curve in line with the 'target 2030' scenario? The full cost breakdown would require bottom-up analysis on a country-by-country basis, with pneumonia interventions identified in wider national health strategies.

FIGURE 8 BENDING THE CURVE ON PNEUMONIA: PNEUMONIA MORTALITY RATE FROM 2015 TO 2030



Source: Johns Hopkins University

For indicative purposes, we developed a rule-of-thumb approximation. This is based on a model used to assess the costs of a range of pneumonia and diarrhoea interventions. The model used LiST to identify interventions needed to reduce pneumonia deaths by 67% by 2025, including drugs and other supplies, health workers and a range of indirect costs. Adjusting for inflation and updating to cover the 2015–25 period, we estimate the scaled-up interventions would require an average increase in annual spending of around $4.5bn.

In one crucial respect, our modelling exercise *understates* the potential benefits of action against pneumonia. This is because the disease cannot be treated in isolation. Many of the preventative and therapeutic interventions required to bend the curve on pneumonia would generate benefits in other areas, notably diarrhoea. Indeed, putting in place the health infrastructure needed to diagnose and treat pneumonia would provide a platform for delivering interventions with the potential to prevent 95% of the 525,000 diarrhoea deaths that occurred in 2015 – and the interaction operates in both directions. Children with diarrhoea are far more likely to die if they have concurrent pneumonia.[20]

One of the central messages of this report is success in combating pneumonia hinges critically on the overall development of health systems. While pneumonia-specific interventions are critical, the impact of these interventions will be determined by the capacity and reach of the underlying health system, including the presence of trained health workers in the community, the availability of essential medicines and diagnostic tools, the strength of referral systems and – critically – the accessibility, affordability and quality of health care. Equity is front and central to all of these areas.

Amoni, nine months old, seen here with her mother, Elizabeth, was treated for pneumonia at a health centre in Kenya. She was referred for treatment by a community health worker trained by Save the Children.

PHOTO: JONATHAN HYAMS/SAVE THE CHILDREN

2 Why are children dying of pneumonia?

KEY POINTS

- Severe malnutrition multiplies the risk of pneumonia death by a factor of four compared with adequately nourished children. The 52 million children in the world who are wasted (below the appropriate weight for height) face grave risks.
- Pneumococcal vaccines (PCVs) could prevent the overwhelming majority of bacterial pneumonia cases, but 170 million children in developing countries are unimmunised.
- Weak health infrastructures and, especially in middle-income countries, the high costs of PCVs may limit coverage and cost lives.
- One-third of children with pneumonia-like symptoms do not seek appropriate care.
- Antibiotic treatment could prevent 70% of pneumonia deaths at an average cost of just 40 US cents – but antibiotic treatment is frequently either unavailable or not provided.
- Diagnostic and treatment failures are widespread, with late detection of hypoxaemia – the cause of 1.9 million hospital admissions for children annually – a major concern.
- Pneumonia risks are skewed towards poor children, but health system provision is skewed towards wealthier children.

The micro-organisms that cause pneumonia are dangerous for all children. What makes them lethal is a combination of background risk and the failure of health systems to prevent or to detect, diagnose and treat pneumonia cases.

BACKGROUND RISKS – UNDERNUTRITION, INSUFFICIENT BREASTFEEDING AND HOUSEHOLD AIR POLLUTION

Some of the most effective armour against fatal pneumonia is to be found outside of health systems. Good nutrition in the womb and in the earliest days after birth greatly reduces the risk of severe pneumonia. Exclusive breastfeeding in the first six months has the power of an effective vaccine – and continued breastfeeding with the gradual introduction of complementary food up until two years of age or beyond is another risk-reducer.

Ensuring that children's lungs are not subjected to household air pollution and or potentially dangerous microbes from unsafe water are also powerful sources of protection.

Malnutrition is associated in nearly half of pneumonia deaths.[1] Why does undernutrition raise the risk of fatality? The inability of weak, poorly-nourished children to cough up infectious bacterial secretions carried by mucus into the lungs is a major factor. Deficiencies of micronutrients – especially zinc and vitamin D – also add to the risks, as does the general weakening of the body's immune system that comes with undernutrition, creating an enabling environment for the spread of pneumonia.

Undernutrition often begins in the antenatal period with the undernutrition of mothers, marking the start of a vicious circle of low birthweight, increased risk of infection and undernutrition. Up to 3% of infants with very low birthweights become infected with pneumonia.[2]

Children who experience undernutrition face greatly elevated risks from pneumonia, even if they are treated. In Kenya, children discharged from hospitals after having been treated had an eight-fold higher risk of death in the following year than their community peers, with undernutrition being the main determinant of risk.[3] This evidence points towards lasting long-term damage that leaves children more susceptible to pneumonia infections. The tragic story of Umi, a young Kenyan girl to whom this report is dedicated, illustrates this point. She recovered from severe malnutrition only to lose her life to a subsequent bout of pneumonia and diarrhoea (see dedication, inside front cover).

The sheer scale of global malnutrition and its slow pace of decline is at the heart of the pneumonia epidemic. In 2016 globally, 52 million children under five were wasted (below the appropriate weight for age), with 17 million severely wasted. In South Asia, home to half of the world's wasted children, 16% are wasted.[4] While wasting data does not permit tracking over time, other data provides a worrying picture. In 2016, there were an estimated 155 million stunted children in the world, meaning they were short for their age.[5] While stunting levels are in decline, they are falling very slowly, at just 1.5% a year – half the rate needed to achieve the 40% reduction in stunting by 2025 envisaged by the Sustainable Development Goals.[6]

Severe acute malnutrition at the levels often seen in humanitarian emergencies greatly amplifies pneumonia risks. On one estimate it increases the mortality rate from a pneumonia episode by a factor of 15.[7] The combination of drought and conflict behind the protracted food crises in sub-Saharan Africa creates a fertile soil for pneumonia, as witnessed by the experience of children in Somalia (Box 3).

Treatment documentation at the mobile health clinics and other facilities delivering support to drought-affected communities points to a high incidence of acute respiratory infection. In South Sudan, health facilities and community-based

BOX 3 LIFE AND DEATH IN SOMALIA: THE STORIES OF HAMDI AND ABDURAHMAN

In 2016, following a series of poor rains, Somalia was struck by the worst drought in living memory. More than 6 million people have been left facing food insecurity as a result. On a conservative estimate, 275,000 children faced life-threatening severe acute malnutrition in mid-2017.

What these figures don't capture is the human suffering that has come with hunger and increased risk of pneumonia. Hamdi was born at the epicentre of the drought. In March 2017, when she was six months old, she was admitted to Save the Children's nutrition stabilisation clinic in Garowe, capital of Puntland. She weighed 8lbs – the average birthweight for a newborn baby in the UK. Her mother, Fatima, had carried her for three days to reach the clinic. Unable to breastfeed, and too weak to take milk from a bottle, Hamdi was provided with nutrition through a nasal tube. Apart from diarrhoea, she had also contracted pneumonia as her immune system collapsed – and she was treated with intravenous antibiotics.

But having been malnourished her whole life, Hamdi's frail body was unable to overcome the illness. She died, a victim of a lethal cocktail of diseases, including pneumonia.

Not every story ends in tragedy. Save the Children is operating mobile health and nutrition clinics funded by the UK and other donors in Saal District. At one outreach centre in a town called Shada, a young boy called Abdurahman, aged two, arrived in a critical condition, with bronchitis, pneumonia and malnutrition. He was treated with antibiotics and oral rehydration therapy. The bronchitis was alleviated, but the pneumonia required treatment with second line antibiotics. Abdurahman recovered and was able to return home.

The Somali drought demonstrates the deadly interaction between pneumonia and acute malnutrition. It also illustrates, as in the case of Abdurahman, the potential for timely aid to save lives. Unfortunately, humanitarian aid typically arrives far too late and in insufficient quantity (see Chapter 4).

distributors supported by Save the Children are struggling to cope with a drought-related surge in pneumonia in areas characterised by already high rates of acute respiratory infection (Box 12: On the frontline of the fight against pneumonia, page 42).

Insufficient breastfeeding – a key cause of child undernutrition – magnifies the risks of pneumonia. Or to frame this positively, children who are appropriately breastfed are less likely to experience severe or fatal pneumonia. In part, that's because breastmilk is the original super-food. The colostrum produced in the first hours and days of a baby's life is rich in antibodies and is the most potent immune system support known to science. It confers protection against potentially harmful pneumococcal bacteria and strengthens a child's natural defences. One recent survey of evidence estimates breastfeeding could prevent around one-third of respiratory infections and over half of hospital admissions associated with those infections.[8]

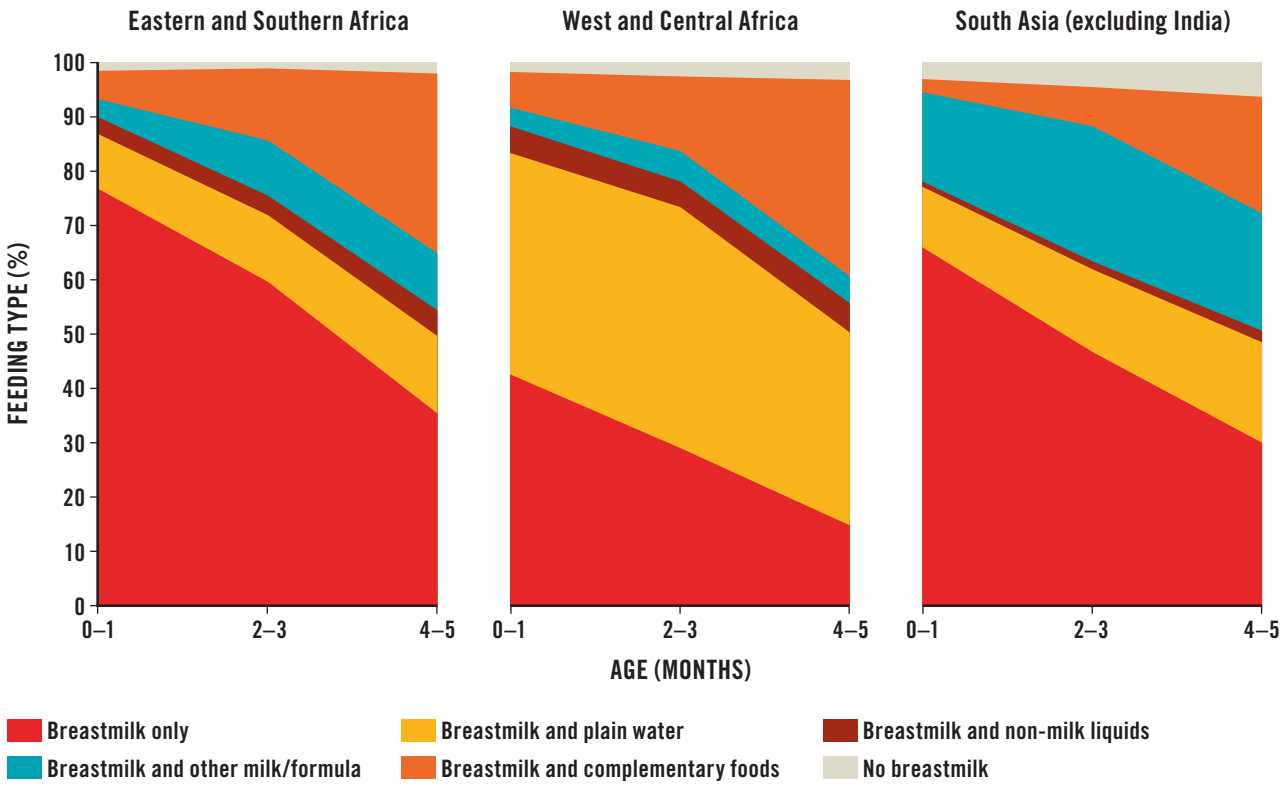
Breastfeeding is also associated with a reduced risk of undernutrition and diarrhoea, both of which are risk factors for pneumonia. Research published in *The Lancet* estimates that suboptimal breastfeeding contributes to an estimated 823,000 avoidable deaths in children under five. Pneumonia will be a primary or secondary factor in many of these deaths.[9]

Unfortunately, breastfeeding rates are sub-optimal across the regions where children are most at risk of pneumonia. Only about half of children begin breastfeeding within the critical first hour. Moreover, while over 80% of newborn babies receive breastmilk, rates of exclusive breastfeeding in the 0–6 month age group drop off rapidly.[10] More than half of children in low-income countries are not exclusively breastfed for the first six months. In lower middle-income countries only around one-third of children are exclusively breastfed in the first six months – and coverage rates are lower still in upper middle-income countries. There is no evidence of these patterns changing for the better.[11]

Transition patterns from exclusive breastfeeding vary. In Central and West Africa, there is a marked shift towards water in infant feeding after 2–3 months, whereas in South Asia complementary foods play a greater role (Figure 9).

Air pollution is a major risk factor for pneumonia. Young children breathe twice as quickly as adults, so they take in more air relative to their body weight.

FIGURE 9 BREASTFEEDING RATES DROP OFF RAPIDLY IN REGIONS WITH A HIGH BURDEN OF PNEUMONIA: BREASTFEEDING OF CHILDREN AGED 0–5 MONTHS BY FEEDING TYPE AND REGION[12]



Joseph and his mother are refugees from South Sudan, now living in a camp in Uganda. Joseph has pneumonia. He is being treated with antibiotics by a Save the Children nurse.

PHOTO: GUILHEM ALANDRY/DOCULAB/SAVE THE CHILDREN

Their respiratory tracts are more permeable, and therefore more vulnerable, and their immune systems are weaker. Ultrafine airborne pollutants caused by smoke or fumes can more easily enter children's lungs and cause life-threatening diseases. It has been estimated that some 300 million children live in areas where pollution is six times or more above WHO international guideline levels, while 2 billion live in areas that exceed the limits for ultrafine particulate matter.[13]

The sources of pollution vary across and within countries. Outdoor air pollution associated with emissions from factories, the burning of rubbish and coal, and traffic is a growing concern. Children living in urban slum environments often face high levels of exposure to these sources of pollution. Indoor air pollution is a major source of respiratory infection in many high-burden pneumonia countries, where the burning of biomass for cooking, heating and lighting is a common source of energy.[14] According to the International Energy Agency, over 80% of households in sub-Saharan Africa and 63% in India use biomass energy sources, ranging from charcoal to wood, straw and animal dung.[15]

IMMUNISATION AGAINST PNEUMONIA: A LONG WAY TO GO

The old adage about prevention being better than cure has a special relevance for pneumonia, especially in low-resource settings. Transitions from early symptoms to severe infection and fatality can be very rapid, especially for children who are malnourished and have limited access to care. Because the most effective treatment for pneumonia comes in the form of antibiotics and diagnosis is difficult, incorrect prescription has the potential to contribute to antimicrobial resistance. Moreover, pneumonia places an enormous burden on health systems at all levels, from community and primary health facilities up to referral hospitals.

For all of these reasons, preventing pneumonia through immunisation matters for protecting lives, preventing microbial resistance, and reducing pressure on the health system. It is also a smart investment. For low-income countries and those lower middle-income countries that receive Gavi support (see page 51), the potential benefit of universal immunisation coverage measured in terms of savings on treatment costs, lost caregiver wages, and reduced productivity has been estimated to average some $9.5bn a year over the period 2011–20 – a return on investment of almost 44:1.[16]

But the real measure of the case for vaccination is that of young lives saved. Immunisation has been one of the most powerful motors reducing child mortality. Expanded coverage of vaccines has driven steep reductions in killer diseases such as measles and neonatal tetanus.

In the case of pneumonia, universal vaccination would not end deaths. At present, there are no vaccines for RSV (see Box 1, page 6) and not all bacterial strains are covered by existing vaccines. However, the pneumococcal conjugate vaccines (PCVs) and Hib vaccines that are available could, if universally applied, probably prevent more than half of all pneumonia deaths in children – around 450,000 lives saved at current mortality levels.[17]

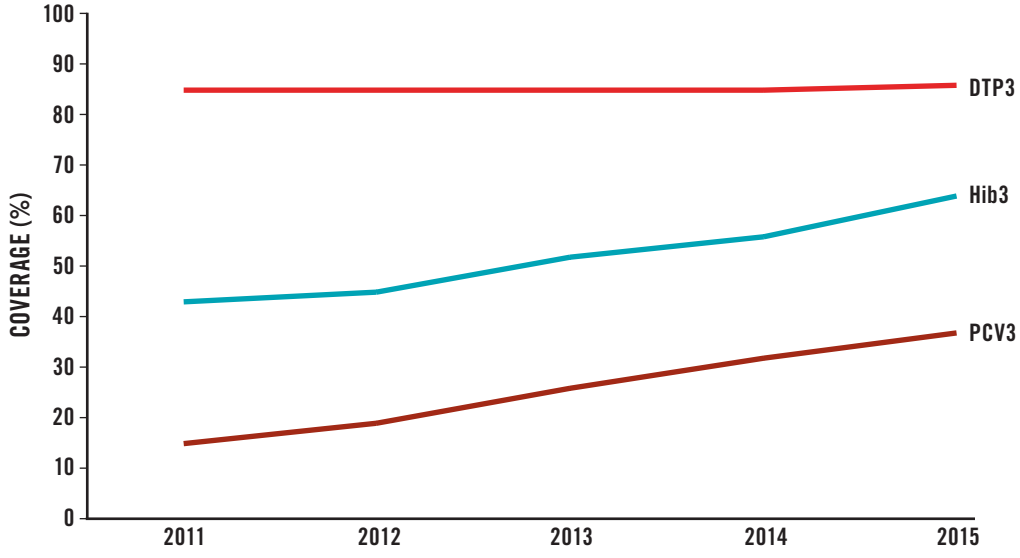
PCVs are now in use across the developed world. Immunisation currently requires three doses, typically administered at eight weeks, 16 weeks and around one year.[18] This schedule lends itself to the integration of PCVs in the delivery cycle for routine immunisation. Trials in developed countries have shown PCV to be highly effective in providing protection against the most common serotypes.[19] In a recent publication of the International Vaccine Access Centre of the John Hopkins School of Public Health, the current PCV vaccines were shown to create wider benefits associated with herd protection, with unvaccinated populations facing less exposure to infection.[20] Trials in the USA suggest the indirect effects of PCV have prevented two to three times as many cases of pneumococcal disease as the direct effects.[21]

Evidence from developing countries is similarly encouraging.[22] Trials in the Gambia found that PCV immunisation reduced the incidence of pneumococcal pneumonia in children aged 2–11 months by 58% and all-cause mortality by 16%. The reduction in pneumococcal pneumonia for children aged 1–2 was 75%.Efficacy trials in South Africa found a reduction of one-third in children hospitalised. [23]

However, the power of immunisation to protect children against pneumonia has been only partially realised. It is now ten years since the WHO recommended the introduction of pneumococcal vaccines into all national immunisation programmes, especially countries with high pneumonia mortality. PCVs have been available in low-income developing countries since 2009 and Hib vaccines since 2000 through the Gavi Alliance. Coverage has been expanding and saving lives. Yet provision is limited and unequal.

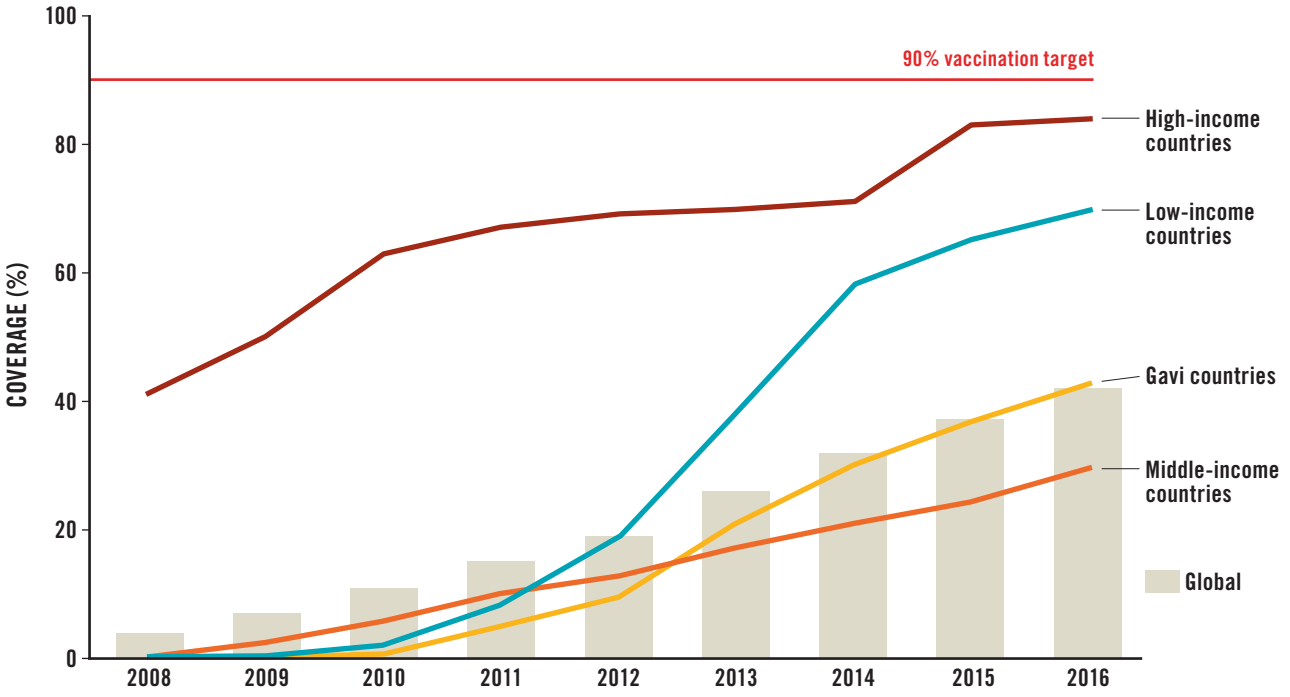
Contrasts between vaccination rates for pneumonia and other illnesses are striking. Today, 86% of children are covered by diphtheria, tetanus and pertussis (DTP) vaccines. By contrast, coverage is just 64% for the Hib vaccine and 37% for PCV (Figure 10).[24]

FIGURE 10 ANTI-PNEUMONIA IMMUNISATION IS LAGGING: GLOBAL IMMUNISATION COVERAGE FOR DTP3, HIB3 AND PCV3



Source: WHO/UNICEF Estimates of National Immunisation Coverage data, 2015

FIGURE 11 THE MISSING MIDDLE – PCV COVERAGE IS HIGHEST IN LOW-INCOME AND HIGH-INCOME COUNTRIES: PCV ANNUAL COVERAGE RATES BY COUNTRY INCOME GROUP



Source: World Health Organization

There is a marked variation in immunisation coverage rates across different groups of countries. Coverage of PCV is, at first sight surprisingly, higher in low-income countries than in middle-income countries (Figure 11). This is testament to the success of the Gavi Alliance in supporting the introduction of the vaccines in the poorest countries, and collaboration from the PCV manufacturers. One striking example comes from Ethiopia, which introduced PCV into its national immunisation programme in 2011 and has gone on to achieve 76% coverage.[25] Of the 73 countries eligible for Gavi Alliance funding, 59 have applied (and been approved for) support. Coverage in Gavi countries has now reached 41%.[26] By contrast, coverage in middle-income countries is less than 30%.

The vaccine coverage profile has some important implications for national and global anti-pneumonia strategies. We estimate the number of unvaccinated children in the 0–2 age range in developing countries at around 170 million. The majority of these children – just over 100 million – live in lower middle-income countries, with India dominating. Around 13 million live in low-income countries (Table 2).

TABLE 2 MOST UNVACCINATED CHILDREN LIVE IN MIDDLE-INCOME COUNTRIES: NUMBER OF 0–2-YEAR-OLD CHILDREN NOT COVERED BY PCV, BY COUNTRY INCOME STATUS

Income group	Number of unvaccinated children (0–2 years)
High income	3,423,523
Low income	13,159,458
Lower middle income	102,994,970
Upper middle income	50,109,167
Total	**169,687,118**

TABLE 3 WHERE ARE THE UNVACCINATED CHILDREN? NUMBER OF 0–2-YEAR-OLD CHILDREN NOT COVERED BY PCV, BY REGION

Region	Number of unvaccinated children (0–2 years)
East Asia and Pacific	56,869,893
Europe and Central Asia	9,175,261
Latin America and Caribbean	3,933,448
Middle East and North Africa	12,922,997
North America	627,171
South Asia	59,332,416
Sub-Saharan Africa	26,825,931
Total	**169,687,118**

Table 3 provides a picture of the regional distribution of unvaccinated children. The data underscores the fact that the vaccine challenge extends far beyond the world's poorest countries in sub-Saharan Africa. However, the challenge facing health authorities in that region should not be under-estimated, not least in view of the underlying demographics. The 0–2 age cohort in sub-Saharan Africa is growing rapidly, while it is static in other developing regions. Over the period 2015 to 2025, the number of children aged less than 2 years old in the region will increase by more than 11 million,[27] or some 15% – an outcome that will place significant new demands on health systems.

Despite the strong progress towards full immunisation coverage in Gavi countries, more rapid progress has been held back by the health system failings that have also seen DTP3 coverage stall. Countries are systematically under-investing in the health infrastructure needed to deliver universal immunisation. Allied to delayed implementation of programmes in some large countries – including Bangladesh – this has led to a gap between Gavi planned coverage schedules and outcomes.[28] Efforts to accelerate progress will hinge critically on the development of a vaccine infrastructure supported by trained health workers, procurement systems, and a cold chain system for the storage and distribution of vaccines.

Implementation arrangements may have fuelled the divergence between Hib and PCV provision. The Hib vaccine has been integrated into established DTP3 programmes through inclusion in the Pentavalent vaccine (which covers DTP, Hepatitis B and Hib). While the Hib vaccine is part of routine immunisation in most countries, 55 countries have yet to introduce PCV. Many of these countries are middle-income.

Low-income and some lower middle-income countries are eligible for support through Gavi so their costs are effectively paid for by aid donors. The annual costs of purchasing these vaccines – $1bn in 2016 – typically represent around 40% of the Gavi Alliance's vaccine procurement budget.[29] Middle-income countries face far higher costs (Figure 12). Reported charges for a full course can range from $40–53 in lower middle-income countries and $43–112 in upper middle-income countries.

Several caveats have to be attached to these figures. The two companies producing PCV vaccines – GSK and Pfizer – operate complex tiered pricing schemes that seek to generate a targeted average profit margin by charging lower prices to the poorest countries and higher prices to richer countries. There is also some confusion in reporting on price. Gavi provisions for government procurement agencies may not extend to private importers, for example. Unfortunately the generalised lack of transparency in reporting on price makes it difficult to undertake consistent cross-country comparisons.

The volume of vaccines supplied by Gavi is at least partly contingent on price. Other things being equal, lower prices means that more can be supplied with the same amounts of aid. For non-Gavi countries with stretched and under-resourced health systems, health planners will inevitably take into consideration vaccine pricing as well as potential health benefits.

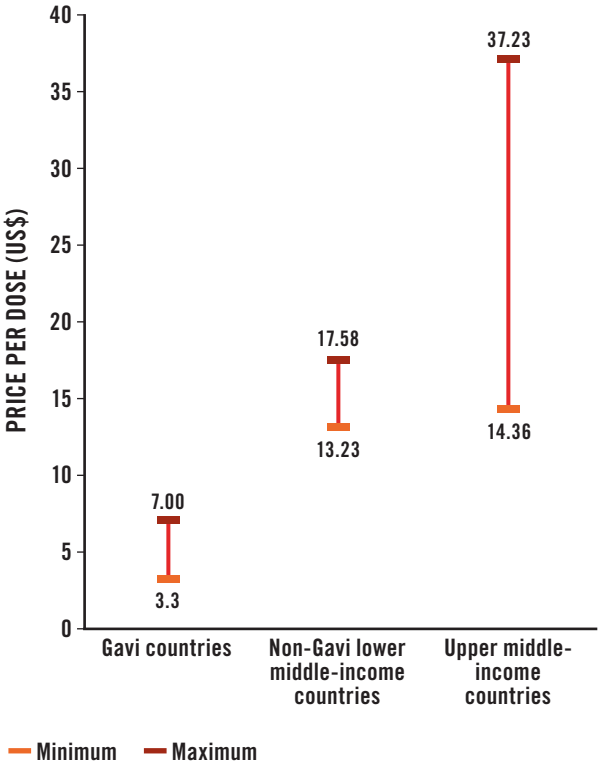
By the same token, price is clearly not the only factor at play. Vaccine coverage is highly unequal

within countries, as well as between countries. While pneumonia background risks are invariably skewed towards the poorest children, the benefits of immunisation are heavily skewed towards wealthier groups.[30] Wealth disaggregated data on PCV vaccination is lacking for most countries. However, it is likely to mirror the type of inequalities in immunisation captured in Figure 13. A child from a wealthy household in Nigeria is 15 times more likely to be fully immunised than a child from a poor household.

FAILURES OF DIAGNOSIS AND TREATMENT

Pneumonia is an eminently treatable disease in children, provided it is diagnosed swiftly and accurately and then treated effectively. These provisos are important. Most cases of pneumonia can be treated with antibiotics costing less than $0.40 for a full course. But if a child with pneumonia does not receive care, or their condition is misdiagnosed, their condition can deteriorate very rapidly. If they have severe pneumonia, treatment requires referral to facilities equipped to treat respiratory failure, provide oxygen treatment and deliver intravenous or intrasmuscular antibiotics. The prevalence of pneumonia deaths is

FIGURE 12 MANY MIDDLE-INCOME COUNTRIES ARE YET TO INTRODUCE PCV: PCV DOSE PRICE FOR GAVI ELIGIBLE COUNTRIES AND COUNTRY INCOME GROUPS*



* Reported prices may include both private and public price

Source: *WHO Price Report: Vaccine product, price and procurement*

FIGURE 13 THE POOREST – AND MOST AT-RISK – CHILDREN ARE LEAST LIKELY TO BE IMMUNISED: INEQUALITIES IN FULL IMMUNISATION COVERAGE BY ECONOMIC LEVEL IN HIGH-BURDEN PNEUMONIA COUNTRIES[31]

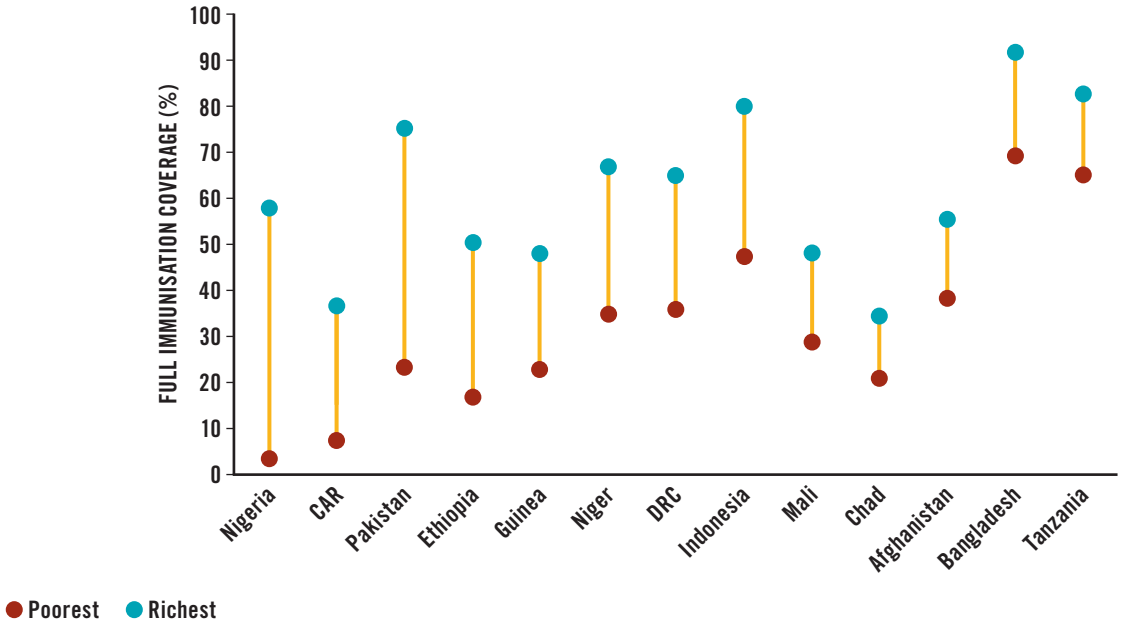


PHOTO: JONATHAN HYAMS/SAVE THE CHILDREN

Community health volunteer Lucas checks the breathing rate of Robert, nine months old, using beads to count the number of breaths per minute. The day before Robert had been diagnosed with pneumonia by a doctor at a health centre in Turkana County, Kenya and prescribed antibiotics, paracetamol and antihistamine.

a symptom of underlying health system failures that deny children access to diagnosis and treatment.

The failures start with access to care. Many children with pneumonia symptoms are not taken for appropriate care. Around one-third of the children with such symptoms fall into this category – and presentation rates are rising slowly, at less than 1% annually.[32] This means that some 40 million children may be denied access to treatment every year.[33] In sub-Saharan Africa, only 46% of children with symptoms are taken for health care.[34] In many countries, curative care often has to be sought from traditional healers or private providers. All too often the care provided is sub-standard and costly, and it often leads to dangerously inadequate treatment outcomes.

Barriers to care vary. In some cases, especially in rural areas, distance to a health facility and associated costs for transport may be the primary factors. In others, parents may be unable to pay if there are charges for treatment. Concerns over the quality of care on offer may also figure prominently. Parents may feel that health workers are inadequately trained, that facilities lack essential drugs, and that they will be treated disrespectfully. Often, all of these factors will come into play. The consequence is that many parents may see traditional healers as a first port of call, delaying recourse to the health system.

Early and accurate diagnosis is critical. In theory, identification of pneumonia symptoms is relatively straightforward. The WHO's Integrated Management of Childhood Illness guidelines provide a simple diagnostic road-map. Most children will present with a cough, chest pain, fever and shortness of breath. Health workers with minimal training can assess a child for respiratory distress by counting their breaths per minute (over 50 for children under one year and over 40 for older children). In more severe cases, a health worker might also observe an in drawing of the chest wall (see page 41).

Treatment regimes are also well-established. Amoxicillin DT is the first-line antibiotic treatment for bacterial pneumonia. Second- and third-line antibiotics will be required to treat more severe and resistant cases. When conditions deteriorate, children have to be referred to higher level facilities. For children at risk of hypoxaemia, a condition in which blood oxygen levels fall to the point where they risk damaging organs, oxygen treatment is critical. In the most severe cases, children may need to have their lungs drained.

For many millions of children suffering from pneumonia, and the parents who care for them, these guidelines represent a distant version of reality. Parents often lack the knowledge they need to recognise pneumonia symptoms. Community health workers may struggle to count the respiratory rate of a distressed infant. Other tell-tale signs of severe pneumonia, such as the skin turning blue with oxygen shortages, may be hard to detect in children with black skin. Without a way to test children for the oxygen levels in their blood, health care workers may be unable to identify a child in need of oxygen treatment until it is too late. When pneumonia presents with other conditions, such diarrhoea, measles and sepsis, the risks of misdiagnosis can rise – and inaccurate diagnosis exposes children to great risks (Box 4).

BOX 4 ON THE BRINK OF DEATH: SULEKA'S STORY

Life has been a struggle for baby Suleka right from birth. Suleka was born underweight. From the outset her mother, Halima, says Suleka suffered from diarrhoea. Suleka then came down with what Halima thought was a cold; she became listless and refused to breastfeed. The diarrhoea got worse, possibly because Suleka was transferred to cows' milk. Other symptoms developed, including fever, coughing, and fast breathing.

Suleka's family are pastoralists in Wajir, north-eastern Kenya – one of the poorest parts of the country. It took Halima several days to find a vehicle able to take her and an increasingly sick Suleka to the closest health facility – located several hours away. Staff at this private dispensary recommended that Halima treat Suleka for simple diarrhoea.

But Suleka's condition continued to deteriorate. Three days after their visit to the dispensary, Halima found another vehicle to take her to Griftu hospital, a referral centre supported by Save the Children. The medical officer on duty, Dr Hassan, immediately diagnosed severe pneumonia, with diarrhoea, malnutrition, and dehydration as complicating factors.

Doctors administered first-line antibiotics available in the centre, and put Suleka on intravenous drips for rehydration and nutrition. Suleka did not respond, so she was put on an intravenous drip with second-line antibiotics. Again, she did not respond. After 24 hours she was put on a third-line antibiotic treatment The fever swiftly abated and Suleka's breathing rate returned to normal levels.

"I felt frightened when I was told it was pneumonia," said Halima. "I was praying to God that my baby will be OK."

Dr Hassan explained that if Suleka had come in two or three days later she wouldn't have survived. He said that most of the pneumonia cases he deals with are – like Suleka – associated with malnutrition, and that parents often delay bringing their children until the cases are severe.

Suleka's case illustrates the complexity of the challenges posed by pneumonia in settings like Wajir that have high levels of poverty and are hard to reach. Chronic under-investment in health infrastructure, large distances between clinics and nomadic livelihoods mean many household lack access to health facilities – and health workers often lack the training they need to diagnose and treat pneumonia.

Suleka, three months old, is treated for pneumonia.

PHOTO: JONATHAN HYAMS/SAVE THE CHILDREN

It is not possible to determine what proportion of children with pneumonia symptoms are treated with antibiotics – but the evidence points to a large treatment deficit. For a large group of countries – including India, Pakistan, Ethiopia, Indonesia and Nigeria – rates of treatment with antibiotics were far below rates of access to a care provider for children with acute respiratory symptoms.[35] Accurate diagnosis may explain part of the gap: not every respiratory case requires antibiotic treatment. However, the unavailability of antibiotics also contributes. Surveys of essential medicine availability show that fewer than 60% of facilities in Tanzania, Kenya, the Democratic Republic of Congo and Mauritania have Amoxicillin available, falling to less than one-quarter in Nepal and Uganda. This may reflect limited investments in marketing and distribution, poor procurement, and a failure on the part of health planners to recognise demand.

Flawed diagnosis and treatment failures are particularly dangerous in the neonatal period. One review of care-seeking found that only 59% of parents or guardians sought care for sick newborn babies.[36] Weak postnatal care systems reduce the chances of diagnosis and treatment. Under 40% of new mothers and only a quarter of newborn babies receive a health check within two days of delivery in the least developed countries.[37] This points to missed opportunities for the critical interventions that could prevent pneumonia deaths. Research evidence shows that oral or injectable antibiotics provided to newborn babies with pneumonia can reduce neonatal mortality by as much as 42%.[38]

Referral systems are often poorly equipped to deliver effective care. Late referral is common – and often fatal. Many children arrive in hospitals after infection has moved from the lungs into the blood stream and spinal fluid, creating the conditions for septic shock and meningitis. Basic therapeutic treatment may also be lacking. Around 13% of the children referred to hospital with pneumonia require treatment with oxygen – 1.9 million cases annually.[39] Yet facilities often lack oxygen treatment altogether, or they are forced to share single oxygen cylinders across large numbers of children.

INEQUALITY AND THE LOTTERY OF BIRTH

Pneumonia powerfully illustrates the lottery of birth. When children are struck by the disease, their prospects for survival depend overwhelmingly on a circumstance over which they have no control – their country of birth. But the lottery extends beyond national boundaries. Levels of care and treatment *within* countries are structured around social fault lines based on wealth, ethnicity, gender and other markers for disadvantage.

The profound importance of health systems can be illustrated by simple life-and-death comparison. Boxes 5 and 6 tell the story of two children in two hospitals, one in the United Kingdom and one in Turkana, northern Kenya. Both children were admitted with pneumonia. One survived because of the level of care available, the other died.

PHOTO: JONATHAN HYAMS/SAVE THE CHILDREN

A dose of intravenous antibiotics is prepared to treat a child with pneumonia at a health centre in Kenya.

BOX 5 A LIFE SAVED IN THE UK

Sophie, aged 16 months, was presented to the emergency department of the Royal Hospital for Sick Children in Edinburgh, Scotland, with a history of lethargy, poor oral intake and high temperatures. She had a history of repeated respiratory tract infections, and had been treated twice in the previous two months with a course of Amoxicillin by her general practitioner (GP).

Immediately before her admission to hospital Sophie's condition had worsened over a period of two to three days. She became more lethargic and suffered from a worse cough, leading intermittently to vomiting. She was seen again by a GP, who referred her to hospital.

On assessment in the hospital emergency department, Sophie had laboured breathing and there was a slight restriction noted in air entry to her right lung. A chest radiograph confirmed a focal chest infection and also showed a small pleural effusion, a build-up of fluid, measured with an ultrasound device.

Apart from being provided with oxygen therapy, Sophie was started on intravenous (IV) antibiotics and fluids. Blood tests subsequently suggested *Streptococcus pneumoniae*. Despite treatment she was persistently feverish and the pleural effusion increased in size. A chest drain was inserted, through which she received three days urokinase, a medicine that helps break down debris from infection.

After the chest drain was removed Sophie's condition worsened. Further imaging (a chest radiograph and CT scan) showed a pocket of air, called a pneumothorax, and evidence of dead lung tissue, called necrotising pneumonia. Sophie was immediately taken to theatre for two chest drains to get rid of the air and fluid. Her haemoglobin had dropped significantly, so she was given a blood cell transfusion.

Over time, Sophie's condition improved. The chest drains were removed and, once she was clinically stable, she was switched to once-daily IV antibiotics, for which she came back to the hospital every day. Overall, she had more than four weeks on IV antibiotics and a further four weeks on oral antibiotics.

Sophie recovered and is being carefully monitored as an outpatient.

BOX 6 A LIFE LOST IN KENYA

Lilian's story should have been different.

Born in Turkana, one of Kenya's most marginalised areas, Lilian was admitted to Lodwar hospital with severe pneumonia. She was just four months old.

She arrived in a distressed state. Her respiratory rate was well above the 50 breaths per minute indicator in WHO guidelines. She was acutely lethargic and unable to keep her food down. Her mother had not recognised the respiratory symptoms and accompanying fever as warning signs for pneumonia. Lacking the knowledge or community support to identify illness, Lilian's mother didn't look for medical help until the situation became desperate.

Lilian was admitted to hospital during the night shift. The emergency clinician suspected malaria and observed diarrhoea, difficulty breathing, coughing and body heat. He tried to stabilise her, starting malaria treatment, giving oral rehydration salts and zinc for the diarrhoea. He sent for more tests and admitted the baby to the main room in the paediatric ward. Nurses administered first-line antibiotics and paracetamol to reduce Lilian's temperature, but she didn't improve. Second-line antibiotics were administered.

On the third day, Lilian was moved to the critical room for oxygen treatment, but her condition continued to deteriorate. In the early morning of her fourth day in hospital Lilian died. There was no clinician on the ward overnight.

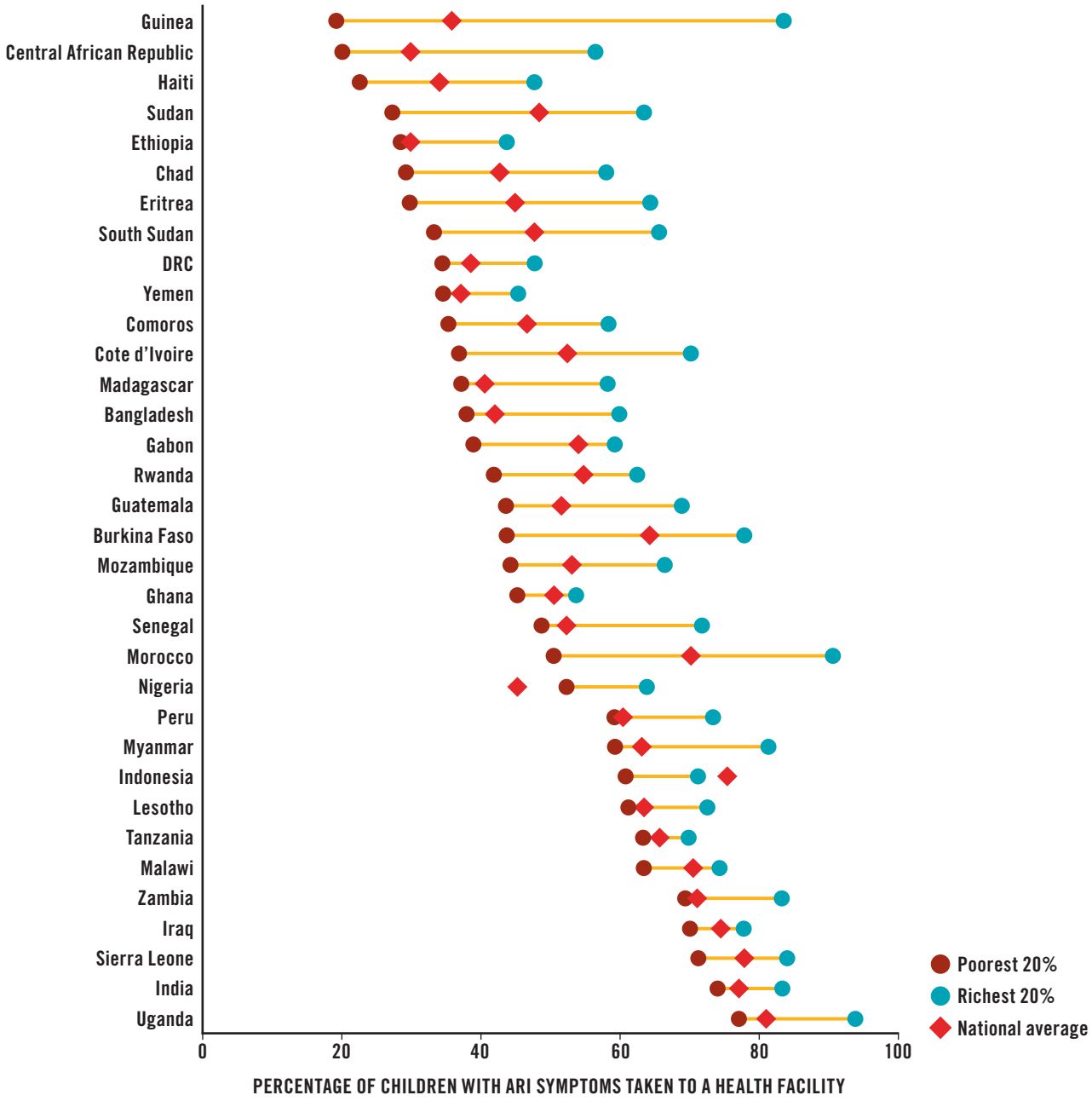
Lilian was one of three babies who died from pneumonia in the hospital during a four-day period.

Health divides within countries are often as stark as those between them. High-income households living in cities like Lagos, Nairobi, Mumbai or Jakarta have access to levels of health care comparable to those available in the richest countries. Low-income households in the same cities, or in rural areas of the same country, occupy a different world. The experience of two Nigerian children is instructive (Box 7).

The stories of Rebecca and Bintu in Nigeria (see opposite page) reflect structural inequalities in access to diagnosis and treatment across high-burden countries. Children in the poorest households with pneumonia symptoms are less likely to be diagnosed and treated than their wealthier counterparts (Figure 14). An inability to afford treatment also figures prominently in explaining the wealth divide in health care across countries (Figure 15).

FIGURE 14 POOR PARENTS LESS LIKELY TO SEEK CARE FOR A CHILD WITH PNEUMONIA SYMPTOMS

Selected countries where the difference between the poorest and richest households is more than five percentage points



Source: Save the Children, Groups-based Inequality Database, based on DHS and MICS surveys

BOX 7 WORLDS APART: THE TALE OF TWO CHILDREN IN NIGERIA

Rebecca, aged 2, lives in a wealthy suburb of Lagos. She contracted a fever, became listless, and developed a cough. After two days, her mother took her to the First Consultants Medical Centre, a 40-bed private hospital whose patients include senior company executives and members of the government's cabinet. Rebecca was promptly x-rayed, blood samples were taken to check for infection and malaria, and pulse oximetry was used to measure blood oxygen levels. Within 30 minutes of Rebecca's arrival, she had been admitted as an inpatient and placed on an intravenous antibiotic drip. The fever swiftly subsided and Rebecca returned home after two days.

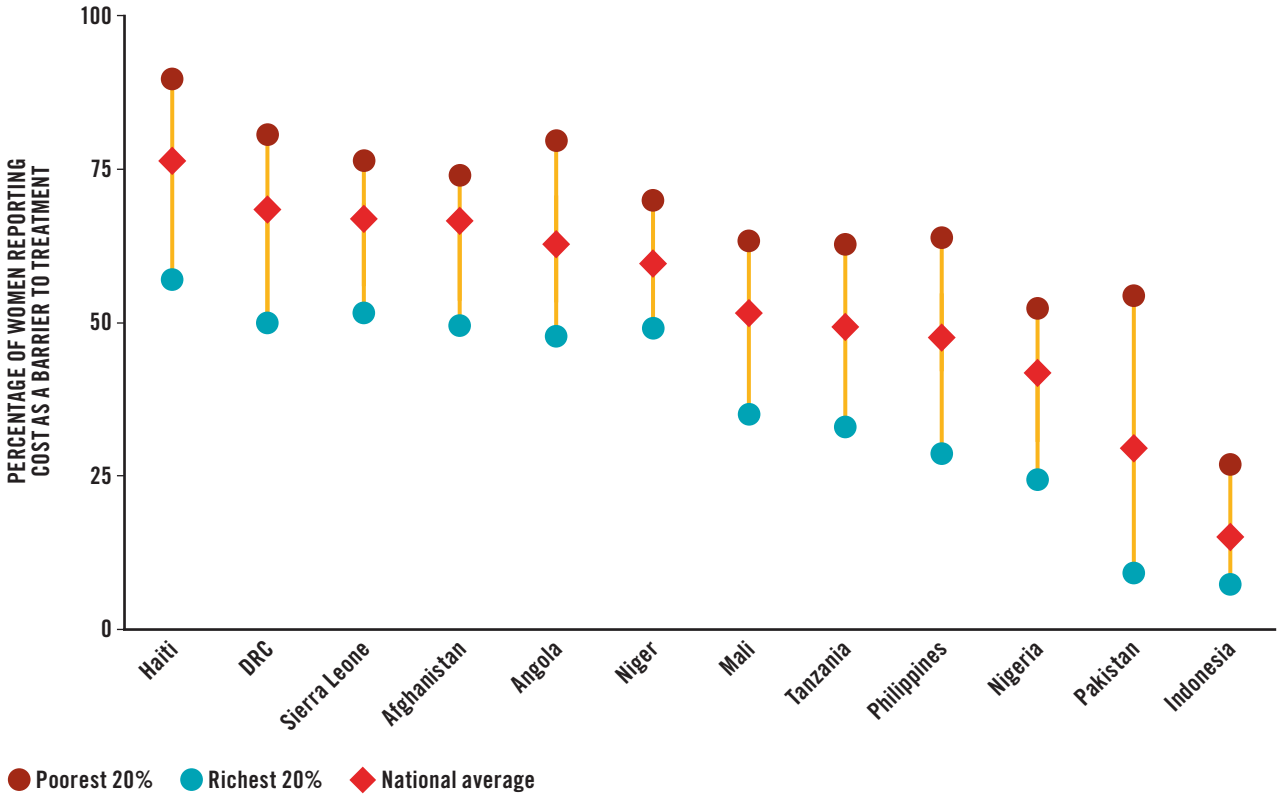
A thousand miles north-east of Lagos, at a stabilisation clinic run by Save the Children in Maiduguri town in Borno State, the children who come for treatment inhabit a different world. Most have severe and acute malnutrition, often with pneumonia, diarrhoea and malaria as compounding factors. Bintu, also aged two, was brought to the clinic by her mother Falmata.

They had been displaced from their village as a result of the conflict between government forces and Boko Haram. Bintu was admitted with malnutrition and severe pneumonia. Doctors treated her with intravenous antibiotics. By the time her treatment was initiated her weakened immune system struggled to fight the infection and Bintu had severe difficulties breathing. She should have been immediately provided with oxygen therapy – but the centre's only cylinder was already being used on another ward. In spite of these challenges Bintu was successfully treated and, thankfully, recovered.

Bintu, age two, suffering from pneumonia, is treated at a Save the Children stabilisation centre in Maiduguri, Nigeria.

PHOTO: TOMMY TRENCHARD/SAVE THE CHILDREN

FIGURE 15 MONEY MATTERS: WOMEN REPORTING COST AS A BARRIER TO TREATMENT



High burden countries with DHS data from 2012 onwards

The rural–urban divide both reflects and reinforces wider wealth disparities. In Ethiopia, 28% of children with reported respiratory infection living in rural areas are seen by a qualified health care worker, rising to 61% for children living in urban areas. These disparities reflect a combination of distance, cost and quality of provision.

WEAK HEALTH SYSTEMS

Health systems hold the key to unlocking progress in combating pneumonia. Through immunisation programmes they can provide the armoury that protects children left vulnerable by poverty, malnutrition and environmental risk factors. By providing diagnosis and treatment they can limit the harm caused by pneumonia, creating the conditions for recovery. Yet none of this is automatic. When health systems fail to reach the most disadvantaged children, when the diagnosis provided by staff is inaccurate, or when facilities lack the resources they need to deliver treatment, the effects of any intervention on pneumonia will be muted. That is why universal health coverage is the defining condition for accelerated progress, as shall be explored in further detail in Chapter 3.

BOX 8 A NEWBORN LIFE LOST IN NEPAL

"It's very difficult to live here," says Soshma, whose home is a remote village in Nepal. "If someone falls sick then taking them to the health post is difficult as it's far away and the roads are bad. When I was pregnant everyone carried me in a basket. It is two hours from here. I didn't make it to the health post in time to give birth. The baby was born close to the health post. When I reached the health post the nurse told us the baby was underweight. They told us to take the baby to Kathmandu.

"When we reached the hospital in Kathmandu the doctors checked my baby and told us the baby would have to be put on ventilator support. I was really scared. The doctors told us that if we took the baby home then the care for the baby would be compromised as there would be smoke, dust and the temperature wouldn't be right. We couldn't afford the hospital so we left.

PHOTO: SUZANNE LEE/SAVE THE CHILDREN

Soshma with her six-month old daughter, Ratshya. Soshma lost her first child to pneumonia because she could not afford health care.

"I was breastfeeding the baby at home and he suddenly coughed. And the next thing I noticed was that the baby's mouth was open. The baby didn't respond when I touched his hands. My husband was away working. I called my father who checked on him and he told me that the baby had passed away.

"My husband, father and our neighbours took the baby for the last rites. I miss him every day.

"We did everything we could. I think if our economic situation was better maybe the baby would have survived. Health services should be available to both rich and poor people. But in Nepal people who are rich have access to good health services whereas the poor don't. When I was pregnant, my parents had saved up money but we had no idea something like this would happen. When we went to Kathmandu to get treatment my father had to take loans from fellow villagers."

3 From local community to national policy – the frontline in pneumonia prevention and treatment

KEY POINTS

- Countries should invest in the development of immunisation systems to deliver pneumococcal vaccines (PCVs) and honour commitments made under the WHO's Global Vaccine Action Plan; Ethiopia, Ghana and Bangladesh, for example, have demonstrated that rapid progress towards universal coverage is possible.
- The development of integrated Community Case Management systems could cut deaths by one-third, but strengthened training and support for health workers is critical.
- Governments should adopt more flexible rules allowing community health providers to dispense antibiotics. This is vital for saving lives; antimicrobial resistance concerns over Amoxicillin may be overstated.
- Far more emphasis should be placed on providing evidence and information to mothers, enabling them to identify pneumonia symptoms and empowering them to seek appropriate care.
- Anti-pneumonia interventions should be integrated into wider strategies for universal health coverage, with governments increasing investments in health to 5% of GDP and strengthening equity by focusing resources on the most disadvantaged people.
- Every high-burden country should adopt a Pneumonia Action Plan setting out strategies for reducing pneumonia deaths to less than 3/1,000 by 2025.

Pneumonia is a global challenge. Combating the disease is a responsibility for every government that has embraced the SDG pledge to end preventable child deaths – and for the companies, non-governmental organisations and financial institutions that have endorsed the goals. Responsibility starts at the national level. It is up to national governments to lead in designing, implementing and financing the strategies needed to prevent pneumonia deaths. While there is no blueprint, these strategies have to be built on the foundations of an integrated approach that simultaneously lowers the background risks associated with malnutrition, insufficient breastfeeding and wider environmental factors, and strengthens the capacity of the health system to prevent, diagnose and treat pneumonia cases.

Creating new 'vertical' programmes that focus on pneumonia to the exclusion of other diseases is *not* the solution. Too many developing country health systems have suffered from disease-specific silos, with programmes often structured around donor priorities rather than national needs. What is needed is an integrated approach that includes pneumonia prevention and case management within wider child health strategies, which are properly financed and coordinated across government agencies.

WHAT DOES A CHILD AT RISK OF PNEUMONIA NEED FROM THE HEALTH SYSTEM?

While pneumonia is easy to diagnose and treat in rich countries, the same is not true for the poorest countries. As one commentator has put it: "The multiplicity of potential causes, and the difficulty in identifying a single cause in a particular case, makes pneumonia a difficult target for health planners."[1] One way of cutting through the complexity is to consider what an informed parent of a child at risk of pneumonia might demand from a health system.

The starting point for any such parent would be prevention of a potentially lethal disease. Vaccination would be a first order priority. Apart from protecting children from avoidable pneumonia, vaccination can protect impoverished families from dealing with the costs that come with an episode of severe pneumonia. Those costs range from paying for treatment to transport charges and income foregone as a result of time spent caring for sick children.

For the parent of a child with symptoms of pneumonia there is no substitute for effective case management. The ability to access quality health care from responsive, accountable providers is critical – beginning with a trained health worker in the community to detect symptoms and, if necessary, refer the child to a health facility for treatment. For parents who have just given birth, a skilled health worker able to detect early onset pneumonia symptoms, including lethargy, weak feeding and fast breathing, can prevent a potential fatality.

Because recovery depends on treatment, informed parents would want their child's case management to follow WHO guidelines, starting with Amoxicillin in dispersible tablet form. They would want clinical staff to be able to identify the signs of severe pneumonia, including hypoxaemia. Once the signs had been detected, they would then want their child referred to a higher-level facility equipped with second-line antibiotics, oxygen treatment and specialised care.

None of these demands are country specific. They would appear on the checklist of any parent in any country in the world. Yet for millions of parents in high-burden pneumonia countries, effective care is out of reach. As we saw in Chapter 2, inequalities in access to care, delayed or inaccurate diagnosis, flawed treatment, and shortages of essential medicines and therapeutic equipment are placing young lives at risk – and the most disadvantaged children have the least chance of securing effective case management.

Health system failures do not operate in isolation. As the most common primary carers, it is mothers who are best-placed to detect the early warning signs of pneumonia and to seek care. Yet mothers are often denied access to the information they need to exercise an informed judgement. In part, that is a consequence of a failure on the part of health authorities to increase awareness of pneumonia symptoms and treatment. But the choices women make and the judgements they exercise also reflect wider power relations within the household and beyond. Ensuring that women have the education, confidence and autonomy to act is critical to improving health outcomes.[2] When women have the right information and decision-making authority in the household, they are more likely to seek care and immunise their children. Conversely, denying women autonomy, status and rights negatively impacts child health and survival.[3]

VACCINATING EVERY LAST CHILD AGAINST PNEUMONIA

Viewed through the prism of national policy, vaccination is the ultimate smart investment. Treating pneumonia places an enormous burden on health systems. In most high-burden countries it is the single biggest source of hospitalisation among young children. Every episode of pneumonia prevented translates into reduced pressure on scarce health resources. Yet most governments continue to under-invest in immunisation.

Most countries have endorsed the WHO's Global Vaccine Action Plan (GVAP). This aims to ensure no child is left unvaccinated by 2020. African governments also adopted, early in 2017, the African Union's Addis Declaration on Immunisation. Delivery has been mixed, at best. At the midpoint of the GVAP more than 19 million children, half of them in Africa, had not received the full DTP3 course – and many countries are significantly off-track.

Some high-burden pneumonia countries – including Nigeria, Pakistan, Mali and Somalia – are slipping backwards on DTP3 coverage, which will hamper implementation of anti-pneumonia programmes.[4]

Given the potential returns on the investment, why are so many countries progressing so slowly? In some cases, the problem can be traced to national policy. Countries should include all WHO recommended vaccines in their immunisation programmes. For high-burden pneumonia countries this includes PCV. However, several countries have yet to follow WHO advice.[5] India only introduced PCVs into its Universal Immunisation Programme in 2017 with a phased pilot programme in three states.[6] Another three high-burden countries – Indonesia, Chad and Somalia – are still not using the PCV vaccine in routine immunisation programmes.[7] Nigeria has included PCV in its national schedule, but it was only recently started and coverage rates are just 13%.[8]

Health infrastructure constraints represent another bottleneck. Introducing a new vaccination programme is not a straightforward operation. It relies on trained health workers, supply chain and cold storage systems, and information systems that allow for real-time monitoring of coverage. Delivery mechanisms have to be able to reach into areas that may be under-served by health facilities. In the case of PCV, which require three doses, the financial, technical and administrative demands all rise. All of which helps to explain why countries that have achieved high and sustained immunisation coverage have typically done so by embedding immunisation in strong primary health care systems.

These systems are not contingent solely on a country's national income. Ghana introduced PCV coverage in 2011, reaching 43% coverage in the first year and near universal immunisation by 2016. Ethiopia has achieved 76% coverage from a standing start in 2011.[9] In both cases, there has been a strong emphasis on expansion of the primary health care system with links to a growing body of community health workers. Education campaigns and community-level engagement have also figured prominently.

Bangladesh is another striking example of good practice. In the late 1980s the country re-invented its immunisation programme. Community-level health workers were authorised to provide almost all vaccinations. Communities were mobilised through information and delivery campaigns bringing together government, non-government organisations and the private sector. The infrastructure created over many years was deployed to introduce PCV and the inactivated poliomyletis vaccine in 2015.[10]

Digital technologies are providing innovative new tools to support universal immunisation. The WHO's District Vaccine Data Management tool has replaced paper reporting with electronic tracking. New mobile technologies for health – m-health – are making it possible to record immunisation, remind parents, and improve stock management. While Nigeria has a poor overall record, in Oyo and Delta states a public–private partnership has created an electronic information system on immunisation covering more than 200 health facilities. Other countries have created specialised agencies to oversee the full spectrum of procurement and supply chain management. One example is Ethiopia's Integrated Procurement Logistic System, which has dramatically improved the availability of vaccines.

All these mechanisms have a particular relevance to the 'last mile' challenges in immunisation. Vaccine coverage rates in urban areas, and among wealthier groups, tend to be very high, even in poorly performing countries. This reflects the unequal distribution of health spending and infrastructure. Reaching marginalised populations in rural areas that may be sparsely populated, or in urban slums under-served by the health system, demand a commitment to equity and innovation.

IMPROVING DIAGNOSIS AND TREATMENT

The principles that apply to immunisation extend to effective case management. Achieving universal coverage of PCVs and ensuring that every child has access to high-quality diagnosis and treatment for pneumonia requires an effective and equitable health system. Identifying the diagnostic tools and drugs needed for treatment is relatively straightforward. Putting in place the investment and governance systems that link vulnerable populations to well-equipped health facilities and health workers who are trained, supported and accountable to the populations they serve is a much bigger challenge.

Recognising that many communities lack access to basic health care, WHO, UNICEF and other agencies, including Save the Children, have actively

promoted integrated Community Case Management (iCCM). Protocols for the identification and treatment of major killers such as pneumonia, diarrhoea and malaria have been developed through an approach known as the Integrated Management of Childhood Illness (IMCI). This broad approach holds out the potential for expanding the reach and strengthening the equity of health systems, with specific benefits for pneumonia treatment. Some estimates suggest iCCM could reduce rates of treatment failure by 40%, reducing pneumonia fatalities by one-third in the process.[11]

Realising the potential of iCCM poses its own challenges (Box 9). Few countries have successfully integrated pneumonia case management into community-based treatment on a national scale.

Frontline health workers often lack the diagnostic skills and the support they need to identify and treat the disease. Malaria is a complicating factor. iCCM programmes across Africa and much of South Asia have been more heavily geared towards the identification and treatment of malaria relative to pneumonia. This reflects both the success of anti-malaria partnerships and the Global Fund, and the failure to address the challenge posed by pneumonia. Given that the clinical presentation of the two diseases is often similar, an inevitable consequence is that children with pneumonia are being treated for malaria, in some cases with fatal consequences. The WHO and UNICEF have recognised the problem and integrated pneumonia into iCCM services as part of strengthened primary

BOX 9 INTEGRATED COMMUNITY CASE MANAGEMENT

For millions of children in low-resource settings, access to health care is constrained by distance, cost and, in many cases, social barriers. For diseases where delayed treatment can compound risks, restricted access poses acute threats. iCCM was designed to mitigate these threats by delivering care in the community through health workers trained to diagnose, treat and refer major diseases.

Community health workers provide the base of the health pyramid for iCCM. Typically drawn from the communities they serve, they are trained and supervised to detect and treat uncomplicated cases of malaria, diarrhoea and pneumonia among children, referring the acutely malnourished and more serious cases to higher level health facilities.

In some cases, their remit can also expand to management of newborn sepsis, or even acute malnutrition. They also play a role in promoting appropriate health-seeking behaviours and family practices including nutrition, sanitation and breastfeeding.

Community health workers often represent a first line of defence against pneumonia. Their training covers the measurement of respiratory distress through the use of a timer.

UNICEF and the World Health Organization see iCCM as "an essential strategy that can both foster equity and contribute to sustained reduction in child mortality." That conclusion is justified. There is evidence that community health workers can play a critical role in preventing child deaths.

However, the challenges are also real. Many community health workers have received limited schooling and are illiterate. The quality of their training and support is highly variable, as is their availability. Over-reliance on volunteers and workers with a semi-volunteer status can limit accountability and availability – some also have farms to run, businesses to operate and children to raise. Even if the community health worker is well trained and available, poor access to health facilities for referral can limit their ability to help parents with sick children.

Approaches to training have also had some unintended consequences. WHO recommends an 11-day training course for case management of common childhood illnesses. In some countries, training and support has been focused on nurses and other health professionals working in primary level facilities, rather than community-based health workers.

Source: UNICEF/WHO, Joint Statement on Integrated Community Case Management

Khadija, five months old, is treated for severe pneumonia at a hospital supported by Save the Children in Wajir, Kenya.

PHOTO: JONATHAN HYAMS/SAVE THE CHILDREN

health systems. However, iCCM implementation in many countries is hampered by shortages of funds for non-malarial drugs and diagnostic kits (see Chapter 4).

The difficulties in implementation should not detract from what is possible. Ethiopia and Bangladesh demonstrate what iCCM approaches can achieve.[12] Both have been in the top rank of countries reducing overall child mortality and pneumonia deaths since 2000. Community health workers have played a critical role in both countries. Ethiopia employs 38,000 community health workers through its Health Extension Programme, extending the reach of the health system into previously uncovered rural areas. Building on this infrastructure, a UNICEF-supported programme in Ethiopia increased the share of parents seeking care for children with suspected pneumonia from 26% to 57% between 2013 and 2015.[13] In Bangladesh, anti-pneumonia strategies have been integrated into community-based extension programmes for newborn babies (See Box 10).

There are other positive examples. In Pakistan, the Lady Health Workers programme set out to increase access to community-case management of pneumonia in Haripur, a high-burden district with a population of more than 700,000 people. At the start of the project, less than 1% of caregivers of children with pneumonia symptoms sought care from the lady health workers, even though they had been trained to diagnose and treat the infection. Research showed the greatest barrier to care was a perception that the lady health workers were there to communicate preventative strategies, not to provide curative treatment. Intensive community-level engagement with village health committees and training of volunteers from communities changed this perception. After two years, care-seeking for treatment by the lady health workers increased to 50%, bringing good-quality care closer to home and decreasing referrals to overloaded health facilities.[14]

Malawi offers another example of progress against the odds. Part of Malawi's success in reducing pneumonia deaths can be traced to

community-based approaches. One of the challenges faced by health planners in the country has been providing health surveillance assistants, a cadre of paid health workers working across villages, with essential medicines. The country's Ministry of Health has addressed this challenge by piloting the use of mobile technologies linking health surveillance assistants to procurement agencies through an application known as cStock – an open-source, web-based tool that allows them to transmit stock information and provide community-level data by text. Similar initiatives are being deployed in Rwanda and Ethiopia.[15]

Health planners in high-burden countries can learn from national good practices in better-performing countries – but there are also islands of good practice within under-performing countries. One example comes from the Democratic Republic of Congo, which has some of the world's highest death rates from pneumonia. In Kasai, Save the Children is working with local authorities to strengthen

BOX 10 BANGLADESH: THE POWER OF INTEGRATED APPROACHES

Bangladesh is a world leader in reducing child mortality, but pneumonia remains a major challenge for policy-makers.

Twenty-five years ago more than 170,000 Bangladeshi children died annually from pneumonia. The figure was coming down very slowly. That picture has been transformed. Today, pneumonia is still the most common cause of death, accounting for 15% of overall child mortality. But deaths have been cut by 90%, to 17,000 annually.

What has driven the change – and how can Bangladesh go the last mile to end preventable pneumonia deaths?

Bangladesh's experience illustrates the power of integrated approaches. Overall living standards have improved with economic growth and falling poverty, while public health and nutrition programmes have reached a growing share of the population. Over 95% of Bangladeshi children are now fully immunised. Breastfeeding is near universal. The level of stunting in children under five declined from 51% in 2004 to 36% in 2014.

Critical to these achievements has been the role of a skilled cadre of female community health workers. Community outreach was instrumental in achieving almost universal immunisation coverage, the world's highest coverage of oral rehydration solution, higher uptake of family planning, and innovative solutions for community-based management for sick newborn babies and severe acute malnutrition.

Save the Children has worked closely over many years in Bangladesh with the Ministry of Health and Family Welfare, local health authorities, local communities, in particular village doctors, and frontline health workers. In 2009, we brought together stakeholders to establish a national coalition advocating for the introduction of pneumococcal vaccine. PCV vaccination has now been included in the national immunisation programme. More recently, Save the Children piloted an iCCM approach to treat common childhood illnesses (pneumonia and diarrhoea) and severe acute malnutrition, training Community Health Care Providers and traditional health providers (village doctors) to deliver life-saving health and nutrition services for children under five – and these programmes are now being integrated into national planning.

For all the progress that has been achieved, Bangladesh faces considerable 'last mile' challenges. There are marked inequalities in health system coverage. In 2014, only 15% of deliveries to the poorest 20% of women occurred in a facility, compared with 70% for the richest wealth quintile. Over one-third of children under five are still stunted. And there are marked disparities in child survival based on wealth and location.

Source: Bangladesh DHS

the health system's capabilities in diagnosing and treating pneumonia though integrated approaches to care (see Box 11).

None of these positive cases should be interpreted as evidence that community health workers present a silver bullet solution. In the best cases, they can provide effective frontline care. However, the quality of that care will be determined in large measure by the strength of the training, support, infrastructure and referral arrangements in the underlying health system. As research by the WHO has underlined, community health workers cannot counteract health systems failures.[16] That is why effective anti-pneumonia strategies have to be built on health systems that expand their reach into under-served communities and improve the quality of treatment. Meanwhile, communities with limited access to health care will continue to rely on local health workers – and it is essential that these workers are trained and equipped to manage pneumonia alongside other killer diseases.

Failures in diagnosis and treatment are particularly marked in dealing with pneumonia. One of the reasons so many children die from what is a treatable disease is that their early symptoms are misdiagnosed, both by parents and community health workers. It may be several days before they are taken to a primary care health facility, by which time the infection will have spread and the symptoms of severe pneumonia may be evident. Being taken to a primary facility, or even a hospital, is not a guarantee of accurate diagnosis or treatment, as we saw in Chapter 2. Many of these outcomes are traceable to deeper health system failures, including under-investment, unequal provision, poor training and a weakly governed infrastructure.

While the systemic failures have to be fixed, there are practical measures health planners can adopt to address the specific challenges posed by pneumonia. Some of these relate to regulations. Children presenting with respiratory distress and other pneumonia symptoms should be placed on an immediate course of antibiotics – and failure to do so represents a medical risk. Yet many high-burden

BOX 11 TREATING PNEUMONIA IN THE DEMOCRATIC REPUBLIC OF CONGO

Acute respiratory infections are the second biggest source of child morbidity and mortality in Kasai Oriental province of DRC. However, rapid progress is possible even in this difficult environment.

Save the Children has trained and deployed community health workers across three health zones of the province – Tshishimbi, Cilundu and Kabeya-Kamwanga. Community health workers are now able to diagnose pneumonia and to treat uncomplicated cases through responsible administration of Amoxicillin, the preferred antibiotic. Health planners have prioritised Amoxicillin provision in local facilities, which has aided more effective treatment. Severe cases are referred by community health workers to health centres, which in turn refer when necessary to hospitals.

In Tshishimbi health zone, the Bena Mbala health centre sees 20–25 cases of pneumonia/acute respiratory infection on average each month. Most cases involve children aged under four. More severe cases – involving children with, for example, a respiratory rate of over 70 and/or anaemia – are referred to Tshishimbi's hospital. There are usually up to five such cases a month.

Over a period of several months in 2017, no deaths of under five children from pneumonia were recorded in this area. The general hospital in Kabeya-Kamwanga reports that most children referred with severe pneumonia make a full recovery.

There are nevertheless considerable challenges. At the general hospital in Kabeya-Kamwanga, for example, the oxygen concentrator – a proven life-saver of children with severe pneumonia – is often out of service for long periods of time. Other hospitals in the region report the same problem. Underreporting of ARI cases in the region is another challenge. In some areas, health centres' reported numbers of pneumonia cases show implausibly wide fluctuations from one month to another. One issue here is that cases of ARI are recorded manually in health facilities and in multiple registers, a process that is inefficient and prone to human error.

countries do not allow community health workers or nurses to prescribe antibiotics.[17] This reflects concerns over antimicrobial resistance, which is a real threat to public health in poor and rich countries alike. However, in the case of pneumonia treatment, overly stringent application of rules prohibiting community health worker antibiotic prescription may be part of the problem.

The evidence available points to a strong case for more flexible rules on antibiotic prescription for pneumonia. Observed resistance to Amoxicillin in poor country settings is typically limited or intermediate, and can be overcome by adherence to recommended treatment guidelines – and Amoxicillin-resistant strains of pneumonia remain rare.[18]

Set against the risks associated with antimicrobial resistance, there is compelling evidence that community-level case management with antibiotics can improve the quality and efficiency of care. Two studies in Pakistan found that treatment failure rates were significantly reduced when community health workers treated severe pneumonia with oral Amoxicillin for five days in the home.[19] While there are dangers of over-prescription if community health workers are left unsupervised and supported, studies show that community health workers adhere to treatment guidelines in 92% of cases involving children, and that trained and supported workers have a good record in identifying and treating childhood pneumonia.[20] Similarly, community health workers can achieve higher consistency of treatment of pneumonia, diarrhoea and malaria, as compared to facility-based workers.[21] It is estimated that community management of all cases of childhood pneumonia could result in a 70% reduction in mortality from pneumonia in children less than five years of age.[22]

Wider health system failures can have a profoundly detrimental effect on the recovery prospects of children with pneumonia. Five concerns stand out:

- **Antibiotic and other essential medicine shortages**: Access to antibiotics is a matter of life and death. Primary health care facilities should be stocked to meet demand for first-line treatment, Amoxicillin dispersible tablets, with higher level facilities stocked with second- and third-line antibiotics, and steroids to open airways. Because pneumonia often presents with other conditions, medicines for diarrhoea, malaria, rehydration and nutrition are also critical.
- **Weak diagnostic and prognostic capabilities**: Hypoxaemia is a major risk for children with pneumonia. Simple pulse oximeters, a device that can be attached to the finger of a child, can measure oxygen levels in blood with a high degree of accuracy, without taking a blood sample. Respiratory distress can also be accurately measured by a simple strap device attached to a child's chest. Both are relatively low cost (see Chapter 4). Neither are widely available in low resource settings.
- **Shortages of oxygen**: Therapeutic oxygen is vital to help children cope with severe pneumonia while antibiotics take effect. Yet many primary and even tertiary level health facilities lack a reliable supply of oxygen. Where oxygen is available, it is often delivered through cylinders that are heavy and costly to transport. They also typically run out after two days for a child with hypoxaemia, and replacements may not be available. Starved of financial resources, many of the district hospitals to which children with pneumonia are referred charge patients for oxygen cylinders – a financing strategy that effectively excludes the very poor. Oxygen concentrators, which make oxygen by extracting it from the atmosphere, provide an alternative to cylinders. Trials in Papua New Guinea found a 35% reduction in the case fatality rate for children with pneumonia following the introduction of oxygen concentrators.[23] The problem is often power. Making oxygen depends on a reliable source of electricity – a commodity lacking across many facilities in high-burden countries.
- **Weak referral systems**: Community-based interventions have to be supported by effective referral systems. When pneumonia strikes it can swiftly transition from a moderate to severe and potentially fatal condition. Ensuring that children are referred quickly and that ambulance services are available to avoid delay are critical, as is a properly resourced referral facility. South Sudan represents an extreme case of iCCM linked to a weak referral capacity (see Box 12).
- **Limited newborn care**: The fatality risks posed by pneumonia for newborn children can only be addressed by care providers trained to diagnose and treat symptoms. Oral and injectable antibiotics provided to newborn babies with pneumonia symptoms can reduce neonatal pneumonia mortality by 42%.[24]

BOX 12 SOUTH SUDAN: ON THE FRONTLINE OF THE FIGHT AGAINST PNEUMONIA

In South Sudan's Kapoeta North region, drought and conflict have disrupted food production and exacerbated already severe poverty. Children are at increased risk from pneumonia.

Community health workers are on the frontline of the effort to save children's lives from pneumonia, along with other life-threatening illnesses. Where community health workers diagnose cases of child pneumonia, they refer them to the primary health care centre. The volunteers work under an integrated Community Case Management programme part-funded by UK Aid and implemented by Save the Children. With high levels of illiteracy in the area, training material has been adapted to identify symptoms associated with malaria (which is rife in the area), pneumonia and diarrhoea.

One case treated at a primary health care centre that Save the Children supports captures the operating environment. Hakaroom, a one-year-old girl, was brought to the centre in August 2017 in a state of respiratory distress and dehydration, and with a fever. Lacking oxygen, medical staff treated her with antibiotics and fluids. Thankfully, she recovered.

Hakaroom's story is a familiar scenario. But many other children are not so fortunate. Like Hakaroom, children coming to the health care centre with pneumonia usually already have advanced symptoms and are at greatly increased risk. Parents may have delayed seeking help. Pneumonia symptoms may have been misdiagnosed initially. Long distances from the health facility add to delays in treatment.

Other children in Kapoeta North are only diagnosed with pneumonia when they are brought to a Save the Children stabilisation centre for treatment for malnutrition. In 2017, the nutrition centre has seen a spike in child pneumonia cases. At the height of the drought, the centre – which serves a population of 110,000 people scattered over a large area – was treating 10–20 pneumonia cases every day.

For children like Hakaroom with severe pneumonia, the chief medical officer at the primary health care centre, Dr Muorwel Dhhol, identifies the absence of oxygen treatment as the greatest risk. "If we had oxygen we would not lose any child because of pneumonia," he said. "But to have oxygen is not simple. There are local generators – but we can't afford them."

Hakaroom, age one, was successfully treated for severe pneumonia.

PHOTO: MARTIN KHARUMWA/SAVE THE CHILDREN

Challenges in these five areas cannot be addressed in a fragmented fashion. The over-reliance on 'vertical' child health programmes targeting specific diseases through separate staff, budgets, delivery mechanisms and training regimes has left a legacy of health sector silos across many of the poorest countries. These silos often reflect donor priorities, rather than the need of vulnerable families for integrated health care. For parents whose children are threatened by multiple health risks that may combine pneumonia, malnutrition and diarrhoea, this makes little sense. That is why integrated approaches delivered through universal health coverage hold the key to success in combating pneumonia.

FINANCING UNIVERSAL HEALTH COVERAGE

No disease illustrates as powerfully as pneumonia why universal health coverage (UHC) is so critical to the attainment of the SDG on child survival. As the new Director General of the World Health Organization has put it: "The key question of universal health coverage is an ethical one… Do we want our fellow citizens to die because they are poor?"[25] That question has a particular resonance for pneumonia, where those dying are mostly poor children.

UHC is based on a set of core principles, including the idea of minimum obligations, progressive realisation over time, cost effectiveness, shared decision-making, and reaching marginalised groups.[26] Translating these principles into practice requires health strategies geared towards the real circumstances of countries at different levels of income, and with different institutional capabilities.

For the poorest countries, the immediate UHC challenge is about raising the overall level of basic provision while strengthening equity. The extent of that challenge should not be understated. Every day, a quarter of a million people are forced into poverty as a result of out-of-pocket expenditure. Many more either delay treatment or don't seek health care because they are unable to afford the costs. The estimated 400 million people in the world currently lacking access to health care include many of the parents of children who die from pneumonia.[27]

UHC is about much more than financing – but adequate financing is critical. Providing the health infrastructure needed to deliver universal basic health care requires an average per capita investment of $86 in public spending.[28] Table 4 captures just how far most high-burden pneumonia countries are from that level of investment. Most are spending well under $30, falling to just $7 in DRC.

The corollary of insufficient public spending is the transfer of financing responsibility to households through out-of-pocket payments. In effect, this is a system of regressive taxation since the poor have to pay a greater share of their income to secure treatment. WHO guidelines suggest out-of-pocket spending should account for no more than 15–20% of health financing.[29] In the case of India, households finance two-thirds of total health expenditure, rising to over 70% in Nigeria. These financing arrangements help to explain why so many pneumonia cases either go untreated or receive delayed treatment. The poorest parents are often unable to afford the cost of care.

There are no simple rules for determining the share of GDP needed to finance UHC. One estimate for poorer developing countries suggests that around 5% of GDP is needed as government spending to deliver a package of basic services reaching 90% of the population.[30] This is more than double the current average low-income country spending levels, and three times spending levels in lower middle-income countries. The low level of public spending on health registered in many high-burden pneumonia countries helps to explain the health system failures documented in this report. India devotes only 1.4% of its GDP to health and Nigeria 0.9%. By contrast, most OECD countries have a more limited reliance on out-of-pocket payments, and devote, on average, 6.5% of GDP to publicly-funded provision.[31] The human consequence of under-investment in India's health system, and its effect in reinforcing social inequalities, are captured in Box 13.

The headline financing figures understate the extent of the UHC financing gap. Resources in many countries are heavily skewed towards higher level health facilities, and away from the primary level clinics that serve poor people.

The impact of overall spending on health outcomes is mediated by the efficiency and equity of spending. Some of the greatest potential impacts for diseases like pneumonia are registered when financial resources are geared towards quality primary health care delivered free at the point of use. One

TABLE 4 HEALTH FINANCING IN HIGH-BURDEN PNEUMONIA COUNTRIES

Country	Public health expenditures per capita in $	Public health expenditures as % of GDP	5% of GDP as public health spending would equal $ per capita per annum	Out-of-pocket expenditures per capita in $	Share of out-of-pocket expenditure in total health expenditures
Afghanistan	20	2.9%	30.60	36	63.9%
Angola	115	2.1%	235.47	43	24.0%
Bangladesh	9	0.8%	54.23	21	67.0%
Benin	19	2.3%	47.18	15	39.1%
Burundi	11	4.0%	15.64	5	21.0%
Cameroon	13	0.9%	72.06	39	66.3%
Central African Republic	8	2.1%	18.86	7	46.2%
Chad	20	2.0%	51.30	15	39.2%
Cote d'Ivoire	26	1.7%	78.50	45	50.8%
DRC	7	1.6%	23.08	7	38.8%
Equatorial Guinea	511	2.9%	950.13	134	20.1%
Ethiopia	16	2.9%	28.56	9	32.3%
Guinea	15	2.7%	28.05	14	45.3%
Guinea-Bissau	8	1.1%	32.13	18	49.5%
Haiti	13	1.6%	41.51	21	34.8%
India	23	1.4%	78.66	47	62.4%
Indonesia	38	1.1%	174.58	47	46.9%
Lesotho	80	8.1%	58.74	17	16.5%
Mali	11	1.6%	41.28	23	47.7%
Mozambique	24	3.9%	31.16	4	9.5%
Niger	13	3.2%	21.53	8	34.3%
Nigeria	30	0.9%	161.08	84	71.7%
Pakistan	13	0.9%	65.85	20	56.3%
Philippines	46	1.6%	142.15	73	53.7%
Sierra Leone	15	1.9%	35.42	52	61.0%
Somalia	N/A	N/A	20.89	N/A	N/A
South Sudan	12	1.1%	57.59	16	54.2%
Sudan	28	1.8%	108.84	98	75.5%
Tanzania	24	2.6%	47.52	12	23.2%
Uganda	13	1.8%	35.96	21	41.0%

Source: World Bank Data

BOX 13 POOR DIAGNOSIS AND NO MEDICINES – A NEAR-FATAL BRUSH WITH PNEUMONIA

Born into a family living in a remote village of the northern Indian state of Uttar Pradesh, Sudama is lucky to be alive. Like one in five of India's children, she was born with a low birthweight at just 2.5kg. Although she was delivered in a facility, she was not breastfed for ten hours and received no postnatal health check for one month.

Just after her first birthday Sudama contracted a bad cough. Her mother treated her with vapour rubs and a traditional medicine. Her condition deteriorated and she developed difficulties in breathing. After four days she started vomiting, prompting her family to take her to a community health centre.

Sudama was diagnosed with pneumonia but the facility had no antibiotics, so her parents purchased the drugs from a private medical store. After three days her condition had still not improved. There was no follow-up from frontline health workers. Alarmed by Sudama's worsening condition, her parents took her to a private health provider who provided medicines. Sudama, now aged eighteen months, has fully recovered.

Suduma's case highlights the challenges facing India's health delivery system. The Medical Officer in the clinic identified limited ambulance availability, restricted oxygen supply and shortages of basic drugs – including Amoxicillin – as major problems, along with the absence of basic laboratory facilities. These are widespread concerns across primary health facilities.

of the most worrying aspects of health budgeting in many high-burden countries is the combination of under-financing and inefficiency.

Recent WHO analysis of public financing for health in sub-Saharan Africa is instructive. Reviewing the share of health in national budgets for 2007/2014 against the period 2000/06, the review found that a large group of countries – including Chad, Mozambique, Zambia and Senegal – were attaching less priority to primary health care. Resources in many countries were heavily skewed towards high-end care; most governments were spending less than 40% of the health budget on primary care.[32] Median per capita spending was three times higher in non-primary care than on primary and preventative services, with hospitals typically receiving 40–60% of the budget. Moreover, countries like the Democratic Republic of Congo, Guinea, Chad and Kenya ended the financial year with between one quarter and one half of their health budgets unspent. The failure to mobilise resources, provide an equitable allocation across different levels of the health system, and actually spend resources is indefensible when children are dying from killer diseases like pneumonia.

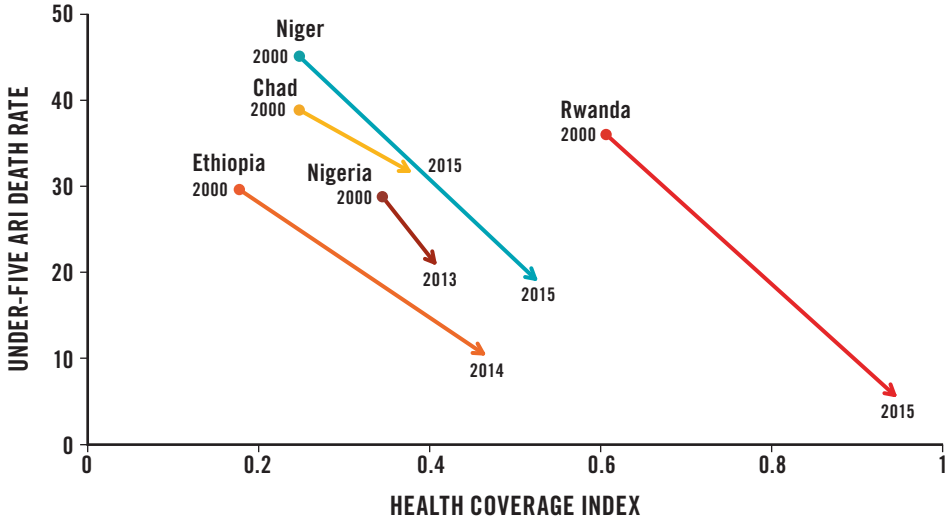
The strong association between reductions in ARI deaths and improved access to health services is illustrated in Figure 16, using a composite index comprising skilled birth attendance and vaccination rates as proxies for health coverage.[33] Exercises such as this are partial in that they do not capture the quality of coverage – and association is not the same as causation. Even so, they point to some of the critical health system conditions for delivering high-impact public investment.

The comparison between Niger and Chad illustrates the link between health care coverage and health outcomes. Although Chad has a higher GDP, Niger has an ARI death rate 40% lower – and the gap is widening. Niger's ARI death rate decreased by more than 57% in the last 15 years, compared with a decrease of only 18% in Chad. An important contributory factor in Niger's success has been the rapid expansion of access to health services, including free health care for pregnant women and children.[34]

Financing also has implications for frontline provision of health care. In the absence of increased spending, it will not be possible to recruit the 18 million additional health workers the WHO

FIGURE 16 THE STRONG ASSOCIATION BETWEEN REDUCTIONS IN DEATHS FROM ACUTE RESPIRATORY INFECTIONS AND IMPROVED ACCESS TO HEALTH SERVICES: UNDER-FIVE ARI MORTALITY vs. HEALTH COVERAGE INDEX

The arrows show the change in the Health Coverage Index between 2000 and 2015* in low- and middle-income countries.



* Exact start and end year depending on available data. Countries without data before 2005 and after 2010 have been omitted.

Data: WHO and World Bank.

estimates are needed in low-income and middle-income countries.[35] However, there is worrying evidence that public spending on health is stagnating as a share of GDP in many developing countries, partly because of a desire to increase investment in infrastructure and other areas seen as more conducive to economic growth. Such efforts may be misdirected. According to the Lancet Commission, around one-quarter of the economic growth registered from 2000–11 resulted directly from health improvements, and investments in health have the potential to yield a return of $9–24 for every $1 in investment.[36]

MITIGATING BACKGROUND RISKS, INCLUDING MALNUTRITION AND HOUSEHOLD AIR POLLUTION

Health interventions will be more effective in environments where governments are also mitigating background risks. Action against malnutrition has the potential to multiply the benefits of investments to combat pneumonia – and there is a growing body of country evidence to demonstrate that rapid progress is possible.

Senegal is a case in point.[37] Since 2000, the country has cut stunting levels by over a third (from over 30% to 19%). The frontline policies for achieving this transformation have included targeted nutrition support to at-risk communities, including micronutrient powders, breastfeeding promotion and conditional cash transfers, where households receive support if they present children to health clinics for nutritional checks and treatment. More than 10,000 community volunteers have been deployed, with local government, village associations and pregnant women's clubs also participating. But the critical catalyst for change has been the role of successive governments in putting nutrition at the centre of the national policy agenda, with a cross-ministerial coordination unit housed in the prime minister's office.

This is not an isolated example. In Peru, the stunting rate was halved from 2007–14 following a presidential initiative and the creation of an inter-ministerial delivery platform overseeing health, nutrition and cash-transfer interventions. While India has a weak record on stunting, individual states – notably Maharashtra – have demonstrated that progress can be accelerated.[38]

Other countries – from Brazil to Ghana and Kenya – have shown, either at the national or the sub-national level, that rapid declines in stunting are achievable.[39] In each case, the same constellation of public policies can be observed. These include setting credible targets and backing them with financial commitments, effective coordination and a mix of interventions targeting disadvantaged groups. While the costs of intervention are real, so too are the potential returns to spending on nutrition – $16 for every $1 invested according to one estimate.[40]

The national leadership and community-level interventions that have moved the dial on malnutrition can also lower wider background risks. Premature transitions from breastfeeding directly contribute to pneumonia deaths, but the persistent decline in breastfeeding reported in many countries has created an impression that governments can do little to influence maternal choices.

That impression is profoundly misleading. Several countries have reported marked increases in breastfeeding. For example, Burkina Faso, Guinea-Bissau and Sierra Leone each made gains in excess of 20 percentage points in five years. In each case, the behaviour change has followed intensive information campaigns delivered through community leaders, health workers and local governments. Limiting inappropriate breast milk substitute (BMS) marketing practices has also made a difference. Evidence from India, which has introduced stringent national legislation based on the WHO Code on BMS marketing, shows that companies comply when the law is clear and enforced.[41]

Tackling the household air pollution that is a major source of pneumonia infections is another priority. Poverty constrains the energy choices made by the poorest households – but the choices can be expanded. Eco-friendly, clean cooking fuel and stoves can improve fuel efficiency and reduce pollution, potentially saving over-burdened women time and money.[42] Meanwhile, the Africa Progress Panel headed by Kofi Annan, the former UN Secretary-General, has highlighted the potential for new off-grid solar technologies to transform energy choices for rural households. These technologies can pay for themselves over a short period of time by cutting the cost of charcoal and other fuels.[43]

DEVELOPING PNEUMONIA ACTION PLANS

While pneumonia case management cannot be treated in isolation, health strategies must address the distinctive diagnostic and treatment challenges posed by the disease. With some notable exceptions, few high-burden countries have developed credible anti-pneumonia strategies. This is despite the deadly toll taken by the disease.

There are no blueprints for success. The Global Action Plan for Pneumonia and Diarrhoea (GAPPD) has identified a range of cost-effective interventions, and the framework has been widely endorsed. However, endorsement has seldom been translated into the investment, training and delivery commitments needed to save lives. The gap between policy statements and outcomes is reflected in the slow progress registered by so many countries.

There are lessons to be derived from country experience. Ethiopia is a world leader in cutting pneumonia deaths; fatalities fell at 7% a year from 2000 to 2015.[44] Analysis of the underlying causes shows that around half of the reduction could be traced to improvements in child nutrition, linked in turn to the expansion of community health programmes and economic growth. Vaccination contributed 30% of the reduction, and treatment through antibiotics to 20% of the reduction. Disaggregation exercises such as this can help provide a guide to policy-makers.

Looking ahead, Ethiopia could achieve deeper reductions in death rates by expanding access to antibiotics. In 2015 only 31% of children with reported pneumonia symptoms were treated with antibiotics.[45] One of the problems identified by health policy analysts was a persistent shortfall in the supply of Amoxicillin to meet demand for pneumonia treatment. New forecasting tools were developed to identify drug requirement costs in the public sector for treating the 7 million pneumonia cases anticipated over the 2017–20 period.[46]

In Tanzania, a parallel exercise estimated that around $1.1m would be needed to treat 2.4 million cases in 2017–18 – less than $1 for a potentially life-saving investment.[47] Comparable measures are needed to address shortages of oxygen and diagnostic tools.

At the same time health strategies have to look beyond finance and technology to the targeting of children at greatest risk. Children who are living in poor households, members of disadvantaged ethnic minority groups, and those living in isolated areas will not automatically be reached through health systems that fail to address underlying equity challenges. Moreover, health strategies have to be supported by measures aimed at lowering the background risks compounding social inequalities.

Developing Pneumonia Action Plans would provide governments with a vehicle to set a clear strategic road-map, engage with partners and deliver change. Such plans could make a difference in three critical areas:

First, they would provide political leaders with an opportunity to put pneumonia on the map. Establishing the disease as a priority not just for health planners but for government would send a clear political signal. The importance of that signal is difficult to overstate. Looking across the experience of many countries, it is difficult to avoid the conclusion that elites continue to view pneumonia as a disease of the poor from which they can be insulated – and which they can treat with indifference. The fact that the number one killer of children in so many countries is so conspicuous by its absence from the statements of political leaders tells its own story.

Second, Pneumonia Action Plans would provide a platform for setting targets consistent with the Sustainable Development Goals. Affirming the goal of cutting deaths to 3/1,000 live births would serve as a guide to policy. As part of this commitment, every high burden country should track and report on progress in cutting pneumonia deaths. Indeed, pneumonia treatment indicators should be established as key benchmarks for the performance of the health system.

Third, a bold national target would turn the spotlight on equity. No country could achieve the 3/1,000 target without identifying the children at greatest risk, mapping gaps in access to the health system, and setting out strategies for targeting disadvantaged populations.

Effective Pneumonia Action Plans would also frame the strategy for translating policy commitments into outcomes, specifying the investment requirements and delivery mechanisms for delivering results. Key elements would include:

- **Information for empowerment**: Enabling parents and carers to identify pneumonia symptoms and understand treatment is vital. High profile information campaigns using mobile technologies and other vehicles could play a central role in increasing awareness and empowering women in particular to make informed health care choices on behalf of their children.
- **Training community-based health workers**: Health systems must continue to expand their reach and deliver universal coverage. The expansion of health workers trained in IMCI represents a first line of defence, and it is essential that communities with no other access to health care are trained and equipped to manage pneumonia. As the first line of defence, community health workers need the skills and diagnostic tools required to spot early warning signs and save lives. Ensuring that iCCM training includes detailed pneumonia diagnosis, and that health workers receive regular in-service support, could strengthen the front-line of defence against pneumonia.
- **Ensuring antibiotics are available**: There is no substitute for antibiotic treatment. Pneumonia Action Plans should assess demand and ensure that local facilities are properly stocked, with health workers trained and authorised to dispense Amoxicillin at the appropriate level.
- **Equipping facilities with diagnostic and prognostic tools and therapeutic equipment**: Pulse oximeters should be available in every primary facility, with referral facilities properly stocked with oxygen treatment.
- **Engaging the private sector**: Governments carry the responsibility for ensuring all children have access to effective treatment for pneumonia, but the private sector is a key partner in areas ranging from procurement and distribution, to low-cost oxygen provision, development of innovative solutions such as clean fuel cooking stoves, information and training.

- **Strengthening data**: Far too little is known about the incidence of pneumonia or the profile of its victims. New data collection tools make it possible to generate detailed information from villages, clinics and dispensaries, as well as hospitals. This information is vital for improved planning, greater efficiency and equity.
- **Creating effective referral systems**: Effective community-level management depends on the links from village health worker to primary health care facilities and higher-level referral facilities. Health planners should monitor these links to ensure at-risk children are not subjected to protracted delays in treatment.
- **Removing barriers to equity, including user charges**: The effectiveness of pneumonia case management is contingent on vulnerable children having access, and their parents being treated with dignity. Charges for the treatment of pneumonia continue to exclude many children from treatment, or to delay their presentation. The consequences are often fatal.

The diversity, scale and complexity of the interventions needed to reduce pneumonia places a premium on joined-up policy responses. Even the best policies in health will fall short of their potential if they are not backed by interventions that curtail the risks that come with malnutrition, poor breastfeeding practices and household air pollution, and vice versa. This report provides a guide to the governance arrangements needed to achieve a breakthrough. Successful Pneumonia Action Plans will be characterised by strategies coordinated across line ministries, with political leaders investing their own authority in delivery.

PHOTO: JONATHAN HYAMS/SAVE THE CHILDREN

Abdigafar, aged six months, from Wajir, Kenya, was referred to hospital by a Save the Children community health worker. He was successfully treated for severe pneumonia and made a full recovery.

4 From local to global – the critical role of international cooperation

KEY POINTS

- There is an opportunity to achieve universal immunisation against pneumonia over the next five years.
- Demand from countries eligible for Gavi support alone is expected to rise from around 150 million doses in 2016 to 180 million doses in 2020 and 260 million doses in 2026.
- Driving down vaccine prices through a mixture of support for research and development, investment in new technologies, increased competition, economies of scale in purchase and aid financing is critical.
- Despite the magnitude of the global pneumonia crisis, the disease receives little attention from aid donors. Aid financing remains limited, which has in turn slowed the pace at which potentially life-saving interventions are reaching children at risk.
- There is an urgent need to mobilise the resources, build the partnerships and spur the innovations that could revolutionise the prevention, diagnosis and treatment of pneumonia on the frontline.
- Humanitarian emergencies elevate the risks of pneumonia. Given that humanitarian crises are increasingly protracted, there is a need to move away from short-term funding to multi-year financing.
- Pneumonia has to be given greater prominence on the international agenda.

The 2030 target date for the Sustainable Development Goals is far beyond the horizon of the world's political leaders, finance ministers and health planners. Some governments may have signed up for the ambitious targets set safe in the knowledge that they will not be held accountable. Yet accountability matters – and accountability to children should be placed at the centre of the SDG reporting system.

The commitment to end preventable child deaths by 2030 represents a solemn pledge on the part of the international community. Decisions taken over the next few years on pneumonia will determine whether or not that pledge is honoured or broken.

The international community has a vital role to play in redeeming the SDG pledge. National governments have the responsibility to create an enabling environment for successful anti-pneumonia interventions. Yet national governments acting alone will fail. Some of the barriers to accelerated progress in cutting pneumonia deaths can only be removed through international cooperation and multilateral action on behalf of children. The high price of vaccines identified in Chapter 2 is a case in point. Other barriers relate to financing for health systems, distortions associated with donor health priorities, and the pace of technology development and transfer.

In this chapter, we look at some of the key areas in which strengthened international cooperation could bend the curve on pneumonia deaths. Many of the challenges to be addressed mirror those that have hampered progress at the national level. Pneumonia is a cause that lacks international champions. It is largely absent from the global development agenda. The disease does not figure in discussions at the annual meetings of the IMF-World Bank, the G7 or the G20. While technical partnerships in the

UN generate high-quality analysis and practical plans of action, pneumonia – an affliction that kills 2,500 children every single day – is for all practical purposes invisible.

UNLEASHING THE POWER OF PREVENTION

"The supreme art of war," wrote the Chinese military strategist and philosopher Sun Tzu, "is to subdue the enemy without fighting." The same principle applies to pneumonia. Both nationally and globally, fighting the disease through treatment is less effective – and more costly – than subduing it through the prevention that comes with vaccination. International cooperation to extend immunisation against pneumonia has already saved many lives. There is now an opportunity to go the next mile and achieve universal immunisation against pneumonia over the next five years.

Multilateral cooperation on vaccines has been an extraordinary success story. Gavi has provided the vehicle through which almost half a billion children have been immunised, preventing 9 million deaths in the process.[1] Immunisation has contributed to a dramatic decline in deaths from measles, from 500,000 in 2000 to less than 100,000 today, and in pertussis (whooping cough). Both diseases are a common cause of bacterial pneumonia, so their decline has been associated with fewer pneumonia deaths.[2]

Gavi was created to extend widely available vaccines to children who were not covered. Created as a unique public–private partnership bringing together governments, donors, UN agencies, pharmaceutical companies and civil society, the partnership removed many of the financial and delivery bottlenecks excluding children from vaccines identified in an Expanded Programme on Immunisation. Over the period 2016–20 Gavi aims to reach another 300 million children, potentially saving 5–6 million lives.[3]

As outlined in Chapter 2, Gavi has already made a major contribution on pneumonia. More than 109 million children in 57 countries had been vaccinated against pneumococcal disease by the end of 2016, pushing coverage rates in Gavi-supported countries to 41%[4] (a six percentage point increase over 2015). The introduction of these vaccines was made possible principally through the Advance Market Commitment (AMC) facility, a $1.5bn financing pool supported by the UK, Italy, Russia, Norway and the Bill & Melinda Gates Foundation.

While progress in cutting pneumonia deaths has been too slow, it would have been far slower in the absence of Gavi's intervention. Between 6 million and 7.5 million pneumonia cases were averted in 2015 as a result of vaccination through Gavi support. By 2020, PCV immunisation in Gavi countries is expected to avert 80,000–150,000 deaths a year. Financing through Gavi has made it possible for countries to act on the WHO's 2007 recommendation that PCVs be introduced into national immunisation programmes. What had previously been seen as an expensive vaccine became accessible to a large group of countries, as a result of reduced guaranteed prices and aid finance.[5]

Eligibility for Gavi support is determined by national income indicators. Countries can apply for support if their per capita income is below $1,580. When countries cross this threshold, they enter a phased transition period over which they become responsible for self-financing their immunisation programmes. There is a special provision through which countries eligible for Gavi support in 2009, when the AMC was created, are still able to access Gavi prices. Moreover, transition countries who had not previously applied for PCV support can apply – Indonesia and Vietnam fall into this category.

Pharmaceutical companies have played a critical role in supporting international immunisation efforts. Gavi has allocated $1bn in funding for the purchase of PCVs procured through the AMC from two companies. GSK provides a 10-valent vaccine (PCV-10), while Pfizer provides a 13-valent vaccine (PCV-13). Both companies have reduced prices over time, to $3.05 in 2017. The price reductions since 2010 have saved an estimated $470m.[6] The fact that PCV-10 and PCV-13 were available in some of the world's poorest countries just one year after they were introduced in rich countries is an indicator of success in its own right: it took eight years to introduce the Hib vaccine, for example.[7]

There have been important moves by the companies to support expanding access to PCVs and other vaccines. In 2015, GSK took the important step of committing to freeze prices for countries transitioning out of Gavi support for ten years, a

commitment matched by Pfizer. In September 2016, both companies agreed to extend Gavi prices to civil society and UN organisations working in non-Gavi countries facing humanitarian emergencies, extending protection to highly vulnerable refugee and displaced populations. An Access to Vaccines Index measuring corporate performance across three areas – research and development, pricing, manufacturing and supply – ranked GSK as the top performer in all three areas in 2017.

GETTING THE PRICES RIGHT

Recognising the very real achievements of Gavi does not detract from the equally real challenges ahead. In the absence of fundamental reforms that make PCVs affordable to more countries, the power of prevention will be only partially realised. Of course, low prices will not override a failure of national governments to develop their immunisation infrastructure – but current prices will limit demand and coverage. There is also a real danger that supply shortfalls will increase pressure on prices over the next few years.

Despite recent price reductions, PCV remains the most expensive vaccine in the Gavi portfolio. Moreover, as shown in Chapter 2, prices escalate sharply for non-Gavi countries. This reflects the 'tiered-pricing' policies of pharmaceutical companies. Gavi countries are at the bottom tier of a price pyramid. Neither GSK nor Pfizer fully disclose prices charged at higher tiers, though national income, target population coverage, contract duration and committed volumes of purchase all inform price-setting.[8] Companies also calibrate price tiers to secure a targeted average profit margin.

Establishing what a fair price for PCV might be is intrinsically difficult – and it is beyond the scope of this report. The producing companies point out that conjugate pneumococcal vaccines require complex manufacturing processes. These involve attaching specific serotypes to a strip of protein. Pfizer reports that PCV-13 requires 400 different raw materials, 580 manufacturing steps and 678 quality tests.[9] Despite investing in new production facilities to meet Gavi demand, it took the company five years to produce sufficient supply.[10]

Scrutiny of the complexity argument is made difficult by information deficits. Neither GSK nor Pfizer disclose their production costs or, beyond Gavi provisions, the prices charged in specific markets – and there are no independent audits available. Given the level of public funds directed towards PCV purchase through the two companies – $1bn up to the end of 2016 – there is a compelling case for enhanced transparency.

Determining the scope for price reductions is similarly difficult. Pfizer and GSK production costs almost certainly vary. Moreover, the two companies may have very different opportunities for cross-subsiding Gavi supplies through revenues in other markets. Pfizer accounts for over 90% of the global PCV market.[11] The company's pneumococcal vaccine (Prevnar) generated revenues of $6.25 billion in 2015,[12] while GSK's revenues for its variant (Synflorix) were $565 million.[13]

Whatever the scope for price reductions, current price levels are unsustainably high in relation to the levels needed to achieve universal immunisation coverage. For some high-burden countries with low coverage rates – Indonesia and the Philippines are examples – prices of between $13.23 and $17.58 for a single dose of PCV have been reported (see Chapter 2),[14] implying full course vaccination costs of $40–53. Individuals buying the vaccines directly, where health services are not providing them, are paying even higher prices.

THE ADVANCE MARKET COMMITMENT – AN IMPORTANT BUT PARTIAL SUCCESS STORY

In some areas, the AMC model has been a limited success story. The original intention of an AMC was to shape the global market by creating incentives to accelerate the development of new products. By guaranteeing the initial purchase price for a guaranteed volume, the hope and expectation was that prospective suppliers would increase their research and development activities, step up the pace of clinical trials, work towards early registration, and invest in scaled-up production.

In the event, market shaping has only been partial for PCV development. The GSK and Pfizer products were already at an advanced stage of development before the AMC was created. Both companies built additional manufacturing capacity in response to rising PCV demand, including AMC contracts. They also adapted products for markets with cold-chain problems. However, the products are not new and

the AMC did not succeed in stimulating new market entrants. Initial forecasts of a third manufacturer entering the market in 2015 or 2016 have proven over-optimistic. Another 12 manufacturers have PCV products in the pipeline, most of them at relatively early stages of development, reflective of the complexity of developing a multi-valent vaccine.

Only two of these companies – the Serum Institute of India and Panacea Biotec (India) – are on the AMC list of registered manufacturers. The Serum Institute has committed to the Gates Foundation to market at prices close to $6 for a full course by producing multi-dose vials at lower manufacturing costs. Other companies in India, China and Canada are potential candidates for market entry.

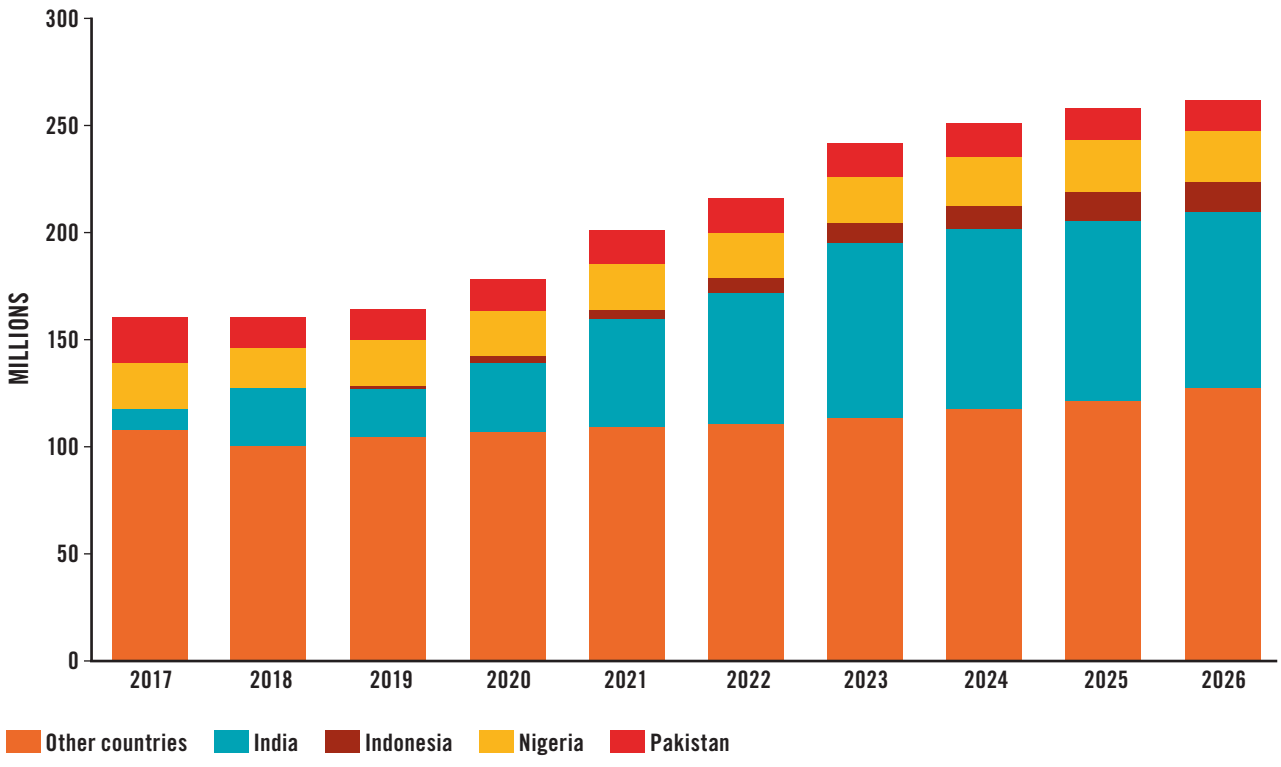
The resources available through Gavi to shape the market have been depleted over the years. With 73% of the initial AMC finance spent, around $400 million is now left. There are concerns that this will be insufficient to create the incentives needed to accelerate the entry into the market of new suppliers.

Those concerns have been compounded by the recent award in India of a patent to Pfizer for its PCV-13 vaccine. The European Patent Office in 2014 rejected a comparable patent claim, citing a lack of novelty and inventiveness.[15] Whatever the rights and wrongs of the technical patent decision, there is a concern that the patent – and any future ones that may be granted – will deter and delay the market entry of new PCVs under development by Panacea Biotec and other companies.[16]

The tensions between corporate intellectual property rights and public health interest in this case raise serious concerns that extend beyond India, not least because the country's pharmaceutical companies are a major potential source of affordable vaccines for sub-Saharan Africa.

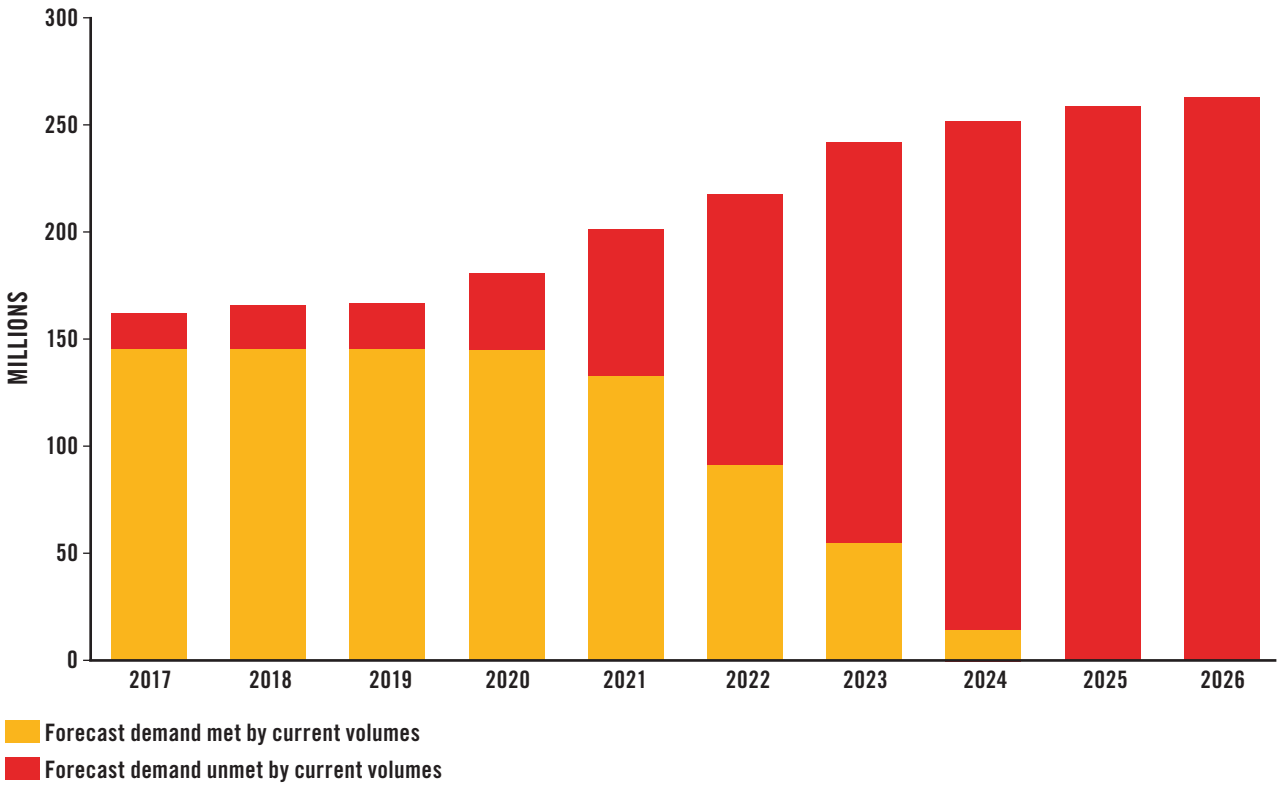
With demand for PCVs set to increase, there is a danger that supply–demand imbalances could drive up prices. Demand from Gavi-eligible countries alone is expected to rise from around 160 million doses in 2017 to 180 million doses in 2020 and to more than 260 million doses in 2026 (Figure 17), with India driving much of this increase. Recent Gavi analysis suggests that meeting projected demand is only achievable with at least one new supplier entering the market by 2020, with a supply capacity of at least 20 million doses.[17] Figure 18 shows the

FIGURE 17 THE RISING DEMAND FOR PCVs FROM GAVI-ELIGIBLE COUNTRIES: FORECAST DEMAND FOR 73 AMC-ELIGIBLE COUNTRIES



Source: Gavi, Pneumococcal conjugate vaccine strategic demand forecasting update, May 2017

FIGURE 18 THE LOOMING SUPPLY SHORTFALL FOR PCVs: FORECAST DEMAND AND CONTRACTED VOLUMES FOR 73 AMC-ELIGIBLE COUNTRIES.



Source: Gavi, Pneumococcal conjugate vaccine strategic demand forecasting update, May 2017

widening gap between forecast demand for doses of PCV and currently contracted Gavi supply.

The market scenario to the mid-2020s raises concerns that go beyond Gavi-supported countries. While the scale-up of PCV manufacturing has been impressive, there have been persistent shortages, most notably in 2012 and 2013, which delayed country introductions. If supply lags behind demand growth, prices could also rise in middle-income countries with large unimmunised populations, potentially weakening non-Gavi strategies aimed at reducing pneumonia deaths.

A NEW GLOBAL COMPACT ON VACCINES AGAINST PNEUMONIA

Building on what is an extraordinary track record under Gavi, the international community has an opportunity to take anti-pneumonia vaccination to the next level. Driving down price through a mixture of funding for research and development, increased competition, economies of scale in purchase and aid financing is critical.

Negotiating a new deal on PCV pricing would help create the conditions for expanded coverage. The companies should be encouraged to explore the potential for deeper price cuts, both for Gavi and for non-Gavi countries. However, aid donors could create an enabling environment for price reductions by increasing the volume of guaranteed purchases under Gavi – and, potentially, by extending guaranteed purchase commitments beyond Gavi.

Various financing instruments could be deployed to raise the volume of PCVs purchased. Aid channelled into Gavi is one route. But future purchases can also be underwritten by bond issues, allowing financial costs to be spread over time. The International Finance Facility for Immunisation (IFFIm), which has raised $6.3bn for Gavi since 2006, is one example of a financing vehicle already deployed to this purpose. Over $200m of IFFIm resources have been put into pneumococcal vaccine support. But more could be done.

In a period of low international interest rates, bond financing, risk guarantees and other instruments are under-utilised instruments for

vaccine delivery. In 2017, the World Bank issued for the first time a bond issue backed by its soft-loan International Development Association facility.[18] With a prospective $8bn in bond finance available, the World Bank could play an expanded role in supporting Gavi. Similarly, the World Bank's private sector arm, the International Finance Corporation, and development finance institutions like the UK's CDC Group could back guaranteed vaccine purchase arrangements with finance and guarantees, potentially leveraging private investment by reducing risk.

There may also be scope for reviewing Gavi's remit. The current transition framework is based on the sound principle that, as countries become richer, they should be doing more to finance their immunisation programmes. But what about middle-income countries with large pockets of unimmunised children who may be living in conditions of acute vulnerability?

The easy answer is that governments should be doing more. However, in devolved systems where it is possible to track the delivery of vaccines to marginalised areas and populations, there may be a compelling case for supporting poorer states and provinces at a sub-national level. Current rules preclude operations of this type, effectively excluding children whose needs are as pronounced as those in countries eligible for Gavi support.

Shaping the market through increased competition remains an unfulfilled but urgent priority. National governments, aid donors and UN agencies have a small window in which to create the conditions for a more competitive market. Without at least one new market entrant by 2020 able to supply at a volume of around 20 million doses – 10% of 2016 supply – there is a real and imminent danger of shortages in Gavi, and price rises outside of Gavi's guarantee arrangements.

Two broad approaches are required to head off this risk. First, the AMC needs a financing window that reflects its original purpose – namely, incentivising research and development, and accelerating clinical trials, testing and registration. That window should be ring-fenced for new suppliers and pipeline products, supplementing guaranteed purchase arrangements for existing suppliers. There is no shortage of evidence that investors respond to the type of market signals that can be created.[19] The development of the new low-price conjugate vaccine for meningitis in Africa (MenAfriVac), sparked by a $70 million grant from the Bill & Melinda Gates Foundation and now manufactured in India at a cost of $0.40 per dose is a case in point.[20]

Second, developing country governments should review the regulatory barriers that appear to have slowed the market entry of new products. Where patents represent a potential barrier to market entry, governments should explore the use of compulsory licensing and other mechanisms to facilitate market entry.

Cooperation between developing country governments could play a role in creating more competitive markets. Vaccine procurement agencies purchase in large volumes, but seldom share information or pool their resources. The Pan American Health Organization's revolving fund – a pooled procurement and financing mechanism for Latin America and the Caribbean – has led to much lower negotiated vaccine prices for the 40 countries in the region. It has also contributed to the earlier introduction of new vaccines compared with other developing countries – at 85% the region has the highest PCV coverage.[21]

Transparency and information are the life-blood of competition – and there are deficits in both areas on vaccines. In 2014, WHO launched the Vaccine Product, Price and Procurement (V3P) project, a price comparison system that marked a step in this direction.[22] However, only 50 countries submitted data in 2016 – and only 59% of non-Gavi middle-income countries are represented in the database.[23] Moreover, the database conceals country names, which precludes direct comparison. It appears that PCV manufacturers have in some cases required purchasing governments and private actors to sign confidentiality agreements. This practice should end with immediate effect. In 2015, 194 countries at the World Health Assembly passed a resolution calling for more affordable vaccines and increased vaccine price transparency.[24]

Looking beyond vaccine pricing and supply, there are potential opportunities for building on the wider immunisation infrastructure to expand PCV coverage. One of the great success stories in child health over the past three decades is the near-eradication of polio. The Global Polio Eradication Initiative has invested $15bn in expanding vaccine coverage – and an estimated $1bn annually is spent on wider immunisation

system activities, ranging from disease surveillance and laboratory support to health worker training. Nigeria received $247 million of polio funding in 2016, paying for 23,269 staff who, in addition to their polio activities, work on routine immunisation and disease outbreak and response.[25] As we move towards a polio-free world, the polio infrastructure over many years could be repurposed to support a global drive towards universal PCV coverage and the elimination of avoidable pneumonia deaths.

INTERNATIONAL AID – MORE AND BETTER IS NEEDED

Despite the magnitude of the global pneumonia crisis, the disease receives little attention from aid donors. Development assistance financing remains limited, which has in turn slowed the pace at which potentially life-saving interventions are reaching children at risk. This has to change.

It is intrinsically difficult to measure the levels of aid geared towards pneumonia prevention and treatment. One source puts the share of development assistance for this purpose at less than 2%, or around $663m in 2015. The bulk of this aid is directed to PCV purchases through Gavi.[26] Moreover, aid for pneumonia (and diarrhoea) has lagged far behind overall increases in aid for child health.[27] While aid directed towards the strengthening of health systems generates benefits for pneumonia, the disease remains a neglected area.

OECD donors do not report on pneumonia-specific financing transfers. This is in contrast to malaria, tuberculosis and HIV/AIDS, reflecting both the existence of the Global Fund for tackling these diseases and an insufficient awareness of the scale of pneumonia. The effectiveness of aid may also be hampered by under-investment in areas with the potential to generate high impacts. Areas such as medical education and training have received lower levels of funding in recent years. This is a critical area for the development of diagnostic and treatment capabilities in dealing with pneumonia.

Pneumonia is also neglected in wider multilateral initiatives. One example is the Global Finance Facility (GFF). This is an innovative financing mechanism designed to close the funding gap – estimated at $33.3bn to 2030 – between current financing and the provisions needed to achieve the 2030 SDG targets for reproductive, maternal, newborn, child and adolescent health.[28] The funding approach brings together domestic resource mobilisation with external financing combining World Bank support, aid, private investment and innovative finance. Support is contingent on the development of national investment cases setting out clear priorities backed by financing commitments and delivery plans. None of the nine investment cases approved by May 2017 included strategies for pneumonia, even though the disease is the first or second biggest killer of newborn babies and children in several of the countries – including Nigeria, the Democratic Republic of Congo, Ethiopia, and Kenya – covered by the GFF.

This is an example of aid donors sending signals to health planners that have unintended consequences. The investment plans presented to the GFF address very real concerns. But business cases are assessed against eight health outcome and financing indicators.[29] Pneumonia does not figure. Including a reduction in pneumonia deaths in the health outcomes to be assessed and pneumonia case management in the investment cases could help unlock new funding, while at the same time supporting the development of more integrated approaches to health system development.

Approaches to aid financing, whether through the GFF or other mechanisms, should apply at the global level the same principle that has to be applied at the national level. Anti-pneumonia strategies should be seen as part of the drive to achieve universal health coverage, with a focus on reaching the poorest. In achieving that aim, donors should also actively support the expanded national resource mobilisation needed to underpin equitable health systems.

One of the first principles of international aid is that it should do no harm – and there are concerns that current arrangements may be inflicting unintended damage on anti-pneumonia efforts. In Chapters 2 and 3 we highlighted a number of the challenges facing integrated Community Case Management (iCCM) approaches. These challenges include the widespread tendency of community health workers to misdiagnose pneumonia as malaria, and shortages of Amoxicillin DT in health facilities. Many underlying factors contribute to both problems, ranging from iCCM training and support to failures

Zipporah, a community health worker trained by Save the Children, with Akokote, age one, who has been receiving treatment for her third episode of pneumonia.

PHOTO: JONATHAN HYAMS/SAVE THE CHILDREN

in procurement and under-investment. However, the aid architecture for health is also playing a role, notably by downplaying the importance of pneumonia.

Contrasts with malaria are instructive. The disease is one of three covered by the Global Fund. Some $10bn has been channelled to countries, providing insecticide-treated bed nets and a new generation of artemisinin-based combination therapies (ACTs) for treatment.[30] Around 668 million courses of ACTs had been provided through to the end of 2016. The Global Fund has also financed the provision of Rapid Diagnostic Test kits for malaria and supported the training of health workers as part of the wider strategy for integrating effective malaria treatment into national health strategies. These investments have saved lives and supported a dramatic decline in malaria deaths among children, but they may also have produced unintended outcomes. Community health workers well trained in malaria diagnosis but poorly trained in diagnosing pneumonia are more likely to attribute a pneumonia-related fever to malaria.

Similarly, the shortages of Amoxicillin DT evident in many high-burden pneumonia countries stands in some contrast to the availability of ACTs. The fact that health planners are able to draw on Global Fund support for ACTs and other anti-malarial commodities while no comparable support is available for Amoxicillin DT may be a factor in skewing the supply of drugs towards malaria treatment. An earlier arrangement under which funding for Amoxicillin DT was covered by the Reproductive, Maternal, Newborn and Child Health Trust Fund created in 2013 has now lapsed.

One consequence is that UNICEF, which plays a pivotal role in supporting iCCM, has struggled to mobilise resources for non-malaria needs, including Amoxicillin DT. Estimates point to an unmet non-malaria iCCM commodity financing requirement of $73m for the period 2018–2022. This includes $29m for the UNICEF-supported areas in 21 high-burden pneumonia countries. The financing requirement for the Democratic Republic of Congo (DRC) – a country with one of the world's highest pneumonia death rates – is $44m, simply

to maintain existing coverage. That coverage extends to around just one-quarter of the country (or 133 out of 516 health zones), with Swedish aid providing the bulk of support. Yet no financial commitments from donors have been secured, which undermines planning for the integration of pneumonia into iCCM strategies.[31]

This is a problem requiring urgent resolution. One obvious route is for aid donors to use the GFF as a vehicle for supporting iCCM and as a channel for providing the $73m needed for non-malarial treatments (which includes oral rehydration therapy and zinc as well as Amoxicillin DT). An additional reason for strengthening financing for Amoxicillin DT supplies is that the drug is less susceptible to antimicrobial resistance than other widely used antibiotics. If the GFF can be deployed to support the Pneumonia Action Plans outlined in Chapter 3, it could also play a greater role in mobilising resources for diagnostic tools such as pulse oximeters and oxygen treatment.

LOWERING BACKGROUND RISKS

Aid also has a vital role to play in lowering background risks for pneumonia. The World Bank estimates that an additional investment of $70 billion over ten years (from all sources) would be needed to achieve global targets for stunting, wasting, exclusive breastfeeding and other interventions. Modelling suggests these investments could reduce overall child mortality by 3.7 million deaths, in part by averting 65 million cases of stunting and ensuring that another 105 million babies are exclusively breastfed in the first six months.[32]

The same exercise provides scenarios for resource mobilisation. Depending on their income levels, governments could close much of the financing gap by increasing spending on health and nutrition, and by tapping into economic growth. However, another $2.5bn annually would also be needed in aid for low-income and lower middle-income countries. Given the very high social and economic returns in prospect, these are modest investments.

Finance is not the only area in which international cooperation can make a difference. Chapters 2 and 3 identified failure to provide exclusive breastfeeding for six months, and continued breastfeeding for up to three years, as a major background risk for pneumonia. Many factors contribute to decisions that result in premature transitions from breastfeeding. One of those factors is the marketing practices of global breast milk substitute (BMS) companies.

WHO's International Code of Marketing of Breast Milk Substitutes provides a detailed rules-based framework for protecting potentially vulnerable children.[33] That framework calls for a prohibition on marketing activities targeting mothers breastfeeding children in their first six months. It also provides detailed guidelines for responsible marketing thereafter. Unfortunately, the major BMS companies have a variable but overwhelmingly poor record on compliance with the WHO Code. Shareholders and institutional investors could play an important role in improving that record.

DRIVING DIAGNOSTIC AND TREATMENT BREAKTHROUGHS

Nearly all childhood deaths from pneumonia are preventable through proper diagnosis and treatment. Simple technologies are available that could, in the hands of properly trained and supported health workers, save lives. Yet these technologies are seldom available in low-resource settings – and there is insufficient investment in the innovations needed to adapt new technologies to real conditions in high-burden pneumonia countries. There is an urgent need to mobilise the resources, build the partnerships and spur the innovations that could revolutionise the diagnosis and treatment of pneumonia on the frontline.[34]

Pulse oximetry for the detection of hypoxaemia, an often fatal complication of pneumonia, is a priority area. This is a cost-effective technology with the potential to transform prognosis, enabling oxygen treatment to be deployed more efficiently, reducing treatment failure rates and ensuring timely referral decisions. Devices tailored for low-resource settings are in development. For example, LifeBox, a charity created by the World Federation of Societies of Anaesthesiologists, has developed a unit available for $250. It has been effectively tested, is accurate and appropriate for infants. Mobile phone applications are also under development, along with oximeters that can be charged by solar power. Accelerating the development and deployment of these technologies is vital if vulnerable children are to secure the benefits of life-saving innovations.

Another area of development is in **automated respiratory rate counting**. Detecting respiratory distress by counting breaths, assessing respiratory sounds and reviewing wider symptoms is difficult, and misdiagnosis is common. New technologies can measure breaths, analyse respiratory sounds and detect exhaled biomarkers. Save the Children has worked with Philips to evaluate use of their ChARM device (Children's Automated Respiratory Monitor), an innovative and easy-to-use breath measurement tool for low-resource settings. UNICEF is currently supporting additional testing in Ethiopia. Looking ahead, the combination of several diagnostic innovations into a single integrated instrument could enable frontline health workers to improve the accuracy of diagnosis and efficacy of subsequent treatment. Philips and Save the Children will test the new SpotCheck Monitor – a combined rate timer and pulse oximeter – in Malawi this year.

There is an urgent need to develop and deploy **new oxygen technologies**. Some of the challenges are set out in Chapter 3. Oxygen concentrators are more reliable and efficient than cylinders, but they need regular maintenance and a constant power source. Grand Challenges Canada and the University of Alberta are testing solar-powered oxygen concentrators in Uganda, and other innovators are developing a concentrator that runs on water. Bubble Continuous Positive Airway Pressure, a simple, non-invasive and low-cost method for supporting breathing in infants experiencing respiratory distress, is being tested in Uganda, Ghana and Bangladesh. Several governments are now integrating oxygen provision into pneumonia strategies (Box 14). New mobile platforms are also under development. The Phone Oximeter, developed by the University of British Columbia and LionsGate Technologies, uses a low-cost sensor powered by a mobile phone to measure blood oxygen levels and then display informed advice for diagnosis and treatment. In all of these areas, aid could play an important role in supporting innovation and, more importantly, facilitating early take-up in high-burden pneumonia countries.

Drug innovations continue to play an important role. The development and introduction of **child-friendly formulations of Amoxicillin** in 250mg dispersible tablet form has resulted in important cost savings and made treatment simpler, saving lives, money and health care resources.[35] These tablets can be dispersed in breastmilk or a small amount of clean water. They have a longer shelf-life, do not need refrigeration, are more

BOX 14: HELPING CHILDREN BREATHE – NEW OXYGEN PARTNERSHIPS

Oxygen treatment is one of the most important treatment regimes for severe pneumonia – and one of the most neglected in national planning. Exceptions to the rule demonstrate what is possible.

In Ethiopia, where pneumonia is among the leading causes of child mortality, a survey found that only 11% of the country's health centres and less than half of hospital paediatric wards were able to provide oxygen – and that less than 14% of staff were trained to operate oxygen-delivery technology. United for Oxygen, a public–private partnership between government, industry, foundations and civil society organisations, has been created to support the government to scale up access to pulse oximetry and oxygen therapy – one of the centrepieces of the country's National Newborn and Child Survival Strategy.

Another positive example comes from Kenya. Hewa Tele, a social enterprise, distributes oxygen cylinders to health facilities. The scheme was piloted in Western Kenya, where it now serves 53 public and private facilities. Hewa Tele has leveraged new technologies and finance to produce high-quality, low-cost cylinders, using local production, and provided training for 120 health workers. Improved procurement and utilisation of oxygen has increased the preparedness and capacity of health facilities to treat not just pneumonia, but sepsis and respiratory distress in newborn babies.

Sources: Stop Pneumonia, 'United for oxygen' (press release), www.stoppneumonia.org/united-for-oxygen/; Hewa Tele website, www.hewatele.org

cost-effective and are easier to administer than other formulations. Unfortunately, many countries have been slow to step up procurement. Looking ahead, the development and introduction of new vaccines for RSV, pneumococcal conjugates that target more serotypes common in Africa, and innovations to reduce dosage requirements from the current level of three to one to two doses could save many lives.

Other under-exploited opportunities present themselves. As highlighted in Chapters 2 and 3, many community-level health workers lack the training and support they need to accurately diagnose pneumonia. This is not entirely surprising. All too often, the nurses and primary-level clinical staff who train them also lack diagnostic skills. There are significant training gaps across the health systems of most high-burden countries.

E-learning could help to close those gaps. Global and regional centres of excellence in pneumonia could play a role in designing visual training modules for primary and community-level health workers. Adapted for low-resource settings, these modules could support the development of more effective iCCM programmes. Many innovative options present themselves. Aid donors could fund national institutions to partner with public health institutions in high-burden countries to develop and implement virtual training programmes. To take one example, the Royal College of Paediatrics and Child Health in the UK has developed a free-to-access e-learning platform designed for implementation in East Africa. The platform, which was part-funded by the UK's Department for International Development, is geared towards health workers operating in low-resource settings.

THE HUMANITARIAN IMPERATIVE

In Chapter 2 we highlighted the elevated risks that come with humanitarian emergencies. Droughts, floods, displacement by conflict and natural disasters come with increased health risks and, all too often, a breakdown of already fragile health systems. Rising levels of severe and acute malnutrition pose very immediate risks of pneumonia, as food emergencies now playing out in sub-Saharan Africa demonstrate.

The humanitarian aid system has a vital role to play in responding to the threats that drive pneumonia epidemics in emergencies. In 2016, that system delivered $27bn in overall assistance – and it saved many lives. Yet the humanitarian architecture is under immense pressure. Aid has failed to match the increased demand created by the Syria crisis and emergencies in Africa. In 2016, there was a 40% shortfall in funding for UN humanitarian appeals.[36]

That financing gap is reflected in provision for vital nutrition interventions. Appeals for nutrition are often chronically under-funded. For example, in mid-2017 just 27% of the appeal for Somalia had been funded despite the scale of the crisis. To make matters worse, funding is volatile and unpredictable, making it impossible to plan and put in place the up-front investments that could prevent a descent into more severe conditions.

Addressing these problems will require reform at many levels. An obvious priority is to ensure that humanitarian appeals in general are more fully funded – and that nutrition appeals are adequately covered. Given that humanitarian crises are increasingly protracted, there is a need to move away from short-term funding to multi-year financing – an area identified as a priority in the World Humanitarian Summit.

As in other areas highlighted in this report, prevention is better than cure in humanitarian responses. Allowing large numbers of children to descend into a state of severe and acute malnutrition is not just indefensible in ethical terms. It also bad economics: the cost of treating malnourished children greatly exceeds the cost of preventing hunger. Cash transfers provide a flexible mechanism for preventing hunger and, by extension, the pneumonia epidemics that accompany humanitarian emergencies.

PUTTING PNEUMONIA ON THE MAP

Perhaps the single greatest contribution the international community could make towards saving lives threatened by pneumonia would be to put the disease on the map. Pneumonia has been recognised as a global health concern since the 1970s. WHO and UNICEF have produced a comprehensive global framework – the Integrated Global Action Plan for Pneumonia and Diarrhoea (GAPPD) – setting out the measures needed to cut deaths.

Yet saving lives from pneumonia remains a global cause without champions. The disease is treated as a peripheral concern by aid donors, international financial institutions and non-government organisations, mirroring the neglect evident in many countries. Unlike HIV/AIDS, malaria and tuberculosis, the battle against pneumonia has yet to grip the public imagination or register on the international agenda, creating a negative cycle of neglect, apathy and piecemeal intervention. The vital commodity lacking is urgency allied with a sense of shared responsibility to save lives.

The Sustainable Development Goals provide an opportunity to change this picture. Ending preventable child deaths by 2030 will remain an unachievable goal unless national governments and the international community act decisively on pneumonia, as well as support SDG target 3.8 on universal health coverage. The GAPPD provides a point of reference. Its target of reducing pneumonia deaths in children to less than 3/1,000 live births should be vigorously supported by the international community.

The world does not need a new 'vertical fund' for pneumonia that treats the disease in isolation. But it does need a greatly strengthened focus on pneumonia within strategies aimed at promoting universal health coverage.

Global and regional initiatives on pneumonia are currently trapped in a low-level equilibrium. From UN agencies to the Bill & Melinda Gates Foundation, individual aid donors and the World Bank, there is no shortage of excellent analysis, practical proposals and insightful reports. Private investors are playing a critical role in innovation, bringing potentially life-saving new technologies and diagnostic tools to the market. Pharmaceutical companies are researching and developing new vaccines and products for treatment. Yet none of this is creating the critical mass for transformative change.

An international summit on pneumonia could play a role in breaking the low-level equilibrium, *provided* it is oriented towards practical action. The proviso is important. The last thing children at risk of pneumonia need is a high-level talking shop that

Prima, age one, and Nirob, five, with their mother, Shipra, at home in Bangladesh. When Nirob was ten weeks old he was ill with pneumonia, diarrhoea and from malnutrition. The family lived far from a health facility. Save the Children workers helped Nirob get life-saving treatment. A health clinic has since been opened by Save the Children in their village.

PHOTO: CJ CLARKE/SAVE THE CHILDREN

delivers an encouraging declaration of intent with no credible plan of action. Nevertheless, summits do have the potential to catalyse change, as witnessed by the creation of the global health funds, debt relief, aid commitment and other breakthroughs in development. Among the conditions under which a summit on pneumonia could make a difference are:

- **High-level buy-in and committed champions**: Much of the international dialogue on pneumonia occurs between technical staff in international organisations and aid agencies. Now is the time for the heads of organisations to stand-up against the biggest killer of children, and commit to working together in support of national strategies. More widely, the global drive against pneumonia needs champions from the developed and the developing world who will increase awareness, mobilise public opinion and galvanise action. The Pneumonia Action Plans outlined in Chapter 3 could provide the national foundations for decisive international action.
- **Clear targets and goals**: The world does not need new targets. However, integrating the GAPPD target of lowering pneumonia deaths to less than 3/1,000 live births into the monitoring framework for the SDGs would help turn the spotlight on the disease. Given the link between inequality and pneumonia, it would also sharpen the SDG focus on equity, universal health coverage and the commitment to leave no one behind.
- **Shared commitment to ambitious delivery**: Eligibility for participating in the summit should be clearly defined. The objective would be to bring together the actors – governments, international agencies, aid donors, the private sector, non-government organisations and researchers – committed to a single common purpose: bending the curve on pneumonia deaths. The overriding aim of the summit: charting a pathway towards the policy reforms, investments and advocacy needed to avert more than 5 million pneumonia deaths by 2030.
- **A partnership for children**: The most successful international development partnerships have been built on national ownership of strategy, backed by predictable finance and technical assistance. One of the aims of the summit would be the creation of an international framework that underpins and supports national anti-pneumonia strategies.
- **An agenda for humanitarian action**: Given the scale of the threats posed by pneumonia to children affected by humanitarian emergencies, the summit would provide an opportunity to frame more effective international responses aimed at saving lives.

Ultimately, the case for any summit meeting rests on the magnitude of the challenge to be addressed and the potential for delivering meaningful outcomes. In the case of pneumonia, that case is clear-cut. It is difficult to imagine a greater cause or more pressing challenge than ending the death of almost one million children annually. The potential for meaningful outcomes is beyond serious dispute – pneumonia deaths are eminently avoidable, preventable and treatable. For these reasons alone, there is an overwhelming case for political leaders, private companies, aid donors and UN agencies, the World Bank and civil society to come together and forge a plan of action to save lives.

5 Recommendations

Pneumonia kills more children than any other disease. It causes immeasurable suffering, leaving its victims gasping for air, and their parents and siblings coping with anxiety, fear and loss. Treatment of the illness imposes costs on desperately poor families, and huge demands on health systems. Yet pneumonia remains a hidden killer. Governments in high-burden countries are failing to implement integrated responses. The international community has yet to develop the partnerships and coalitions needed to achieve a breakthrough. The end result is that pneumonia deaths are falling too slowly.

Changing this picture is a test of the pledge made to children under the Sustainable Development Goals. If the current trajectory on pneumonia deaths continues to 2030, the commitment to end preventable child deaths will become a broken promise. This report has described the scale of the pneumonia crisis and identified the practical measures needed to bend the curve on pneumonia deaths. Implementing these measures through decisive national action backed by international cooperation could save more than 5 million lives by 2030. On any measure, this is a prize worth fighting for. While the detail of strategies to combat pneumonia will vary by country, the evidence set out in this report points to five broad approaches that should guide the fight against pneumonia.

Putting the number one infectious killer of children on the map: National and international efforts to combat pneumonia are trapped in a low-level equilibrium. Political leaders in high-burden countries have a responsibility to make anti-pneumonia strategies not just a health priority, but a national priority. Aid donors, UN agencies, the World Bank, corporate leaders and civil society campaigners must also rise to a challenge that has been neglected for too long. Recommendations include:

- An international summit dedicated to the single purpose of preventing 5 million pneumonia deaths by 2030. Bringing together high-burden country governments and international actors, the summit could act as a catalyst for change and provide a platform for the development of new partnerships. The key to success: high-level political buy-in and an agenda geared to results.
- Pneumonia Actions Plans in every high-burden country setting out the prevention and treatment strategies for cutting pneumonia deaths (see below), with political leaders in high-burden countries driving impementation.
- Action by global champions to put pneumonia on the international agenda, with leaders of UN agencies, the World Bank and northern governments acting decisively to broker international action, with global champions from North and South taking up the cause.

Preventing pneumonia deaths through universal vaccination: Too many children are denied the benefits of vaccination against pneumonia, including 170 million children aged 0–2 in developing countries. National action to build an immunisation infrastructure able to reach the most marginalised children is critical. But without a renewed and strengthened global compact to deliver affordable vaccines, the power of vaccines to save lives will be only partially realised. Proposals set out in this report include:

- National investment in immunisation infrastructure to expand the reach and quality of health system delivery, with a sharpened focus on equity
- Inclusion of pneumococcal conjugate vaccines (PCVs) in national immunisation programmes
- Reduced prices for PCVs delivered through Gavi by current suppliers, supported by financing for increased guaranteed purchase commitments, new finance and risk guarantees, and new corporate initiatives that build on past price reductions
- An increased emphasis on ‘market shaping’ geared towards support for the entry of at least one new supplier by 2020, with dedicated

financing set to accelerate research and development, clinical trials and early registration through companies not yet in the market, targeting an entry price of $6 for a full course for Gavi countries.
- Regulation and legislation, including compulsory licences, to ensure that patents do not obstruct the market-entry of new suppliers – pneumonia meets the 'health emergency' criteria required to trigger compulsory licensing
- Pfizer and GSK to explore opportunities for lowering PCV prices through cross-subsidisation and reform of their tiered pricing structures to further lower prices for Gavi-eligible countries and for non-Gavi countries with large unimmunised populations, subject in the latter case to governments developing plans to reach these populations.
- Reform of Gavi rules to allow for support to sub-national regions and provinces of countries deemed ineligible because of their income levels
- Increased transparency on pricing of PCVs in different markets.

Treating pneumonia through better case management and universal health coverage:
The central theme of this report is that effective pneumonia case management requires an integrated approach. One take-home message can be simply summarised: weak health systems will not deliver strong outcomes on pneumonia. Universal health coverage is about ensuring that all citizens have access to affordable care regardless of their wealth, ethnicity, gender or location. That care has to include access to health providers able to accurately diagnose and effectively treat pneumonia. Polarised debates over the merits of 'vertical' (disease specific) versus 'horizontal' (health system) are increasingly anachronistic. Saving lives from pneumonia requires health systems – including the trained staff, properly equipped facilities and referral systems – that are able to diagnose and treat a specific disease that kills two children every minute, often in concert with other diseases. The **Pneumonia Action Plans** proposed in Chapter 3 would include:
- Financial provisions and delivery strategies for reaching a childhood pneumonia death rate of less than 3/1,000 live births by 2025, as envisaged under the Integrated Global Action Plan for Pneumonia and Diarrhoea
- Strategies for reducing the background risks associated with malnutrition, premature transition from exclusive breastfeeding, household air pollution, and restricted access to clean water and sanitation
- Information campaigns from the national to village levels aimed at increasing awareness of pneumonia, with community mobilisation geared towards empowering mothers to identify symptoms and demand treatment
- Detailed mapping of health system coverage gaps, including areas with high concentrations of pneumonia deaths and weak service provision
- Coverage targets to include 90% appropriate case management by 2020, linked to targets, delivery schedules and financing provisions aimed at making Amoxicillin DT and other essential drugs available in every clinic; increasing frontline provision of diagnostic tools, such as pulse oximeters and devices to measure respiratory distress; and ensuring that oxygen is available to treat children threatened by hypoxaemia.
- Strategies to strengthen case management of pneumonia in the community, where most children are treated, through improved training and support for health workers delivering the Integrated Management of Childhood Illness, while at the same time extending the reach of more skilled providers through the health system
- Measures to strengthen referral systems so that children who develop severe pneumonia can be swiftly transitioned from the community to primary and higher-level facilities up to tertiary hospitals, where those with serious complications can be treated
- Reform of rules making it illegal for community health workers to dispense antibiotics, along with measures to address concerns over antimicrobial resistance through more effective regulation of over-the-counter purchases – it is unacceptable that children are being allowed to die for lack of simple antibiotic treatment
- Establishment of pneumonia child mortality and case management indicators as key benchmarks for the performance of the health system
- Strategies for strengthening data and information systems using new technologies to improve reporting on pneumonia
- Integration of the Pneumonia Action Plan into the wider national strategy for achieving universal health coverage.

Building an international partnership: National governments have primary responsibility for preventing the deaths of their children, but strengthened international cooperation is critical. The UN Convention on the Rights of the Child imposes an obligation on all governments to "ensure to the maximum extent possible the survival and development of the child". It is difficult to square that obligation with the current state of international cooperation on pneumonia. This report identifies a number of practical measures to change this picture, among them:

- Support for the strengthening of health systems and universal health coverage
- A new global deal on immunisation aimed at achieving 90% global PCV coverage by 2022
- Financing the estimated $73m funding deficit estimated by UNICEF for non-malarial iCCM interventions in 22 high-burden countries
- The mobilisation of development finance to support pneumonia vaccination, including World Bank bonds and risk guarantees
- Reform of the Global Finance Facility to include pneumonia in the indicators used to assess national investment plans
- Measures to strengthen the compliance with the WHO Code of marketing of breastmilk substitutes
- International action to combat malnutrition, with an increase of $2.5bn in aid commitments
- More effective responses to the threat posed by malnutrition in humanitarian emergencies, including full funding of nutrition appeals, multi-year support for protracted crises, and an increased use of cash transfers
- Cooperation between private companies and governments to accelerate the pace of innovation in areas to improve prevention, diagnosis and treatment of pneumonia as part of universal health coverage.

An unrelenting focus on equity and the most disadvantaged children: Unjustified and unfair inequality – inequity – is at the heart of the pneumonia epidemic. While all children are at risk, pneumonia remains a disease of poverty. The risks of fatality are concentrated in children disadvantaged because they are born into poor households, living in a hard-to-reach area, or members of a marginalised ethnic minority. In South Asia, being a girl greatly elevates the risk of pneumonia death. The poverty, inequality and discrimination experienced by disadvantaged children combine to make them far more likely to contract pneumonia, and less likely to get treated and diagnosed. No strategy, national or international, for combating pneumonia will succeed unless it breaks the cycle of disadvantage that fuels the pneumonia epidemic. Without a focus on equity, the benefits of universal health coverage will trickle down to the poor too slowly to achieve the targets identified in this report. Proposed measures to strengthen equity include:

- New approaches to monitoring performance under the Sustainable Development Goals – governments could report on the pace at which the death rate gap is closing between children from the poorest and richest 20%, urban and rural areas, and different social groups
- 'Progressive universalism' in health care provision, with progress towards universal health coverage prioritising the most disadvantaged children and areas in the allocation of financial resources and health workers
- Measures to promote equity in health through the withdrawal of user-charges and governance arrangements that make providers more accountable to disadvantaged communities
- Empowering women to make more informed decision and exercise choice through improved information and mobilisation to combat discrimination.

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FIGHTING FOR BREATH

"Over the course of today, 2,500 young lives will be lost to pneumonia. My hope is that policy-makers around the world will read this report, reflect on its content and be seized by what Martin Luther King called 'the fierce urgency of now'."

Kofi Annan, former UN Secretary-General

"Global attention can drive great improvements in the lives of people in developing countries. Child deaths from pneumonia expose persistent inequalities in nutrition, immunisation and access to health services. I strongly welcome this new report and Save the Children's determination to draw attention to these injustices."

Professor Peter Piot, Director of London School of Hygiene & Tropical Medicine

"What is at stake if the world does not heed Save the Children's report? Certainly the achievement of the new global health goals for many, many countries, but more critically the lives of millions of children who will continue to die because we decided not to pay attention to an infection that we know how to prevent, diagnose and treat – pneumonia."

Leith Greenslade, CEO, JustActions, former Vice-Chair, MDG Health Alliance, the UN Special Envoy for Health

The fight against pneumonia deaths is being lost – and the children on the frontline are paying with their lives. *Fighting for Breath* turns a spotlight on the inequalities, policy failures and indifference holding back progress. It challenges governments, international agencies, private companies and non-governmental organisations to come together in a coalition committed to saving lives.

Collectively we have it in our power to save 5 million young lives over the next 15 years. This report sets out how we can do it.

savethechildren.org.uk