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The management of childhood pneumonia in settings with a high burden of HIV (part 1)

Why does childhood pneumonia matter?

This review owes much to conversations and correspondence over the last month with a number of people. We'd like to thank Dr Shamim Qazi and Dr Lulu Muhe both of the Department of Child and Adolescent Health and Development at WHO, Dr Siobhan Crowley of the Department of HIV/AIDS at WHO, Dr Annelies Van Rie of the University of North Carolina, Dr Henry Barigye, who has just taken up a post with ICAP in Tanzania, Dr Tunga Namjilsurent, Communications Officer for the Partnership for Maternal Newborn and Child Health, Dr Joy Lawn of Saving Newborn Lives/Save the Children US and Dr Stephen Graham of the Centre for International Child Health at the University of Melbourne Australia.

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Pneumonia

is an acute infection affecting the lungs that interferes with breathing and oxygen absorption. It is characterised by coughing and fast or difficult breathing, but there are additional symptoms or danger signs indicating more severe cases described below.

Pneumonia is **the single biggest killer of children worldwide**, causing an estimated 2.4 million deaths in neonates and children under the age of five every year.¹ Thus, it accounts for nearly one out of every 5 deaths in young children. Most of the deaths occur in resource-constrained countries (50% in sub-Saharan Africa and 20% in South-East Asia) where 151 million cases of childhood pneumonia are estimated to occur each year — 11 to 20 million of which may require hospitalisation.²

Such staggering figures ought to mobilise a global effort to address pneumonia, but instead “pneumonia is a forgotten pandemic” according to [a 2006 report from WHO and UNICEF](#).³ This childhood illness receives little press, modest funding, inadequate attention from governments, local health programmes, bi- and multilateral funding partners, and there is a shortage of modern era research into how to better manage the disease.

One of the reasons could be the lack of advocacy for issues affecting children at most risk from poor and remote communities.

But the low profile of pneumonia as a global health issue could also be due in part to a perception that it is “manageable” with antibiotics (so is tuberculosis — and look at the scale of that problem). Plus, now there are vaccines for the leading causes of bacterial pneumonia— though most children in low resource settings are not getting them.

It may also be partly because a simple plan to manage most cases of pneumonia already exists, and has long been incorporated into the [Integrated Management of Childhood Illnesses \(IMCI\) strategy](#) (a holistic approach to childhood illness aimed at improving health worker skills, strengthening health systems and engaging

and improving community and family practices to deal with the main causes of mortality and morbidity in children under 5 in resource limited settings).⁴ Unintentionally, pneumonia may have been so well integrated into Maternal, Newborn and Child Healthcare (MNCH) policy that it has become virtually invisible as a global health issue.

As a result, there's a sense that the challenges to pneumonia management are primarily operational. Partly, this is true — a recent report from Tanzania, one of the countries where IMCI was first piloted in the mid 90's, noted shockingly low implementation of the local IMCI-based guidelines for facilities; and a health systems audit in the northeast of the country found that documentation at the health facilities surveyed was so poor that it was impossible for the researchers to conclude whether children were getting the right diagnosis and treatment or not.⁵ What records they could find suggested that even the most “basic clinical signs were often not checked.”

“The main cause of the high mortality from pneumonia (mainly in developing countries) is a lack of access to effective health services,” according to a report on an informal consultation held last year by WHO and UNICEF to develop a [Global Action Plan for the Prevention and Control of Pneumonia \(GAPP\)](#).

Weak MNCH services are a perennial problem — one that should grab more people's attention.

But there is another barrier to implementing improved pneumonia management: HIV.

Home treatment for children with severe pneumonia now possible — in non-HIV settings

A landmark study published earlier this year in the Lancet reported that children with a presumptive diagnosis of severe pneumonia (made by a physician or trained health worker) could be just as effectively treated with oral antibiotic pills (5 days of amoxicillin) in their own homes as they could be in a hospital with more intensive therapy (injected ampicillin, followed by oral amoxicillin) although ‘very’ severe cases (with danger signs as defined below) should still be taken immediately to a well-equipped facility.⁶

Similar community case management strategies for pneumonia — in which community health workers are trained to recognise pneumonia and give the mother or caregiver appropriate antibiotics to treat “non-severe” cases at home, and refer the more severe cases — are already integrated into IMCI and have a proven track record in some resource-constrained countries, particularly in Asia.^{7, 8} Now, the findings of this large randomised study in over 2000 children in Pakistan suggest that the approach could potentially be extended to manage severe and life-threatening pneumonia.

Since large numbers of children actually die of severe pneumonia before ever making it to a hospital, local assessment and home-based care for pneumonia could present families with a treatment option that is effective, convenient, more equitable and more compassionate — while at the same time reducing the burden on public health systems. One might expect it would offer similar potential in sub-Saharan Africa, particularly in rural areas where it can be hard or impossible to get to a hospital in time, and where task shifting is increasingly being employed to improve health service delivery.

There's just one caveat:

“This treatment strategy for severe pneumonia will not be useful in high HIV prevalence settings,” WHO said in a press release earlier this year.^{9, 10} Yet the majority of pneumonia deaths occur in sub-Saharan Africa.

"The standard case management guidelines for pneumonia recommended by WHO for use in areas with low HIV burdens are less effective in areas where HIV burdens are high," Dr Prakash Jeena of the Department of Paediatrics and Child Health, of the University of KwaZulu-Natal wrote in an editorial in [a recent issue of the Bulletin of the World Health Organization](#).¹¹ This special issue, one of the first outcomes of GAPP, contains 16 reviews and articles dedicated to different aspects of the prevention and control of childhood pneumonia. .

Some steps in the approach — such as getting a mother to take a child with signs of pneumonia to see a community health worker for immediate assessment — remain important to saving children's lives everywhere. But unfortunately, home care may not always be possible at present because the oral antibiotics currently prescribed for children with pneumonia don't work (or work as well) for some of the infections causing severe pneumonia in infants and young children with, or exposed to, HIV. In addition, pneumonia in children with HIV may rapidly become so severe that they may need to be given oxygen and other services only available at larger health facilities — and even in hospitals outcomes are often poor.

Dr Jeena cited a recent South African study in a hospital setting (which we'll refer to as the Durban Paediatric Pneumonia Study or DPPS) that found that even when using a treatment regimen optimised for severe disease in HIV-infected children, the cumulative rate of failure was still quite high — especially in infants under one year of age with or exposed to HIV.¹²

So what exactly should be done to benefit the most children in settings with a high burden of HIV? Can the strategy be improved upon, somehow, in a way that would benefit all children? There are few easy answers.

"There are a large number of problems in designing sensible guidelines for pneumonia in practice, and there is very little work being done to try and address what should actually happen in terms of modifying guidelines," said Dr Mike English of the Child and Newborn Health Group, Kemri in Nairobi, Kenya at a symposium on childhood pneumonia and HIV in Africa at the World Union Conference on Lung Health in Cape Town last November.¹³

"HIV has made life doubly difficult... and we are paying the price for having neglected key areas of clinical pneumonia research. For the clinician and the public policy makers, there are many more questions than answers in the search for optimum treatment approaches."

It's possible that the perfect could be the enemy of the good when it comes to pneumonia management. As we hope to show in this article, there are a number of policies and actions that could help mitigate the impact of HIV on pneumonia and reduce the suffering and death it causes in sub-Saharan Africa. But to achieve the best possible results, ART/PMTCT programmes and MNCH will need to work together and pool their financial, logistical resources and technical know-how, and engage all the potential partners involved in providing supportive and palliative care services within the community.

HIV's impact upon pneumonia in children

As high as the estimates of the global pneumonia burden are, they may not accurately reflect the full impact of HIV on pneumonia over the past decade.¹⁴ In fact, the most recent figures are essentially the result of incidence rate estimates drawn from studies conducted between 1969 and 1999 and then applied to the current populations of at-risk children.¹⁵ However, studies have shown that in high burden countries, HIV has changed the formula by

dramatically increasing the incidence, severity and mortality associated with pneumonia.

For instance, according to the GAPP report, the incidence of childhood pneumonia in South Africa has increased by 45% since 1995.¹⁶ So in high burden settings, HIV could be fuelling the pneumonia pandemic in much the same way as it does tuberculosis (TB). At the same time, the impact of pneumonia on children with, or even exposed to HIV, is devastating.

"Pneumonia is the most common cause of illness, hospitalisation and death in HIV-infected children," said Dr Heather Zar, of the Red Cross Children's Hospital and the University of Cape Town, who also spoke at the symposium on childhood pneumonia last November.¹⁷ In fact, 90% of HIV-infected children will develop a respiratory illness during the course of their HIV disease — and most of these illnesses will be due to pneumonia.¹⁸

Studies also show that simply having a mother who is HIV-infected puts infants at a greater risk of pneumonia, treatment failure and death — perhaps because they are exposed to more infections from their parents, are more likely to be malnourished or because they do not receive protective immunity transplacentally or from their mother's breast milk.^{19, 20} But it is the HIV-infected infants who fare the worst, with a case fatality rate that is 3–8 times higher than in HIV-uninfected children.²¹

"Although children with HIV comprise less than 5% of the childhood population, [in] sub-Saharan African countries, these children suffer disproportionately from pneumonia (nine times greater risk) and are susceptible to pneumonia caused by a greater variety of pathogens. In South Africa, HIV-infected children account for 45% of all childhood pneumonia morbidity and 90% of pneumonia mortality," Madhi et al wrote in the recent WHO Bulletin.²²

The same infections causing pneumonia can also seriously involve other parts of the respiratory tract or body. For instance, HIV-infected infants and children with bacterial pneumonia are also far more likely to become bacteraemic. In one pneumococcal vaccine trial, 22% of the HIV-positive children were bacteraemic compared to only 7% among the HIV-negative children.²³

The emergence of previously less common causes of pneumonia, and changes in the pattern and frequency of others are described further below. This wider range of infections poses challenges for diagnosis, which in turn results in inappropriate or sub-optimal treatment, and increases the risk of drug resistance. There is a significant chance this resistance could spread within the community— altering the effectiveness of the antibiotics used for empiric treatment.²⁴ And since treatment failure is more common, there is also a greater risk of recurrent pneumonia.

Additionally, while vaccination for the major causes of bacterial pneumonia is still recommended, data suggest it is less effective in children with HIV. Since at least part of some vaccines' effectiveness comes from "herd immunity" (protecting people, whether vaccinated or not, by reducing the pool of infectious cases who can transmit the infection), a large population with untreated advanced HIV disease suffering frequent infections could theoretically diminish a vaccine's effectiveness at the population level.

Finally, HIV drains health care resources from MNCH services since more children require treatment, hospital admission and intensive care for pneumonia.²⁵ HIV/PMTCT programmes and funding partners could offset the system-wide costs of HIV by taking a more holistic approach but are often rather narrow in focus, which may be in the long run be self-defeating.

For instance, children with HIV are more likely to have severe pneumonia with hypoxia (oxygen deficiency in body tissues) and need to be given oxygen. But in many small hospitals, not to mention primary health care clinics, oxygen is already in short supply if it is available at all.²⁶ According to the GAPP report, “WHO has been promoting the availability of oxygen in small hospitals in developing countries [but] several surveys of these hospitals in recent years, however, have shown that oxygen is either not available at all in many hospitals or is not used appropriately.”²⁷ Hypoxia increases the risk of dying from severe to very severe pneumonia fivefold²⁸; so stock outs of oxygen can lead to the death of any child with severe pneumonia, with or without HIV.

Causes of pneumonia

Over the last hundred years of medical science, the major causes of pneumonia in HIV-negative children have been identified, including such pathogens as *Streptococcus pneumoniae* (the leading overall cause of pneumonia in children), *Haemophilus influenzae* type b, respiratory syncytial virus (RSV) and influenza, *Staphylococcus aureus* and *Klebsiella pneumoniae*, along with a number of less common infections (see Table). But data on the role of many pathogens in pneumonia — or the interpretations of the data — are conflicting, and the methods used to diagnose or report on infections vary from study to study. Thus at present, reliable data on the current distribution and relative frequencies of the different pathogens causing pneumonia in different populations are limited, and further research and surveillance is urgently needed in order to determine optimal treatment and prevention strategies for childhood pneumonia.²⁹

Table: infectious organisms causing or associated with pneumonia*

Category	Pathogen	Notes
Bacterial	<i>Streptococcus pneumoniae</i>	The leading cause of vaccine-preventable deaths in children under 5, may be responsible for over 50% of severe pneumonia cases, and an even higher proportion of fatal cases.
	<i>Haemophilus influenzae</i> type B	Responsible for between 15–30% of cases and death, but with establishment of vaccination programmes may be becoming less important
	<i>Staphylococcus aureus</i> (some methicillin resistant (MRSA))	Associated with poorer outcomes
	<i>Klebsiella pneumoniae</i>	Gram-negative infections more difficult to treat
	Other less common: Non-typable <i>H. influenzae</i> (NTHI), non-typhoid <i>Salmonella</i> spp., <i>Escherichia coli</i> , <i>Pseudomonas</i> spp., <i>Chlamydia</i> spp., <i>Mycoplasma pneumoniae</i>	Conflicting data on the role of some of these pathogens in pneumonia, but if involved, they may not be well covered by current treatment guidelines

	<i>Mycobacterium tuberculosis</i> (TB)	Can present as acute pneumonia
Fungal	<i>Pneumocystis jirovecii</i> (PCP)	Once thought to be a rare cause of pneumonia in Africa, studies over the last decade show it is common in infants with HIV, and even in some HIV-exposed infants
	Others: <i>aspergillus</i> , <i>cryptococcus</i> , <i>coccidiomycosis</i> , <i>histoplasmosis</i>	
Viral	Respiratory syncytial virus (RSV)	May occur in 30–40% of children hospitalised with severe pneumonia
	Influenza A and B	
	Cytomegalovirus (CMV)	In children with HIV with low CD4 cells, can cause primary pneumonitis or disseminated disease, found in mixed infections
	Others: metapneumovirus, parainfluenza, adenovirus, , varicella, measles	
Mixed infections	Bacterial coinfections, viral/bacterial coinfections, PCP coinfections commonly mixed with viral, bacterial, or mycobacterial infections	Associated with a higher risk of mortality

*Drawn mostly from Dr Heather Zar's presentation at the World Union meeting, Rudan et al's review in the Bulletin of the WHO, and *Pneumonia: The Forgotten Killer of Children*.

But HIV has broadened the spectrum of infections that can cause pneumonia — perhaps most notably *Pneumocystis jirovecii* pneumonia (PCP), which has emerged as a major cause of pneumonia and death in infants. Since, again, methodology varies from study to study, it is difficult to say with any certainty how much each of the infections contributes to pneumonia seen in children exposed to or with HIV. (Again, much of the following is based upon the review presented by Dr Heather Zar at the World Union on Lung Health).

In general, it is safe to say that many of the less common infections in the Table are more likely to be found in infants and children with HIV or exposed to HIV.

Bacterial infections

The most common cause of pneumonia generally remains the most important cause in children with HIV, and there has been an increasing incidence of *S.pneumoniae* in settings with a high burden of HIV, especially among infants under one year old. But commonly, *S. aureus* — with an increasing prevalence of methicillin resistance (MRSA) — and gram-negative bacteria such as *K. pneumoniae* or *P. aeruginosa* occur — which makes the selection of a good empiric treatment more difficult.

M. tuberculosis has also been reported in about 8% of children hospitalised with acute pneumonia, but since TB in children is particularly difficult to diagnose, the burden may actually be greater.^{30,31} In the DPPS study 53/358 (15%) children with severe or very severe pneumonia had TB.³²

Viral infections

Although a study by Madhi et al found that viral causes accounted for a lower percentage of the cases of severe lower respiratory track infections in children with HIV (probably because other infections have become more common), the relative incidence rate of severe viral-associated pneumonia was much higher, ranging from 1.9 for RSV (range 1.2-2.8) to 8.03 for influenza A or B (range 5.0-12.7), and 15.07 for adenovirus (6.62-34.33).³³

Some opportunistic viral infections may also be associated with pneumonia. For instance, CMV has been found upon diagnostic evaluations in children with primary pneumonitis and HIV, especially those with very low CD4 cells — but its contribution to the illness and the best form of management are controversial (see below).

PCP

Most fungal opportunistic infections are a rare cause of pneumonia, only occurring with disseminated disease in very immunosuppressed children.

However, *P. jirovecii*, formerly called *Pneumocystis carinii*, or PCP, and classified as a protozoan, is now considered to be an atypical fungal organism — and far more importantly, a major cause of severe pneumonia in HIV-infected and perhaps even some HIV-exposed infants.³⁴

At one time, PCP was thought to be relatively rare in sub-Saharan Africa because it can be difficult to diagnose in resource-constrained settings, and there was much disagreement over the interpretation of some of the studies that did report it. Furthermore, in the pivotal cotrimoxazole study in Zambian children (CHAP) with HIV, PCP was not observed in the placebo arm — but that study only included children over 1 year of age.³⁵ In the last decade, and especially since the HIV pandemic swept into South Africa, where hospitals are better equipped, the preponderance of evidence has shown that PCP preferentially targets infants, especially those between 3 to 6 months of age.

36,37,38,39,40,41,42,43,44,45

“Initially we all believed that PCP didn’t exist in Africa,” said Dr Jeena, speaking at the symposium on childhood pneumonia at the World Union Lung Conference in Cape Town.⁴⁶ “But papers first published in 1995 from Côte d’Ivoire showed it accounted for a high proportion of mortality and that’s been replicated across most parts of Africa.⁴⁷ We were also silly at that point because if we looked at the data from Wakefield et al, we found that over 80% of patients had got antibodies to PCP at 8 years [of age].⁴⁸ So obviously the fungus was around long ago, we were just missing it somewhere along the line.”

“Consistently data from studies in central hospitals - so there is a likely bias to more severe pneumonia and therefore PCP - have shown that PCP is a very common cause of death in HIV-infected infants,” Dr Stephen Graham told HATIP.

Dr Graham is currently at the Centre for International Child Health, Royal Children’s Hospital, Melbourne, Australia but previously worked in Malawi for ten years. “Of course, causes of death do not accurately reflect burden of disease — so bacteria such as pneumococcus are likely to be a much more common cause of pneumonia but because the case fatality rate is lower for pneumococcal pneumonia than for PCP, the difference in burden of disease is not well reflected in autopsy data.”

“PCP is the commonest cause of death from pneumonia in those below 6 months of age, and accounts for a quarter of the cases in infants over 6 months of age,” Dr Zar said in Cape Town.

In fact, according to a report of a WHO consultation on cotrimoxazole, PCP causes at least one out of every four deaths in HIV-infected infants under the age of one.⁴⁹ And Dr Graham thinks it may be even higher:

“Overall, PCP seems to be the cause of death in about 35% of HIV-infected infants so it’s worth preventing,” he said.

Even more disturbing figures have recently come out due to better auditing of the causes of death in children in some hospitals in South Africa. For instance, according to the *Saving Children 2005* report, “during analysis of the Witbank Hospital’s Child Healthcare Problem Identification Programme data at the end of 2004 and beginning of 2005, it became clear that deaths due to suspected pneumocystis pneumonia (PCP) constituted the biggest single cause of mortality (44% of all child deaths were due to PCP). Further analysis revealed that the failure of the PMTCT programme in the district could be linked to this high mortality rate. In every single PCP death either the mother had never been on the PMTCT programme or some mistake had been made during the execution of the programme (e.g. no cotrimoxazole prophylaxis from six weeks).”

Dr Graham noted that, even though there are fewer data, PCP does occur in young HIV-negative infants as well — perhaps because they receive little passive immunity to it from their mothers.^{50,51,52} There were 3 cases in HIV-negative infants in the DPPS study, and Dr Jeena suggested that a mother with PCP might even transmit it directly to her breastfeeding child.

Polymicrobial disease (mixed infections)

One of the reasons why outcomes are often poor in children with HIV is that they may have more than one respiratory infection at once. For instance, Madhi et al reported that coinfections, such as influenza and bacterial infections were more common in HIV-infected children (78% vs 31%).⁵³ And the DPPS study reported that more than one organism were found in 70% of children with severe or very severe pneumonia.⁵⁴ These infections were more likely to be unresponsive to usual antibiotics and were associated with a higher risk of mortality.

Here’s where infections such as CMV may become more important.

“We all said [CMV] was probably an innocent bystander,” said Dr Jeena. But in [the DPPS study which he co-authored] more than PCP, we found CMV to be the commonest organism that we identified [in infants]... CMV occurred mainly between 1 to 12 months of age.”

One possibility, however, is that polymicrobial disease and the poor outcomes are simply a consequence (and a sign of) extremely advanced HIV disease. Mixed infections are more likely to occur in children without a viable immune system — especially given with poor infection control practices at home and in health facilities.

But CMV is probably not innocent in these infants. It is also likely that CMV or other infections could be driving HIV replication, and indeed, Dr Jeena said it was found in the children with extremely high HIV RNA loads. In fact, in a small study that Dr Jeena conducted treatment with ganciclovir did seem to improve survival versus a historical control. The treatment effect suggests that the CMV is indeed contributing to mortality (more below).

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The management of childhood pneumonia in settings with a high burden of HIV (part 2)

Optimising pneumonia case management

Given the complexity of its causes, how best should pneumonia be managed in a setting with a high burden of HIV? Rather than re-invent the wheel, the following sections borrow liberally from

Pneumonia, the Forgotten Killer of Children, IMCI materials and the *Pocket Book of Hospital Care for Children* to describe the current case management of childhood pneumonia approach. It is beyond the scope of this HATIP to examine the entire evidence base surrounding the pneumonia case management approach (please see the resources section for links where you can download these materials). Nevertheless, HATIP would like to highlight a few key points and critical elements, and make a few comments along the way.

The basic principles of case management are simple enough:

- teach mothers/caregivers to recognise the signs and symptoms of pneumonia
- get the child with pneumonia to appropriate care
- treat with the appropriate antibiotics

According to *Pneumonia, the Forgotten Killer of Children*, if these steps, and key preventive interventions such as expanded vaccination programmes and cotrimoxazole prophylaxis were universally put into practice, 1.6 million children's lives could be saved. But evidence also suggests that to work in high HIV burden settings, there will also have to be much more aggressive HIV prevention work, universal access to provider-initiated HIV testing and post-natal follow-up, universal cotrimoxazole for HIV-infected/exposed infants and all-round strengthening of maternal newborn child health services.

But of course, even the most basic activities aren't being performed the way they should be; and, perhaps, the "simple" case management strategy is easier said than done. Take, for instance, the first step — teaching the mother/caregiver when to suspect pneumonia.

Recognising pneumonia and seeking appropriate care

"It is critical that caregivers understand the importance of this disease and the risk it poses to their children's health." Pneumonia, the Forgotten Killer of Children.

Caregivers need to be taught that the hallmark symptoms - **cough with either difficulty breathing or rapid breathing** - should prompt them to seek out trained health personnel or a healthcare centre for diagnosis and treatment. But the report cites findings from a recent survey showing that only one of five caregivers knows these symptoms require immediate action.

But since children frequently get coughs from colds, caregivers need a clear explanation of how to recognise "difficulty breathing or rapid breathing." (IMCI defines difficult breathing as any unusual breathing pattern; rapid breathing is defined below).

And something else that complicates matters is that a child with pneumonia will have other symptoms as well: possibly fever, chills, headaches, loss of appetite or wheezing. By the time the mother/caregiver seeks a trained health worker, there may be symptoms of severe pneumonia such as struggling to breathe, referred to as 'lower chest wall indrawing' because the lower part of the chest moves in or retracts noticeably while the child is trying to inhale; flaring nostrils; stridor (a harsh noise made during inhalation — as opposed to wheezing when breathing out), or grunting in infants.

In infants (under two months of age), stridor or grunting signs are danger signs. Children (especially infants) with very severe pneumonia also may have central cyanosis (grey purple skin), be unable to drink or breastfeed, vomit everything, have convulsions, hypothermia, unconsciousness, or lethargy (be abnormally sleepy or

difficult to wake) or present with head nodding (a sign of severe respiratory distress).

Some of the more common early symptoms overlap with other diseases which caregivers have been taught to be more afraid of. For instance, fever and rapid breathing are also symptoms of malaria — and campaigns have had some success teaching parents/caregivers in malaria-endemic regions to give antimalarials to their children with fever. Thus, the caregiver's first action might be to give antimalarials and wait for a response. But the delay of appropriate treatment could make the difference between life and death.

Delays and inappropriate treatment in rural Uganda

This is just what Källender et al describe happening in rural Uganda [in the recent WHO Bulletin](#).⁵⁵ Between November 2005 and August 2007, the researchers interviewed thousands of people and reviewed the individual case histories of children who had died of pneumonia to try to understand why these children did not survive. The cause of death was assigned for 164 children, (44) 27% with pneumonia. The researchers conceded that these were verbal/social autopsies and couldn't possibly be foolproof, but they made some interesting observations nonetheless.

First, is that most of the children were first treated at home: 52% with antimalarials and 27% with antibiotics (about a quarter got both). This was associated with a median 2-day delay in seeking out a qualified healthcare provider, most likely because they were waiting to see improvement on the medication. (More than half the time the medicines were leftovers from neighbours or family and only sometimes came from the private sector or pharmacist).

"Given the likelihood that some mothers missed the early pneumonia symptoms and only took action when the child was severely sick, a 2-day delay could be detrimental for sick children," wrote Källender et al. Also, given the source of the drugs, it seems likely that the "dosing, duration, type, and quality of the antibiotics may have been inadequate or inappropriate, leading to resistance development and treatment failures.

Health system failures also played a part in the children's death. Once appropriate care was sought out, many were taken to the district hospital, which referred them onto the regional hospital because they were too poorly equipped to provide critical care to children. A couple died in transit. Of the 44 children who died of pneumonia, only one had received oxygen.

One take-home message was that the malaria and pneumonia management strategies should be better integrated (rather than separate vertical interventions). The researchers note some major inequities in how the diseases are managed. For instance, even local shopkeepers and trained community workers can dispense antimalarials for presumptive treatment of fever at the community level but policies prohibit dispensing of antibiotics without a prescription.

"To improve quality of care where it occurs and to reduce inappropriate use of drugs, integrated child-health interventions in the home, community and private sector are needed. The feasibility and effect on mortality of training community health workers and drug vendors on management of pneumonia and malaria with prepacked drugs should be tested, while the quality of health-facility care needs to improve," the researchers concluded.

Expanding the cadres who can offer appropriate care

It may not always be easy for a caregiver to rush their child to appropriate care, particularly when it is remote and they have no transport. So it is crucial to identify the people nearby within the community (including local shopkeepers and, of course, traditional healers) to whom caregivers are likely to go, and to provide those individuals with adequate training and supervision to recognise and treat non-severe pneumonia, and to know how to respond appropriately to more severe cases.

According to basic IMCI materials, lower level health workers assessing a child must first check for general danger signs (such as convulsions, lethargy, vomiting everything or inability to drink or breastfeed) that indicate that the child urgently needs medical attention. A primary health care nurse should be able to complete an assessment, if necessary provide some emergency care to stabilise a child, and provide the pre-referral treatment, such as the first dose of an appropriate antibiotic, before sending the child onto a better equipped facility for treatment.

Clearly, at the very least lay health workers must be trained to recognise danger signals and make immediate referrals – though local programmes will need to determine what other activities they can be entrusted with before referral. Nevertheless, at the very least, lives could be saved if health programmes would meet with community stakeholders to work out the logistics to make any referrals effective ones.

Assessing and classifying the child with cough and difficult breathing

After checking for danger signs, asking about cough and difficult breathing are the highest priority questions in IMCI in children over 2 months of age (neonates are handled somewhat differently). Again, this approach should be standardised across health cadres who are dispensing antimalarials so that the approach to child health is consistent across sectors.

The next question regards how long the child has been coughing (to try to flag whether the child might have TB or some other serious chronic respiratory condition) – but the IMCI handbook recommends referral for TB assessment only after they have been coughing for 21 days. This is problematic, because, again, TB can present as acute pneumonia in children with HIV.

“Sputum sampling in under-fives is very difficult. This is why it is not part of IMCI,” Dr Shamin Qazi, of the Department of Child and Adolescent Health and Development at WHO, told HATIP.

Yet algorithms will need to be adjusted somehow to speed the diagnosis of TB in children. Otherwise, there is a chance that child with infectious TB will be sent back into the community with only cotrimoxazole or perhaps malaria treatment. (We hope to cover the topic of tuberculosis in children in a future issue).

At the lower levels of care, there are three key steps for classifying the severity of suspected pneumonia.

First, the health worker assesses rapid breathing by counting the child's breaths per minute. If the child is between 2 and 12 months old, rapid breathing is 50 breaths or more per minute; and if the child is between 12 months and 5 years, rapid breathing is 40 breaths or more per minute.

Then health workers should look and listen for lower chest wall indrawing or stridor.

Any child with fast breathing alone is to be classified as having pneumonia and could be empirically treated. Any child who also has either lower chest wall indrawing or stridor is classified as having severe pneumonia or very severe disease, and is supposed to be referred to a properly equipped health facility for further assessment and treatment – at least until new operational guidance (due to the results from Hazir et al's study of home-based care of severe pneumonia in Pakistan) comes out.

In theory, at the hospital setting, the child would be further classified as having [severe pneumonia](#) if they only have lower chest wall indrawing without any of the other danger signs (being cyanosed, unable to drink, reduced level of consciousness) that indicate severe disease.

According to Dr English however, this rarely occurs in practice. “If you didn't have any of those [signs of very severe pneumonia] [then you're severe pneumonia, and amazingly those two things are supposed to be different](#). Although when you ask people, nobody's ever considered them as different and they've rarely treated them differently except in clinical trials.”

Reducing the child's suffering during initial and referral assessments

But it is impossible to assess a child who is crying or frightened. The IMCI Handbook recommends that the mother hold the child in her lap to keep her child calm, and that sleeping children should not be woken.

It is important to make the child as comfortable as possible anyway, so anyone assessing a child with suspected pneumonia should keep in mind how the child might be suffering.

“Symptoms associated with lung involvement can be very disturbing to patients. Severe air hunger or a sensation of suffocation can lead to escalating feelings of fear, anxiety, and panic. Relief of symptoms can make a great deal of difference in the quality of life,” write Dr Liz Gwyther and colleagues in the *Clinical Guide to Supportive and Palliative Care for HIV/AIDS in Sub-Saharan Africa*. The guide makes the following recommendations to relieve the child's sensation of shortness of breath:

- Positioning for comfort (extra pillows to raise the chest)
- Assistance with walking
- Humidified air (create steam by heating a pan of water)
- Fanning the face
- Fresh air
- For cough, suggest soothing remedies such as honey and lemon, plain or with eucalyptus leaves or neem tree oil, and to loosen sputum, suggest plenty of water and other liquids.

The child should be given appropriate analgesics to manage fever, and opioids might be considered for those who are very distressed, or to alleviate the sensation of shortness of breath. The *Pocket Book* recommends using a rapid-acting bronchodilator for the child who is wheezing, and making sure that any thick secretions in the throat are removed by gentle suction. Effective antibiotic treatment and oxygen therapy (below) are, of course, also palliative measures.

Presumptive treatment

It is not possible to distinguish between the different causes of pneumonia with any degree of certainty on the basis of clinical presentation alone. Since time is of the essence, prompt empiric treatment must be given, which is why it is so important that research be conducted to determine which infections are causing pneumonia locally, so as to refine treatment strategies over the long run.

As noted earlier in the article, treatment recommendations are in a state of flux. What follows comes from the most recent edition of the *Pocket Book*.

Empiric Treatment Recommendations

(adapted from the *Pocket Book* — please see for complete details)⁵⁶

Very severe pneumonia:

Ampicillin (50 mg/kg IM every 6 hours) and gentamicin (7.5 mg/kg IM once a day) for 5 days. If there's a good response, treat in hospital or as an outpatient with oral amoxicillin (15 mg/kg three times a day) plus IM gentamicin once daily for a further 5 days. Or use chloramphenicol (25 mg/kg IM or IV every 8 hours) until improvement, then continue orally 4 times a day for a total course of 10 days. Or use ceftriaxone (80 mg/kg IM or IV once daily). If no improvement in 48 hours, treat as for staphylococcal pneumonia: switch to gentamicin (7.5 mg/kg IM once a day) and cloxacillin (50 mg/kg IM or IV every 6 hours), for. When the child improves, continue cloxacillin (or dicloxacillin) orally 4 times a day for a total course of 3 weeks.

Give oxygen to all children with very severe pneumonia (see more below)

Children should be frequently monitored for signs of improvement (by nurses at least every 3 hours and twice daily by doctors). (See further diagnostic investigations if there are complications).

HIV confirmed or suspected

: Treat as above, but if no improvement within 48 hours, switch to ceftriaxone (80 mg/kg IV once daily over 30 minutes) if available. If it is not available, use the gentamicin/cloxacillin regimen described above.

In addition, from start of treatment, give high-dose cotrimoxazole (8 mg/kg of trimethoprim and 40 mg/kg of sulfamethoxazole IV every 8 hours or orally 3 times a day) for 3 weeks. (During his talk in Cape Town, Dr Jeena pointed out that the amount of fluid that intravenous cotrimoxazole is given in has a significant effect on outcomes: "You actually require large volumes of fluid and if you don't include it in your total fluid volume, you end up with pulmonary oedema." Most countries in the region do not have intravenous cotrimoxazole and use oral suspension or portions of tablets.

Severe pneumonia:

benzylpenicillin alone (50,000 units/kg IM or IV every 6 hours) for at least 3 days. Once the child oral amoxicillin (25 mg/kg twice a day for two more days. If no improvement, treatment to be switched to chloramphenicol (25 mg/kg q8 hrs IM or IV) until improvement, after which point the drug should be continued orally for 10 days. If there was still no improvement, treat as very severe pneumonia. For severe pneumonia in HIV-infected or exposed children, treatment is the same as described above HIV in for very severe pneumonia. See attached document.

Non-severe pneumonia

: on an outpatient basis: cotrimoxazole (4 mg/kg trimethoprim/20 mg/kg sulfamethoxazole twice a day) for 5 days or amoxicillin (25

mg/kg twice a day) for 5 days if in an HIV setting. However, amoxicillin is preferred if the child is already on cotrimoxazole prophylaxis or lives in a setting where cotrimoxazole is commonly used (in other words, where bacteria may be less sensitive to the drug).

Treatment duration in children with HIV:

There are few data to indicate what the optimal duration of antibiotics should be in children with HIV. Also, should children who are known to be HIV-infected or exposed perhaps be offered broad spectrum antibiotics from the start (including treatment for staphylococcal pneumonia) rather than waiting for poor outcomes?

In the DPPS study, the odds ratio of a poor outcome in a child with HIV was 10.3. In this high HIV incidence study (65% of the participants), 42% below the age of 12 months failed standard therapy. In the APPIS study, at 14 days, 41% of the HIV infected infants with severe pneumonia failed treatment or had passed away.⁵⁷

Further diagnostic investigations

Diagnostic evaluations take the backseat in pneumonia case management (and will continue to do so until new real time diagnostic tests become available that are practical in resource limited settings).

"It's often difficult to pin-point the cause of pneumonia in an operational setting," Dr Doug Wilson, Head of Medicine at Edendale Hospital in KwaZulu Natal told HATIP. "Both sputum – which is hard to get out of kids anyway – and blood cultures have low yield – a nightmare if you're worried about drug resistance."

But there are situations where further diagnostic investigations could prove useful, such as in children who are not responding to treatment, to diagnose uncommon HIV-related causes of pneumonia, or PCP in settings where there is not such a high prevalence of HIV.

Although the treatment algorithm included recommends treatment for staphylococcal pneumonia if the standard regimen fails, suggestive investigations include chest x-rays (with pneumatocele or pneumothorax with effusions), Gram stained sputum smears (revealing numerous Gram-positive cocci), or heavy growth of *S. aureus* in cultured sputum or empyema fluid. The child may also have septic skin pustules.⁵⁸

As already noted, bacteraemia is common, so blood cultures may be useful. In practice, though, health workers rarely send for cultures of bacterial infections, which is part of the reason why there isn't a good sense for which infections are actually causing pneumonia.⁵⁹

If a pyogenic (pus-laden) effusion forms in the pleural cavity, it should be drained and then analysed for infectious organisms (for protein and glucose content, cell count and differential count, Gram and Ziehl-Neelsen staining, and bacterial and *Mycobacterium tuberculosis* culture).⁶⁰

The need to diagnose PCP in infant may sound questionable in a setting with a high prevalence of HIV. But having a high index of suspicion or a confirmed diagnosis could help guide choices regarding alternative treatment regimens and supportive care, such as corticosteroids.

The *Pocket Book* includes WHO guidelines for the diagnosis of PCP, which state that: "PCP should be presumptively diagnosed in any child who has severe or very severe pneumonia and bilateral interstitial infiltrates on chest X-ray. Consider the possibility of pneumocystis pneumonia in children, known or suspected to have

HIV, whose ordinary pneumonia does not respond to treatment. Pneumocystis pneumonia occurs most frequently in infants and is often associated with hypoxia. Fast breathing is the most common presenting sign, respiratory distress is out of proportion with chest findings; fever is often mild. Peak age is 4–6 months.”

Wijesingh and Graham reviewed the evidence base [for the guidance](#) in detail in *The Journal of Tropical Pediatrics* in 2007.⁶¹

Dr Jeena also presented some recent analysis from the DPPS (see table), stressing “these children don’t have chest signs - upon auscultation [listening with a stethoscope], there’s nothing to hear. Multivariate analysis basically showed the higher the HIV viral load, the greater the risk for PCP; they were all under 6 months, had clinical cyanosis; and again no chest signs.”

He added that they do not have much fever, although they show all the classical signs of respiratory distress, tend to be more hypoxaemic than children with bacterial infection, and often show signs of HIV/AIDS.

Significant findings in PCP cases (n=33) DPPS

Variable	Odds Ratio (95% Confidence Interval)	P value
No chest signs on auscultation	10.06 (4.64-21.7)	<0.001
Danger Signs	6.09 (1.5-53.7)	0.006
Under 6 months	All	<0.001
Clinically cyanosed	5.94 (2-17)	<0.001
Z score <3 sd weight age	0.233 (0.54-1)	<0.001

He said that chest x-rays are actually variable. “It depends on where you pick up the disease, whether you pick up the disease earlier on — and that’s when you get your interstitial patchy changes with hyperinflation [ground glass], or whether you pick the disease up later, when you’ve got AIDS where they’ve got a full spectrum of alveolar consolidation,” he said.

A good quality sputum specimen can be used to diagnose PCP, however, certain techniques such as lung aspiration and bronchoalveolar lavage may be too invasive and could exacerbate respiratory problems in infants.

CMV also presents challenges for diagnosis in most resource-limited settings. Clinical presentation is very similar to PCP, with radiological evidence of interstitial pneumonitis.

“CMV serology is not sensitive,” said Dr Jeena. “Often in our situation, we rely on the CMV DNA PCR to actually identify — and in a study we published, we showed a sensitivity of 90 to 100% and a positive predictive value for cytopathic disease of 80%.”

Cotrimoxazole resistance

Another matter is how to manage children failing standard PCP treatment.

“PCP has poor outcomes even in developed countries and even with appropriate therapy including ICU,” said Dr. Zar, with a mortality of 47% (PCP) vs 18% (non-PCP pneumonia).⁶²

Dr Jeena stressed: “Even in Great Ormond Street [a centre of excellence in the UK], once upon a time, they were doing poorly with PCP (with a 2 year survival of only 12.5%). [Now \[due to ART\] they don’t see](#) PCP, that’s the good news.”

The poor outcomes despite cotrimoxazole raise several issues. For instance, how much is due to the emergence of resistant *P. jirovecii* strains? A study by Dr Zar and colleagues found resistance in 13% of strains in South Africa,⁶³ though she noted that many have questioned the impact of resistant strains on outcomes. “Poor outcomes are more likely to be due to coinfections than to resistance,” Dr Zar told HATIP.

However Dr Jeena cited several studies where the presence of a mutation conferring resistance to cotrimoxazole was associated with poorer outcomes.^{64, 65, 66}

“Now in many parts of Africa you won’t be able to diagnose resistance,” he said. “So the current recommendation is that we probably should be looking at some clinical marker: if by [seven days](#) a child does not respond to cotrimoxazole, we should be thinking maybe this is resistance and then considering a change of therapy. There aren’t any studies to actually prove this yet but we really need to do some work around this thing because there’s no doubt — even with appropriate therapy for PCP — these children still don’t do very well.”

He listed a number of possible alternatives including clindamycin and primaquine (the most effective) or trimethoprim with dapsone.

Corticosteroids

However, the fact that the highest mortality in children with PCP is during the first few days on therapy, suggests that some other mechanism may be to blame for many of the failures. Specifically, failing to manage the inflammation associated with the condition.

But there are mixed opinions about the use of corticosteroids which may reduce inflammation, but at the same time increase susceptibility to many common pathogens.

Corticosteroids have long been given to people with PCP and are associated with a reduction in mortality (in patients with A/a gradient > 35 mmHg or room air PaO₂<70 mmHg); and a recent Cochrane Review concluded that even though the number and size of trials was small, the evidence suggested a beneficial effect in patients who were hypoxaemic.⁶⁷

Dr Jeena points out that most of those data come from industrialised countries however. “The developing countries are very different from the developed countries in that the microbiological load of opportunistic infections is much higher in developing countries. We need to have a guarded approach in this regard. If you’ve got a very high degree of suspicion, or you’ve got criteria which indicate that you require this type of therapy, only then should we be using corticosteroids otherwise you may put your patient at risk.”

At the same time, clinicians must decide quickly. “In adult data, corticosteroids were only effective if used in the first 48 hours,” said Dr Zar. “So if there is a high suspicion of PCP and moderate or severe illness, corticosteroids should be used early.”

Prevention: strengthening MNCH services the best policy?

“Children are dying of diseases that are preventable and treatable with tools that are simple i.e. IMCI; prevention of HIV infection of young women; prevention of transmission of HIV from mother-to-child; and cotrimoxazole prophylaxis.” Saving Children: 2005⁶⁸

Ultimately, the best way to reduce HIV’s impact on pneumonia is to control it through preventive interventions starting as far upstream as possible, by scaling up family-based prevention and provider-initiated testing and counselling in general and ANC HIV

testing and prevention counselling in particular. But other evidence-based preventive activities must be scaled up as well. General MNCH strengthening is essential: stakeholders, policy makers, funders and researchers should consider the possibility that, with these preventive interventions in place, providing the best care possible for all children may lead to the best possible outcomes in children with HIV and pneumonia.

Antenatal HIV testing, and HIV prevention or treatment for the mother

Having a child die of HIV-related pneumonia is the last way that one should have to find out about one's own HIV status. Provider-initiated testing and counselling and other HIV testing outreach services must be universally available to reach all pregnant women.

Women should receive targeted care and support with ART, when indicated for their own health, if positive, and if HIV-negative, targeting counselling services to prevent HIV transmission to women during the ante and post natal periods (when women are at an especially high risk for HIV acquisition). For instance, data from last year's International AIDS Society Meeting in Sydney showed an 8% incidence of recent seroconversion (within the previous six months) among pregnant women attending clinics in Botswana.⁶⁹ Follow-up testing of mothers at vaccination visits in South Africa also suggest this.⁷⁰ Engaging her male partner(s) in testing and counselling may be important for the success of prevention efforts.

PMTCT

HIV-positive women should receive the best available regimen to prevent mother to child transmission, preferably ART, and preferably for as long as the mother breastfeeds. The continuing low uptake of PMTCT simply isn't acceptable and ultimately impacts on the quality of care that every child receives.

Accurate child health cards

Documentation of maternal HIV status (with indicators such as HIV-positive, last test date negative, refused test) or the child's HIV status on the caregiver-held child health cards may be essential for the well being of *all* children in HIV-endemic settings. If included in the initial assessment, having a child health card available documenting current HIV exposure status (treating untested as HIV-exposed) could allow the implementation of more aggressive community case management of pneumonia to be attempted in high HIV burden settings. However, in order to not disclose a child or mother's HIV status, community care workers would have to be trained to respect HIV confidentiality.

Another alternative would be training HIV community care workers/home based care teams in the implementation of the spectrum of community-based MNCH interventions (malaria, TB screening, etc) to offer families with HIV an alternate entry point to care.

Universal access to cotrimoxazole prophylaxis

WHO and UNICEF recommend cotrimoxazole prophylaxis for all HIV-positive children, as well as for infants born to HIV-infected mothers, in order to prevent pneumonia (and other infections) and UNICEF has made it a target to provide cotrimoxazole (and/or antiretroviral treatment) by 2010 to 80 per cent of children in need. And yet, in the most recent update on the campaign, *Children and AIDS Second Stocktaking Report*, which came out last month, only a small number of countries are reporting on rolling out cotrimoxazole.⁷¹

"Out of an estimated 4 million children in need of cotrimoxazole prophylaxis (HIV-exposed and HIV-infected), only 4% are currently receiving this intervention," wrote Zachariah et al in a review of the major barriers preventing the scale-up of cotrimoxazole prophylaxis.⁷² Of course, one of the chief reasons for this is the lack of coverage of PMTCT programmes and their appalling lack of follow-up.

Among the numerous specific actions proposed to tackle these challenges, the authors suggest that cotrimoxazole be made as an essential component of routine maternal and child-health services at all levels of the health system. One option, "the universal option" is cotrimoxazole prophylaxis for all infants and children born to mothers confirmed or *suspected* of living with HIV. This strategy may only be considered in settings with a high prevalence of HIV, high infant mortality caused by infectious diseases, or limited health infrastructure.

If *suspected* includes a mother who has refused the offer of HIV testing, this option may indeed be universal enough.

Given that there is usually good participation in at least the first vaccination visit around 6 weeks, MNCH programmes in high HIV burden countries could offer mothers another chance to test (including those who were negative at or prior to delivery), and provide cotrimoxazole for the child to all of those without an HIV-negative test result. The timing is crucial, because although cotrimoxazole reduces the risk of malaria and a variety of bacterial infection in children, and the risk of PCP in infants, the peak incidence of PCP is between 2 and 6 months, so the window of opportunity is narrow.

Universal access to ART for HIV-positive children

Ultimately the burden of pneumonia in infants with HIV could be relieved by treating all children with antiretrovirals, but this will require a scale-up of infant HIV testing. Infant HIV testing was discussed in detail [in edition 100 of HATIP](#).

A table presented by Dr Zar illustrates how ART can dramatically reduce the incidence of respiratory infections in children (although it doesn't account for other changes in care such as prophylaxis and the conjugate pneumococcal vaccine).

Incidence of respiratory infections in children on HAART vs. pre-HAART

OI category	Post-HAART ⁷³		Pre-HAART ⁷⁴	
	IR per 100 Child yrs	95%CI	IR per 100 Child yrs	95%CI
Bacterial pneumonia	2.2	1.8-2.6	11.1	10.3-12.0
Bacteraemia	0.4	0.2-0.5	3.3	2.9-3.8
Dissem. Myco av./ MOTT	0.1	0.1-0.3	1.8	1.5-2.1
PCP	0.1	0.04-0.2	1.3	1.1-1.6

Universal access to immunisation

"Vaccines against the two leading bacterial causes of child pneumonia deaths, *Haemophilus influenzae* type b (Hib) and *Streptococcus pneumoniae* (pneumococcus), can further improve child survival by preventing about 1,075,000 child deaths per year,"

Madhi et al wrote in a review of the vaccines in the recent WHO Bulletin.⁷⁵

Although the vaccines are less effective in children with HIV not on ART (65% and 54%, respectively), compared with children without HIV (83% and 90%, respectively), “because of a 20–40 times increased risk of illness from these bacteria, HIV-infected children still derive a significant protective effect and the absolute burden of invasive disease and pneumonia prevented by the vaccines exceeds that of HIV non-infected children”

Newer conjugate vaccines may offer even broader protection — though they will be more expensive.

HIV funding partners might want to consider helping out, because making certain that all children are vaccinated is in the best interest of children (and adults) with HIV since the reduction in infectious bacterial illness could improve herd immunity, as discussed previously.

Addressing other risk factors of pneumonia

A number of other factors also increase the risk of pneumonia in children.

“Environmental factors, such as living in crowded homes and exposure to parental smoking or indoor air pollution, may also have a role to play in increasing children’s susceptibility to pneumonia and its severe consequences,” according to the *Pneumonia, Forgotten Killer of Children* report. In fact, a recent randomised controlled trial in Guatemala reported that decreasing indoor air pollution by installing stoves with a chimney achieved a marked reduction in cases of severe pneumonia.⁷⁶

Lack of exclusive breastfeeding and poor nutrition are risk factors for pneumonia, and there is evidence that providing zinc in settings where zinc deficiency is common may reduce the risk of pneumonia.⁷⁷

Handwashing and hygiene in the home may be particularly important where people are living with HIV.⁷⁸

Infection control continues to be neglected in healthcare facility settings, leading to the spread of pneumonia and potentially polymicrobial mixes in hospitalised children with HIV. (An upcoming HATIP will investigate how hospitals in resource-limited settings are unsafe.)

Advocating for MNCH strengthening

In high burden settings, HIV impacts on all children with pneumonia. HIV programmes and donor partners have to step up to the plate, advocate and work to strengthen MNCH services, to make certain that effective broad-spectrum community based support mechanisms are in place to respond quickly to the various causes of child illness, and that there is improved surveillance of the causes of pneumonia/drug susceptibility.

For instance, children with severe pneumonia should not be turned away from a district hospital because it is poorly equipped. And in many settings, few facilities have adequate supplies of oxygen or pulse oximeters — a device that should help healthcare workers recognise hypoxaemia, improve survival and make oxygen delivery more efficient. According to the GAPP report, WHO has been promoting the availability of oxygen and pulse oximeters to smaller hospitals in developing countries.

In the recent WHO Bulletin, Enarson et al report on The Child Lung Health Programme (CLHP), an initiative scaling up oxygen delivery throughout paediatric wards in Malawi. The Government of Malawi, the International Union Against Tuberculosis and Lung

Disease and the Bill and Melinda Gates Foundation deserve credit for demonstrating that this is feasible in a low income setting.

There should be closer collaboration between HIV/PMTCT programmes and MNCH programmes to identify common needs. For instance, in South Africa at least, there is no such thing as post-natal care between the birth and vaccination visit.

Perhaps HIV-related community-based mechanisms for follow-up visits and maternal support (groups like Mothers2Mothers) or home-based care groups could be utilised and expanded to bridge this gap by making a least one follow-up visit at 3 or 4 weeks after birth for families.

Services could be offered such as home-based family rapid HIV testing, infant feeding counselling and support, cotrimoxazole if appropriate, scheduling vaccination visits, counselling about a safe home environment (indoor pollution, hand washing, basic hygiene), as well as reinforcing messages about what illnesses should prompt caregivers to seek out trained healthcare personnel and other essential MNCH services. It’s a tall order perhaps, but it could be a part of what HIV programmes should contribute to, and a way to become better integrated with, improved MNCH services.

Advocates of children with HIV need to be advocates for MNCH services, because without a continuum of care, many children with HIV and pneumonia won’t have much of a chance.

Resource list

Childhood pneumonia resources

- The Special Bulletin of the WHO on childhood pneumonia, index and links to download at:
<http://www.who.int/bulletin/volumes/86/5/en/index.html>.
- The Global action plan for the prevention and control of pneumonia (GAPP), see
http://whqlibdoc.who.int/publications/2008/9789241596336_eng.pdf
- IMCI has a number of useful materials and tools available online, see
http://www.who.int/child_adolescent_health/documents/imci/en/index.html
- *The Pocket book of hospital care for children: guidelines for the management of common illnesses with limited resources* can be download at
<http://whqlibdoc.who.int/publications/2005/9241546700.pdf>.
- Guidelines on co-trimoxazole prophylaxis for HIV-related infections among children, adolescents and adults
<http://www.who.int/hiv/pub/guidelines/ctx/en/index.html>
- *Pneumonia: the Forgotten Killer of Children:*
http://www.unicef.org/publications/index_35626.html

The Child Healthcare Problem Identification Programme in South Africa published the following reports:

- *Saving Children* http://www.childpip.org.za/saving_children.html
- *Every Death Counts: Saving the lives of mothers, babies and children in South Africa*. This new report suggests that child mortality in South Africa could be cut in half with full coverage of basic packages already existing in the South African healthcare system addressing 5 major challenges: pregnancy and childbirth complications, newborn illness, childhood illness, HIV & AIDS and malnutrition. Download here at
http://www.childpip.org.za/everydeathcounts/documents/EDC_report_final.pdf

Palliative care resources

- The AIDSmap Palliative Care Portal:
<http://www.aidsmap.com/cms1038390.aspx>
- The African Palliative Care Association: <http://www.apca.co.ug/>
- The Hospice Palliative Care Association South Africa:
<http://www.hospicepalliativecaresa.co.za/>
- The International Association for Hospice and Palliative Care:
<http://www.hospicecare.com>
- The International Children's Palliative Care Network:
<http://www.icpcn.org.uk/> (in particular, see their international directory)
- The Association for the Physically Disabled (APD) helps South Africans with physical disabilities: <http://www.apd.org.za/>
- The Child Rights Information Network:
<http://www.crin.org/index.asp>
- Foundation for Hospices in Sub-Saharan Africa (FHSSA):
www.fhssa.org
- The International Federation of Red Cross and Red Crescent Societies: <http://www.ifrc.org>
- The Elizabeth Glaser Pediatric AIDS Foundation:
<http://www.pedaids.org>
- The WHO pain ladder:
<http://www.who.int/cancer/palliative/painladder/en>
- A Clinical Guide to Supportive and Palliative Care for HIV/AIDS in Sub-Saharan Africa addresses the many aspects of palliative care that are key in caring for the person living with HIV/AIDS from an African perspective: to read online:
<http://www.fhssa.org/i4a/pages/Index.cfm?pageID=3361>

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A regular electronic newsletter for health care workers and community-based organisations on HIV treatment in resource-limited settings.

The newsletter is edited by Theo Smart (Cape Town) and Keith Alcorn, NAM's Senior Editor (London).

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