
*Is IMCI an effective mechanism for delivery of
child survival interventions in a high HIV
prevalence setting?*

*A study to determine the effectiveness of the Integrated
Management of Childhood Illness (IMCI) strategy in management of
sick children in routine practise in primary health care clinics in
South Africa*

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Declaration

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Publications emanating from this work

1. Horwood C, Vermaak K, Butler LM, Rollins N, Haskins L, Nkosi P, Qazi S (2011). Presenting complaints of children under 5 years attending primary health care clinics in a high HIV prevalence setting in South Africa. *Trop Med Int Health*. **16** (1): 42-52. **Page 62**
2. Horwood C, Voce A, Vermaak K, Rollins N, Qazi S (2009). Experiences of training and implementation of integrated management of childhood illness (IMCI) in South Africa: a qualitative evaluation of the IMCI case management training course. *BMC Pediatr*. **9**(1): 62. **Page 73**
3. Horwood C, Voce A, Vermaak K, Rollins N, Qazi S (2009). Routine checks for HIV in children attending primary health care facilities in South Africa: Attitudes of nurses and child caregivers. *Soc Sci Med*. **70**: 313-320. **Page 82**
4. Horwood C, Vermaak K, Rollins N, Haskins L, Nkosi P, Qazi S (2009). An evaluation of the quality of IMCI assessments among IMCI trained health workers in South Africa. *PLoS One*. **4**(6):e5937 **Page 90**
5. Horwood C, Vermaak K, Rollins N, Haskins L, Nkosi P, Qazi S (2009). Paediatric HIV management at primary care level: an evaluation of the integrated management of childhood illness (IMCI) guidelines for HIV. *BMC Pediatr*. **9**(1): 59. **Page 96**

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Acronyms

ANC	Antenatal clinic
AIDS	Acquired immune deficiency syndrome
ART	Antiretroviral Treatment
ARI	Acute respiratory infections programme
ARV	Antiretroviral
AZT	Zidovudine
CDD	Control of diarrhoeal diseases programme
CMR	Child mortality rate
EPI	Expanded programme for immunisation
DHIS	District health information system
DHS	Demographic health survey
DoH	Department of Health
FGD	Focus group discussion
HFS	Health facility survey
HIV	Human Immunodeficiency Virus
HW	Health worker
IGME	Inter-agency group for child mortality estimation
IMCI	Integrated Management of Childhood Illnesses
IMR	Infant mortality rate
KZN	KwaZulu-Natal
MCE	Multi-country evaluation (of IMCI)
MDG	Millennium Development Goal
MTCT	Mother to child transmission of HIV
NVP	Nevirapine
PCR	Polymerase chain reaction (virological test for HIV)
PHC	Primary health care
PMTCT	Prevention of Mother to Child Transmission
RTHC	Road to Health Card (patient held child health record)
SA	South Africa
WHO	World Health Organisation
UNICEF	United Nations Children's Fund
VCT	Voluntary counselling and testing

Ethics approval

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Abstract

Introduction: Integrated management of childhood illness (IMCI) is a child survival strategy that has been adopted in South Africa (SA) as the standard of care for managing sick children in the primary health care setting. IMCI includes guidelines for management of paediatric HIV. This study aimed to investigate effectiveness of IMCI as a vehicle to deliver essential child survival interventions, particularly HIV interventions, in routine practise in a high HIV prevalence setting, and to investigate barriers and enabling factors for IMCI implementation.

Methods: The study was conducted in Limpopo and KwaZulu-Natal provinces, SA. In the qualitative component, focus group discussions were conducted with IMCI trained health workers and carers of children under 5 years, to explore experiences of IMCI implementation, particularly the HIV component, from the perspective of both target groups.

A comparative survey was then conducted. Randomly selected IMCI trained nurses were observed for up to 20 consultations with sick children presenting consecutively to the facility, and their findings compared to those of an IMCI expert who subsequently assessed the child. Observed children were tested for HIV.

Results: IMCI trained nurses found IMCI training informative and empowering, and there was agreement among nurses that their skills in managing sick children improved after training. Barriers to IMCI implementation included increased time required for IMCI consultations and lack of support from colleagues. IMCI trained nurses expressed reluctance to implement the HIV component of IMCI, believing it to be unnecessary, unacceptable to mothers and that they lacked the skills to implement HIV care.

In total, 77 IMCI trained nurses were observed for a total of 1357 consultations between May 2006 and January 2007; nurses were observed for a mean of 17.7 consultations. Components of the IMCI assessment were frequently omitted; 14/77(18%) nurses asked about all main symptoms in every child. IMCI classifications were often incorrect; 52/112 (46.4%) children with a general danger sign were correctly classified. The HIV component was poorly implemented, 342/1357 (25.2%) children were correctly classified for HIV, although the HIV algorithm performed well when implemented by IMCI experts.

Conclusion: IMCI implementation is fragmented and incomplete. Interventions are urgently needed to achieve and maintain high quality health worker performance in implementing IMCI.

Outline of Submission

Chapter One: Introduction and literature review

An introduction and overview of the background to the research and the context in which it was developed. To locate the study and the papers presented here in relation to the relevant literature, the review includes literature from the time when this study was conducted to provide the context for the research, as well as current literature to show the relevance of this work today.

Chapter Two: IMCI in South Africa

A description of IMCI implementation in South Africa; this includes the development of the HIV component of IMCI, which comprises a clinical algorithm for identifying symptomatic HIV infection in children and accompanying HIV management guidelines. The initial evaluation of the HIV algorithm, undertaken by myself as the principal investigator in 2001, is described. This evaluation ultimately led to the work presented in this thesis. Also described is the evolution of the HIV/IMCI component, the adoption of the HIV component by WHO, and its implementation in most high HIV prevalence countries in sub-Saharan Africa.

Chapter Three: Rationale for the research

An explanation of the rationale for undertaking the South African IMCI Effectiveness study, and a statement of the research questions and reasons for the choice of methodology. A conceptual framework is presented that links together the five publications emanating from this work to form an integrated body of research to evaluate the effectiveness of the IMCI strategy as a mechanism to provide child survival interventions in a high HIV prevalence setting in South Africa.

Chapter Four: Research Design

The research methods, study sites and research participants for the South African IMCI Effectiveness Study are described, as well as the methods of data analysis and ethical considerations relating to this research.

Chapter Five: Research papers

Five first author publications in peer reviewed journals are presented, based on the findings of the SA IMCI Effectiveness Study. Each publication is relevant to the research question, and adds to the knowledge in the field in order for IMCI practitioners and health planners to improve IMCI implementation in South Africa and other high HIV prevalence settings.

Chapter 6: Discussion

The main findings are discussed and the overall conclusion of the work is summarised.

Chapter 7: Conclusions and recommendations

Final conclusions and recommendations for improving IMCI implementation are presented.

References

Appendices

Prior Publication:

- Appendix 1 Horwood C, *et al.* Diagnosis of paediatric HIV infection in a primary health care setting with a clinical algorithm. Bulletin of the World Health Organization 2003. **81**(12): 858-866

Focus Group Discussions:

- Appendix 2 Focus group discussion guide for IMCI trained nurses
Appendix 3 Focus group discussion guide for child carers
Appendix 4 Informed consent for focus group discussion: health workers
Appendix 5 Informed consent for focus group discussion: child carers

Comparative survey:

- Appendix 6 Informed consent form (comparative survey)
Appendix 7 Form 1: Health worker information form
Appendix 8 Form 2: Health worker observation form
Appendix 9 Form 3: IMCI expert practitioner recording form
Appendix 10 Form 4: Clinical signs for WHO staging form
Appendix 11 Form 5: Facility review form

Chapter One: Introduction and literature review

1.1 Introduction

The South African HIV/IMCI Effectiveness Study presented in this thesis aimed to evaluate the effectiveness of IMCI in routine practise in a high HIV prevalence setting in South Africa. The study investigated implementation of IMCI and explored barriers to and enabling factors for implementation, from the perspective of IMCI trained health workers and child carers, with a particular focus on the HIV component. No previous evaluation of IMCI has included an assessment of the HIV component; neither has there previously been a large-scale IMCI evaluation in a high HIV prevalence setting.

In the following literature review, literature is presented from the period prior to 2006, when this research project was developed and planned, to describe the context in which the research was undertaken. Current literature is also presented, where relevant, to bring readers up-to-date, show the current relevance of the work, and contextualise the research papers presented. This literature review provides the evidence base that informed the conceptualisation of the study including:

- The burden of child mortality, globally and in South Africa
- Underlying determinants and direct causes of child mortality
- The impact of HIV on child mortality in high HIV prevalence settings
- Development of child survival interventions, including IMCI
- The evidence base supporting IMCI.

1.2 Child mortality

Child mortality declined rapidly during the 20th century in almost all countries, due to effective public health interventions and better economic and social performance worldwide. However, the rate of decline has slowed, with reductions peaking in about 1980. Although this might be expected in countries with low child mortality rates, the decline also occurred in high mortality regions and in some cases, previous gains have been reversed (1). Huge disparities remain in child mortality between rich and poor countries, with 99% of deaths occurring in low-income countries, and these gaps are widening (2). There was a 71% reduction in child mortality from 1970- 2000 in developed countries compared to only a 40% reduction in low-income countries (3). Sub-Saharan Africa had the highest child mortality rate from 1970-74, and since then has had the slowest rate of decline (4).

As a component of the United Nations (UN) Millennium Declaration in 2000 (5), a commitment was made by 189 participating nations to reduce child mortality by two-thirds between 1990 and 2015; this is **Millennium Development Goal 4** (MDG4). Globally, over the past decade there has been considerable progress towards achieving this goal, with the total child mortality rate (CMR) declining from 89 per 1000 live births in 1990, to 60 per 1000 in 2009. However, this rate of decline is still insufficient to achieve MDG 4 by 2015 (6), and infant and child mortality remain high in developing countries where over eight million child deaths occur annually. As the total number of global child deaths has declined from over 12million in 1990 to 8.1 million in 2009, there has been a further concentration in under-5 mortality, with 70% of all under-5 deaths in 2009 occurring in just 15 countries (6). While child mortality has improved in other regions, the proportion of all child deaths which occur in sub-Saharan Africa has increased, so that almost half of all global child deaths now occur in this region (6). Almost all countries (30/31) with a child mortality greater than 100 per 1000 live births are in now sub-Saharan Africa. Child mortality in the African region was 129 per 1000 live births in 2009, nearly double the level in other developing regions, and around 20 times the average for developed regions (7).

Most children die in the first year of life, and most child deaths occur in a small number of low-income countries (8). Most children continue to die from common, preventable and easily treatable childhood diseases, such as diarrhoea and pneumonia, often associated with co-existing malnutrition. Long established treatments for these conditions still reach less than half of children who need them (9). In recent years, HIV/AIDS has contributed to a high proportion of deaths in high HIV prevalence countries, particularly in sub-Saharan Africa, where there has been a reversal of trends of improvement in child mortality in several countries (10), including South Africa (11).

1.2.1 Measuring child mortality

The child mortality rate (CMR), defined as the probability of dying between birth and the age of 59 months, is expressed per 1000 live births, and is a fundamental indicator of child health. The infant mortality rate (IMR) is defined as the probability of a live born infant dying between birth and one year of age, per 1000 live births. Child mortality is a composite measure of health risks at a young age, and the most appropriate indicator for evaluating outcomes of interventions aimed at improving child survival (1).

Data obtained from complete registration of births and deaths provides the best basis for measurements of CMR, but this is not available in many countries that lack reliable and comprehensive vital registration systems. In such cases, estimates of CMR are based on periodic cross-sectional surveys, like demographic health surveys. This makes it difficult to assess trends over time, depending on the number of sources and the differences in methods of estimation. These techniques may also be biased towards capturing mortality in most recent times (1). Compared to other regions, the quality of survey data and vital registration is frequently poor in the sub-Saharan African region. Consequently, estimates for many countries depend on statistical modelling or verbal autopsy methods, and include substantial uncertainty (12). However, estimates and trends in child mortality are not usually presented with uncertainty bounds, which may give the impression that all estimates are equally precise (13). Measuring child mortality accurately is particularly difficult where there is an association between the death of the child and the mother, since a mother who has died cannot be included in a survey. This may lead to an underestimation of child mortality in areas where a significant proportion of maternal deaths are due to HIV/AIDS, making it difficult to assess the impact of HIV on child mortality (1, 6). The United Nations inter-agency group for child mortality estimation (IGME) was formed in 2004 to compile all available national level data on child deaths and provide consistent estimates of child mortality for countries, including high HIV prevalence countries, so that progress towards the 2015 deadline for achieving MDG 4 can be accurately charted (6).

1.2.2 Social determinants of child mortality

It is important to highlight the socioeconomic conditions in which most child deaths occur. These are often referred to as the 'distal' determinants of child mortality, in contrast to 'proximal' causes of child deaths, like diarrhoea or pneumonia, and are of critical importance if sustainable and equitable solutions are to be found. Children are particularly vulnerable to socioeconomic inequities because they are growing and developing, and are dependent on others to ensure their health. Child mortality shows a clear social gradient, but without any biological reason for this (14), and is,

therefore, an example of inequity, meaning an inequality that is unnecessary and avoidable and, therefore, unfair and unjust.

The social circumstances into which a baby is born dramatically affect his or her expectations. Growing up in poverty has long-term effects on cognitive development, mediated, at least partly, by childhood nutrition, and leading ultimately to a negative impact on adult outcomes like height attainment, school achievement, income, and offspring birth weight (2). The highest level of education achieved by the mother is an important determinant of the health of the child, even when other socioeconomic factors are kept constant (2). For example, in El Salvador, infant mortality among babies born to mothers with no education is at least four times that among infants of mothers with a secondary education (14). Birth spacing and provision of family planning services are important to prevent preterm births, low birth weight babies and neonatal deaths; birth spacing of less than 24 months significantly increases the risk of these events (15). Child spacing and improving educational opportunities for women and girls can improve child survival.

Therefore, risk factors for child mortality include poverty, gender inequality, social status and education. Poorer children are more likely to live in overcrowded conditions, with poor sanitation and unsafe water, and be exposed to disease. Such unhygienic and unsafe environments put children at risk. Drinking unsafe water, having inadequate water for hygiene, and lack of sanitation, are estimated to contribute annually to 1.5million child deaths globally, and to around 88% of deaths from diarrhoea (4). Under-nutrition is common where there is poverty, and reduces resistance to disease (6). Poorer children are less likely to be immunised (2) or to have access to good quality health services, and their parents are less likely to seek care from an appropriate provider (3). Antenatal care and skilled care at delivery are critical for prevention of neonatal deaths, but even where coverage of antenatal care (ANC) is high, poorer mothers have fewer visits, attend later in pregnancy and receive poorer quality of care (2).

In South Africa, inequality and poverty continue to be the legacy of the previous apartheid regime, and this has led to marked differences in child mortality between different socioeconomic groups, between regions of the country, and between racial groups. Poverty and poor socioeconomic conditions may be seen as the underlying cause of many of these child deaths. Water and sanitation facilities vary widely between provinces and within provinces in SA. Nationally, 14 % of households do not have toilet facilities, but in the Eastern Cape province, where much of the population is rural, this is as high as 30%, and 64% of households are without piped water (16). Child mortality is twice as high in the rural Eastern Cape as in the urban Western Cape, and four times higher for black than for white children (17). However, racial disparities in mortality have narrowed in the past 3 decades, due in part to improved education of women and increased family spacing

(11). Although increases in child mortality in the 1990s can be plausibly accounted for by HIV/AIDS, it is important that efforts to improve the health status of South African children also address issues of improving education of women, providing clean water and sanitation, and ensuring safe environments for children, particularly in rural areas (11).

1.2.3 Direct causes of child mortality

In 2008, 68% of the 8.1 million global child deaths were caused by infectious diseases (12). It is estimated that over 60% of these deaths could be prevented by the use of proven interventions that are available and affordable today (8). In children under 5 years, the most important single causes of death are pneumonia, diarrhoea and preterm birth complications (12). As child mortality has fallen, the relative proportion of deaths in the neonatal period (0-28 days) has increased (4). Infants who are not breastfed, particularly below the age of six months, are at increased risk of death from diarrhoea and pneumonia compared to those being breastfed. Infants being mixed fed in this age group (i.e., receiving breast milk as well as other foods or fluids) are at higher risk of death than those being exclusively breastfed (4).

Although diarrhoea and pneumonia account for a high proportion of deaths in all countries with a high child mortality, epidemiological profiles show variations in the main causes of death from region to region, and within regions, particularly in Africa: deaths attributable to malaria and AIDS occur almost entirely in Africa (18). Of the 4.2 million deaths in the African region in 2008, 29% occurred in the neonatal period. Major causes of death were pneumonia, malaria, diarrhoea, as well as preterm birth complications and birth asphyxia (12). This highlights the need for accurate cause-of-death data at country level to prioritise services and delivery of interventions.

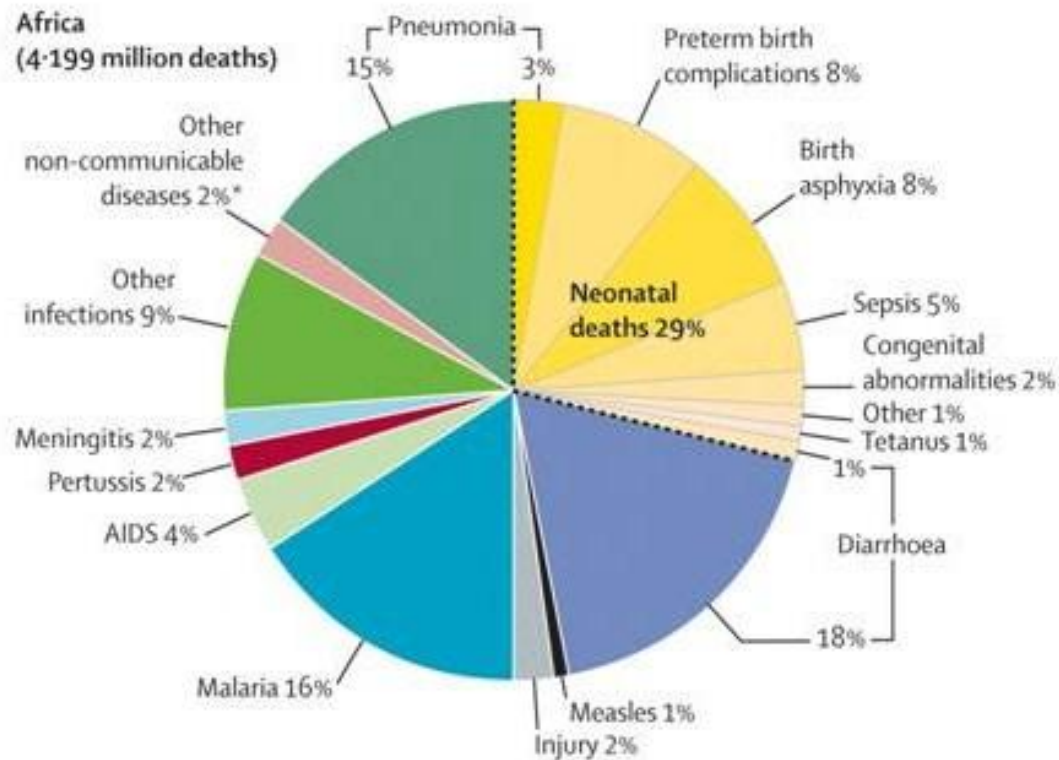


Figure 1: Causes of child deaths in Africa 2008

1.2.4 Impact of HIV on child deaths

In 2006, when this study was conducted, an estimated 2.3 million children were living with HIV/AIDS, 380 000 children aged < 5years died from AIDS related causes (92% in Africa), and 530 000 children were newly infected with HIV (19). However, HIV/AIDS was the cause of only a small proportion of global child deaths and only 4% of child deaths in the sub-Saharan African region. An estimated 51% of all AIDS deaths in children occurred in just five countries: South Africa, Nigeria, Mozambique, Tanzania and Uganda (12).

AIDS deaths are concentrated in a small number of countries, in several of these countries AIDS is the most important cause of child mortality, including South Africa (12). Most HIV infected infants acquire HIV from their mother, and without treatment around one-third of these children will die before the age of one year, and over half before the age of two years (20). Improvements in child survival in high HIV prevalence countries will not occur without effective strategies to improve coverage of PMTCT interventions, and increased access to ART for mothers and children.

Interventions to prevent mother-to-child transmission of HIV and appropriately manage children born to HIV infected women have been tested among breastfeeding and non-breastfeeding

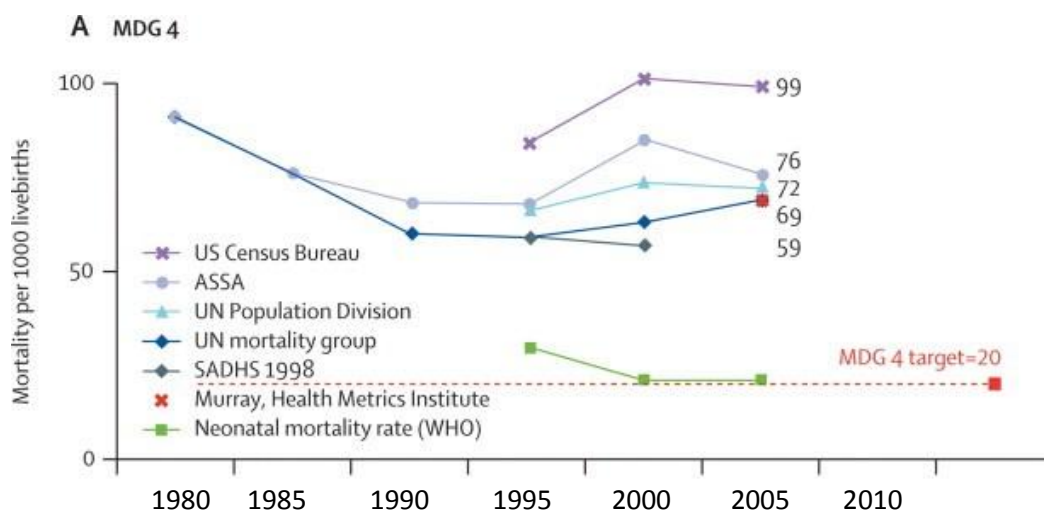
populations, in both low- and high-income settings (21-25). These interventions include antiretroviral prophylaxis during pregnancy, labour, and the post-partum period, as well as appropriate infant feeding practises. Co-trimoxazole prophylaxis is a simple, inexpensive and effective strategy which has been shown to decrease morbidity and mortality due to pneumocystis pneumonia (PCP) and other pathogens in HIV infected children, even without specific antiretroviral therapy (26). Mortality among HIV exposed infants is significantly associated with low maternal CD4 count and maternal death; the death of the mother increases the risk of death even among uninfected children (20).

In 2005, it was estimated that in low- and middle-income countries fewer than one in 10 HIV infected pregnant women received antiretroviral prophylaxis to prevent mother-to-child transmission, 4% of children needing co-trimoxazole prophylaxis received it, and only 10% of children requiring ART received it (19). By 2009, significant strides had been made in implementation of HIV interventions, with 53% of HIV infected pregnant women receiving ARV prophylaxis globally, and 28% of children in need receiving ART. This has led to optimism that targets for virtual elimination of paediatric HIV by 2015 may be achievable (27, 28).

1.2.5 Child mortality in South Africa

In South Africa, despite the introduction of a supportive policy framework, free health services for children, and child support grants, child mortality increased following the advent of democracy in 1994 (29). Although estimates of child mortality in South Africa vary due to inadequate vital statistics (30-32), it is estimated that nearly 100 000 children under five years die each year (29). IGME estimates child mortality in South Africa in 2009 was 62 per 1000 live births (6), but other sources give higher estimates (33) (figure 2). South Africa is one of only 12 countries where there have been increases in child mortality since the baseline for MDG4 in 1990 (11, 29), and it is unlikely that South Africa will achieve this goal (34). This is largely due to the impact of the HIV epidemic, both directly on HIV infected children and indirectly due to the effects on child health of maternal illness and death.

South Africa has one of the worst AIDS epidemics in the world, and HIV/AIDS is the single leading cause of death among both mothers and children under five years (33). In South Africa in 2006, there were an estimated 5.4 million people living with HIV (35), one million AIDS orphans (36), and 29.1% of pregnant women attending government antenatal clinics were HIV infected (37). Antenatal HIV sero-prevalence has remained stable since that time, but is consistently highest in KwaZulu-Natal



From: Chopra M, Lawn JE, Sanders D, Barron P, Karim SS, Bradshaw D, et al. Achieving the health Millennium Development Goals for South Africa: challenges and priorities. *Lancet*. 2009. Epub 2009/08/28.

Figure 2: Estimates of child mortality in South Africa 1980-2005

province (KZN), where HIV prevalence among pregnant women was 39.5% in 2009 (38). HIV/AIDS is the cause of over 50% of deaths in children under five years, and over 80% of child deaths outside the neonatal period (29). 18% of children needing antiretroviral treatment (ART) in South Africa had access to this in 2005 (19), increasing to 54% (approximately 96 000 children) in 2009 (27). However, childhood infections like diarrhoeal disease, lower respiratory tract infections and meningitis also remain important causes of mortality (16). It is estimated that over 60% of children who died were underweight for age and one third were severely malnourished. Over 75% of these severely malnourished children also had clinical AIDS (33). The 2003 Demographic and Health Survey (DHS) found that supplementation of breast milk with other food or fluids starts early in South Africa, and exclusive breastfeeding is uncommon, with only 12% of infants under four months of age being exclusively breastfed, and almost 40% using a bottle and teat (17).

Child survival interventions

The appropriate management of common childhood infections and malnutrition are among the most cost-effective interventions that will have the greatest impact on reducing the global burden of disease (39). In 2003, the Bellagio Child Survival Study Group estimated that six million deaths could be prevented by universal coverage of key child survival interventions in the 42 countries where most child deaths occurred. It was estimated that effective and integrated management of childhood illnesses could prevent 3.2million deaths, and that a group of effective nutritional interventions including breastfeeding, complementary feeding, vitamin A and zinc supplementation could save a further 2.4million children each year (8). The additional cost was estimated at US\$ 5.1 billion, amounting to \$1.23 per head and \$887 for each life saved (40).

The challenge that remains is how to achieve universal coverage of key child survival interventions. Implementation of child survival interventions takes place in the context of global inequalities, and may even lead to worsening inequity because interventions tend to go to richer people first. Even when equitably targeted, richer people tend to seek services first. Child mortality is a sensitive indicator of inequity in health and health care (41), and specific approaches must be taken to reach those children most at risk. This could include screening for, and preferentially targeting, poor people for interventions, or aiming for universal coverage of interventions to ensure that the poorest also benefit (3).

A series of initiatives have been developed by international agencies aimed at improving coverage of child survival interventions. For example, in 1974 the expanded programme for immunisation (EPI) was launched at a time when less than 5% of children in the world were immunised; as a result of EPI implementation, global coverage of diphtheria, tetanus and pertussis (DTP) vaccine now exceeds 75% (42). In the 1980's, the observation that a small number of conditions were responsible for the vast majority of under-five deaths led to a strategy of 'selective primary health care' and the development of the GOBI initiative, which promoted growth monitoring, oral rehydration therapy, breastfeeding and immunisation. Later FFF (food supplements, family spacing and female education) was added to GOBI to address additional determinants of child survival (GOBI-FFF). More recently, single-disease based programmes like Control of Diarrhoeal Disease (CDD) and Acute Respiratory Infection (ARI) were developed by WHO and the United Nations Children's Fund (UNICEF). These programmes successfully reduced mortality by improving case management at primary health care level of those conditions that cause most child deaths, using simple, evidence-based algorithms to guide health workers (43).

However, despite the success of single disease-specific interventions, by the early 1990s it was realised that signs and symptoms of major childhood diseases overlap substantially, and severely ill

children frequently have more than one co-existing condition. Concerns were raised that children could die if inappropriately managed with a disease specific protocol (44), and that opportunities were lost for increasing coverage of preventive interventions that are critical for reducing child deaths. In addition, health initiatives addressing child deaths in the context of specific diseases tended to result in fragmented delivery systems rather than co-ordinated efforts to meet the needs of children and their families (45). It was proposed that a more integrated approach was required; this would improve managerial efficiency, and avoid the duplication of effort in training, supervision and drug supply management caused by separate vertical approaches (46). As a result, the IMCI strategy was developed by WHO and UNICEF to provide a holistic approach to the management of the sick child (47).

Global child mortality has improved in the past decade. The rate of decline in child mortality from 2000 to 2009 was double that between 1990 and 1999 (7), and many low-income countries are on track to reach MDG 4, including some countries in Africa (48). A common feature of countries that have made the most substantial progress in reducing child mortality, has been a rapid increase in equitable coverage of simple, cost effective public health interventions (7). In order to accelerate declines in child mortality, an equity based approach is required, using local data to identify the most effective interventions, and the most vulnerable babies and children at whom they should be targeted.

1.3 Integrated Management of Childhood Illness

Integrated management of childhood illness (IMCI) was launched in 1995 (44). It aims to provide an integrated approach to child survival, including both preventive and treatment interventions, at primary care level and in the community. IMCI aims to reduce child mortality and morbidity, and improve growth and development, and is recommended for use in countries where infant mortality is greater than 40 per 1000 live births (49). Recommended interventions are based on strong evidence and are feasible to implement in low-income countries (8). At the core of the IMCI strategy are evidence-based guidelines for concurrent management of those conditions causing the most child deaths (pneumonia, diarrhoea, dysentery, malaria, measles and malnutrition). Many deaths in South African children could be prevented through implementation of good quality primary health care services, and IMCI is currently the standard of care for management of sick children at primary health care level in SA. Improving IMCI implementation has been suggested as one strategy most likely to reduce the burden of disease in South Africa (30), but the success of any child survival intervention in a high HIV prevalence setting is dependent on its ability to effectively improve coverage of PMTCT interventions, and ART for mothers and children.

The IMCI strategy comprises three components (50). The first component aims to improve **case management** skills of health workers working at primary care level, using evidence-based guidelines supported by structured training (44). However, improving health workers skills will not improve quality of care unless the health system provides the resources and infrastructure required. Health workers function as an integral part of the health system, and may not be able to implement the IMCI guidelines unless all required drugs and equipment are available at the health facility, the referral system functions effectively, and there is a system of supervision for IMCI trained health workers. The second component of IMCI is, therefore, a **health system component** to ensure that the health system is strengthened to support IMCI interventions. This is based on a review of health facility supports required for IMCI implementation and, therefore, contributes to improving supervision, drug supply management and health information systems (41).

The third component of IMCI is the **community component**, which aims to provide a complementary community-based approach to increase demand and acceptance of child health services, and improve family practises at household level, particularly in relation to care-seeking and home management of child illnesses (51). For facility-based child health interventions to be successful, health facilities and community-based health workers should deliver consistent messages.

Since the first countries began implementing IMCI in 1996, over 100 countries across all geographic regions have now adopted the strategy, including 44 in sub-Saharan Africa (52).

Guidelines for IMCI implementation recommend that the strategy be introduced in three stages. In the **introductory phase**, there is orientation and planning, and building of commitment, as well as adaptation of the IMCI materials according to local epidemiological and cultural characteristics. In the **early implementation phase** countries start implementing IMCI in a limited area to gain experience and develop management and training capacity. Lessons learned from this phase should be taken forward into the **expansion phase** (50).

1.4.1 IMCI case management

Rather than making a diagnosis, IMCI practitioners classify the child's illness according to severity using a series of colour-coded algorithms, and there is strong emphasis on nutrition, health promotion and counselling. IMCI guidelines are based on both expert opinion and research findings, and are built around a series of simple questions and easily recognised and well-defined signs and symptoms (49). In the absence of diagnostic support, health workers rely on the clinical history, and on signs and symptoms. The sensitivity and specificity of these clinical signs (53-55), and the ability of IMCI guidelines to assist health workers to identify and appropriately treat sick children were validated during development of the guidelines (54, 56, 57).

Interventions included in IMCI can be categorised into curative treatments, disease prevention and health promotion interventions. Treatment interventions include antibiotic treatment for acute respiratory infections, and oral rehydration therapy for diarrhoeal diseases. Preventive interventions include immunisations, regular vitamin A supplementation, and antiretroviral drugs to prevent mother-to-child transmission of HIV. Health promotion interventions include appropriate advice and support for breastfeeding, complementary feeding, and good hygiene practises. IMCI case management guidelines have been regularly updated to comply with new evidence and updates to related management guidelines.

Primary care workers are trained in the use of the IMCI guidelines during a structured 11-day in-service training course which is supported with training materials, including written materials, wall-charts, photographs and videos. The training course was first field-tested in 1997 and is regularly updated as appropriate (58). Participants undertake 11 days of training which combine work in the classroom with hands-on clinical practise, and are provided with job aids to assist with implementation (IMCI chart booklet). In addition, each participant should also receive at least one follow-up visit in their own health facility, after completion of training, to reinforce the skills acquired during training (59). Although most IMCI training is aimed at nurses and other mid-level health workers at PHC level, in many settings an abbreviated training course is used to provide training for doctors.

Detailed guidelines were developed by WHO to standardise and maintain the quality of IMCI training. These guidelines specify the work to be completed during training, the ratio of facilitators to participants (at least one to four), and the time spent on clinical practise. Facilitators who conduct IMCI training are selected based on their good performance in the 11-day case management training course, and receive an additional five days of facilitation training. Tools to monitor the quality of IMCI case management training courses are also provided (50), to ensure that training quality is maintained during the expansion phase. Although all new IMCI practitioners should receive a follow-up visit, it has been difficult to sustain implementation of follow-up visits in IMCI implementing countries, and they have often been abandoned in the expansion phase of IMCI (60).

To impact significantly on child health, at least 60% of health workers managing sick children in each facility should be IMCI trained (61), but in many countries training coverage has remained low (46). In addition, with expansion of IMCI implementation in countries, because of resource constraints and the high cost of training, many countries have revised and shortened the IMCI training, with less time spent on individual feedback and on clinical practise, and more work done away from the classroom. In most cases, these shortened IMCI courses have not been evaluated (62). There has also been no published evaluation of the 11-day IMCI case management training course since its inception in 1997.

1.4.2 IMCI Evaluation: Multi-country evaluation of IMCI

The Multi-country Evaluation of IMCI Effectiveness, Cost and Impact (IMCI-MCE), was a large-scale IMCI impact evaluation conducted in Bangladesh, Brazil, Peru, Tanzania, and Uganda between 2000 and 2007 (63). The objective was to assess the behavioural, nutritional and mortality impact of IMCI, as well as to document the effect of IMCI interventions on health worker performance (60). If shown to be effective, this model could be adapted, and applied to other public health interventions (61). An interagency group on IMCI monitoring was formed and, from the literature and experience of experts, this group developed a generic set of quality indicators. The IMCI-MCE consisted of a series of independent studies with compatible designs to allow direct comparisons, but tailored to the situation in each participating country. Methods included audits of facilities, observations of case management and household surveys, with data collected at different levels at each site, including household, community and health facility (64). The findings of the MCE will be reviewed in this literature review, although many of the findings were published only after the current study was underway.

Results of the MCE convincingly showed that, in all sites, children received better care from health workers trained in IMCI compared to those who were not IMCI trained. Children seen by IMCI trained health workers were more likely to receive a full assessment and more likely to be managed

correctly, and there was a strong and consistent association between IMCI implementation and improvements in counselling activities (65-67). Combining data from three MCE sites (Uganda, Brazil and Tanzania) demonstrated that, across these sites, children seen by health workers trained in IMCI were significantly more likely to receive correct prescriptions for antibiotics, and carers were more likely to be able to describe correctly how to give the antibiotic drug at home. There were also significant reductions in unnecessary use of antibiotics in all three countries (64). However, implementation of the community component of IMCI was shown to be weak in most settings (60).

Of the five sites where MCE studies were conducted, findings from Bangladesh and Tanzania, in particular, demonstrated good quality of care post IMCI implementation, with large improvements in the management of sick children compared to the control group. These studies were distinct from the other MCE studies because they were conducted in the early phase of IMCI implementation using structured and controlled methods, in a relatively small geographical area, where coverage of IMCI training and implementation was very high.

In **Bangladesh**, a cluster randomised trial was conducted in a single district over five years, with 10 first-level health facilities randomly allocated to each of the control and intervention arms. Over 90% of health workers were trained in IMCI in intervention sites and many complementary activities were undertaken in the intervention areas to support IMCI: village health workers were recruited and trained to manage sick children and provide health education messages, local imams were trained and supported to give health promotion at the mosque, and two theatre groups were supported to regularly undertake open air theatre shows in IMCI villages to convey key messages (68). The study showed impressive improvements in quality of care in IMCI areas compared to control areas: the proportion of children needing an antibiotic who were correctly treated was 78% in intervention clinics compared to 2.4% in control clinics. The Bangladesh study was the only MCE study able to demonstrate increased health service utilisation in intervention areas. There was a steady increase in appropriate care-seeking in intervention areas during the study period, compared to control areas, where care-seeking was unchanged. Community surveys also showed significant reductions in stunting, and significant improvements in infant feeding practises in intervention districts (67).

In **Tanzania** IMCI implementation was evaluated in only four districts (two intervention, two control), in a non-randomised controlled trial. High levels of quality were achieved: 73% of children who needed an antibiotic received it in intervention clinics versus 35% in control clinics (66). However, participating districts were not selected randomly, but on the basis, not only of having adopted IMCI, but also of having achieved exceptionally high coverage of IMCI training (69). Over 90% of health workers seeing sick children were IMCI trained in the intervention districts (70). In

contrast to Bangladesh, no difference was shown in care-seeking, stunting or feeding practises between IMCI and non-IMCI districts. In both Tanzania and Bangladesh, reductions in child mortality in IMCI areas were demonstrated, although in neither case were these reductions statistically significant (66, 67).

The other three IMCI-MCE studies, in **Uganda, Brazil and Peru**, were conducted during the expansion phase of IMCI implementation, over larger areas, and with less support from researchers. These studies were, therefore, closer to effectiveness rather than efficacy studies, and much smaller improvements were demonstrated. These studies showed that, despite significant improvements in quality of care indicators in IMCI areas, quality of care remained poor even for children seen by IMCI trained health workers. For example, in Brazil, where most children in the intervention group were seen by IMCI trained doctors, the proportion of children with pneumonia who were correctly treated was 58% (71). In Uganda this varied between 35-51% in IMCI areas over the three-year study period [60]. In Peru, only around 10-14% of children needing an antibiotic received one, even after IMCI training (65).

Another finding, with important policy implications, was the good performance in IMCI implementation among non-professional IMCI trained health workers that was shown in both Uganda and Bangladesh. In Bangladesh, village health workers (VHWs) were recruited in intervention areas as a response to the observation that, even after introduction of IMCI, appropriate care-seeking remained very low and very few sick children accessed appropriate treatment, making the impact of IMCI difficult to assess. The aim of recruiting and training VHWs was to improve access to IMCI treatments by providing community-based management of non-severe pneumonia and diarrhoea. The VHWs had no formal medical training, and were trained in IMCI for 10 days. In an independent assessment they were able to manage 64% of sick children correctly, similar to the performance of nurses trained in IMCI (65% correctly managed). Exposure to VHWs was very high (>90%) in intervention areas; so these workers were directly responsible for the impressive improvements in appropriate care-seeking, and also contributed to the improved outcomes demonstrated (67). In Uganda, IMCI trained auxiliary staff performed better in management of pneumonia than professional staff, although this was not consistent throughout the period of the study (65).

The **cost-effectiveness** component of the IMCI-MCE showed that IMCI was efficient and cost less than standard care in some settings (70). In Tanzania, IMCI implementation resulted in significant cost savings in implementation districts, although much of this was due to lower hospital usage in these districts, and it was not clear whether this was related directly to IMCI implementation. However, when hospital costs were excluded, savings were still made (72).

In Brazil, the cost per child correctly managed was lower in IMCI districts (71). Time and motion studies showed that, on average, IMCI trained health workers spent more time on a sick child consultation than non-IMCI trained health workers. This was inversely correlated with the number of consultations per day per health worker, so that consultation time decreased with increasing workload (73). Similarly, in Tanzania, time spent on consultations was higher in IMCI areas, and this did not appear to be because less time was spent on other consultations, but rather that less time was spent on administrative activities or on non-productive time (72). There was a trend towards improvement of quality of care with increasing training coverage (65).

1.4.2.1 Limitations of the IMCI-MCE

Selection of sites was a major source of bias in all IMCI-MCE studies, apart from in Bangladesh where intervention clinics were randomly selected. In Brazil and Tanzania, to ensure that MCE study sites were suitable for evaluating IMCI impact, intervention areas were selected according to explicitly stated criteria. These included timely IMCI implementation with adequate training coverage, as well as availability of partners to support IMCI, like funding agencies and the Ministry of Health (69). Similarly, in the Tanzania study, intervention districts were selected based on their success in implementing IMCI and achieving high coverage of IMCI training in facilities. Both intervention districts in Tanzania had achieved over 90% coverage of IMCI trained health workers prior to being selected. Control districts were selected on the basis that they had not even started IMCI implementation several years after IMCI was adopted nationally in Tanzania.

Early intervention sites have been shown to be those with the most functional health systems, close to main towns, and with motivated health managers (74). Therefore, sites that adopted IMCI early could be expected to perform better. Although demographic indices were similar at baseline in IMCI and control districts, it is likely that management of health care services in intervention and control districts were actually systematically different, and intervention districts self-selected themselves because they were well functioning. Similarly, in the Brazil study, all intervention districts were required to have continued and appropriate coverage of IMCI trained health workers managing sick children, over the previous two-year period, and were matched to control districts selected because IMCI was not being implemented.

A generic set of indices of quality of care, together with a facility-based tool for their measurement, was developed for the IMCI-MCE (75). These indicators were synthesized from indicators of adherence to IMCI guidelines. For example, checking for IMCI danger signs like ‘child vomits everything’, or for specific IMCI signs like ‘palmar pallor’, is not likely to be complied with in a non-IMCI setting. Similarly, it is unlikely that a non-IMCI trained practitioner will make a ‘correct classification’. This is an important bias towards showing improvements in quality of care in IMCI

areas, since the indicators selected almost ensure that IMCI trained health workers will perform the selected activities better. Even when the indicators used in the IMCI-MCE appear more generic, for example ‘child received an antibiotic where indicated’, the correct prescription was defined as being the correct dosage and formulation as recommended by IMCI, but it was not clear what the policies were in non-IMCI districts and whether alternative formulations may also provide acceptable treatment.

Composite indicators were developed to describe quality of care. For example ‘child correctly classified’ or ‘child needing oral antibiotic received one’, so that the indication for the antibiotic (pneumonia, dysentery, ear infection) is often not given. Health worker performance was scored using a set of 14 key assessment tasks, to provide a composite index of integrated child assessment, and facility review findings were also summarised into a composite index of readiness to implement IMCI (75). As a result, it was frequently not possible to pinpoint implementation gaps and failures in performance, or to determine whether these gaps were due to poor quality of care or whether non-IMCI trained health workers took a different, but also acceptable, approach to the management of a sick child. The indicators selected in the IMCI-MCE make IMCI performance difficult to assess and understand fully, and there is a danger that the indicators presented may be misleading.

Relatively small numbers of observations undertaken in the MCE meant it was not possible to assess the competence of health workers to identify and manage serious illness in children and, therefore, health workers’ ability to manage severe illness was assessed using scenarios. These scenarios served as a proxy for assessing management of rare illness events, and gave rise to a composite indicator of performance termed ‘knowledge of correct case management for severe illness and young infants’ (75). However, scenarios based on knowledge of theory of IMCI are not adequate to assess whether health workers have the appropriate clinical skills.

Another major limitation to the IMCI-MCE is that the findings did not adequately reflect the problems that may be involved in **scaling up the IMCI programme** because studies were conducted early in the implementation of IMCI, using a subset of indicators in a limited geographical area (65). In reality, effectiveness evaluations involve different degrees of control by the research team, so that there is actually a continuum between efficacy and effectiveness (61). The MCE study in Uganda was conducted just as IMCI implementation in all districts was achieved. When reporting the findings, the researchers noted that poor performance of health workers in their study contrasts with improvements shown in other MCE studies, and attributed this to problems of scale-up. In particular, high standards of IMCI training were not maintained during the expansion phase, and effective supervision was lacking. The conclusion was that high training coverage is not sufficient for provision of adequate facility-based health care (65). When reporting on pooled data relating to

health worker performance from the Uganda, Brazil and Tanzania studies, Tanzania stands out as demonstrating a much stronger effect. The authors suggest that this is related to the high quality of IMCI training, supervision and follow-up in the intervention sites in the Tanzanian study, compared to Uganda and Brazil where IMCI implementation in the expansion phase was less well controlled (64).

Overall, the MCE showed that many countries failed to move beyond the introductory stage to implement IMCI fully and achieve the coverage required to make an impact, and countries with high child mortality rates that most needed IMCI frequently lacked the health system infrastructure and support to deliver it (60). No public health intervention can be considered effective unless it can be scaled up to achieve coverage sufficient to meaningfully impact on population health. In the continuum between efficacy and effectiveness evaluations, the MCE findings reflect more efficacy than effectiveness. The MCE shows that IMCI can improve delivery of appropriate treatments and quality of facility based child health care, but it also shows clearly that the success of IMCI depends on how intensively it is implemented.

When an organisation or individual is strongly invested in a strategy, like IMCI, it may be difficult to be fully objective in its evaluation, which could lead to bias. WHO, particularly the team who developed the IMCI strategy, invested considerable funds, personnel, time and commitment into this important initiative, and were, therefore, deeply invested in getting a positive result. This was recognised at the outset of the IMCI-MCE and explicitly addressed, and several processes were put in place to minimise the introduction of bias. Despite this, the MCE team admit that careful negotiations were required in writing of the papers, between the principal investigator and WHO staff members, to reach a final draft of publications that were acceptable to all authors (69).

Another problem was conflicts of interest that arose in terms of resource allocation during the IMCI-MCE, where the evaluation was consuming resources that could have been used to improve implementation, while at the same time showing that implementation was inadequate. The result for the IMCI-MCE was that, because planning for both implementation and evaluation of IMCI was going on at the same time, the evaluation process itself was likely to have had an effect on IMCI implementation in the selected MCE sites (69).

1.4 Conclusion

Many children die in developing countries, despite the availability of effective interventions, but coverage of such interventions remains inadequate, particularly among the most vulnerable infants and children. Efforts to develop an effective mechanism to deliver key child survival interventions led to the development of the IMCI strategy in the early 1990s. The adoption of the Millennium Development Goals led to a major focus on child survival and considerable improvements in child mortality have been achieved in the past decade. However, sub-Saharan Africa has lagged behind, and despite recent improvements, South Africa has shown no overall improvement in child mortality since 1990 (76), largely due to the impact of the AIDS epidemic. IMCI implementation is the standard of care for sick children attending PHC facilities in South Africa, where HIV/AIDS is the cause of most child deaths. Hence, if IMCI is to be effective as a child survival strategy in this setting, IMCI implementation must effectively improve coverage of PMTCT and ART for mothers and children. If outcomes for South African children are to be improved, it is crucial to determine whether implementation of the IMCI strategy, including the HIV component, is achieving this goal, and to identify barriers and enablers to its effective implementation.

This study aimed to evaluate the effectiveness of IMCI as a mechanism for delivering key child survival interventions, including HIV/PMTCT management, in routine practice in a high HIV prevalence area in two provinces in South Africa.

Chapter Two: IMCI in South Africa

In 1998, when IMCI was adopted in South Africa, the HIV epidemic was having a devastating impact on child health. Child mortality in South Africa increased by about one-third during the five years up to 1998 (11). This prompted the development of the HIV algorithm for identification of symptomatic HIV in children and accompanying guidelines for management of childhood HIV. This HIV/IMCI component underpins the research presented in this thesis, and its development will be described in detail.

2.1 IMCI implementation in South Africa

During the introductory phase of IMCI implementation, it is recommended that the IMCI clinical case management guidelines be modified according to the epidemiological profile, health system characteristics, and culture in each country or setting (69). This requires accurate cause-of-death information. Determinants of child mortality are complex and need to be clearly understood in order to identify and prioritise appropriate child survival interventions. A detailed and comprehensive IMCI Adaptation Guide is provided by WHO to assist countries in adapting the IMCI guidelines (77).

Prior to IMCI implementation, a technical task team was set up in the province of KwaZulu-Natal (KZN), South Africa, to make adaptations to the IMCI clinical guidelines to suit the setting in KZN. This task team, chaired by myself, included three paediatricians, a pharmacist and primary care practitioners (two professional nurses and a doctor).

2.2 Development of the HIV component of IMCI

In 1997, as the IMCI guidelines were being adapted, HIV prevalence among pregnant women in South Africa was increasing rapidly, with the highest HIV prevalence in KZN (78). However, management of HIV-infected children by primary health care workers was not specifically addressed in the generic IMCI case management guidelines. There were several reasons for this: at that time no specific treatment was available for HIV infected children, management of children with HIV was primarily hospital-based, and most HIV-infected children presented with conditions addressed by IMCI (79). In addition, IMCI guidelines already recommend that any child with a severe illness, or whose condition did not improve with routine treatment, should be referred to the district hospital for further management.

However, the IMCI technical task team responsible for adapting the IMCI guidelines in KZN made the decision that a child survival strategy, being introduced in a setting where antenatal HIV prevalence was among the highest in the world, should specifically and directly address HIV/AIDS. Even in the absence of specific HIV treatment, health workers at PHC clinics, with support from referral services, were in the best position to identify and offer continued support to HIV-infected children, and their families, in the community. As a result, an HIV component was developed and added to the IMCI case management guidelines in South Africa. The aim of this IMCI/HIV component was to provide health workers with tools to counsel mothers about HIV and identify children at-risk of HIV infection, and to provide guidelines for HIV testing of children and for management of HIV infected children. Treatments available at that time included co-trimoxazole prophylaxis, and pain control where indicated. Implementation of these HIV guidelines would provide mothers and health workers with information about the child's illness, and assist them to provide appropriate care. Another anticipated benefit was that mothers receiving on-going treatment and support for their child at the local clinic, could also access health care for themselves, particularly counselling about safer sexual behaviour and contraceptive use.

The first version of the HIV algorithm, developed in KZN in 1998 (Figure 2), was based on local clinical experience and WHO clinical case definitions for paediatric AIDS (80). This HIV algorithm was integrated into the IMCI clinical guidelines such that IMCI trained health workers asked a series of 'HIV questions' during the routine assessment of every child. A single question was added to the assessment of each of the four main symptoms for this purpose. If there was a positive answer to any of the HIV questions, the health worker would undertake an additional assessment of the child, according to the HIV algorithm (Figure 2), to look for other symptoms or signs suggesting HIV infection. If the child was found to have three signs or symptoms suggestive of symptomatic HIV infection, the health worker would make a classification of SUSPECTED SYMPTOMATIC HIV, and the mother was advised to attend for counselling and HIV testing of the child. If the HIV test was positive, the child would receive on-going care at primary level. The aim of the HIV algorithm was to be a screening tool to identify high-risk children who would benefit from HIV testing, rather than to accurately diagnose HIV positive children.

This HIV algorithm was subsequently adopted throughout South Africa. As a result, WHO held an expert consultative meeting in Durban in 2000 (81), where a draft generic HIV component based on the algorithm shown in Figure 2 was accepted and recommended for implementation in high HIV prevalence countries (79). At this meeting, it was proposed that the HIV algorithm should be formally evaluated in KZN.

THEN CONSIDER SYMPTOMATIC HIV INFECTION

CONSIDER SYMPTOMATIC HIV INFECTION IN EVERY CHILD

- > IF THE ANSWER WAS "YES" TO ANY OF THE HIV RELATED QUESTIONS OR
- > IF THE CHILD HAS A HISTORY OF HERPES ZOSTER OR TUBERCULOSIS OR
- > IF A PARENT OR SIBLING IS KNOWN TO BE HIV +VE

ASK:

- Has the child had more than one severe chest infection in the past 3 months? (p. 2)
- Has the child had frequent bouts of or persistent diarrhoea in the past 3 months? (p. 3)
- Has the child had fever for more than one month? (p.4)
- Does the child have a poor appetite?
- Does the child have a chronic ear infection? (p. 5)
- Has the child lost weight according to history or the RTHC?
- Does the child have evidence of past or present herpes zoster*?
- Does the child have evidence of past or present TB?
- Is a parent or sibling known to have TB or HIV infection?
- Is there past or present evidence of severe seborrhoeic dermatitis?

THEN LOOK AND FEEL:

- Is the child's weight below the 3rd centile?
- Any enlarged lymph glands in more than one of the following sites: neck, axillae groins?
- Is there oral thrush which extends to the back of the mouth or throat?

* Herpes zoster is a rash consisting of small and very painful blisters, which usually occur on one side of the face or trunk .

**Classify as:
Suspected Symptomatic HIV infection**
if:
⇒ the answer is 'yes' to any three of these questions.

SUSPECTED SYMPTOMATIC HIV INFECTION

- Refer the mother and child to hospital *or*
- Counsel the mother and refer for HIV testing *or*
- Counsel the mother and take blood for HIV testing at the clinic.

- Arrange for follow up visit for post-test counselling
- Initiate treatment according to the classification (p 10)
- Counsel the mother on the mangement of the child (p. 18)

SYMPTOMATIC
HIV INFECTION
MALNUTRITION, ANAEMIA
IMMUNIZATION

Figure 3: KZN HIV algorithm (1998)

2.2.1 Evaluation of the HIV algorithm

The initial HIV algorithm shown in Figure 2 was evaluated in KZN in 2001, by Horwood and colleagues, with funding support from WHO (Appendix 1). In total, 690 consecutive children aged 2-59 months attending the paediatric outpatient department in a district hospital in KZN were enrolled in the study. Each child had a standardised detailed clinical examination by a paediatrician, and was then separately assessed by an expert IMCI practitioner for SUSPECTED SYMPTOMATIC HIV using the HIV algorithm. All enrolled children were then tested for HIV. 198/690 (28.7%) children tested HIV positive, 56.1% of whom were classified as SUSPECTED SYMPTOMATIC HIV by the IMCI expert. The specificity of the HIV algorithm was 85.0%, and the positive predictive value (PPV) was 60.0% (82).

A statistical model was developed based on the significant predictors of HIV infection identified among children in the study population. Different combinations of clinical features were tested, using this model to maximise the sensitivity and specificity of the algorithm, and a revised and simplified HIV algorithm was developed (Figure 3). This algorithm had a sensitivity of 70.1% and specificity of 80.1% when applied to the KZN study sample (82), and was the basis for a generic WHO HIV algorithm, recommended for IMCI implementation in high HIV prevalence countries. As a result, in 2002, WHO revised the IMCI adaptation materials to include management of children with symptomatic HIV, for those countries wishing to include HIV management in their IMCI materials (79). To ensure that the KZN study findings could be replicated in other high HIV prevalence settings, where childhood illnesses like diarrhoea and malnutrition may be more common in HIV uninfected children, the KZN study methodology was repeated in Ethiopia (83) and in Uganda (unpublished) with funding support from WHO.

However, the algorithm soon required further revisions as PMTCT programmes became available in high HIV prevalence countries, and HIV testing for mothers and HIV PCR testing for infants became more widespread at primary care level. An updated HIV algorithm was developed, taking into account HIV test results of the mother and child, if available, and included an additional classification for HIV exposure. In 2008, WHO published a revised algorithm (Figure 4) and chart booklet. The revised algorithm includes more detailed information on ART for children, treatment of mouth and skin lesions, and opportunistic infections. It is currently recommended for IMCI implementation in high HIV prevalence countries (84). Although, this current version of the algorithm still includes an assessment of signs of symptomatic HIV for children who not been tested for HIV, much more emphasis is placed on ensuring that mothers receive HIV test results for their children and appropriate care and treatment thereafter. The IMCI/HIV algorithm,

therefore, provides an important link to PMTCT and ART programmes within a well-established, integrated child health programme.

There has been no formal evaluation of implementation of the HIV component in routine practise, but in 2001, a small-scale health facility survey (HFS) was conducted in four provinces in South Africa, using the standard WHO HFS methodology, with the addition of a single indicator relating to HIV classification. The findings showed that only one of 18 children identified as SUSPECTED SYMPTOMATIC HIV by the IMCI expert was correctly classified by the observed health worker. Although the numbers of observed children in this review were small, the findings suggest poor implementation of the HIV component by IMCI trained health workers (85).

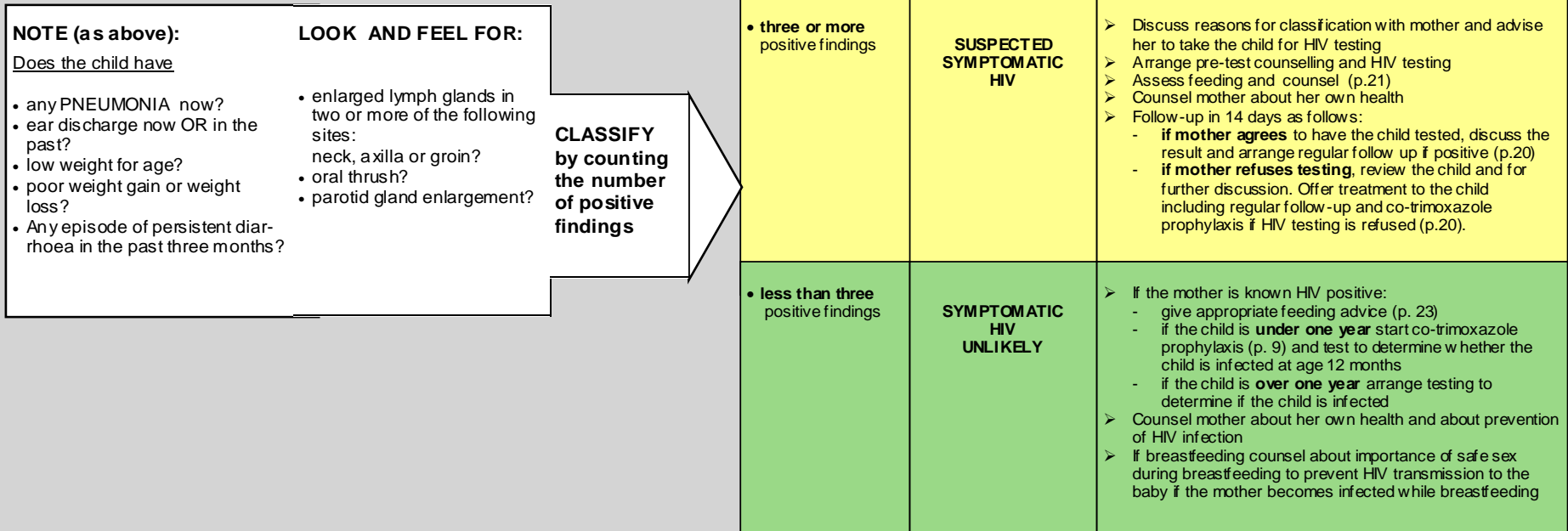
2.3 Conclusion

In the past decade, there have been major advances in HIV management, including introduction of antiretroviral drugs for HIV prevention and treatment, leading to several large-scale changes to HIV programmes in South Africa, which form a background to this work. The HIV component of IMCI has been revised several times since its introduction in 1998, when co-trimoxazole prophylaxis was the only treatment available for HIV management in South Africa. These revisions eventually led to the publication of the current WHO generic HIV/IMCI guidelines. The HIV component of IMCI has been implemented in South Africa, and other countries in sub-Saharan Africa, including Botswana, Ethiopia, Kenya, Nigeria, Lesotho, Namibia, Swaziland, Tanzania, Uganda, Zambia and Zimbabwe [77]. Therefore, the HIV component is being implemented, with WHO support, in all countries with the highest prevalence of HIV, as well as those countries with the largest numbers of childhood AIDS deaths.

IF THE CHILD-

- has a classification today of PNEUMONIA or PERSISTENT DIARRHOEA or NOT GROWING WELL
OR
- Has had an episode of persistent diarrhoea in the past three months
OR
- Has had a discharging ear at any time
OR
- If the mother is known to be HIV positive*

ASSESS FOR SYMPTOMATIC HIV INFECTION *:



***If the child has been classified as symptomatic HIV in the past and had a positive HIV test, do not assess again - give follow-up care for confirmed symptomatic HIV (p. 20)**

Figure 4: KZN HIV algorithm (2002 version)

► Then check for HIV infection*

❖ Has the mother or child had an HIV test?

OR

❖ Does the child have one or more of the following conditions?:

- Pneumonia **
- Persistent diarrhoea **
- Ear discharge (acute or chronic)
- Very low weight for age**

If yes to one of the two questions above, enter the box below and look for the following conditions suggesting HIV infection:

NOTE OR ASK:	LOOK and FEEL:
❖ PNEUMONIA ?	❖ Oral thrush
❖ PERSISTENT DIARRHOEA?	❖ Parotid enlargement
❖ EAR DISCHARGE?	❖ Generalized persistent lymphadenopathy
❖ VERY LOW WEIGHT?	
HIV test result available for mother/child?	

CLASSIFY

HIV status of mother and child unknown

HIV status of mother and/or child known

* A child who has already been put on ART does not need to be assessed with this HIV box.
 ** Includes severe forms such as severe pneumonia. In the case of severe forms, complete assessment quickly and refer child URGENTLY.

SIGNS	CLASSIFY	IDENTIFY TREATMENTS
<ul style="list-style-type: none"> • 2 or more conditions AND <ul style="list-style-type: none"> • No test results for child or mother 	SUSPECTED SYMPTOMATIC HIV INFECTION	<ul style="list-style-type: none"> • Treat, counsel and follow-up existing infection • Give co-trimoxazole prophylaxis • Give Vitamin A supplements from 6 months of age every 6 months • Assess the child's feeding and provide appropriate counselling to the mother • Test to confirm HIV infection • Refer for further assessment including HIV care/ART • Follow-up in 14 days, then monthly for 3 months and then every 3 months or as per immunization schedule
<ul style="list-style-type: none"> • Less than 2 conditions AND <ul style="list-style-type: none"> • No test result for child or mother 	SYMPTOMATIC HIV INFECTION UNLIKELY	<ul style="list-style-type: none"> • Treat, counsel and follow-up existing infections • Advise the mother about feeding and about her own health • Encourage HIV testing
<ul style="list-style-type: none"> • Positive HIV antibody test for child 18 months and above OR <ul style="list-style-type: none"> • Positive HIV virological test 	CONFIRMED HIV INFECTION	<ul style="list-style-type: none"> • Treat, counsel and follow-up existing infections • Give co-trimoxazole prophylaxis • Give Vitamin A supplement from 6 months of age every 6 months • Assess the child's feeding and provide appropriate counselling to the mother • Refer for further assessment including HIV care/ART • Follow-up in 14 days, then monthly for 3 months and then every 3 months or as per immunization schedule
One or both of the following: <ul style="list-style-type: none"> • Mother HIV positive and no test result for child OR <ul style="list-style-type: none"> • Child less than 18 months with positive antibody test 	HIV EXPOSED/ POSSIBLE HIV	<ul style="list-style-type: none"> • Treat, counsel and follow-up existing infections • Give co-trimoxazole prophylaxis • Give Vitamin A supplements from 6 months of age every 6 months • Assess the child's feeding and provide appropriate counselling to the mother • Confirm HIV infection status of child as soon as possible with best available test • Follow-up in 14 days, then monthly for 3 months and then every 3 months or as per immunization schedule**
<ul style="list-style-type: none"> • Negative HIV test in mother or child AND not enough signs to classify as suspected symptomatic HIV infection 	HIV INFECTION UNLIKELY	<ul style="list-style-type: none"> • Treat, counsel and follow-up existing infections • Advise the mother about feeding and about her own health

Figure 5: WHO generic HIV algorithm for high HIV prevalence countries (current version 2008) [84]

Chapter Three: Rationale for South African HIV/IMCI effectiveness study

The SA HIV/IMCI Effectiveness Study, presented in this thesis, is a continuation of work that started in 1998 with the development of an HIV component for IMCI, and led to the publication of the WHO generic IMCI guideline for high HIV prevalence areas (84). The aim of this study was to evaluate the effectiveness of IMCI implementation, with particular focus on the HIV component, in routine practise in a high HIV prevalence area in two provinces of South Africa. The study was conducted to determine whether the IMCI programme, a complex public health programme widely adopted in South Africa, is achieving the levels of effective implementation required to reach high coverage of interventions among children attending PHC facilities, in the 'real-life' situation. The study also sought to identify barriers and enablers to implementation of IMCI, particularly the HIV component, to provide an evidence-base to improve IMCI implementation, and provide additional information about the sustainability of IMCI.

This study was designed with a focus on the implementation of the HIV component of IMCI, particularly to investigate determinants of health workers ability and willingness to take every opportunity, during the course of routine care, to identify HIV infected and exposed children and deliver appropriate interventions. This was because there are unique challenges involved in caring for HIV infected patients, and implementation of the HIV component is fundamental to overall success of IMCI in high HIV prevalence settings. Although the African countries participating in IMCI-MCE had a relatively high HIV prevalence (5.4% and 6.2% in Uganda and Tanzania, respectively, in 2007), and both countries had adapted IMCI guidelines to include HIV, there has been no previous large-scale evaluation of IMCI implementation conducted in a high HIV prevalence setting, and no effectiveness study of the HIV component. Apart from a small preliminary study conducted by the author to evaluate the efficacy of the HIV algorithm (82), no research has been conducted to assess the sensitivity, specificity and positive predictive value of the HIV algorithm in routine practise, or the coverage of HIV interventions recommended by the IMCI guidelines at operational PHC level.

3.1 Rationale for measuring *effectiveness* of IMCI

The effectiveness of an intervention is defined as the effect of the intervention under routine field conditions, as contrasted with efficacy, which is defined as its effect under ideal conditions (86). Establishing the efficacy of an intervention is most appropriately done in a randomised controlled trial (RCT), but having identified an efficacious intervention, research is also required to define feasible, acceptable and cost-effective mechanisms to deliver the intervention in the real-life situation. The efficacy of individual interventions delivered through IMCI is already well established. For example, pneumonia and diarrhoea case management; ART initiation in HIV infected children; and preventive interventions, like prevention of mother-to-child transmission (PMTCT), immunisation, vitamin A have been shown to reduce mortality and morbidity among children under five years old (8). Improving coverage and access to such clinical and preventive services has been shown to reduce child mortality (87), but effective and sustainable delivery mechanisms at a population level are required to achieve this at population level.

Service delivery mechanisms can be considered in different ways: 1) according to who receives the care, and how these beneficiaries are accessed, 2) according to who delivers the care, or 3) where the care is provided (88). Delivery mechanisms fall into three broad categories, namely clinically based services delivered at the individual level; services delivered episodically through outreach; and community and family-orientated services, which deliver care in the home (87). Using immunisation as an example: the efficacy of this single intervention is well established and a variety of delivery mechanisms have been developed and employed to deliver immunisations and improve immunisation coverage. Clinic-based services delivered at the individual level include immunisation provided by health workers at dedicated immunisation clinics, or as an integrated component of a sick child consultation, or in the private sector using public-private partnerships to increase the number of service providers. Immunisations can be delivered episodically through outreach by large-scale immunisation campaigns in the community, or may be provided by community-based workers at household level. Therefore, IMCI can be seen as a mechanism for delivery of child survival interventions, including immunisation.

It is important to know which delivery mechanisms are capable of achieving high coverage of specific interventions in various epidemiological, health system and cultural contexts (89). Only by paying close attention to whether mothers and children receive IMCI interventions is it possible to determine whether IMCI is an effective, equitable and sustainable delivery method, and whether mortality reductions are likely (60). Programme success in such an evaluation is defined as gains in intervention coverage and/or health effects under real-world conditions, and the objective of an effectiveness evaluation is to measure coverage of well-established interventions, not to establish the efficacy of a new intervention. In this study, effectiveness of IMCI as a mechanism to deliver a

combination of child survival interventions was evaluated, and no attempt was made in this study to show impact on child mortality.

The SA HIV/IMCI Effectiveness Study is a true effectiveness study because, first, it was conducted in the expansion phase of IMCI implementation, several years after IMCI adoption in South Africa. IMCI training had been on-going for approximately eight years in study sites at the time of data collection. Second, IMCI was being implemented routinely by the Department of Health, with no additional support from the researchers or from outside agencies. Finally, the study was conducted over a large area: the total population of KwaZulu-Natal is 10.8 million and that of Limpopo is 5.5million, together comprising approximately 32 % of the total South African population (90). All IMCI trained health workers currently managing sick children at PHC clinics in this area were included in the sampling frame.

The principal reason for undertaking any programme evaluation is to influence decision-making in relation to that programme, and the design of the evaluation, therefore, depends on who the decision makers are, and what types of decisions will be made (91). It is important for public health practitioners, and health planners to have the relevant information about programme functioning that is required for implementing effective strategies to improve programme effectiveness. Information should be collected about how the intervention was delivered, participation of staff, and problems encountered, both to determine programme effectiveness and to understand the role of factors that may reduce the impact of the intervention (92). It is known that programmes to implement effective interventions are often inequitable, poor quality and short-lived, so it is important to identify the determinants of success (86). For the IMCI programme, the most important questions for decision-makers in health policy and planning are, first, whether effective IMCI implementation is being achieved, and, second, whether any barriers and enabling factors for IMCI implementation can be identified and addressed to improve programme functioning. This study was designed to address the questions that most concern decision makers, and to answer these questions without delays or unnecessary use of resources.

3.2 Rationale for the methodology selected

The SA HIV/IMCI Effectiveness Study employed a mixed methods approach to investigate the effectiveness of IMCI implementation in South Africa. In this study, qualitative and quantitative data were collected sequentially. Qualitative methods were used to explore experiences of IMCI training and implementation, and quantitative methods were used to provide numerical estimates of IMCI implementation coverage. The two methodologies are complementary in

nature, so that the results of the two components add information and clarify the overall findings and, therefore, provide a more holistic picture of IMCI implementation.

3.2.1 Focus group discussions (FGDs)

Implementation of public health interventions demands behaviour change, but factors that determine whether health workers change their behaviours or practises are rarely investigated (92). Developing an understanding of factors that influence the performance of health workers can improve implementation of guidelines, leading to improvements in provision of public health interventions like IMCI. This includes how health workers experience learning, and what determines their ability to acquire new knowledge, and implement this knowledge in routine practise in the workplace. Their experiences provide critical insight into understanding why some aspects of an intervention work well and others do not. Training is one factor influencing health worker performance, and may lead to development of knowledge and skills required for implementation, but training alone does not result in comprehensive implementation and high coverage of the proposed interventions (65, 93).

Focus group discussions (FGDs) were conducted with IMCI trained health workers and child carers. FGDs are a form of group interview, which are not intended to be objective or representative, but have the advantage of allowing researchers to elicit a multitude of views, and to explore and contrast the views of participants (94). Focus groups explicitly use the interaction between participants as part of the methodology, so that group processes help participants explore and clarify their views in a way that would not be possible in a one-to-one interview. This method is particularly suitable for exploring participants' knowledge and experience, and for examining work place cultures (95). This approach was chosen as the best methodology to explore how IMCI trained nurses experienced IMCI training, whether they acquired the skills required to implement IMCI, and what the barriers and enablers for implementation were, in order to develop a deeper understanding of the determinants of health workers ability and willingness to implement IMCI.

Focus groups are particularly useful for exploring attitudes of participants, which often are not easily encapsulated in reasoned responses to direct questions (95). FGDs were also used to explore the attitudes of health workers and child carers to the implementation of the HIV component of IMCI, particularly the inclusion of routine checks for HIV in all consultations with sick children, and to explore the particular challenges related to provision of HIV care. Using this methodology with a sensitive topic like HIV does have possible disadvantages. The presence of other research participants may compromise confidentiality, so that people may be less willing to discuss personal experiences in a group setting, and dissenting voices may not be heard.

3.2.2 Comparative survey of IMCI trained health workers

The quantitative component of the study was a comparative survey of IMCI trained health workers, undertaken at PHC clinics. This component provided quantitative data about health workers performance in implementing the IMCI guidelines, when compared to an expert IMCI practitioner. The purpose was to estimate coverage of IMCI interventions, identify gaps in IMCI implementation, and provide quantitative estimates of the findings of the qualitative component.

With the drive to evidence-based medicine, randomised controlled trials (RCT) have been applied increasingly in the field of public health and health policy. Although evidence-based health care is important and desirable, it must go beyond RCTs, which are frequently inadequate for scientific assessment of the performance of large-scale interventions, because it is unlikely that the conditions found in RCTs can be replicated in real world conditions (96). Interventions being evaluated must be carefully monitored and supported during a RCT, and conducted over a well-defined and limited geographical area. The need for control groups, without access to the intervention, limits the use of RCTs to new interventions, so this type of methodology cannot easily be applied to interventions already established over a large area, or to assess the implementation and sustainability of such interventions in routine practise. RCTs may fail to answer some of the relevant questions about large-scale public health interventions, so alternative and complementary approaches are needed to provide valid, generalisable evidence to add to the knowledge of programme performance. Causal pathways for public health interventions involve not just biological, but also behavioural steps that need to be understood and measured to demonstrate a logical sequence between intervention and outcome (96). Therefore, RCTs have limited value in assessment of the effectiveness of an intervention in real-world conditions, and would be unsuitable for evaluating IMCI implementation, which is already well-established and widely implemented in South Africa.

We decided on a comparative survey of IMCI trained health workers, where consultations with IMCI trained health workers were directly observed and the findings compared with a defined standard of performance as demonstrated by an IMCI expert. The technique of direct observation of consultations has been shown to provide the most valid and reliable picture of what health workers do (97). However, even observed performance may not represent routine performance, since health workers know that they are being observed. Without a control group, it may not be possible to attribute any improvements in coverage that are demonstrated as being the direct result of IMCI implementation or infer that IMCI has directly led to improvements in quality of care (91). When this study was conducted it was more important to determine whether the goals of the programme were being achieved and to identify any shortfalls, rather than to establish any causal relationship. The study did not aim to measure impact on childhood

morbidity or mortality, or on behavioural indicators. This type of evaluation, where provision, utilisation and/or coverage are measured, can be termed a performance evaluation, as opposed to an impact evaluation, and it assesses how well programme activities have met the expected objectives (91).

Our methodology is different from that used in WHO IMCI health facility surveys or in other published evaluations of IMCI, because the unit of sampling was the IMCI trained health worker, rather than the observed child or the health facility. This allowed a more detailed analysis of the patterns of individual health worker performance in assessment, classification and management of sick children than has been previously reported. We were able to clearly identify implementation gaps and weaknesses in health worker skills. Although the emphasis of this study is appropriately placed on HIV management, diarrhoea, severe pneumonia, and malnutrition continue to be important causes of death among South African children, and so it was important that all components of IMCI implementation be evaluated. This study provides new knowledge in the field of IMCI evaluation research, as well as about the effectiveness of IMCI as a mechanism for implementation of child survival interventions, particularly the determinants of health worker performance and HIV care in a high HIV prevalence setting.

3.3 Conceptual framework

The framework for the evaluation reflects a conceptual model outlining pathways through which the programme is expected to achieve coverage of key interventions and impact on child mortality. It is important to differentiate between the interventions themselves, and the mechanism for delivering them. For example, immunisation coverage will not be the same if delivered by IMCI, by community health workers, or via a national immunisation campaign (86). The choice of delivery strategy affects the quality, cost-effectiveness, coverage, and sustainability of the intervention. An evaluation should be seen as measuring the ability of the chosen model to deliver coverage of interventions. It is important to know how well large-scale complex programmes, such as IMCI, deliver efficacious interventions using different delivery channels.

In order for IMCI to be an effective mechanism to deliver child survival interventions in a high HIV prevalence area:

- Child carers must bring sick children to the clinic appropriately
- IMCI algorithms must address the majority of presenting complaints of children at primary health care clinics
- IMCI trained health workers must receive adequate training on all components of IMCI, including the HIV component
- IMCI trained health workers must acquire the skills required for IMCI implementation
- IMCI trained health workers must be able to transfer effectively the new skills, developed during training, to the workplace
- All resources required for IMCI implementation, for example drugs and equipment, must be available at primary health care clinics
- IMCI must be implemented according to the guidelines so IMCI practitioners identify and appropriately manage those children at highest risk of mortality.

IMCI implementation, therefore, depends on a sequence of events and inputs that affect individual IMCI trained health workers in the workplace, and that must be in place if effective implementation is to be achieved. This study focussed on the effectiveness of IMCI to deliver essential interventions to sick children in *the context of the primary health care clinic*. The conceptual model shows community factors, outside of the health facility, even though these were not examined as part of the study. These can include, for example, health seeking behaviours and socioeconomic factors, which may impact coverage of child survival interventions.

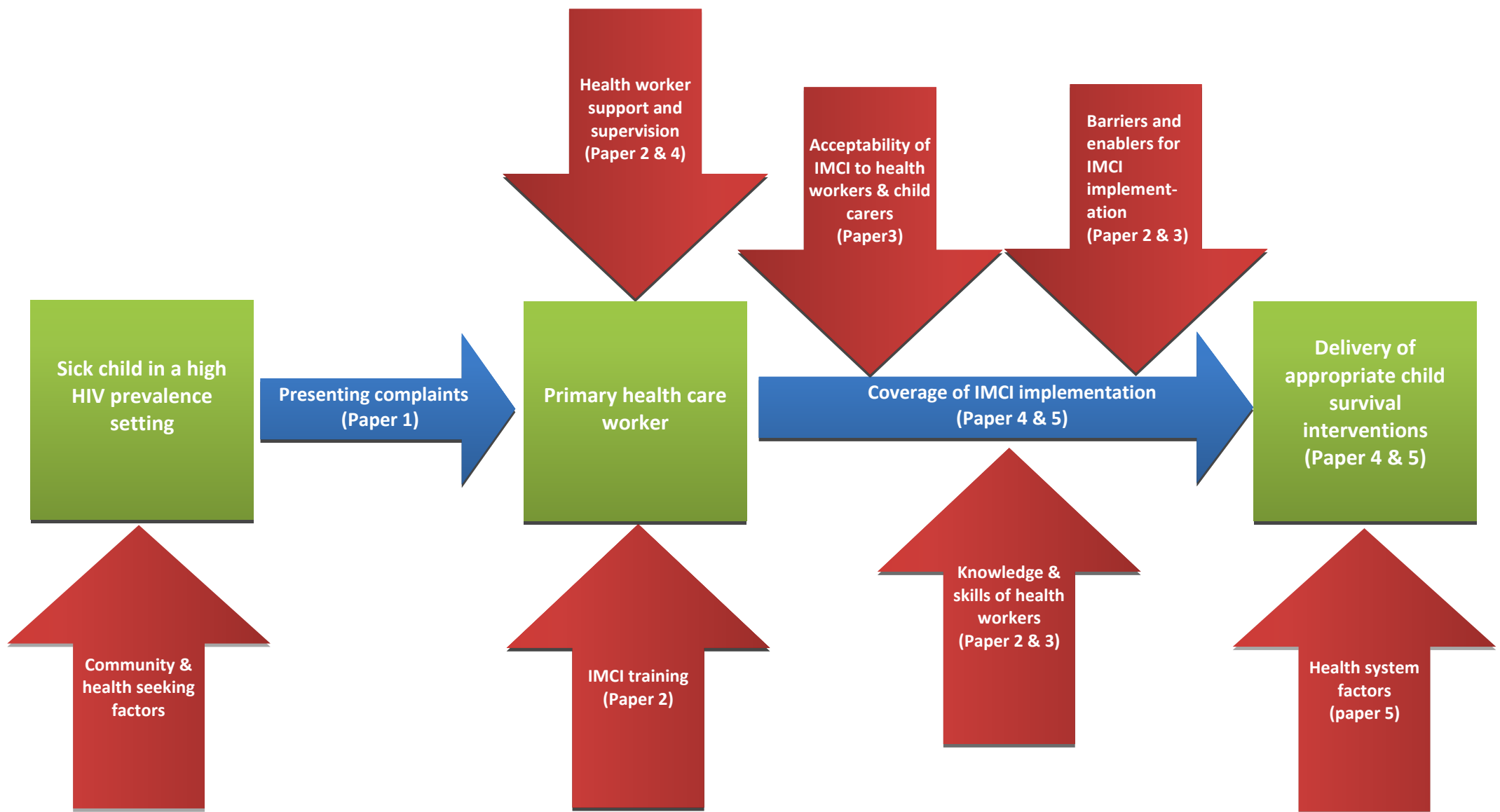


Figure 6: Conceptual framework: effectiveness of IMCI implementation in primary health care clinics in a high HIV prevalence setting in South Africa (as related to published papers)

3.4 Research questions

This research study sought to address the following research questions.

Paper1 – Presenting complaints of children under five years attending PHC clinics in South Africa:

1. What are the reasons for seeking care for children under five-years at PHC clinics in two provinces in South Africa, and are these reasons addressed by IMCI?
2. What is the burden of disease among children under five-years attending PHC clinics? What proportion of these children require urgent referral and why?
3. What is the prevalence of HIV infection in a population of under five-year old children attending PHC clinics?

Paper2 – A qualitative evaluation of the IMCI case management training course:

4. From the perspective of IMCI trained health workers, did the 11-day case management course equip them with the skills required for implementation of IMCI in the workplace?
5. What are the barriers to and enabling factors for implementation of IMCI in the workplace from the perspective of IMCI trained health workers?

Paper 3 - Attitudes of health workers and child caregivers to implementation of the HIV component of IMCI:

6. What are the attitudes of IMCI trained health workers to implementing the HIV component of IMCI, including the routine assessment for HIV in every child?
7. Do carers find the HIV-related questions and HIV related issues that health workers raise during a routine consultation acceptable, and do they believe that the questions will help children?

Paper 4 – An evaluation of the quality of IMCI assessments among IMCI trained health workers in South Africa:

8. What proportion of children attending PHC facilities are correctly assessed, classified and managed by IMCI trained health workers in routine practise?
9. What proportion of IMCI trained health workers are able to classify more than 80% of children correctly for each main symptom? What proportion is able to classify 60-80% of children correctly? What proportion is able to classify less than 60% of children correctly?
10. What proportions of children with each main symptom are correctly classified by IMCI trained health workers?

11. Where are the gaps in IMCI implementation (which components of IMCI are most frequently omitted)?
12. Where are the weaknesses in the skills of IMCI trained health workers (which IMCI classifications are most frequently made incorrectly)?

Paper 5 – An evaluation of the IMCI guidelines for HIV:

13. How effective is the HIV algorithm in identifying symptomatic HIV when used by IMCI trained health workers under operational conditions, as compared to an expert IMCI practitioner? As compared to an HIV test?
14. How effective is the HIV algorithm in identifying symptomatic HIV when used by an expert IMCI practitioner as compared to an HIV test?
15. In routine practise, what proportion of HIV exposed and infected children receive key interventions for HIV management (co-trimoxazole prophylaxis, PCR testing, infant feeding and nutrition counselling and follow-up)?

Chapter Four: Methods

4.1 Aim of the study

To evaluate the effectiveness of the Integrated Management of Childhood Illness (IMCI) strategy in routine practise in primary health care services in South Africa

4.1.1 Objectives

1. To describe the disease profile of children under 5 years presenting to primary health care clinics
2. To explore IMCI trained health workers experiences of the content, structure and methodology of the IMCI case management course, and of implementing IMCI after training, including barriers and enabling factors affecting IMCI implementation in the workplace.
3. To explore attitudes and experiences of IMCI trained health workers and carers of children under 5 years, towards implementation of the HIV component of IMCI.
4. To assess the implementation of IMCI during routine practise by IMCI trained health workers at primary health care level.
5. To compare the effectiveness of the HIV component of IMCI in routine practise and when used by IMCI experts.

4.1.2 Outcomes

4.1.2.1 Primary outcome measures

- 1
 - a) Presenting complaints of children under five years attending PHC clinics
 - b) The disease profile among children under five years attending PHC clinics
 - c) The HIV prevalence among children under five years attending PHC clinics
- 2
 - a) Experiences of the adapted training course with regard to content, structure and methodology, as described by IMCI trained health workers.
 - b) Barriers and enabling factors identified by IMCI trained health workers that facilitate or prevent IMCI implementation in the workplace.
- 3
 - a) Attitudes of IMCI trained health workers towards the implementation of the HIV component of the IMCI guidelines.

- b) Barriers and enabling factors identified by IMCI trained health workers that facilitate or prevent them from managing HIV exposed and infected children according to the HIV component of IMCI.
 - c) The acceptability of routine checks for HIV infection in all children attending the clinic from the perspective of carers of children under five years.
4.
 - a) The proportion of children under five years attending PHC clinics who are correctly classified by the IMCI trained health worker as compared to an IMCI expert.
 - b) The proportion of IMCI trained health workers who were able to classify 80% of sick children correctly, as compared to an IMCI expert.
 - c) The proportion of all IMCI classifications that were correctly made by the IMCI trained health worker, as compared to an IMCI expert.
 5.
 - a) The proportion of HIV exposed or infected children correctly assessed and classified for SUSPECTED SYMPTOMATIC HIV by IMCI trained health workers, as compared to an IMCI expert.
 - b) The proportion of all IMCI trained health workers who classify all children correctly as having SUSPECTED SYMPTOMATIC HIV or not, as compared to an IMCI expert.

4.1.2.2 Secondary outcome measures

1.
 - a) The proportion of children under five years attending PHC clinics who are underweight or not growing well.
 - b) The proportion of children under five years attending PHC clinics who require urgent referral.
2.
 - a) A description of the experiences of IMCI trained health workers of IMCI implementation in the workplace, including whether they acquired the skills required for IMCI implementation.
 - b) A description of the experiences of IMCI trained health workers of follow-up after training.
3.
 - a) A description of the experiences of IMCI trained health workers during implementation of the HIV component of the IMCI guidelines.
 - b) The acceptability to caregivers of on-going care for HIV infected children and HIV exposed children being carried out by IMCI trained health workers at clinic level.
4.
 - a) The average time since IMCI training among IMCI trained health workers.

- b) The proportion of PHC clinics where more than 60% of professional nurses were IMCI trained.
 - c) The number of follow-up visits after IMCI training received by IMCI trained health workers.
 - d) The proportion of IMCI trained health workers who refer to the IMCI chart booklet during all observed consultations.
 - e) The proportion of under five children where a feeding assessment was indicated and where this was undertaken by the IMCI trained health worker.
- 5.
- a) The proportion of children attending primary level services who are classified as SUSPECTED SYMPTOMATIC HIV.
 - b) The sensitivity, specificity and positive predictive value of the HIV algorithm, as used by an IMCI expert, for identifying symptomatic HIV infection determined against an HIV test.
 - c) The proportion of children classified as SUSPECTED SYMPTOMATIC HIV who are offered on-site HIV testing or are referred for HIV testing.
 - d) The proportion of children identified as SUSPECTED SYMPTOMATIC HIV who receive key treatments, including co-trimoxazole prophylaxis, and appropriate infant feeding and follow-up advice.

4.2 Methods

4.2.1 General

The study comprised a qualitative component to investigate factors affecting health worker performance in implementing IMCI guidelines, and a comparative survey of IMCI trained health workers to evaluate the implementation of IMCI in routine practice.

4.2.2 Study sites

The study was conducted in PHC clinics in two provinces of South Africa: Limpopo province and Kwazulu-Natal (KZN) province.

4.2.2.1 Limpopo province

The **Limpopo province** started IMCI training in 1998, and was one of the first provinces to do so. In 2006, when data were collected for this study, 1325 health workers had been trained, representing approximately 47% of primary health care staff caring for sick children in Limpopo. Out of a total of 474 primary health care clinics, 283 (60%) were implementing IMCI and 169 (36%) were saturated with IMCI-trained staff (i.e. $\geq 60\%$ of professional nurses trained in IMCI case management). IMCI was being implemented in all six districts in Limpopo. Limpopo Province had also made significant achievements in implementing the Community Component of IMCI (c-IMCI), strengthening the health system and undertaking pre-service IMCI training. At the time of the study, the province had a population of 5.5 million. It is predominantly rural, with high rates of poverty and poor access to basic services (98). The antenatal HIV seroprevalence in Limpopo province was 20.6% in 2006 (99).



Figure 7: Map of Limpopo Province

4.2.2.2 KwaZulu-Natal

IMCI implementation started in KwaZulu-Natal (KZN) in 1998 and IMCI was implemented in all 11 districts in the province by 2006. Although 1300 primary health care workers had been trained in IMCI at the time this study was conducted, only 799 were practicing in PHC clinics; only 32% of health care workers seeing children at PHC level were trained in IMCI. Of 604 primary health care facilities in the province, 64% had at least one IMCI trained health worker and 22% of clinics had $\geq 60\%$ of health workers trained in IMCI. KZN was South Africa's most populous province, with two large urban centres in Durban and Pietermaritzburg and a population of around 10million. Although rates of poverty are lower in KZN compared to Limpopo, almost 50% of the KZN population still live in rural areas (100). In 2006, KZN had the highest antenatal HIV prevalence in South Africa with 39.1% of women attending government antenatal clinics testing positive for HIV (99).

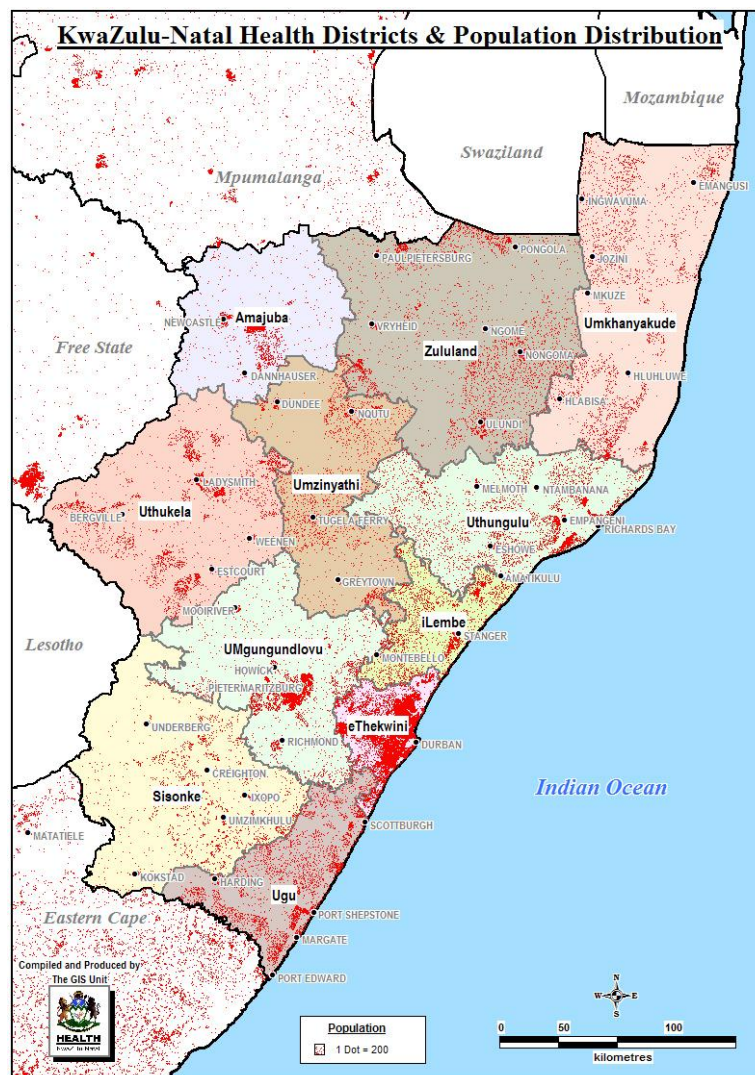


Figure 8: Map of KwaZulu-Natal province

4.2.3 Study population

The study population comprised all IMCI trained health workers working in PHC clinics in Limpopo and KZN provinces. All IMCI trained health workers working in PHC clinics were professional (registered) nurses, and all had attended an 11-day IMCI case management training course. Limpopo and KZN provinces were purposively selected to participate in the study at the request of the South African National Department of Health, because they were regarded as being at the forefront of IMCI implementation in South Africa.

4.2.4 Sampling strategy

4.2.4.1 FGDs

Ten FGDs were conducted in KZN and Limpopo, with both IMCI trained health workers (three groups in KZN, two groups in Limpopo), and with carers of children under five years (three groups in KZN, two groups in Limpopo). Urban and rural districts were selected in each province by convenience sampling.

IMCI trained nurses: Participants were purposively selected from a list of all IMCI trained nurses who were working in PHC clinics in each province in 2006. Selection was undertaken in consultation with the provincial IMCI co-ordinator, on the basis that participants had i) attended an 11 IMCI case management course, ii) were currently working in a PHC clinic and iii) they were willing to participate in a discussion about IMCI implementation. These criteria were applied to ensure that participants had relevant experience to provide in-depth information for the discussions. Up to 10 IMCI trained nurses were included in each FGD.

Child carers: For FGDs with carers, the study population was carers of children under five years who brought children to the clinic on the day of the FGD. Clinics implementing IMCI were selected in each province by convenience sampling to include both urban and rural clinics. Eligible participants included mothers and carers who were caring for the child most days. Other carers bringing a child to the clinic, who were not the main carer, were excluded. Participation was offered to all those eligible and waiting in the queue on the day of the FGD, and selection was based on the willingness of participants to take part in a discussion about the care they receive at the clinic for their children. Up to 10 mothers or caregivers who volunteered to take part, regardless of their HIV status, were included in each group.

4.2.4.2 Comparative survey

The sampling frame included all IMCI trained health workers working in primary health care clinics in KZN and Limpopo provinces at the time of data collection; all eligible health workers were nurses.

Sample size for observed consultations

The number of consultations to be observed for each health worker, to effectively assess competence of health workers in identifying and managing children with HIV infection, was determined by the prevalence of SUSPECTED SYMPTOMATIC HIV in the clinic population. In order to assess health worker performance, each observed health worker needed to assess and classify at least one child with this classification. However, HIV prevalence among children in communities or in the clinic population was unknown, and the only data available were the HIV prevalence among women attending government antenatal care services. The antenatal HIV prevalence for each province was used to estimate the prevalence of HIV infection in children under five years. In KZN, the antenatal prevalence was 40.7% in 2004 [37]. Assuming that one-third of children become HIV infected through vertical transmission, the community prevalence in children under five years could be estimated to be around 13.5%. In Limpopo, similar assumptions suggested a community prevalence of approximately 6.5%. However, this may have been an overestimate since many HIV infected children die in the first year of life, and HIV infected children are likely to attend health facilities more frequently. Using these estimates, while acknowledging that they are imprecise, we planned to observe each health worker for 20 consultations. Thus, in Limpopo, observed health workers were expected to see one child and, in KZN, two children with SUSPECTED SYMPTOMATIC HIV during the 20 consultations observed.

Sample size for observed health workers

The sample size calculation was based on the determination of two outcomes, both related to the health worker's performance in implementing the HIV component of IMCI.

The first outcome was the sensitivity of the HIV algorithm when used by IMCI trained health workers compared to its use by an expert IMCI practitioner. This was calculated by estimating the proportion of HIV exposed or infected children correctly assessed and classified for SUSPECTED SYMPTOMATIC HIV by an IMCI trained health worker as compared to an IMCI expert (primary outcome 5a).

The following calculation was to determine the number of HIV positive children required in order to estimate the sensitivity of the algorithm.

The sample size calculation was based on the assumption that 80% (+/- 10%) of children with SUSPECTED SYMPTOMATIC HIV would be correctly identified by observed health workers, with

acceptable confidence limits of sensitivity between 70% and 90%. If the number of children examined by each health worker was 20, it was assumed that one of these children would have SUSPECTED SYMPTOMATIC HIV. The sample size was calculated using the formula for comparing two proportions:

$$n = \frac{P_1(1-p_1) + P_2(1-p_2)}{(P_1 - p_2)^2} (Z_\alpha + Z_\beta)^2$$

Thus, the number of symptomatic HIV cases required: = $\frac{(1.96)^2 (0.8) (0.2)}{(0.1)^2} = 62$

The number of children with SUSPECTED SYMPTOMATIC HIV required for observation was 62 and, based on the assumption that each health worker would be observed assessing at least one child with SUSPECTED SYMPTOMATIC HIV, the total number of health workers to be observed was 62.

The second outcome was the proportion of health workers who would make a correct classification for HIV in all 20 cases that they examine. This is a health worker based outcome and was calculated by estimating the proportion of all health workers observed who would classify all children correctly as having SUSPECTED SYMPTOMATIC HIV or not, as compared to an expert IMCI practitioner (primary outcome 5b). The sample size was calculated by assuming that the proportion of health workers able to correctly classify for HIV in all the children examined would be 80% with acceptable limits of the expected proportion between 70% and 90%.

Number of health workers required was therefore: = $\frac{(1.96)^2 (0.8) (0.2)}{(0.1)^2} = 62$

The number of health workers to be observed was, therefore, 62 and sampling was stratified by province with equal numbers selected in each province (31 health workers in each of the two provinces). This calculation was not dependent on the prevalence of SUSPECTED SYMPTOMATIC HIV in the observed population. Participants were randomly selected from a list of all IMCI trained health workers in each province obtained from the provincial IMCI co-ordinator. Selected health workers were not informed ahead of time that they were to be observed, but a general circular was sent out by the provincial Child Health Programme Manager informing staff that a survey of child health practices was to be undertaken and that observers would be visiting clinics to undertake observations of health workers managing sick children.

Determination of HIV prevalence among clinic attenders

From these calculations, 600 consultations in total were to be observed in each province. HIV test results from these children would be used to determine the prevalence of HIV infection among clinic attenders. The sample size required to determine accurately HIV prevalence in this population was calculated as follows:

$$n = z^2 \frac{P(1-P)}{\sigma^2}$$

Z= 1.96; P= prevalence; n= sample and σ is absolute precision

Thus, with a sample of 600 observed children in each province, the precision of 95% confidence intervals at different prevalence rates from 5 to 15% is shown below:

Prevalence	n	Precision	Lower Limit	Upper Limit
5%	600	$\pm 1.7\%$	3.3%	6.7%
7%	600	± 2.0	5.0%	9.0%
10%	600	± 2.4	7.6%	12.4%
15%	600	$\pm 2.9\%$	12.1%	17.9%

However, as the study progressed and in the light of an interim analysis, the sample size was revised to ensure that an adequate number of assessments were included to meet the primary objectives. The interim analysis showed that only 26% of health workers had correctly classified all children, and the community prevalence of HIV in Limpopo province was only 2%. The sample was, therefore, recalculated, and increased to 77 health workers. An additional 15 IMCI trained health workers were randomly selected in KZN, where HIV prevalence was higher.

4.3 Data collection

4.3.1 Focus group discussions

The researchers arranged FGDs in each province with the assistance of provincial IMCI role-players. A minimum of six and maximum of ten participants were selected for each FGD, depending on logistics. Two researchers conducted the FGDs using focus group discussion guides (Appendices 2 and 3). One researcher conducted the FGD and the other researcher took notes.

FGDs with health workers were conducted in English and those with carers were conducted in the local language, with a translator to translate for the researcher. The local language was Zulu in KZN and, in Limpopo, one FGD was conducted in Venda and one in Pedi. All discussions were audio-recorded. Participants were assured that, although a report would be written, comments from individuals would be anonymous and no names or other identifiers would be attached to any comment.

FGDs with **IMCI trained nurses** were conducted to discuss their experiences of IMCI training and of implementing IMCI in the workplace. Selected nurses were informed in writing about the research beforehand and requested to participate. They were informed that they would receive compensation for their transport costs and refreshments. Those willing to participate provided formal written consent (Appendix 4). FGDs were conducted at a convenient central point in the district and, to minimise disruption at clinics, groups were conducted in the afternoon.

Participants got to the venue using their own transport and received a small incentive (R50/ US\$ 6.25) to compensate for this; they were also served refreshments at the end of the discussion.

FGDs with **child-carers** were held at clinics selected by the district IMCI co-ordinator. The groups were conducted on the day when most immunisations are given to maximise the number of mothers or carers eligible to participate. Written informed consent was obtained from each participant, after a thorough explanation of the project (Appendix 5). After the FGD, participants were served refreshments. Researchers also ensured that participants' children were seen by a health worker timeously to minimise delays for participants.

4.3.2 Comparative survey

Seventy seven IMCI trained nurses were observed (31 in Limpopo, 45 in KZN) and data were collected in a total of 74 PHC clinics (29 in Limpopo, 45 in KZN). In Limpopo observations were conducted in all 6 districts as follows: Vhembe district (8 clinics); Mopani district (5 clinics); Sekhukhune district (4 clinics); Capricorn district (5 clinics); Bohlabelo district (7 clinics). Similarly in KZN participating clinics were selected from all 11 districts as follows: eThekweni district (8 clinics); Umgungundlovu district (3 clinics); Ilembe district (1 clinic); Ugu district (4 clinics); Sisonke district (3 clinics); Umzinyathi district (4 clinics); Zululand district (4 clinics); Umkhanyakude district (4 clinics); Amajuba district (6 clinics); Uthukela district (5 clinics); uThungulu district (3 clinics).

At each facility there were a number of steps in data collection. Study staff were introduced to carers of children waiting in the queue at the beginning of each day by a senior member of staff at the clinic, and the purpose of the research was explained. All carers of children aged 2-59 months, attending the clinic with a sick child, were approached individually by the study counsellor and asked to provide written informed consent using a detailed consent form (Appendix 6).

Consent was requested first for observation of the consultation. Carers were informed that an observer would be present during their child's consultation with the health worker and that, after the consultation, they would see a second observer who would also examine the child. If consent was obtained for observation, *and the carer was the parent or legal guardian of the child*, consent was requested for HIV counselling and testing of the child (VCT). Specific written consent was requested for HIV testing. If this was obtained, the counsellor undertook HIV pre-test counselling, so that blood samples could be taken during the data collection process. If consent for HIV testing was refused, the child was only observed and no blood sample for HIV testing was taken. If the carer was not the legal guardian of the child, consent was requested for observation only. If the child was known to be HIV infected and attending for follow-up, this was recorded and no further testing was done.

4.3.2.1 Observations

Each health worker was observed for a total of 20 consultations. On arrival at the clinic, the study team arranged for all eligible children waiting in the queue to be seen by the IMCI trained health worker and observed. This ensured that observed cases were a consecutive series of children attending the clinic. All children arriving at the clinic were added to those due to be observed. Observations continued until 20 sick child consultations had been observed, or for three days - whichever was the shorter. Observations were conducted by IMCI expert practitioners. IMCI experts were all professional nurses who had attended IMCI case management training, IMCI facilitators' training and had experience of being a course director for IMCI case management training. IMCI experts worked in teams of two: one IMCI expert (observer 1) sat in on the consultation and recorded the findings and activities of the health worker, and a second IMCI expert (observer 2), working in a different room, assessed each observed child and recorded the correct findings. To reduce observer bias, observed health workers were informed that observers were assessing child health care practises in the clinic, but not that IMCI in particular was being evaluated. Observations were completed regardless of whether the health worker was implementing IMCI, or using a different approach to the assessment and management of sick children.

Observations were undertaken as follows:

- Before starting the observations, the first IMCI expert (observer 1) recorded the study number of each observed health worker, and details of any training that the health worker had undergone related to care and management of children, including the dates of IMCI training, and details of IMCI supervision visits received (Appendix 7: Form 1 – Health worker information form).

- During observation of consultations with sick children, the findings of the health worker, and the care given to each child was recorded by observer 1 using a structured observers recording form based on the IMCI recording form (Appendix 8: Form 2 – Health worker observation form).
- A second IMCI expert (observer2) then reassessed the child in a separate room, without access to the findings of the health worker. Observer 2 recorded the findings of the IMCI assessment on a data collection sheet based on the IMCI recording form (Appendix 9: Form 3 - IMCI expert practitioner recording form).
- After completing Form 3, observer 2 reviewed the findings of the health worker and ensured that the child received all essential treatments according to IMCI guidelines.
- If consent was given by the mother or legal guardian for linked HIV testing, and pre-test counselling had been completed by the study counsellor, a heel prick sample was taken for HIV testing by observer 2.
- Observer 2 then completed clinical staging according to the WHO clinical staging for HIV in all children who had *not* been confirmed as HIV negative, including children confirmed HIV positive and children confirmed HIV exposed and awaiting a PCR result. The child was checked for signs of HIV according to the WHO Revised Clinical Staging of HIV/AIDS for Infants and Children (101), using a recording form simplified for use in primary care (Appendix 10: Form 4 –clinical signs for WHO staging form). This information was used to determine the clinical stage for children who were subsequently identified as HIV infected.
- Arrangements were made by observer 2 for on-going care of HIV infected and exposed children:
 - Children where the HIV status was confirmed as positive or negative received post-test counselling from the study counsellor.
 - Children confirmed as HIV infected were started on co-trimoxazole prophylaxis and referred for assessment for antiretroviral treatment.
 - Children under 18 months with a positive rapid test were confirmed as HIV exposed and were started on co-trimoxazole prophylaxis and arrangements were made for continued follow-up and post-test counselling when the PCR result was available.
- Where the HIV status of the child could not be confirmed at the initial visit, post-test counselling was arranged with the study counsellor at a later visit. This was usually for children below 18months with a positive HIV rapid test. The child was considered HIV exposed and started on co-trimoxazole at the initial visit, and a follow-up visit was scheduled for when the PCR result was available. Post-test counselling was given to the carer at this

follow-up visit. If the carer was the mother, appropriate counselling and advice was given regarding her own status and the importance of HIV testing.

- If the child was classified as SUSPECTED SYMPTOMATIC HIV by observer 2, and the carer was the mother or legal guardian but had *not* consented to HIV testing, the mother was counselled and informed her that there are clinical reasons for the child to be tested for HIV. If the mother then agreed to HIV testing, she returned to the study counsellor for pre-test counselling before the blood sample was taken. If the mother still refused to provide consent for HIV testing, despite a clinical indication, she was offered additional counselling by the study team.

This sequence of observations continued until the health worker had been observed for a total of 20 consultations. Observers did not interfere with the assessment or management of the child, or give any feedback to the health worker during or after the consultation. If the findings of the health worker were not clear from observation alone, the observer asked the health worker to clarify the findings on completion of the consultation. If the management of the child was incorrect or incomplete, the management was changed by observer 2 as appropriate.

4.3.2.2 HIV testing

After completing the assessment of the child, observer 2 determined whether consent was given for HIV testing, and if so, a capillary blood sample was taken. All HIV testing was undertaken by trained nurses. Observer 2 provided the counsellor with the results of the HIV test, so that appropriate HIV post-test counselling could be done. All blood samples for HIV testing were discarded after testing; no blood samples were stored for any purpose.

In **children over 18 months of age**, HIV testing was done using HIV rapid tests. The initial test used the Abbott Determine™ HIV -1/2 test (Abbott, Wiesbaden, Germany). If the initial test was negative, the child was confirmed as HIV uninfected and appropriate post-test counselling was provided. If the initial rapid test was positive, a confirmatory rapid test was done using Smart Chek™ test (World diagnostics, Miami, USA). If the confirmatory test was positive, the child was considered HIV infected and appropriate post-test counselling was done. Arrangements were made for follow-up and on-going management of all newly diagnosed HIV infected children. Post-test counselling was given on the same day for all children over 18 months, unless HIV results were discordant, in which case blood was sent for ELISA testing and arrangements made for post-test counselling at a later date.

For **children aged below 18 months** an initial HIV rapid test was done using the Abbott Determine™ HIV -1/2 test. If this was negative, the child was considered HIV uninfected and the carer was given appropriate post-test counselling by the study counsellor. At the same time as taking the blood for the rapid test, dried blood spot (DBS) samples were collected by finger or heel prick using a lancet and collected onto filter paper. Filter papers were spotted with 50 micro litres of whole blood, air-dried (usually 3 hours) and then placed into envelopes labelled with the name, study number and age of the child. Each envelope was placed inside a sealing plastic bag with desiccant granules. If the initial HIV rapid test was positive, the child was considered HIV exposed, and the DBS sample was transported to Inkosi Albert Luthuli Central Hospital (IALCH) in Durban for HIV PCR testing to confirm the HIV infection status. DBS samples were tested for HIV-1 DNA using the HIV-1 DNA test, version 1.5 (Roche, Branchburg, USA). For children below 18 months of age, carers were requested to attend for post-test counselling, at a later date, when the PCR test result was available.

CD4 counts were done on all children confirmed as HIV infected. A sample of 1-2ml of blood was taken in an EDTA tube (Vacurette, GreinerBio-one, Kremsumunster, Austria), which was sent to IALCH for CD-4 cell count. This was performed using the Panleucogated CD4 Epics® XL™ (Beckmancoulter, Galway, Ireland). All children who were confirmed HIV infected were referred to the HIV clinic for possible ART initiation.

4.3.2.3 Review of health facility supports

After completion of all observations, the two observers reviewed the resources available at the clinic to support the implementation of IMCI. This included availability of medication, counsellors, and HIV counselling and testing services for children, and whether there was privacy to provide follow-up for HIV infected children.

The observers then reviewed the clinic registers and recorded the number of sick children under five years who attended the clinic, the number of first antenatal visits, as well as the number of children and pregnant women tested for HIV in the previous calendar month. HIV infection is not recorded in the clinic records, but the number of prescriptions for co-trimoxazole syrup prophylaxis to children under one year over a period of a month was used as an aggregated indicator for follow-up of HIV infected or exposed children. The number of scripts for co-trimoxazole syrup was compared to the number of women testing HIV positive over a similar time period to give a crude estimate of follow-up for HIV exposed infants. This information was recorded on the Health Facility Observation Form (Appendix 11: Form 5 - Facility review form).

Only after completion of all observations, before the observers left the clinic, was feedback given to observed health worker about their overall performance during all observed consultations. This was to avoid any process of 'learning' occurring over the period of observation through giving health workers feedback during data collection.

4.2.3.4. Flow of activities

The observers undertook a series of activities during their visit to each primary level health facility as shown below. In facilities where there was more than one IMCI trained health worker the observer completed all observations for all health workers before doing the review of the health facility.

Figure 9: Flow of study activities

	Study worker responsible	Activity	Data collection tool
1.	Observer 1	Health worker information	Form 1: Health worker information form
For each observed child (aged 2-59months):			
2.	Study counsellor	Consent for observation of consultation	Consent form
3.	Study counsellor	Consent for VCT & pre-test counselling)	Consent form
4.	Observer 1	Observation of health worker consultation with sick child	Form 2: Health worker observation form
5.	Observer 2	Re-assessment of the child to obtain correct findings	Form 3: Expert IMCI practitioner recording form
6.	Observer 2	Blood sample for HIV testing	
7.	Observer 2	Modified WHO Clinical staging for HIV in infants and Children	Form 4: clinical signs for WHO staging form
8.	Study counsellor	Post-test counselling if HIV status confirmed	
9.	Study counsellor	Appointment for post-test counselling if HIV status not confirmed	
10.	Observer 2	Initiate treatment of all infected or exposed children and arrange follow-up	
Repeat until 20 observations completed			
11.	Both observers	Review of health facility	Form 5: Health Facility Review form
12.	Both observers	Feedback to observed health worker	

4.4 Data Analyses

4.4.1 Focus group discussions

Audio tapes from FGDs with carers were transcribed verbatim in the local language and then translated. The audio tapes from FGD's conducted in English were also transcribed verbatim. The transcripts, together with the researcher's written observations, were analysed by two researchers independently. Descriptive thematic coding was the primary analytical strategy (102). Major and minor themes were identified manually, and conflicting interpretations were discussed by the two researchers in order to reach a consensus position. Justification of each researcher's interpretations and theme selection was sought in the data, and the major and minor themes were represented as far as possible in the FGD participants' own words. The relationship of the major themes to the research questions, and to one another, was explained.

4.4.2 Comparative survey

All observed health workers were allocated a code linked to the province and district where they worked. No identifying information about the health worker or the facility was recorded. The health worker code was recorded on each data collection tool, so that data from observations could be linked for each observed health worker and comparisons of performance between districts and provinces could be made. Each observed child was also given a number linked to the code for the health worker, so that the health workers' findings could be linked to the findings of observer 2, and to the HIV result.

All variables were pre-coded and data were double-entered into an Epi-info database (version 6.04) and validated to zero errors. Results of HIV tests and CD4 counts were added to the database when these were available. For every child confirmed as HIV positive, findings of the WHO clinical staging of the child were reviewed, and a clinical stage was assigned and added to the data base. The findings regarding staging for children who were subsequently found to be HIV negative were discarded.

After completion of data entry, the data were cleaned by checking for consistency. Source documents were used to confirm the correct entry where there was inconsistency. Range checks were used to ensure that all entries fell within the appropriate range of values for each variable. Analysis was conducted using SPSS (version 13.0), Stata (version 13.0) and SAS 9.2.

4.4.2.1 Disease profile of children

The analysis of disease profiles compared presenting complaints, disease classifications, nutritional status, and hospital referral in children presenting for care at PHC clinics in Limpopo and KZN. HIV seroprevalence by age group and province was calculated and 95% confidence

intervals (CIs) were calculated using the Wilson approach. Logistic regression was performed to adjust for confounding and to assess for potential effect modification by age, province, and HIV infection status.

4.4.2.2 Evaluation of the quality of IMCI assessments:

To evaluate the performance of observed health workers, health worker assessments were compared to those made by the IMCI experts, which were taken as the reference assessment for the purposes of analysis. To assess the performance of each health worker during the period of analysis, the proportion of observed children correctly assessed for each main symptom was calculated for each health worker. Using the child as the unit of analysis, the proportion of children with each main symptom who were assessed correctly, assessed incorrectly or not assessed at all by each observed health worker was calculated. The proportion of children with each IMCI classification who were correctly classified by observed health workers was calculated, using the child as the unit of analysis. We calculated 95% confidence intervals for all performance indicators

4.4.2.3 Evaluation of IMCI guidelines for HIV

To evaluate the performance of health workers in the assessment for HIV, the sensitivity of the algorithm when used by the IMCI trained health worker as compared to the expert IMCI practitioner was calculated. This was the proportion of children identified as SUSPECTED SYMPTOMATIC HIV by the expert IMCI practitioner who were correctly identified by IMCI trained health workers.

The sensitivity of the HIV algorithm when used by the IMCI trained health worker and by the IMCI expert, as compared to the HIV test result, was determined by calculating the proportion of all children with positive HIV tests who were identified as SUSPECTED SYMPTOMATIC HIV by the health worker and by the IMCI expert. The specificity of the HIV algorithm was determined by calculating the proportion of HIV negative children who were correctly identified as SYMPTOMATIC HIV UNLIKELY by the IMCI trained health worker and IMCI expert. Using the number of children identified as SUSPECTED SYMPTOMATIC HIV by the expert IMCI practitioner as the denominator, the proportion of these children who were managed appropriately and given correct feeding advice by IMCI trained health workers was calculated.

4.5 Ethical considerations

Permission for undertaking the research project was obtained from the Heads of Health in KZN and Limpopo provinces, and from the Research Directorate at the South African National Department of Health. Ethical approval was obtained from the Biomedical Ethics Review Committees of the University of KwaZulu-Natal, Durban (Ref. E214/05) and the World Health Organization, Geneva, Switzerland.

This research study provided benefits to the study population and to mothers and children attending PHC facilities in the two provinces, by providing evidence-based recommendations to improve health care delivery to sick children. We were able to determine the effectiveness of IMCI at operational level and whether IMCI is being implemented as intended. This allowed us to conclude whether IMCI is an effective mechanism to improve coverage of key interventions, particularly PMTCT and HIV management, at clinics in South Africa and elsewhere. Evidence-based recommendations have been made to improve IMCI implementation and improve quality of care for children.

4.5.1 Focus group discussions

Health care workers participating in FGDs were informed, in writing, about the research beforehand and requested to attend. Those who attended were given a full explanation of the purpose of the research and provided written consent. Anyone not wishing to participate was free to refuse. Carers of children were asked to volunteer to participate on the day of the discussion. Those willing to participate were given a full explanation of the research and provided written consent. All participants were assured that they were free to refuse or withdraw at any time, without adverse consequences.

Local Department of Health managers were excluded from involvement in any of the FGDs, so that both mothers and nurses could participate freely. All participants were assured that individual contributions to the discussions are confidential and that no individuals will be named in any report. Participants in FGDs with nurses were paid a small, locally appropriate amount to compensate for travelling expenses (R50/\$6.25) and were given refreshments. Child carers were given refreshments only. There were no additional incentives to participate.

One risk to participants was that participation could be time consuming. This was minimised for health workers by undertaking FGDs during work time and providing compensation for transport costs. For carers, we ensured that their children were seen timeously by a health worker on completion of the FGD. Participants might have felt uncomfortable about some of the questions, particularly those about HIV. To minimise this, the discussion was kept general so that no participant felt pressured to speak about personal experiences.

4.5.2 Comparative survey

All IMCI trained health workers were informed beforehand, by a circular from the Maternal and Child Health programme manager for each province, that a study was being undertaken to assess care provided to children at clinics. Health workers were not told individually that they had been selected, or given a date when observers would visit the clinic. Observers referred to the circular when they arrived at the clinic. Health workers were told that observations were anonymous and that implementation of child health care in general was being evaluated, rather than their individual performance. Health workers gave verbal consent, but since this was a South African National Department of Health review, health workers were requested by the Department of Health to participate. No identifying information about individual health workers was recorded. Data from observations were linked using a code for each health worker.

All carers bringing a child aged 2-59 months to the clinic on the day of the study were given general information about the research being undertaken. They were then seen individually by a study counsellor to obtain consent. Carers were told that there would be an observer present during the consultation with the health worker, and that after the consultation a second observer would see the child and ask some additional questions. Carers were informed that they could refuse participation at any time without their care being adversely affected, and that all observers were qualified health workers.

Possible risks for carers included that privacy during the consultation may have been compromised by the presence of an observer, and observations could have led to some delays for child carers. However, carers generally appreciated the additional time with the health worker, and care of the child was likely improved as a result of the observation and second assessment by the IMCI expert.

If the carer was the parent or legal guardian, he/she was asked to consent to receive HIV pre-test counselling, after which he/she could decide whether to have the child tested for HIV. Carers were informed that they were free to refuse without adverse consequences, and that all children attending the clinic were being asked to participate in the study and have an HIV test, so participation in the study did not mean that we think the child has HIV. If the carer agreed, HIV pre-test counselling was provided by the study counsellor and, if the carer still agreed to linked HIV testing, written consent for HIV testing was obtained.

There are a number of possible risks relating to HIV testing: blood sampling was undertaken in children where it was not immediately indicated, the effects of which were minimised by use of capillary rather than venous samples. In those patients having venepuncture for clinical reasons, a drop of blood obtained was used for HIV testing, thus avoiding unnecessary trauma for the child.

The study was conducted in a very high HIV prevalence area where antiretroviral treatments are available. Our study made HIV counselling and testing more accessible to many children and their mothers or legal guardians. It was expected that children would be identified as HIV infected at an earlier stage and would benefit from having earlier access to treatments. When children were identified as HIV exposed, appropriate interventions, with co-trimoxazole and on-going follow-up, were initiated immediately. Mothers of children who tested negative were given the opportunity to have individual counselling about HIV, and were advised about testing for themselves and staying HIV negative. For breastfeeding mothers, counselling was given about safe sex during breastfeeding. In this way, counselling provided during the study by the study counsellors is likely to have led to beneficial outcomes for children enrolled in the study and their mothers.

In order to ensure that the mother or legal guardian was giving informed consent for HIV testing:

- All consent was obtained by a trained HIV counsellor in the local language
- The purposes of the study were explained in detail
- The mother or guardian was assured that the care of the child would in no way be adversely affected should consent be refused
- Mothers or guardians provided written consent using a detailed consent form translated into the local language
- Mothers were given information on the benefits of HIV testing, and received comprehensive HIV pre- and post-test counselling.

4.6 Study organisation

4.6.1 Project manager

The study was overseen by the researcher (CH) who functioned as project manager. She was responsible for training of staff members, overseeing their work, and ensuring that the study operated effectively and efficiently. The project manager took overall responsibility for data collection. This included developing systems and standard operating procedures, as well as supervision of the provincial study co-ordinators to ensure that these procedures were implemented. The project manager provided support to the provincial co-ordinators for any problems that arose. On completion of data entry, data cleaning and analysis was undertaken by the project manager with support from a statistician.

4.6.2 Data collection teams

A team of two observers and two counsellors collected data in each of the two provinces, supervised by a research co-ordinator in each province.

4.6.2.1 Research co-ordinator

The research co-ordinator was responsible for the day-to-day running of the study in each province, and ensuring that the project was conducted according to the standard operating procedures.

Key responsibilities included:

- Liaison with district management teams
- Organising the field work, including arranging the schedule of clinic visits, and accommodation and transport for field workers
- Ensuring data collection forms and other supplies were available at all times
- Managing and numbering of the data collection tools
- Collection of completed forms
- Quality control
- Transport and storage of dried blood spot samples
- Supervision of data collection.

4.6.2.2 IMCI expert practitioners

IMCI expert practitioners were all experienced IMCI practitioners and IMCI facilitators, and received additional training in data collection, to ensure that the quality of the observer's assessment represented a gold standard. IMCI experts were responsible for doing observations, and undertaking data collection and blood sampling according to standard operating procedures. When children were identified as HIV infected or HIV exposed, it was the responsibility of the IMCI experts to initiate treatments and arrange for appropriate on-going follow-up using routine services.

4.6.2.3 Study counsellors

All study counsellors had completed a two-week AIDS counselling course, and additional training in obtaining informed consent. Counsellors were responsible for obtaining informed consent for all mothers or carers of children to be observed, as well as pre- and post-test counselling for carers/guardians who agreed to HIV testing.

4.7 Training of data collection teams

Two weeks of staff training for project staff was conducted at a single venue for IMCI experts, counsellors and study co-ordinators. This training was conducted by the project manager (CH).

The training covered the following aspects:

- Revision of information regarding HIV infection, risks of HIV transmission, HIV testing in children etc.
- Revision of IMCI case management with emphasis on the HIV adaptations to IMCI
- Clinical practise in IMCI classification and management conducted in both inpatient and outpatient facilities
- Clinical practise in feeding assessments and advice for mothers of children with SUSPECTED SYMPTOMATIC HIV using role plays and clinical practise
- Instruction and clinical practise in counselling skills and in obtaining informed consent
- Training on the use of the WHO Clinical staging for Infants and Children adapted for use in primary care, including relevant clinical skills
- Instruction and practise with use of HIV rapid test kits
- Instruction and practise at taking dried blood spot samples for HIV PCR testing and in the handling of these samples
- Practise in the use of the data collection tools using instructions and role plays
- Supervised practise of using the data collection tools in the field.

4.8 Pilot study

The pilot study was integrated into the training of data collection teams so that both activities were completed during the two-week training period. Data collectors visited IMCI trained health workers at two clinics not included in the final sample and conducted all aspects of data collection according to the standard operating procedures. In this way, logistical problems were identified and the tools were tested in a field situation. Adaptations to the tools were made as required.

Chapter Five: Publications

Paper 1: Disease profile of children under 5 years attending primary health care clinics in a high HIV prevalence setting in South Africa (Horwood *et al.*, *Tropical Medicine and International Health*, 2011). The disease profile among children attending primary health care facilities in two provinces of South Africa is described, including the burden of severe illness and undiagnosed HIV disease. This provides a picture of the burden of childhood illnesses that IMCI trained health workers address during day-to-day consultations with sick children, and whether these complaints are comprehensively addressed by IMCI guidelines.

Paper 2: Experiences of training and implementation of integrated management of childhood illness (IMCI) in South Africa: a qualitative evaluation of the IMCI case management training course (Horwood *et al.*, *BMC Pediatrics*, 2009). This paper explores and describes IMCI trained nurses' experiences of the content and methodology of the IMCI training course, as well as their experiences, as newly trained IMCI practitioners, in transferring their skills to the workplace after training. Enabling factors and barriers to IMCI implementation are explored.

Paper 3: Routine checks for HIV in children attending primary health care facilities in South Africa: attitudes of nurses and child caregivers (Horwood *et al.*, *Social Science and Medicine*, 2009). In this paper experiences of the implementation of the HIV component of IMCI, including checking every child for HIV, are explored from the perspective of IMCI trained nurses, and mothers or carers of young children attending the clinic. IMCI trained nurses also describe the barriers and enablers for implementation of the HIV component of IMCI.

Paper 4: An Evaluation of the Quality of IMCI Assessments among IMCI Trained Health Workers in South Africa (Horwood *et al.*, *PLoS One*, 2009). In this paper, data are presented describing IMCI implementation by IMCI trained health workers in their routine practice in two provinces in South Africa. Using the observed health worker as the unit of analysis, as well as the child, this paper presents a detailed analysis of the gaps in IMCI implementation, and makes appropriate evidence-based recommendations.

Paper 5: Paediatric HIV management at primary care level: an evaluation of the integrated management of childhood illness (IMCI) guidelines for HIV (Horwood *et al.*, *BMC paediatrics*, 2009). This paper describes implementation of the HIV component of IMCI in detail. We compare the effectiveness of the IMCI HIV algorithm when comprehensively implemented by IMCI experts, with its use in routine practice, and finally with HIV results.

Disease profile of children under 5 years attending primary health care clinics in a high HIV prevalence setting in South Africa

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Summary

OBJECTIVE To describe the presenting complaints and disease profile of children attending primary health care (PHC) clinics in two provinces of South Africa.

METHODS Participants were sick children 2–59 months old presenting for care at PHC clinics in KwaZulu-Natal (KZN) and Limpopo provinces from 2006–2007. Children were assessed by an expert Integrated Management of Childhood Illnesses (IMCI) practitioner. Children for whom parental/guardian consent was obtained were tested for HIV.

RESULTS A total of 1357 children attending one of 74 clinics were assessed. HIV seroprevalence overall was 7.1%, but was significantly higher in KZN than Limpopo (7.5 vs. 2.4%; OR = 3.3, 95% CI 1.9–5.8%). Commonest presenting complaints were cough (72%), skin conditions (22%) and diarrhoea (19%). Of 1349 children, 120 (8.9%) had a weight below the third percentile; 108/1357 (8.0%) children required urgent referral, most commonly for severe pneumonia (53.7%) and severe malnutrition (16.7%). In multivariate analyses, severe pneumonia, growth faltering and urgent referral were independently associated with younger age, residence in KZN and HIV infection ($P < 0.05$).

CONCLUSIONS Many children with severe illnesses and undiagnosed HIV infection present to PHC facilities. PHC staff require skills to correctly manage these conditions and undertake HIV testing. Although IMCI provides evidence-based guidelines, implementation must be improved to achieve adequate coverage of life-saving interventions.

keywords HIV/epidemiology, child health services, South Africa/epidemiology, primary health care, Africa, Integrated Management of Childhood Illness

Introduction

The millennium development goal for child mortality (MDG4) commits nations to reduce child deaths by two-thirds by 2015 (UN 2000). However, in South Africa, child mortality has increased over the past decade (Chopra *et al.* 2009a), despite the introduction of free health care services for children. This increase is largely driven by HIV, and there is a correspondingly high HIV prevalence among pregnant women (SA National Department of Health [DoH] 2008). HIV causes over 50% of deaths in children under 5 years (Chopra *et al.* 2009a), but diarrhoeal disease, lower respiratory infections and malnutrition are still important causes of child mortality (Garrib *et al.*

2006). Most child deaths could be prevented by the implementation of good quality primary health care (PHC) services (Bradshaw *et al.* 2003).

Integrated Management of Childhood Illness (IMCI) was introduced in South Africa in 1997 and is the gold standard for management of sick children at PHC level. IMCI is a child survival strategy developed by WHO and UNICEF (Tulloch 1999), which aims to improve case management skills of first-level health workers, strengthen the health system for effective management of sick children and promote good family and community child care practices (Bryce *et al.* 2005). IMCI provides guidelines for health workers in the management of those conditions causing most child deaths. Guidelines are

adapted to suit local conditions, and in South Africa, IMCI guidelines focus on acute respiratory infections, diarrhoeal disease, meningitis, malaria, ear infections, HIV and malnutrition.

Although there are published reports describing causes of child deaths in South Africa (Grandin *et al.* 2006; Bradshaw *et al.* 2008) and some hospital-based data on morbidity in children (Zwi *et al.* 1999; Yeung *et al.* 2000), we are not aware of any published data describing morbidity among children at primary care level. It is important to understand the profile of diseases with which children present to PHC facilities to inform child health policies and to ensure health workers have the resources and training to provide appropriate care for children.

In this article, we describe the disease profile of children under 5 years attending PHC clinics in two provinces of South Africa, with particular reference to the prevalence of paediatric HIV in this population.

Methods

Study sites and population

The study was conducted between May 2006 and January 2007 in two provinces in South Africa: KwaZulu-Natal (KZN) and Limpopo. Limpopo province has an estimated population of 5.2 million (Statistics South Africa 2009) and is predominantly rural, with high rates of poverty and unemployment, and poor access to basic services (SA DoH 2004; SA DoH and Medical Research Council 2007). KZN has relatively lower rates of poverty and several large urban centres, but almost 50% of the population still live in rural areas (Van Aardt & Schacht 2004), and with a population of over 10 million, KZN is the most populous of South Africa's provinces (Statistics South Africa 2009). Antenatal HIV seroprevalence in 2006 was 39.1% in KZN and 20.7% in Limpopo (SA National DoH 2007).

The primary objective of this study was to evaluate IMCI implementation, particularly the HIV component (Horwood *et al.* 2009b). To identify health workers for inclusion in the study, we randomly selected IMCI-trained health workers by a simple random sample, using computer-generated random numbers, from a list of all IMCI-trained health workers currently working in PHC clinics in the two provinces. Seventy-seven health workers, all registered nurses, were selected (31 in Limpopo and 46 in KZN); data were therefore collected in the 74 PHC clinics (29 in Limpopo and 45 in KZN) where these nurses were working. At the time of the study, IMCI was being implemented at 60% (283/474) of PHC clinics in Limpopo, and 64% (387/604) clinics in KZN.

At each clinic, children 2–59 months old who presented for care because of illness (not for immunisations or weighing only) and their accompanying caregivers were recruited to participate. Once informed consent was obtained, consultations between IMCI-trained nurses and sick children were observed by an IMCI expert who recorded the presenting complaints reported by the caregiver. Thereafter, a second IMCI expert assessed the same child independently. Selected nurses were observed for 20 consecutive consultations with study-eligible children, or for 3 days if 20 observations had not been completed in that time. All IMCI experts were experienced IMCI practitioners who received training in use of data collection tools, which were piloted prior to start of data collection.

Measures

Integrated Management of Childhood Illness experts used standardized data collection tools to record children's clinical presentations and classification of disease. Clinical features identified in the assessment are clearly defined according to IMCI guidelines (WHO 2002). The findings of the assessment by the second IMCI expert were considered to be the gold standard for the present analyses.

Presenting complaints

Children presenting symptoms were assessed from caregiver reports to the observed health worker and to the second IMCI expert to ensure that comprehensive information about caregivers' complaints was included. A coding system was developed for presenting complaints; these were coded into groups of related symptoms, which were considered as relating to a single condition. Coding of presenting complaints was conducted by two doctors independently, according to agreed criteria, discrepancies were discussed and agreement reached. Coding is described in Table 2.

Disease classification

Findings were classified according to IMCI guidelines, which are a set of evidence-based guidelines for management of the leading causes of mortality and severe morbidity in children under 5 years of age (WHO 2008).

Nutritional status

All children were routinely weighed, and the weight-for-age plotted on the South African growth monitoring chart (SA National DoH 2002). Children were defined as being underweight if the weight was below the third percentile

(weight-for-age Z-score [WAZ] <-2 standard deviations), and severe malnutrition was defined as those children with weight below the marasmic line (WAZ <-3 standard deviations). If the child's weight was above the third percentile, the weight gain was assessed from the curve plotted on the growth chart: weight gain parallel to the growth curve was defined as good weight gain, weight gain falling away from the curve was defined as inadequate weight gain, or if there was documented weight loss, this was recorded.

HIV testing

Children over 18 months old were screened for HIV antibodies using the rapid test Determine™ HIV-1/2 (Abbott, Wiesbaden, Germany). All positives were confirmed by a second HIV rapid test using the Smart Check™ HIV1/2 (World Diagnostics Inc, Miami, USA). If the screening HIV rapid test was positive in children younger than 18 months, HIV status was confirmed with PCR testing. Fifty microlitres of whole blood was collected by heel prick using a lancet and dropped onto a filter paper for the dried blood spot (DBS). The filter paper was transported to Inkosi Albert Luthuli Central Hospital in Durban for PCR testing. The DBSs were tested for HIV-1 DNA using the HIV-1 DNA test, version 1.5 (Roche, Branchburg, USA). All blood samples were discarded when HIV testing was complete.

Statistical analysis

Our primary analysis compared presenting complaints, disease classifications, nutritional status and hospital referral in children presenting for care in PHC clinics in Limpopo and KZN. HIV seroprevalence by age group and province was calculated, and 95% confidence intervals (CIs) were calculated using the Wilson approach. Logistic regression was performed to adjust for confounding and assessed for potential effect modification by age, province and HIV infection status. HIV status was included to account for differences in outcomes attributable to HIV infection. Province was also included to account for additional differences (e.g. population density, water sources, socio-economic status, etc.) between provinces not accounted for by other model covariates such as HIV status. Because the sample included children presenting for care at different clinics through each of two provinces, it could not be assumed that their outcomes were independent of province. Therefore, we used the generalized estimating equations approach with an exchangeable correlation structure to account for within-clinic correlations of responses (Liang & Zeger 1986; Zeger & Liang

1986). All potential explanatory variables were retained in regression models. Analyses were conducted using SAS 9.2 (SAS Institute, Cary, NC).

Ethical approval

Permission to undertake the study was obtained from the South African National DoH, and the provincial Departments of Health in Limpopo and KZN. Written informed consent was obtained from the caregiver who accompanied the child to the clinic. Separate consent was requested for HIV testing of children. For children accompanied by a caregiver who was not the legal guardian, consent was requested for observation and assessment by the IMCI expert only. When consent for HIV testing was obtained, pre- and post-test counselling was provided by HIV counsellors on the study team, and the mother received the result. Ethical approval was obtained from the Biomedical Research Ethics Committees of the University of KwaZulu-Natal Medical School, Durban, and the World Health Organization, Geneva.

Results

Participants

A total of 1357 children between 2 and 59 months of age [median = 15 months, interquartile range (IQR) 7–29 months] presenting for care at one of 74 PHC clinics in KZN ($n = 858$) and Limpopo provinces ($n = 499$) between May 2006 and January 2007 were assessed (Table 1).

HIV seroprevalence among children

Carers of 10 (0.74%) children reported that the child had had a prior positive HIV test, which was confirmed from

Table 1 Characteristics of 1357 children age 2–59 months presenting to primary health care facilities in KwaZulu-Natal (KZN) ($n = 858$) and Limpopo provinces ($n = 499$), South Africa

	KZN	Limpopo	Overall
	N (%)	N (%)	N (%)
Age group			
2–11 months	344 (40.1%)	207 (41.5%)	551 (40.6%)
12–23 months	222 (25.9%)	122 (24.5%)	344 (25.4%)
24–35 months	137 (16.0%)	74 (14.8%)	211 (15.6%)
36–47 months	90 (10.5%)	62 (12.4%)	152 (11.2%)
48–60 months	65 (7.6%)	34 (6.8%)	99 (7.3%)
HIV infection status			
Infected	64 (7.5%)	12 (2.4%)	76 (5.6%)
Uninfected	603 (70.3%)	386 (77.4%)	989 (72.9%)
Unknown	191 (22.3%)	101 (20.2%)	292 (21.5%)

clinic records. Of 1347 children with unknown HIV status, consent for HIV testing was obtained from the carers of 1060 (78.7%) children; evaluable results were available for 1054 children, 66 (6.3%) were confirmed HIV-infected and 988 (93.7%) tested negative for HIV, resulting in an overall HIV seroprevalence of 7.1% (76/1064). HIV seroprevalence by province is presented in Table 1, and by province and age group in Figure 1. HIV seroprevalence was significantly higher among children attending clinics in KZN compared to Limpopo (7.5 vs. 2.4%; OR = 3.3, 95% CI 1.9–5.8, $P < 0.001$), but was not significantly associated with months of age (OR 1.0, 95% CI 0.99–1.02, $P_{\text{trend}} = 0.24$).

Presenting complaints

The most common presenting complaints were cough or difficult breathing (72%), skin conditions (22%) and diarrhoea (19%) (Table 2). Of 1357 enrolled children, 551 (41%) presented with two or more complaints (median number of complaints = 1, IQR = 1–2, absolute range = 1–4). In analyses adjusted for age (months), province and HIV status, the odds of presenting with two or more complaints were significantly higher among

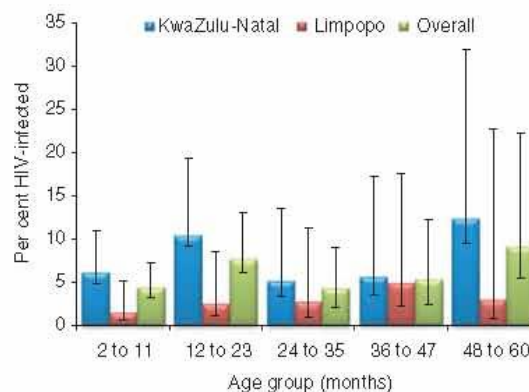


Figure 1 HIV seroprevalence in children by province and age group.

children presenting to clinics in KZN [adjusted odds ratio (AOR) 1.8, 95% CI 1.4–2.3, $P < 0.001$] and among children who were HIV-infected compared to those who were HIV-uninfected or whose HIV status was unknown (AOR 2.3, 95% CI 1.4–3.9, $P = 0.001$). The number of presenting

Table 2 Presenting complaints of 1357 children age 2–59 months presenting to primary health care facilities in KwaZulu-Natal province ($n = 858$) and Limpopo province ($n = 499$), South Africa^a

Presenting complaint	Definition	Number presenting with complaint	%
Cough or difficult breathing	With/without fever, runny nose, vomiting [†] , sneezing. Includes carer reports the child has asthma ($n = 6$)	976	71.9
Runny nose	Includes runny/blocked nose, 'flu', sneezing, without cough	15	1.1
Diarrhoeal disease	With/without abdominal pain, vomiting, fever. Includes diarrhoea with blood ($n = 13$)	261	19.2
Abdominal complaints (without diarrhoea)	Includes abdominal pain, vomiting & constipation	74	5.5
Worms	Carer reports seeing worms	40	2.9
Mouth sores/ulcers	Includes oral thrush reported by the carer	74	5.5
Skin conditions	Includes rash, skin sores, or abscess (10) on any part of the body	295	21.7
Ear infection	Includes ear pain or ear discharge with/without fever	85	6.3
Eye problem	Includes discharging eyes, sore eyes or red eyes	68	5.0
Fever alone	Fever with no other associated symptoms	11	0.81
Sore throat	Carer reports that child has a sore throat	12	0.88
Injury	Carer reports an injury	12	0.88
Miscellaneous	Includes convulsions (2), nose bleed (5), headache (10), grinding teeth (3), urinary symptoms (3), itchy ears without pain or discharge (10), poor appetite alone, mumps, swelling, TB follow-up, thrush, penile discharge or sores, joint pains, bleeding gums, delayed development, teething etc.	87	6.4

^aComplaints as presented by carer prior to direct questioning about symptoms.

[†]Vomiting was considered to be related to the cough if no other abdominal symptoms were reported. Vomiting without cough or with other abdominal symptoms was coded as diarrhoeal disease or abdominal complaint.

complaints did not differ significantly by age (AOR 1.007, 95%CI 1.0–1.02, $P = 0.06$).

Cough and difficulty breathing

Cough and difficulty breathing was mentioned by 976/1357 (71.9%) carers when asked about their child's problems, but by 1076 (79.3%) when asked directly if the child had a cough or difficult breathing. Of these children, 59 (5.5%) had lower chest wall in-drawing during inspiration and 3 (0.28%) had stridor. These 62 children were classified as having severe pneumonia (Table 3) and referred urgently to hospital. Pneumonia was defined as the presence of tachypnoea (>50 breaths per minute if 2–11 months old; >40 breaths per minute if 12–59 months old). A total of 358 (33.3%) children with cough had pneumonia and treated at home with oral antibiotics (Table 3). Most children with cough (59.9%) had no signs of respiratory distress and received no specific treatment.

In analyses adjusted for age (months), province and HIV infection status, diagnoses with pneumonia and severe pneumonia increased significantly with younger age ($P < 0.001$) (Table 4). HIV-infected children had seven times the odds of being diagnosed with severe pneumonia compared to HIV-uninfected children (AOR 7.1, 95%CI 3.4–14.8).

Diarrhoeal disease

Children with diarrhoea were assessed for dehydration according to the presence or absence of four signs: child's general condition, how the child is drinking, skin turgor and sunken eyes. When questioned directly, 310/1357 (22.8%) carers reported the child had diarrhoea (Table 3). Presentation with diarrhoea was independently associated with younger age (AOR = 0.97, 95%CI 0.96–0.98, $P < 0.001$), residence in KZN (AOR = 1.7, 95%CI 1.3–2.3, $P < 0.001$) and HIV infection (AOR 1.6, 95%CI 1.001–2.4, $P = 0.05$).

Of 310 children with diarrhoea, 3 (0.97%) had severe dehydration (defined as diarrhoea with two of the following signs: lethargic or unconscious, unable to drink or drinking poorly, sunken eyes, skin pinch goes back very slowly >2 s) and 37 (11.9%) had some dehydration (defined as diarrhoea with two of the following signs: restless or irritable, drinking eagerly or thirsty, slow skin pinch and sunken eyes) (Table 3). Younger age was independently associated with having some or severe dehydration ($P < 0.01$) (Table 4).

Among children with diarrhoea, 33 (10.6%) had dysentery (defined as blood in the stool), and 12 (3.9%) had persistent diarrhoea (defined as diarrhoea for >14 days).

Table 3 Disease classifications among children presenting at primary health clinics in Limpopo province and KwaZulu-Natal province, South Africa

	Presentation with cough or difficulty breathing ($n = 1076$)*						Presentation with diarrhoea ($N = 310$)*				All children ($N = 1357$)	
	Severe Pneumonia		Pneumonia		Cough or cold		Some or severe dehydration		Poor weight gain or weight loss		Yes	No
	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No		
Age (months), per 1 month increase (median, IQR)	6.0 (3.0–16.0)	15.0 (7.0–29.0)	11.0 (5.0–19.0)	18.0 (9.0–34.0)	20.0 (10.0–35.0)	10.0 (5.0–18.0)	9.0 (5.5–16.0)	13.0 (7.0–22.0)	13.5 (8.0–22.0)	13.0 (6.0–26.0)		
Province												
Limpopo	10 (16.1%)	420 (41.4%)	156 (43.6%)	274 (38.2%)	261 (40.5%)	169 (39.2%)	7 (17.5%)	77 (28.6%)	99 (24.6%)	354 (47.0%)		
KwaZulu-Natal	52 (83.9%)	594 (58.6%)	202 (56.4%)	444 (61.8%)	384 (59.5%)	262 (60.8%)	33 (82.5%)	192 (71.4%)	303 (75.4)	399 (53.0)		
HIV infection status												
Uninfected	35 (56.5%)	756 (74.6%)	263 (73.5%)	528 (73.5%)	484 (75.0%)	307 (71.2%)	27 (67.5%)	199 (74.0%)	278 (69.2)	576 (76.5)		
Infected	14 (22.6%)	48 (4.7%)	25 (7.0%)	37 (5.2%)	21 (3.3%)	41 (9.5%)	4 (10.0%)	20 (7.4%)	43 (10.7)	23 (3.1)		
Unknown	13 (21.0%)	210 (20.7%)	70 (19.6%)	153 (21.3%)	140 (21.7%)	83 (19.3%)	9 (22.5%)	50 (18.6%)	81 (20.2)	154 (20.5)		

*Number of carers who reported symptom after being directly asked about their child's problems by the nurse.

†Missing data for 1 child.

Table 4 Determinants of respiratory disease, dehydration and growth faltering among children presenting at primary health clinics in Limpopo province and KwaZulu-Natal province, South Africa

	Presentation with cough or difficulty breathing (<i>n</i> = 1076)†				Presentation with diarrhoea (<i>n</i> = 310)‡				All children (<i>n</i> = 1357)					
	Severe Pneumonia <i>N</i> = 62		Pneumonia <i>N</i> = 358		Cough or cold <i>N</i> = 645		Some or severe dehydration <i>N</i> = 40		Poor weight gain or weight loss <i>N</i> = 402		OR (95%CI)‡		AOR (95%CI)‡	
	OR (95%CI)	AOR (95%CI)‡	OR (95%CI)	AOR (95%CI)‡	OR (95%CI)	AOR (95%CI)‡	OR (95%CI)	AOR (95%CI)‡	OR (95%CI)	AOR (95%CI)‡	OR (95%CI)	AOR (95%CI)‡	OR (95%CI)	AOR (95%CI)‡
Age, per 1 month increase	0.94 (0.91–0.97)***	0.93 (0.90–0.96)***	0.95 (0.94–0.96)***	0.95 (0.94–0.96)***	1.1 (1.05–1.07)***	1.1 (1.05–1.07)***	0.95 (0.91–0.99)**	0.94 (0.90–0.98)**	0.99 (0.98–1.0)*	0.99 (0.98–1.0)*	0.99 (0.98–1.0)*	0.99 (0.98–1.0)*	0.99 (0.98–1.0)*	0.99 (0.98–1.0)*
Province														
Limpopo	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference
KwaZulu-Natal	3.7 (1.9–7.0)***	3.2 (1.7–6.1)***	0.80 (0.62–1.03)	0.75 (0.57–0.99)*	0.95 (0.75–1.2)	1.04 (0.79–1.4)	1.8 (0.61–5.2)	1.8 (0.57–5.7)	2.8 (1.9–4.1)***	2.6 (1.8–3.8)***	2.8 (1.9–4.1)***	2.6 (1.8–3.8)***	2.6 (1.8–3.8)***	2.6 (1.8–3.8)***
HIV infection status§														
Uninfected	6.1 (3.2–11.6)	7.1 (3.4–14.8)	1.4 (0.82–2.3)	1.8 (1.02–3.2)	0.33 (0.20–0.52)	0.21 (0.12–0.38)	1.6 (0.58–4.3)	1.9 (0.64–5.7)	3.5 (2.2–5.4)	3.4 (2.1–5.5)	3.5 (2.2–5.4)	3.4 (2.1–5.5)	3.4 (2.1–5.5)	3.4 (2.1–5.5)
Infected	1.3 (0.74–2.4)	1.7 (0.89–3.1)	0.92 (0.62–1.4)	1.2 (0.78–1.8)	1.1 (0.75–1.5)	0.81 (0.56–1.2)	1.4 (0.65–3.0)	1.6 (0.74–3.3)	1.04 (0.76–1.4)	1.1 (0.77–1.4)	1.6 (0.76–3.3)	1.1 (0.77–1.4)	1.1 (0.77–1.4)	1.1 (0.77–1.4)
Unknown	χ ² (2) = 8.7**	χ ² (2) = 8.9**	χ ² (2) = 1.9	χ ² (2) = 3.7	χ ² (2) = 14.6***	χ ² (2) = 17.3***	χ ² (2) = 1.2	χ ² (2) = 1.9	χ ² (2) = 16.7***	χ ² (2) = 15.8***	χ ² (2) = 16.7***	χ ² (2) = 15.8***	χ ² (2) = 15.8***	χ ² (2) = 15.8***

P* ≤ 0.05, *P* ≤ 0.01, ****P* ≤ 0.001.

†Number of carers who reported symptom after being directly asked about their child's problems by the nurse.

‡Adjusted for all other variables in column.

§For explanatory variables with three or more levels, the omnibus Wald chi-square test was performed to calculate the *P* value.

After controlling for age (months) and HIV infection status, only residence in KZN was associated with classification of dysentery (AOR 2.4, 95%CI 1.04–5.5, $P = 0.04$). There was no evidence for an association between age, province or HIV infection status and classification of persistent diarrhoea ($P > 0.05$ for all).

Nutritional assessment

Weight-for-age Z-scores were available for 1349 children. With reference to the South African national growth monitoring charts (SA National DoH, 2002), 120 (8.9%) children were underweight, including 12 (10.0%) with severe malnutrition (WAZ < -3 standard deviations). Seven children with severe malnutrition were HIV-infected. In analyses adjusted for age (months), province and HIV infection status, HIV-infected children had significantly higher odds of being underweight than children who were HIV-uninfected or whose HIV status was unknown (AOR = 5.4, 95%CI 3.1–9.3, $P < 0.001$). There was no evidence for an independent association between being underweight and age (AOR 1.0, 95%CI 0.99–1.0) or province (AOR 1.1, 0.60–2.1).

Growth charts were available for 1155 children; 753 (65.2%) children were gaining weight well, 210 (18.2%)

had inadequate weight gain and 192 (16.6%) had documented weight loss (Table 3). Younger age, residence in KZN and HIV infection were independently associated with inadequate weight gain or loss (Table 4). The odds of inadequate weight gain or loss were more three times greater among HIV-infected children than HIV-uninfected children (Table 4).

When directly asked, caregivers reported weight loss in 329/1357 (24.2%) children, but this was never mentioned as a presenting complaint. There was moderate correlation between reported and documented weight loss; 164/192 (85.4%) children with documented weight loss were reported as having lost weight ($P < 0.001$, correlation coefficient ($\Phi = 0.64$)). Similarly, there was moderate correlation between reported weight loss and growth faltering; carers of 252/401 (62.8%) children with documented inadequate weight gain or weight loss reported that the child had lost weight ($P < 0.001$, $\Phi = 0.66$).

Urgent referral

Following IMCI guidelines, 108/1357 (8.0%) children required urgent referral to the district hospital (Table 5). Thirteen (12.0%) children had more than one condition requiring referral: six children had both severe pneumonia

Table 5 Reasons for referral to hospital of children age 2–59 months presenting to primary health clinics, $N = 108$

Reason for referral	Defined as	Number of children referred* <i>n</i> (%)
Severe pneumonia	Cough with chest in-drawing† ± fast breathing	58 (53.7%)
Severe malnutrition	Weight-for-age Z-score > -3 standard deviations below expected weight	18 (16.7%)
Blood in the stool	Blood in stools AND dehydration OR child aged below 12 months	15 (13.8%)
Persistent diarrhoea	Diarrhoea for 14 days or more AND dehydration OR reported weight loss	11 (10.2%)
Convulsions‡	History of convulsions with this illness	6 (5.6%)
Vomits everything or unable to drink/breastfeed	Child either unable to take fluids or unable to keep any fluids down	4 (3.7%)
Diarrhoea with severe dehydration	Diarrhoea with two of the following: Lethargic or unconscious; Unable to drink or drinking poorly; Sunken eyes; Skin pinch goes back >2 s	3 (2.8%)
Lethargic or unconscious	Child who is unresponsive or drowsy	3 (2.8%)
Stridor	Harsh noise heard on inspiration	3 (2.8%)
Possible meningitis	Stiff neck or bulging fontanelle	2 (1.9%)

*Total does not sum to total number of children because some children referred for two or more reasons.

†Defined as the lower chest wall moving in when the child breathes out.

‡Includes four children where the mother only reported convulsions when asked during the consultation, rather than as a presenting complaint.

Table 6 Determinants of urgent referral among children presenting at primary health clinics in Limpopo province and KwaZulu-Natal (KZN) province, South Africa ($n = 1357$)

	Unadjusted OR (95% CI) <i>P</i> value	Adjusted OR† (95% CI) <i>P</i> value
Age, per 1 month increase	0.96 (0.94–0.98)***	0.95 (0.93–0.97)***
Province		
Limpopo	Reference	Reference
KZN	2.9 (1.7–5.0)***	2.5 (1.5–4.2)***
HIV infection status‡		
Uninfected	Reference	Reference
Infected	8.9 (5.1–15.6)	10.0 (5.2–19.2)
Unknown	1.1 (0.71–1.8)	1.3 (0.80–2.2)
	$\chi^2(2) = 14.6$ ***	$\chi^2(2) = 14.6$ ***

*** $P \leq 0.001$.

†Adjusted for all variables in column.

‡For explanatory variables with three or more levels, the omnibus Wald chi-square test was performed to calculate the *P* value.

and severe malnutrition; two children with severe malnutrition also had stridor and one had persistent diarrhoea; one child with severe pneumonia also had blood in the stools. Of three children who were lethargic or unconscious, two had severe dehydration and one had severe pneumonia. Of 28 HIV-infected children requiring urgent referral, 11 (39.3%) had severe malnutrition and 14 (50.0%) had severe pneumonia, including two with both conditions. Younger age, residence in KZN and HIV infection were independently associated with urgent referral (Table 6). HIV-infected children had 10 times the odds of being referred that HIV-uninfected children had.

Discussion

We examined presenting complaints, disease classification, nutritional status and HIV seroprevalence in a large sample of sick children attending PHC facilities in South Africa. To our knowledge, this is the first study to describe the disease profile of this population of children. Our findings show that serious illnesses, including emergency conditions and undiagnosed HIV infection, are common among children at PHC level. MDG4 requires a two-thirds reduction in child mortality by 2015, whereas South Africa is one of only 12 countries globally where child mortality is increasing (Chopra *et al.* 2009b). Our findings highlight the important role of good quality PHC services in managing life-threatening conditions in children, including identification and management of HIV infection, and we confirm that the overwhelming majority of serious illness is

caused by a small number of conditions. This gives clear direction for interventions to improve childhood morbidity and mortality at primary level.

Most children presented with a cough or difficult breathing, and pneumonia was the commonest cause of severe illness. Pneumonia is the largest cause of child deaths globally, causing an estimated 2 million deaths annually (Mulholland 2007). Health workers must have skills to identify and manage children with severe pneumonia and distinguish them from the many children with coughs and colds. IMCI provides the current standard for pneumonia case management at primary level in most developing countries, but coverage and quality of IMCI implementation is frequently poor (Armstrong Schellenberg *et al.* 2004; Pariyo *et al.* 2005; Rowe *et al.* 2009), and may not reach the poorest communities (Victora *et al.* 2006). In South Africa, IMCI implementation is sub-optimal, and IMCI-trained health workers perform most poorly in the assessment of seriously ill children (Horwood *et al.* 2009a). Training in assessment and management of acute respiratory infections is a simpler alternative to IMCI, which could achieve rapid coverage and give health workers skills to manage most of the severely ill children in our setting. However, if clinics are to provide integrated and holistic care to children, innovative solutions are required to improve IMCI implementation and maintain health worker skills at primary level. There is a need for improved evaluations of methods to develop and sustain adequate coverage of child survival interventions (Victora *et al.* 2004).

Despite availability of interventions for the prevention of mother-to-child HIV transmission (PMTCT), undiagnosed HIV infection is common among children attending PHC clinics in South Africa and is frequently associated with severe disease and malnutrition (Horwood *et al.* 2009b). In our study, one-third of children requiring referral were found to be HIV-infected. Further, we found a statistically significant association between HIV infection and the presence of severe pneumonia, as well as faltering growth. The obtained findings for effects, though based on relatively small group sizes, are potentially useful in suggesting future targets of focused research. Follow-up of infants enrolled in PMTCT programmes is frequently poor (Doherty *et al.* 2005; Jones *et al.* 2005) and depends on health workers at PHC clinics identifying HIV-exposed children (Sherman *et al.* 2004). Early initiation of antiretroviral therapy in HIV-infected children substantially improves outcomes (Violari *et al.* 2008), but only a minority of children needing treatment currently receive it (World Health Organization, United Nations Children's Fund, UNAIDS, 2009). Increasing provider-initiated voluntary counselling and testing for children at PHC clinics should therefore be a priority, and in high HIV

prevalence settings, screening all children for HIV should be considered (Rollins *et al.* 2007). Training in the specific counselling and communication skills required when dealing with children and families in the context of severe or terminal illness would improve health workers' confidence to initiate HIV testing and provide ongoing care for HIV-infected children (Horwood *et al.* 2009c). All children under 5 years referred from PHC clinics to hospital should routinely be tested for HIV.

A comparison of disease profiles of children in the higher HIV prevalence area of KZN with those in the lower prevalence area of Limpopo showed that even when controlling for HIV infection, living in KZN was an independent risk factor for having multiple complaints, pneumonia (including severe pneumonia) and growth faltering. There is little systematic evidence examining the health of HIV-exposed but uninfected children, but increased mortality has been described, particularly where the mother has advanced disease or has died (Newell *et al.* 2004; Marinda *et al.* 2007). A high proportion of children in KZN are HIV-exposed, and as HIV transmission rates from mother-to-child are reduced by increasing coverage and effectiveness of PMTCT programmes, the health problems of these children are likely to become of major public health importance. Further research is required to determine the health needs of these children and to evaluate interventions (Filteau 2009).

Many sick children were malnourished, with more than a third of children having either poor weight gain or loss of weight. Weight-for-age below the third percentile, a later sign of malnutrition, was less common. If growth monitoring is to improve outcomes, it should be combined with feeding advice and with food supplements and vitamin A (Bhutta *et al.* 2008). Health workers must plot the weight-for-age on the growth chart at every visit, intervene early if weight gain is poor, and directly ask mothers about a history of weight loss in the child. Counselling mothers about infant feeding should be routine in a child health consultation. Health workers require adequate training and resources for the management of children with growth faltering. Although zinc supplementation improves outcomes, particularly in children with diarrhoea, zinc formulations are not currently available in PHC facilities in South Africa.

Conclusion

If children's lives are to be saved and quality of care for children in PHC clinics improved, health workers need to have the skills to manage common presenting problems, identify severely ill children and those with unidentified HIV infection, and to provide appropriate, effective

interventions. IMCI is currently the gold standard for management of sick children at primary level but implementation needs to be improved if adequate coverage is to be achieved.

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References

- Armstrong Schellenberg JR, Adam T, Mshinda H *et al.* (2004) Effectiveness and cost of facility-based Integrated Management of Childhood Illness (IMCI) in Tanzania. *Lancet* 364, 1583–1594.
- Bhutta ZA, Ahmed T, Black RE *et al.* (2008) What works? Interventions for maternal and child undernutrition and survival. *Lancet* 371, 417–440.
- Bradshaw D, Bourne D & Nannan N (2003) What are the leading causes of death among South African Children? *MRC Policy Brief No 3*, Medical Research Council, Cape Town, South Africa. <http://www.mrc.ac.za/policybriefs/childmortality.pdf> (accessed 2 November 2010).
- Bradshaw D, Chopra M, Kerber K *et al.* (2008) Every death counts: use of mortality audit data for decision making to save the lives of mothers, babies, and children in South Africa. *Lancet* 371, 1294–1304.
- Bryce J, Victora CG, Habicht JP, Black RE & Scherpbier RW (2005) Programmatic pathways to child survival: results of a multi-country evaluation of Integrated Management of Childhood Illness. *Health Policy and Planning* 20 (Suppl. 1), i5–i17.

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- Chopra M, Daviaud E, Pattinson R, Fonn S & Lawn JE (2009a) Saving the lives of South Africa's mothers, babies, and children: can the health system deliver? *Lancet* 374, 835–846.
- Chopra M, Lawn JE, Sanders D *et al.* (2009b) Achieving the health Millennium Development Goals for South Africa: challenges and priorities. *Lancet* 374, 1023–1031.
- Department Of Health: South Africa (2004) *State of the Province: Limpopo*. National Department of Health, Pretoria, South Africa.
- Department Of Health: South Africa (2007) *HIV and AIDS and STI Strategic Plan for South Africa 2007–2011*. National Department of Health, Pretoria, South Africa.
- Doherty TM, McCoy D & Donohue S (2005) Health system constraints to optimal coverage of the prevention of mother-to-child HIV transmission programme in South Africa: lessons from the implementation of the national pilot programme. *African Health Sciences* 5, 213–218.
- Filteau S (2009) The HIV-exposed, uninfected African child. *Tropical Medicine & International Health* 14, 276–287.
- Garrib A, Jaffar S, Knight S, Bradshaw D & Bennish ML (2006) Rates and causes of child mortality in an area of high HIV prevalence in rural South Africa. *Tropical Medicine & International Health* 11, 1841–1848.
- Grandin W, Westwood T, Lagerdien K & King MS (2006) Deaths at Red Cross Children's Hospital, Cape Town 1999–2003 – a study of death notification forms. *South African Medical Journal* 96, 964–968.
- Horwood C, Vermaak K, Rollins N, Haskins L, Nkosi P & Qazi S (2009a) An evaluation of the quality of IMCI assessments among IMCI trained health workers in South Africa. *PLoS ONE* 4, e5937.
- Horwood C, Vermaak K, Rollins N, Haskins L, Nkosi P & Qazi S (2009b) Paediatric HIV management at primary care level: an evaluation of the integrated management of childhood illness (IMCI) guidelines for HIV. *BMC Pediatrics* 9, 59.
- Horwood C, Voce A, Vermaak K, Rollins N & Qazi S (2009c) Routine checks for HIV in children attending primary health care facilities in South Africa: attitudes of nurses and child caregivers. *Social Science and Medicine* 65, 1249–1259.
- Jones SA, Sherman GG & Varga CA (2005) Exploring socio-economic conditions and poor follow-up rates of HIV-exposed infants in Johannesburg, South Africa. *AIDS Care* 17, 466–470.
- Liang KY & Zeger SL (1986) Longitudinal data analysis using generalized linear models. *Biometrika* 73, 13–22.
- Marinda E, Humphrey JH, Iliff PJ *et al.* (2007) Child mortality according to maternal and infant HIV status in Zimbabwe. *Pediatric Infectious Disease Journal* 26, 519–526.
- Mulholland K (2007) Childhood pneumonia mortality – a permanent global emergency. *Lancet* 370, 285–289.
- Newell ML, Coovadia H, Cortina-Borja M, Rollins N, Gaillard P & Dabis F (2004) Mortality of infected and uninfected infants born to HIV-infected mothers in Africa: a pooled analysis. *Lancet* 364, 1236–1243.
- Pariyo GW, Gouws E, Bryce J & Burnham G (2005) Improving facility-based care for sick children in Uganda: training is not enough. *Health Policy and Planning* 20 (Suppl. 1), i58–i68.
- Rollins N, Little K, Mzolo S, Horwood C & Newell ML (2007) Surveillance of mother-to-child transmission prevention programmes at immunization clinics: the case for universal screening. *AIDS* 21, 1341–1347.
- Rowe AK, Onikpo F, Lama M, Osterholt DM, Rowe SY & Deming MS (2009) A multifaceted intervention to improve health worker adherence to integrated management of childhood illness guidelines in Benin. *American Journal of Public Health* 99, 837–846.
- Sherman GG, Jones SA, Coovadia AH, Urban MF & Bolton KD (2004) PMTCT from research to reality – results from a routine service. *South African Medical Journal* 94, 289–292.
- South African Department Of Health (2002) The Road to Health Chart: guidelines for health workers. Available at: <http://www.doh.gov.za/search/index.html> (accessed 20 April 2010).
- South African Department Of Health (2008) *The National HIV and Syphilis Seroprevalence Survey 2007*. National Department of Health, Pretoria. Available at: <http://www.doh.gov.za/docs/index.html> (accessed 20 April 2010).
- South African Department Of Health & Medical Research Council (2007) *South African Demographic and Health Survey, 2003*. Pretoria. Available at: <http://www.doh.gov.za/docs/index.html> (accessed 20 April 2010).
- Statistics South Africa (2009) *Mid-year Population Estimates 2009*. Statistics South Africa, Pretoria. <http://www.statssa.gov.za/publications/P0302/P03022009.pdf> (accessed 2 November 2010).
- Tulloch J (1999) Integrated approach to child health in developing countries. *Lancet* 354 (Suppl. 2), S116–S120.
- United Nations (2000) United Nations General Assembly Resolution 2, Session 55. United Nations Millennium Declaration on 8 September 2000.
- Van Aardt CJ & Schacht A (2004) *Demographic and Statistical Overview: 1994–2004*. Department of Social Development, Pretoria, South Africa.
- Victoria CG, Hanson K, Bryce J & Vaughan JP (2004) Achieving universal coverage with health interventions. *Lancet* 364, 1541–1548.
- Victoria CG, Huicho L, Amaral JJ *et al.* (2006) Are health interventions implemented where they are most needed? district uptake of the integrated management of childhood illness strategy in Brazil, Peru and the United Republic of Tanzania. *Bulletin of the World Health Organization* 84, 792–801.
- Violari A, Cotton MF, Gibb DM *et al.* (2008) Early antiretroviral therapy and mortality among HIV-infected infants. *New England Journal of Medicine* 359, 2233–2244.
- World Health Organization (2002) *IMCI Adaptation Guide*, WHO, Geneva. World Health Organization. Available at: http://www.who.int/child_adolescent_health/documents/imci_adaptation/en/index.html (accessed 20 April 2010).
- World Health Organization (2008) *IMCI Chart Booklet for High HIV Settings*. WHO, Geneva. Available at: http://www.who.int/child_adolescent_health/documents/9789241597388/en/index.html (accessed 20 April 2010).

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World Health Organization, United Nations Children's Fund, UNAIDS (2009) *Towards universal access: scaling up priority HIV/AIDS interventions in the health sector. Progress report 2009*. World Health Organization, Geneva.

Yeung S, Wilkinson D, Escott S & Gilks CF (2000) Paediatric HIV infection in a rural South African district hospital. *Journal of Tropical Pediatrics* **46**, 107–110.

Zeger SL & Liang KY (1986) Longitudinal data analysis for discrete and continuous outcomes. *Biometrics* **42**, 121–130.

Zwi KJ, Pettifor JM & Soderlund N (1999) Paediatric hospital admissions at a South African urban regional hospital: the impact of HIV, 1992–1997. *Annals of Tropical Paediatrics* **19**, 135–142.

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Research article

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Experiences of training and implementation of integrated management of childhood illness (IMCI) in South Africa: a qualitative evaluation of the IMCI case management training course

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Abstract

Background: Integrated Management of Childhood Illness (IMCI) is a strategy to reduce mortality and morbidity in children under-5 years by improving management of common illnesses at primary level. IMCI has been shown to improve health worker performance, but constraints have been identified in achieving sufficient coverage to improve child survival, and implementation remains sub-optimal. At the core of the IMCI strategy is a clinical guideline whereby health workers use a series of algorithms to assess and manage a sick child, and give counselling to carers. IMCI is taught using a structured 11-day training course that combines classroom work with clinical practise; a variety of training techniques are used, supported by comprehensive training materials and detailed instructions for facilitators.

Methods: We conducted focus group discussions with IMCI trained health workers to explore their experiences of the methodology and content of the IMCI training course, whether they thought they gained the skills required for implementation, and their experiences of follow-up visits.

Results: Health workers found the training interesting, informative and empowering, and there was consensus that it improved their skills in managing sick children. They appreciated the variety of learning methods employed, and felt that repetition was important to reinforce knowledge and skills. Facilitators were rated highly for their knowledge and commitment, as well as their ability to identify problems and help participants as required. However, health workers felt strongly that the training time was too short to acquire skills in all areas of IMCI. Their increased confidence in managing sick children was identified by health workers as an enabling factor for IMCI implementation in the workplace, but additional time required for IMCI consultations was expressed as a major barrier. Although follow-up visits were described as very helpful, these were often delayed and there was no ongoing clinical supervision.

Conclusion: The IMCI training course was reported to be an effective method of acquiring skills, but more time is required, either during the course, or with follow-up, to improve IMCI implementation. Innovative solutions may be required to ensure that adequate skills are acquired and maintained.

Background

Infant and child mortality remains high in developing countries, where almost 10 million deaths occur annually in children under-5 years old [1]; most deaths are from common, preventable and easily treatable childhood diseases [2]. The millennium development goal for child mortality commits nations to reduce child deaths by two thirds by 2015 [3]. However, in South Africa, child mortality has risen over the past decade. HIV/AIDS is the commonest cause of death in children under-5 years, but diarrhoeal disease, pneumonia and malnutrition remain important causes of mortality [4]. More than 60% of global child deaths could be prevented by proven interventions available and affordable today [5], but coverage remains low particularly in low income countries [6]. The challenge is to improve coverage of child survival interventions to a level that will have a positive impact on child mortality [7].

Integrated Management of Childhood Illness (IMCI) is a strategy developed by the World Health Organisation (WHO) and United Nations Children's Fund (UNICEF) to improve child survival in resource poor settings [8]. IMCI seeks to improve case management skills of first level health workers, strengthen the health system for effective management of sick children, and promote good family and community child care practices [9]. The child is treated holistically with evidence based interventions that are feasible to implement in countries where most child deaths occur [5]. South Africa adopted IMCI in 1997, and is one of over 100 developing countries to do so [10].

At the core of the IMCI strategy are integrated guidelines for assessment and management of sick children at primary level, focussing on the conditions that cause most child deaths [11]. Rather than make a diagnosis, IMCI practitioners classify the child's illness according to severity using a series of algorithms, from which specific treatments are identified. IMCI guidelines are built around a series of simple questions, and easily recognised and defined signs and symptoms [12-14], with emphasis on nutrition, health promotion and counselling. Primary care workers are trained in IMCI using a structured training course developed by WHO, which is supported with extensive learning materials. Course participants receive a chart booklet containing all the IMCI guidelines to use as a desk reference. The 11 days of training combines classroom work with hands-on clinical practise, and participants achieve competency by repetition, combined with individual feedback from facilitators [15]. To achieve high quality training, IMCI facilitators are carefully selected, on the basis of their performance, to attend an additional 5-day IMCI facilitators training course. WHO recommends at least one facilitator for every four participants, and tools

are provided for intensive monitoring of participants' progress. A course director oversees the quality of the training, and reviews the performance of participants [15]. A detailed guide directs facilitators in conducting each learning activity, so that content and activities are largely consistent between different training sites and different countries. All IMCI trained health workers should receive at least one follow-up visit in their own health facility after training, to reinforce their skills and solve implementation problems [16].

IMCI provides a model for comprehensive implementation of proven public health interventions. An evaluation carried out in 5 countries [17] showed improvements in health worker performance following IMCI training [18,19]. Children seen by IMCI trained health workers were significantly more likely to receive correct treatments, and IMCI trained health workers communicated better with carers [20]. Although IMCI consultations take longer, IMCI was shown to be efficient [21] and cost less than routine care in some settings [22]. Despite these improvements, absolute levels of health worker performance were often poor. In Uganda, less than half of children received correct treatment [23], and in Peru this was as low as 10% [24]. Even in the most successful implementation sites there was considerable room for improvement [25].

If child survival is to be improved, reasons for poor performance of IMCI trained health workers must be identified and understood. The knowledge and skills acquired during training are important determinants of performance, but performance is also influenced by other factors, including health workers' perceptions and motivation, attitudes of the client and community, and the environment in the health facility. Health workers face continually changing environments, so even if a new guideline is fully understood they may not replace their pre-existing practise, but are more likely to modify it to incorporate some aspects of the new guidelines [26]. Supervision has been shown to improve performance [27] and can bridge the gap between knowledge and practise. It is, therefore, important to know how health workers experience learning and implementing IMCI, and their experiences of follow-up visits, to understand what determines health workers' ability to acquire new skills and transfer them to the workplace.

There have been no previous published evaluations of IMCI case management training since its initial field test in 1997 [28]. In this article we describe the experiences of the content and methodology of the IMCI training from the perspective of IMCI trained health workers in South Africa, and whether health workers feel that they were given the skills to implement IMCI. We also investigate

their experiences of IMCI implementation, including barriers and enabling factors to implementing IMCI in the workplace, and experiences of follow-up after training.

Methods

Setting

Focus group discussions (FGD's) with IMCI trained health workers were conducted in two provinces of South Africa, KwaZulu-Natal (KZN) and Limpopo, in April and May 2006. Both provinces began implementing IMCI in 1998 and, at the time of our study, 1325 health workers had been trained in Limpopo and 1300 in KZN, comprising 47% and 32% of health workers seeing children in primary health care (PHC) clinics respectively. IMCI was being implemented in 283 of 474 (60%) PHC clinics in Limpopo, and 387 of 604 (64%) clinics in KZN. All IMCI trained health workers working in PHC clinics are registered nurses. A total of five FGD's were conducted, three in KZN and two in Limpopo. Ethical approval was obtained from the Biomedical Research Ethics Committees of the University of KwaZulu-Natal Medical School, Durban, and WHO, Geneva.

Respondents

Limpopo and KZN provinces were selected at the request of the Department of Health, because they are regarded as the two provinces at the forefront of IMCI implementation in South Africa. Urban and rural districts were then selected in each province based on convenience, three districts in KZN, and two in Limpopo. IMCI co-ordinators from each district selected up to 10 IMCI trained nurses to participate in the focus groups. Nurses were purposively selected on the basis that they had attended an 11-day IMCI course, were currently working in a PHC clinic, and that they would contribute to a discussion of IMCI implementation. These selection criteria were applied to ensure that respondents had relevant experience of IMCI training and implementation, and would provide in-depth information for the discussions. This approach is inherent in purposive sampling strategies, where the focus is on understanding important cases rather than on generalising from a sample to a population[29].

Respondents were informed in writing about the research and invited to participate. They were compensated for transport costs and received refreshments, but there was no other incentive to participate. Written consent was obtained, and anyone not wishing to participate was free to refuse. Respondents were assured that individual comments would remain confidential.

Discussions with nurses were conducted by an experienced researcher (AV) with the help of an observer who took notes (CH). Discussions were conducted in English

and were audio recorded. The discussions were open-ended, and allowed respondents to direct the discussion.

Analysis of the data

The audio tapes were transcribed verbatim. The transcriptions, together with the observation notes, were analyzed by two researchers independently. Major and minor themes were identified through manual content analysis of the transcripts, and differing interpretations were discussed in order to reach consensus. Consensus was reached on all themes.

Results

General experiences

Overall, respondents found the IMCI training interesting, informative, empowering, and transformative. There was consensus that the training improved their skills and confidence in managing sick children. Respondents were relieved that they would not be formally assessed, and they found the learning situation relaxed, and accepting.

"It was eye-opening, very much interesting, but phew the workload! But at the end it's just that it's nice, because we are not going to write a test, you grasp whatever you can." (FGD 4)

"The situation was relaxed, there is no shouting ... and there is no shame if you are left behind. No, you just feel the same like others." (FGD 1)

Respondents experienced the facilitators as dedicated and friendly. Facilitators took time to explain, were knowledgeable, well-informed and experienced, and had a lot of understanding of the context within which the health workers functioned.

" [the facilitators] convey the message alright, and they are kind and friendly, they don't have attitudes, the situation was relaxed. They seem to have a lot of understanding, a lot of knowledge, because if you ask some questions, they just answer you there and then. Yes, and they can spot a person who is behind, and they can just assist you." (FGD 1)

"They [facilitators] were people who had worked in the clinics before, so they knew what problems we go through, making it easier." (FGD 4)

During IMCI training, progress of participants' is monitored and additional help provided as necessary. It was frequently mentioned that facilitators were responsive to 'slow learners', so it appeared that respondents noticed and appreciated this.

"When we go to the clinical session- let's say that person has missed a sign, then they [facilitators] will be with this per-

son and show her how to identify a positive sign on that child, so that she can see her mistake and next time she will be able to do it correctly." (FGD 3)

Content of the training

The content of IMCI training was described as comprehensive, covering all aspects of managing a sick child in a way that simplified the management of childhood illnesses, and reduced the anxiety previously felt about assessing and caring for children, especially young babies.

"For me it was exciting, because before I used to have an attitude about assessing a child. I wasn't sure what to look at in a child, especially a newborn, it was not easy for me. But after IMCI I gained a lot of skills and knowledge, and now for me it is easy when I am going to assess a child, there's not much problem." (FGD 4)

In particular respondents mentioned that they found the HIV component of IMCI to be "very good" and "very important", particularly when dealing with the mother of a child suspected to be infected with HIV.

"It gave me the skills .. on how to approach the mother [about HIV], which was a bit difficult before, but after doing IMCI I started enjoying it ... I even developed my own tricky ways of approaching the mother." (FGD 1)

However, many respondents felt there was too much information to learn in 11 days of training. The first week is spent on the module 'the sick child aged 2 months up to 5 years', and 'the sick young infant aged 1 week up to 2 months' is completed during the second week, together with modules on counselling and follow-up for sick children. There was consensus that more time was needed for the sick young infant, which was felt to be very important. Similarly, some respondents felt that the time allocated to breastfeeding was inadequate.

"Eleven days is too strenuous. By the time when we come to the end of the course everybody is just exhausted, they don't absorb anything, especially with the sick young infant At least the first part of it, the first week, it's good." (FGD 1)

"When coming to breastfeeding, I gained the experience after training, not during training. The facilitators were very much fast, they were in a hurry." (FGD 2)

Training Methods: Classroom

Training methods are highly structured, and a variety of teaching methods are used. Participants are given reading, written exercises, and case studies to complete, and feedback is given to individuals, or to the whole group. There are presentations from facilitators, group discussions, role-plays, photographs, and video presentations. There

was general agreement that the training methods were good, helpful, improved understanding of the course content, and facilitated integration between theory and practice. Respondents appreciated the variety of adult learning methods employed, and the reinforcement that was provided by utilising different methods to cover the same material. They also appreciated the "recapping" sessions at the beginning of each day.

"The methods [were] very good, [they] involved all the types of methods used in teaching. A theoretical and a practical [part], and the exercises in between so we can practise what we learnt, the demonstrations, the role plays and also the exercises. And there is a lot of repetition, that's why at the end of the training they are now able to implement what they have learnt, because they repeat." (FGD 3)

Some respondents expressed that the course materials were user-friendly and easy to read.

"The chart booklet as well as the manuals they are user-friendly, it is easy to follow them, they are short, straight to the point and you know it's easy to read" (FGD 1)

Training methods: Practical

Participants attend one-hour clinical sessions in the hospital paediatric ward, and in the PHC clinic each day. Clinical teaching is provided by the facilitators in the clinic, and by a doctor on the ward who is trained in IMCI clinical instruction. Respondents stated that the practical component was useful to reinforce the theory they had learnt, and to learn clinical skills. A major theme identified was that respondents felt they needed more time for the practical, particularly because of the travelling involved.

"During practical there are doctors who guide us. They tell you 'go and listen to that child and hear the sound', and they will tell you 'this is the sound', and then if you don't know that sound, you listen to the child ... oh, that is the one they are talking about ... [We know] because we have experienced it in the practical" (FGD4)

"The practical part is not enough, because you have to be in the ward maybe [for] plus or minus one hour, doing three or four cases, and then after that you go back to the clinic so you had to rush." (FGD 1)

Training period

IMCI training is conducted for 11 days over two consecutive weeks. It was strongly and repeatedly expressed by most respondents that the period of training was too short. However, in one focus group, some did feel that the period of training "was OK".

"The training period was too short for what we've been doing. It was too short, and there were more modules to read at the same time... I think maybe if you can just add some other weeks to the training and just give it some [more] time." (FGD 1)

"The period of training, I think it was OK, because the participants had that time of being in the classroom where they go through all the manuals, and then they also have a session of going out to the clinical session where they implement what they have learnt in the class." (FGD 3)

Follow up after training

Follow-up visits are considered part of IMCI training, and should be carried out 4-6 weeks after IMCI training to help new IMCI practitioners transfer their skills to the workplace. Some respondents reported that it took months, sometimes years, before they received a follow-up visit. Respondents anticipated the follow-up visit with ambivalent feelings: they wanted the visit, but were unsure how their performance would be rated. Most respondents reported either no follow-up or one follow-up visit, but some reported receiving a second visit during a provincial IMCI review. No one reported receiving ongoing follow-up. Experiences of follow-up visits were generally positive: during the visit facilitators helped to affirm correct practice, and provided guidance if modifications were required. Follow-up visits motivated newly trained IMCI practitioners and helped gain the support of non-IMCI trained staff.

"They always tell us that they will do follow-up in 4 to 6 weeks, but it takes long, even two years or so.... At the clinic I was the first one to be trained in IMCI and I was stranded alone without having their [the facilitators'] support. I tried to update my colleagues, but they were reluctant to change." (FGD2)

"On my side, after a few months, someone came from the district office to check if I had some problems At first there was some shivering [apprehension]. We sat down and we talked, after we talked about some conditions I found that I was on the right track." (FGD 2)

" [after the follow-up visit] we have that motivation ... [and] the support from our colleagues, ... it even made other people in the clinic want to go on the training" (FGD 3)

IMCI implementation: enabling factors

Respondents in all focus groups consistently expressed that their confidence in managing children, particularly young infants, had increased, and that they felt empowered and knowledgeable in their practise after attending the course.

"It was quite an exciting experience. Before it wasn't nice; I didn't like to examine a child because I didn't have the skills to do that. But after IMCI in fact it was quite a nice experience ... so really it opened my eyes." (FGD 4)

" You work with confidence because you know what you are doing. Like before I used to go to the place where there were no children because I really was not too sure what I was doing, but since I know this IMCI I know exactly what I am doing." (FGD 1)

Implementation of IMCI was consistently described by respondents as being time consuming, but this was also seen as beneficial in improving the relationship with mothers, and the respondents' confidence improved when using the IMCI approach led to the mothers seeing them with a new respect.

"In IMCI we ought to examine the child from head to toe, so most of the mothers they enjoy the examination, so they encourage others in the community." (FGD3)

The chart booklet was seen as a useful desk aid, which guided them in the management of children and improved their confidence in transferring their skills to the workplace after training.

"And then if you are assisting a child, you open your IMCI book, so you can no longer make a mistake, that's what's nice because you are not alone, everything you've got there." (FGD 4)

"Now I know the right dose [of medication] that must be given. So after IMCI, whether you are a genius or not, the chart booklet must be there all the time." (FGD 2)

Other factors mentioned as facilitating implementation of IMCI was the support of colleagues, especially those who were IMCI trained, and that treatments recommended by IMCI are available at the clinic.

"We have that motivation from the people that were trained before you, the support from our colleagues" (FGD3)

"One thing I can say is the treatment, because we have got it at the clinic, so if the chart booklet says 'give this for that' you know that you [have] got it." (FGD4)

IMCI implementation: barriers

The biggest barrier to IMCI implementation, that was consistently mentioned, was that IMCI consultations take longer, which is a particular problem given staff shortages in many clinics.

"I am the only one who is IMCI trained, so it is not easy to do it the correct way because I will not be able to finish these children by 4 pm." (FGD4)

Lack of support from colleagues in the clinic, particularly those not trained in IMCI, was identified as a major barrier. Encouraging other members of the health team, including ambulance services and doctors at the referral hospital, to support IMCI was expressed as a challenge.

"The people who are not [IMCI] trained, they seem to have a negative attitude towards the people who are IMCI trained, because that person will not understand why is it that you are taking too long to finish your clients." (FGD 4)

"If the sister in charge of the clinic did not undergo this training she will not understand the IMCI language and if I want to implement IMCI it will be a problem." (FGD2)

The time taken for IMCI consultations did cause longer waiting times. Respondents described dealing with this situation in several different ways; non-IMCI trained nurses took over care of some children, IMCI was only partially implemented, or some children did not get seen at the end of the day.

" Sometimes you find that someone who is not trained is [seeing children] ...other nurses are just outside helping to consult." (FGD 3)

"In other clients, you can see, you cannot give one hundred percent what you are supposed to give, because you have to push the line [reduce the queue]." (FGD 1)

"You have to cut the patients when it is 4 o'clock. So you see, you won't be able to see them all. We will implement [IMCI], but we won't manage to see them." (FGD3)

Patient expectations were also identified as a barrier; mothers expect to receive treatments that are no longer used according to IMCI. This is worse if the practises of IMCI trained and non-IMCI trained nurses are inconsistent.

"They [mothers] are unhappy because we are not all trained. So on another day they will see someone who will give paracetamol when the temperature is 36, and they get confused." (FGD2)

"They are expecting to go home with something. We tell them to give the hydration at home, or the cough remedy at home, they don't like it." (FGD4)

Recommendations suggested by respondents

Respondents suggested that all clinic nurses be trained in IMCI, and that all IMCI trained nurses also be trained in prevention of mother to child transmission of HIV (PMTCT) and HIV/AIDS counselling. In addition, they felt that the period of IMCI training should be increased, with more emphasis on the module for the sick young infant. Suggestions included that the training be split into two separate weeks, or that an extra week be allocated to the sick young infant. Respondents felt that clinical sessions could be re-organised, to reduce the time spent travelling for short clinical sessions. They also suggested that increasing IMCI coverage would strengthen implementation, that facilitators work full-time on IMCI, and that more follow-up visits and IMCI update workshops should be held.

"You would start with the sick child from [age] two months to five years, let's say [this is covered over] two weeks and then another week [for the sick young infant]... because now we do a lot of travelling ... that was really exhausting, plus homework." (FGD 1)

Discussion

Overall, the IMCI training course was consistently very well received by respondents, who reported that the variety of methodologies enhanced the experience of the training, and reinforced the skills and knowledge required. Training materials were well understood by participants. The WHO approach of providing detailed guidelines for facilitators supported by complex, well-developed training materials ensures that training is interesting, well prepared and information is consistent. It requires skills and resources to develop high quality training materials, so providing generic materials which can then be adapted at country level [30] worked very well in our setting.

IMCI facilitators are carefully selected, well trained, and supervised by a course director, and the high ratio of facilitators to participants allows careful monitoring of participants' progress. In this evaluation, facilitators were consistently rated very highly by respondents in terms of their knowledge and exceptional commitment, as well as for their ability to identify problems and help individual participants. From this evaluation it can be said that strict selection criteria for facilitators helped to ensure good quality of IMCI training, which has been maintained during the expansion of the IMCI strategy.

Health workers in all groups strongly endorsed the IMCI approach to assessment and management of a sick child, frequently saying that this had been a challenging area of their practise prior to IMCI training, and that they gained confidence and skills from IMCI. The training was felt to

be comprehensive, and participants gained most of the required skills. The approach of using simple, defined signs and symptoms to assess a child gave practitioners clarity and confidence in their practise.

The major problem identified with IMCI training was a lack of sufficient time during the course. One reason for this is that, in South Africa and other high HIV prevalence countries, an HIV component has been added to IMCI without extending the duration of the course [31]. Although respondents attended IMCI courses in different districts and at different times, in all but one of the FGD's, lack of time was the strongest theme in all areas of the discussion. It was felt that time was too short for completion of all activities, that the workload was excessive, and too much time was spent travelling, making the clinical sessions rushed. In particular, participants did not get maximum benefit from the modules on the young infant and breastfeeding. Although respondents mentioned that there was a lot of repetition, this was felt to be needed for them to learn the materials thoroughly. Given shortages of skilled staff in many developing countries, it is difficult for health workers to leave their workplace for 11 days of training, and conducting an IMCI course is logistically difficult and expensive. This makes it difficult to extend the training period, and in several countries the training course has been shortened [32], although this may adversely affect performance [23]. If benefits to child survival are expected from IMCI, given the poor performance of IMCI trained health workers [33], is it realistic to expect that all skills required for management of sick children can be acquired over 11 days, and that these skills can be maintained for years to come?

If longer training is not feasible, alternative approaches could be taken. The course could be split into two week-long components, giving participants time to practise their skills before moving to the second week. Course participants could be given self-learning tasks away from the classroom, for example video or written exercises, or a case log, which could be assessed by facilitators. Interactive computer-based learning methods could also be a useful aid to learning. Clinical practise could be re-organised, with fewer longer clinical sessions, and clinical practise away from the course could be introduced. A formal assessment on completion of training could replace some of the monitoring currently undertaken during the course, despite respondents in this study saying that the lack of a formal assessment was a positive aspect of the training. As health worker performance has been shown to be weakest in assessment of severely ill children [33,34], a formal assessment would also ensure that all IMCI practitioners reach competency in assessing those signs on which these classifications depend. Similar strategies could be used to maintain IMCI skills over time.

Training alone has been shown to have little lasting effect on health worker performance [35], and adherence to guidelines may be poor regardless of having undergone training [36]. So, for sustainable improvements, training should be combined with other approaches, including supervision [37]. IMCI requires radical changes in practise, so follow-up visits are critical for helping newly trained IMCI practitioners to transfer their skills to the workplace. Although respondents reported that follow-up visits were beneficial, these were frequently delayed, which can lead to a loss of skills [27]. Follow-up visits include assessment of clinical competence, so IMCI supervisors must be competent IMCI practitioners, and should attend an additional 5-day course on IMCI follow-up. In KZN and Limpopo IMCI facilitators do follow-up visits because clinic supervisors do not have the skills, making clinical supervision unsustainable. Implementing and sustaining follow up after IMCI training has repeatedly been shown to be a problem in Bangladesh, Tanzania, Peru and Uganda [19,23-25], suggesting that follow-up should be reviewed to make it less resource intensive. For example, newly trained IMCI practitioners could come to a central clinical venue where observations and discussions could be used to provide support for implementation. Ongoing IMCI updates, as suggested by respondents, could give opportunities for IMCI practitioners to meet, solve problems together, and provide peer support. Other methods of improving implementation like awarding clinics 'IMCI excellent' accreditation could be used to motivate practitioners. A recent study evaluating interventions to improve performance of IMCI trained health workers, showed that a combination of additional supports following training (training and support for supervisors, ongoing supervision, additional job aids, and non financial incentives) improved performance of health workers significantly. This suggests that success in maintaining health worker performance requires interventions that target multiple determinants of health worker practise, although providing ongoing supervision remained a problem [38].

The additional time taken for an IMCI consultation was expressed as a barrier to implementation, leading to partial implementation of IMCI, which has been repeatedly shown in assessments of IMCI implementation [23]. Counselling messages recommended by IMCI are time consuming for health workers to deliver, and health workers under time pressure could limit counselling messages to those that are most essential, or alternative ways of delivering counselling messages, for example written materials, could shorten the consultation time. However, IMCI skills improve with practise [39], and newly trained IMCI practitioners need support in the initial period after completion of training if they are to gain confidence. Time pressures could be reduced by allocating a reduced work-

load initially, and other nurses and child carers could be informed that IMCI implementation may take longer initially, but this is due to improvements in the care of sick children. Another important barrier was carers demanding medication not recommended by IMCI, which has also been a problem in other settings [37]. If treatments are to be discontinued, this policy should be implemented consistently and guidelines provided for all health workers seeing children, or if possible, such medications could be removed from the clinic. If not addressed, this issue will continue to undermine IMCI implementation.

Limitations to this study include that respondents for the focus group discussions were selected by IMCI co-ordinators who were familiar with respondents and may have been involved in their training. Co-ordinators however, were not present at FGD's, and although they knew IMCI was to be discussed they were not told that the training specifically was being assessed. Respondents were told that individual comments would be confidential, but it is possible that they had the perception that researchers wanted to hear positive things about IMCI training and implementation.

Conclusion

IMCI training course participants gave positive feedback about the content and methodology of the IMCI training, however it was strongly felt that the course was too short to acquire all skills and follow-up after training is currently insufficient to bridge this gap. Further research is required to prospectively assess the training and determine whether different training approaches could improve health worker performance. If IMCI coverage is to be improved sufficiently to have a beneficial effect on child survival, innovative solutions are urgently required to ensure that newly trained practitioners can transfer their skills to the workplace and maintain these skills over time. These approaches would also need further research to determine which interventions would be most effective.

Competing interests

The authors declare that they have no competing interests.

Authors' contributions

CH was the principal investigator for the study, designed the study, supervised data collection, analysed the data and wrote the paper. AV advised on data collection, conducted the focus groups, analysed the data and helped write the paper. KV participated in designing the study, analysing the data and writing the paper. NR and SQ advised on the design of the study, the analysis of the findings and the writing of the paper. All authors read and approved the final manuscript.

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References

1. UNICEF: **The state of the world's children 2008: child survival.** 2007 [<http://www.unicef.org/sowc08/report/report.php>]. New York: UNICEF
2. Black RE, Morris SS, Bryce J: **Where and why are 10 million children dying every year?** *Lancet* 2003, **361(9376)**:2226-2234.
3. UN: **United Nations Millennium Declaration.** 2000 [<http://www.un.org/millennium/declaration/ares552e.htm>].
4. Bradshaw DBD, Nannan N: **What are the leading causes of death among South African Children?** *MRC Policy Brief* 2003, **No 3**.
5. Jones G, Steketee RW, Black RE, Bhutta ZA, Morris SS: **How many child deaths can we prevent this year?** *Lancet* 2003, **362(9377)**:65-71.
6. Bryce J, El Arifeen S, Pariyo G, Lanata C, Gwatkin D, Habicht JP: **Reducing child mortality: can public health deliver?** *Lancet* 2003, **362(9378)**:159-164.
7. Victora CG, Hanson K, Bryce J, Vaughan JP: **Achieving universal coverage with health interventions.** *Lancet* 2004, **364(9444)**:1541-1548.
8. Tulloch J: **Integrated approach to child health in developing countries.** *Lancet* 1999, **354(Suppl 2)**:S1116-S1120.
9. Bryce J, Victora CG, Habicht JP, Black RE, Scherpbier RW: **Programmatic pathways to child survival: results of a multi-country evaluation of Integrated Management of Childhood Illness.** *Health policy and planning* 2005, **20(Suppl 1)**:i5-i17.
10. WHO: **Child and adolescent health and development progress report 2002-2003.** Geneva 2004:63-66.
11. Gove S: **Integrated management of childhood illness by outpatient health workers: technical basis and overview. The WHO Working Group on Guidelines for Integrated Management of the Sick Child.** *Bulletin of the World Health Organization* 1997, **75(Suppl 1)**:7-24.
12. Kalter HD, Burnham G, Kolstad PR, Hossain M, Schillinger JA, Khan NZ, Saha S, de WV, Kenya-Mugisha N, Schwartz B, et al: **Evaluation of clinical signs to diagnose anaemia in Uganda and Bangladesh, in areas with and without malaria.** *Bull World Health Organ* 1997, **75(Suppl 1)**:103-111.
13. Weber MW, Kellingray SD, Palmer A, Jaffar S, Mulholland EK, Greenwood BM: **Pallor as a clinical sign of severe anaemia in children: an investigation in the Gambia.** *Bulletin of the World Health Organization* 1997, **75(Suppl 1)**:113-118.
14. Zucker JR, Perkins BA, Jafari H, Otieno J, Obonyo C, Campbell CC: **Clinical signs for the recognition of children with moderate or severe anaemia in western Kenya.** *Bull World Health Organ* 1997, **75(Suppl 1)**:97-102.
15. World Health Organization: **Integrated management of childhood illness: conclusions. WHO Division of Child Health and Development.** *Bulletin of the World Health Organization* 1997, **75(Suppl 1)**:119-128.
16. Lambrechts T, Bryce J, Orinda V: **Integrated management of childhood illness: a summary of first experiences.** *Bulletin of the World Health Organization* 1999, **77(7)**:582-594.

17. Bryce J, Victora CG, Habicht JP, Vaughan JP, Black RE: **The multi-country evaluation of the integrated management of childhood illness strategy: lessons for the evaluation of public health interventions.** *American journal of public health* 2004, **94(3)**:406-415.
18. Armstrong Schellenberg J, Bryce J, de Savigny D, Lambrechts T, Mbuya C, Mgalula L, Wilczynska K: **The effect of Integrated Management of Childhood Illness on observed quality of care of under-fives in rural Tanzania.** *Health policy and planning* 2004, **19(1)**:1-10.
19. El Arifeen S, Blum LS, Hoque DM, Chowdhury EK, Khan R, Black RE, Victora CG, Bryce J: **Integrated Management of Childhood Illness (IMCI) in Bangladesh: early findings from a cluster-randomised study.** *Lancet* 2004, **364(9445)**:1595-1602.
20. Gouws e, Bryce J, Habicht JP, Amaral J, Pariyo G, Schellenberg JA, Fontaine O: **Improving antimicrobial use among health workers in first-level facilities: results from the multi-country evaluation of the Integrated Management of Childhood Illness strategy.** *Bull World Health Organ* 2004, **82(7)**:509-515.
21. Bryce J, Gouws E, Adam T, Black RE, Schellenberg JA, Manzi F, Victora CG, Habicht JP: **Improving quality and efficiency of facility-based child health care through Integrated Management of Childhood Illness in Tanzania.** *Health policy and planning* 2005, **20(Suppl 1)**:i69-i76.
22. Adam T, Manzi F, Schellenberg JA, Mgalula L, de Savigny D, Evans DB: **Does the Integrated Management of Childhood Illness cost more than routine care? Results from the United Republic of Tanzania.** *Bulletin of the World Health Organization* 2005, **83(5)**:369-377.
23. Pariyo GVV, Gouws E, Bryce J, Burnham G: **Improving facility-based care for sick children in Uganda: training is not enough.** *Health policy and planning* 2005, **20(Suppl 1)**:i58-i68.
24. Huidho L, Davila M, Campos M, Drasbek C, Bryce J, Victora CG: **Scaling up integrated management of childhood illness to the national level: achievements and challenges in Peru.** *Health policy and planning* 2005, **20(1)**:14-24.
25. Armstrong Schellenberg JR, Adam T, Mshinda H, Masanja H, Kabadi G, Mukasa O, John T, Charles S, Nathan R, Wilczynska K, et al.: **Effectiveness and cost of facility-based Integrated Management of Childhood Illness (IMCI) in Tanzania.** *Lancet* 2004, **364(9445)**:1583-1594.
26. Rowe AK, de Savigny D, Lanata CF, Victora CG: **How can we achieve and maintain high-quality performance of health workers in low-resource settings?** *Lancet* 2005, **366(9490)**:1026-1035.
27. Chaudhary N, Mohanty PN, Sharma M: **Integrated management of childhood illness (IMCI) follow-up of basic health workers.** *Indian J Pediatr* 2005, **72(9)**:735-739.
28. World Health Organization: **Integrated management of childhood illness: field test of the WHO/UNICEF training course in Arusha, United Republic of Tanzania. WHO Division of Child Health and Development & WHO Regional Office for Africa.** *Bull World Health Organ.* 1997, **75(Suppl 1)**:55-64.
29. Patton MQ: **Enhancing the quality and credibility of qualitative analysis.** *Health Serv Res* 1999, **34(5 Pt 2)**:1189-1208.
30. World Health Organization: **IMCI Adaptation Guide.** Geneva 2002.
31. Qazi SA, Muhe LM: **Integrating HIV management for children into the Integrated Management of Childhood Illness guidelines.** *Trans R Soc Trop Med Hyg.* 2006, **100(1)**:10-13.
32. World Health Organization: **The analytic review of the integrated management of childhood illness strategy.** Geneva 2003:26.
33. Horwood C, Vermaak K, Rollins N, Haskins L, Nkosi P, Qazi S: **An evaluation of the quality of IMCI assessments among IMCI trained health workers in South Africa.** *PLoS One* 2009, **4(6)**:e5937.
34. **Health worker performance after training in integrated management of childhood illness--Western Province, Kenya, 1996-1997.** *MMWR Morb Mortal Wkly Rep* 1998, **47(46)**:998-1001.
35. Haines A, Kuruwilla S, Borchert M: **Bridging the implementation gap between knowledge and action for health.** *Bulletin of the World Health Organization* 2004, **82(10)**:724-731. discussion 732.
36. Rowe AK, Hamel MJ, Flanders WD, Doutizanga R, Ndoyo J, Deming MS: **Predictors of correct treatment of children with fever seen at outpatient health facilities in the Central African Republic.** *Am J Epidemiol* 2000, **151(10)**:1029-1035.
37. Rowe AK, Onikpo F, Lama M, Cokou F, Deming MS: **Management of childhood illness at health facilities in Benin: problems and their causes.** *American journal of public health* 2001, **91(10)**:1625-1635.
38. Rowe AK, Onikpo F, Lama M, Osterholt DM, Rowe SY, Deming MS: **A multifaceted intervention to improve health worker adherence to integrated management of childhood illness guidelines in Benin.** *American journal of public health* 2009, **99(5)**:837-846.
39. Kelly JM, Rowe AK, Onikpo F, Lama M, Cokouits F, Deming MS: **Care takers' recall of Integrated Management of Childhood Illness counselling messages in Benin.** *Trop Doct* 2007, **37(2)**:75-79.

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Routine checks for HIV in children attending primary health care facilities in South Africa: Attitudes of nurses and child caregivers[☆]

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ABSTRACT

Management of HIV-infected and exposed children is challenging for health workers in primary care settings. Integrated management of childhood illness (IMCI) is a WHO/UNICEF strategy for improving morbidity and mortality in under 5 children attending first level facilities in developing countries. In high HIV-prevalence settings, IMCI includes an HIV component for identification and management of HIV-infected and exposed children, which requires health workers to ask all mothers about their HIV status and check all children for signs of HIV. Effective implementation of the HIV component depends on the ability and willingness of health workers to take every opportunity to identify HIV-infected children during routine care, and implementation in South Africa is poor.

In 2006, we conducted 10 focus groups in two provinces in South Africa with IMCI-trained nurses, and with mothers attending first level facilities, to determine their attitudes towards, and experiences of, routine checks for HIV during consultations with sick children. Nurses were frequently unwilling to check for HIV in all children, believing it was unnecessary, unacceptable to mothers, and that they lack skills to implement HIV care. Nurses feared mothers would become upset or make a complaint. Mothers consistently recognised the importance of checking children for HIV and supported implementation of routine checks, although the attitude of the nurse was important in determining the acceptability of HIV-related questions. Mothers expressed fears about lack of confidentiality from nurses, and that receiving HIV-related services could lead to unintentional disclosure of their HIV status.

Nurses lack the skills in HIV management and communication skills to implement the HIV component of IMCI. We identify issues relate to improved training, clear policies on record keeping, and organization of health services to respect privacy and confidentiality, to improve the willingness of health workers to provide HIV care and mothers to accept it.

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Introduction

South Africa is experiencing one of the largest HIV epidemics in the world. HIV seroprevalence among pregnant women attending government antenatal clinics was 29.1% in 2006 (DOH, 2007), and vertical transmission has resulted in a large burden of paediatric HIV disease and reversal of gains achieved in reducing child mortality. In South Africa, HIV causes over 40% of child deaths (Bradshaw & Nannan, 2003), an estimated 290 000 children under 15 years are living with HIV (UNICEF, 2008), and HIV-related illness and death has had a devastating effect on households and communities (Hosegood, Preston-Whyte, Busza, Moitse, & Timaeus, 2007). Despite the introduction of interventions to prevent mother to child transmission of HIV (PMTCT), high vertical transmission rates have been reported (Rollins, Little, Mzolo, Horwood, & Newell,

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2007), and inadequate follow-up of HIV-exposed children is found in PMTCT programmes across the region (Doherty, McCoy, & Donohue, 2005; Perez et al., 2004; Sherman, Jones, Coovadia, Urban, & Bolton, 2004).

Poor PMTCT follow-up results in lost opportunities for early testing of HIV-exposed children and delays in treatment initiation, and is associated with poor parental education, low socioeconomic status, and poor support from family and partners (Ioannidis et al., 1999; Jones, Sherman, & Varga, 2005). Fear that receiving PMTCT services, particularly infant formula, could lead to unintentional disclosure of HIV status (Kebaabetswe, 2007), and fear of negative interactions with staff have been identified by mothers as barriers to attending follow-up (Painter et al., 2004). Without access to treatment, over half of HIV-infected children die before their second birthday (Newell et al., 2004). Most deaths occur from common childhood illnesses, and most children who die never reach an HIV diagnosis or enter HIV care. Anti-retroviral treatment (ART) is now available, but only a small minority of children needing treatment receive it, an estimated 32 000 South African children in 2007 (UNICEF, 2008). Children are under-represented among those receiving ART (Orne-Gliemann et al., 2008), despite evidence of the benefits of early treatment initiation (Violari et al., 2008). Most HIV-related deaths in children could be prevented by early HIV diagnosis, effective care for common childhood illnesses, and ART. Access to child health services is the first step to secure HIV care for children (World Health Organization & UNICEF, 2008).

Integrated management of childhood illness (IMCI) is a strategy developed by the World Health Organization (WHO) and United Nations Children's Fund (UNICEF) to improve child survival in resource poor settings (Gove, 1997). IMCI was adopted by South Africa in 1997, as the gold standard for delivery of child health services at primary level, but IMCI guidelines did not specifically include HIV. In South Africa, and other high HIV-prevalence countries, IMCI guidelines were, therefore, adapted to include a validated HIV component to identify and manage children with symptomatic HIV infection, and those who are HIV exposed (Qazi & Muhe, 2006). According to the IMCI/HIV guidelines, health workers ask every mother bringing a sick child to the clinic about her HIV status, and check all children for those common signs and symptoms most predictive of symptomatic HIV infection. This includes asking about previous infections, and a brief examination for enlarged lymph nodes, parotid gland enlargement and oral thrush. IMCI sets out clear criteria based on these findings, according to which a child may be identified as HIV exposed, or classified as 'suspected symptomatic HIV infection', and the mother offered HIV testing for the child (Horwood, Liebeschuetz, Blaauw, Cassol, & Qazi, 2003). IMCI classifications are usually recorded on the child's medical card, and IMCI provides no specific guidance about recording of HIV-related information. Theoretical and clinical training for implementation of the HIV component was added to the 11-day IMCI training course, but without increasing the duration of the course. IMCI is the main point of entry to HIV care for children attending primary level facilities in South Africa, and is identified as a priority area for action by the South African Department of Health (Department of Health, 2007), but implementation has been sub-optimal (Horwood et al., 2009).

Theoretical context

Health workers are the key to service provision for HIV-infected mothers and their children, but unless adequately trained, skilled and motivated, they may become a constraint to scaling up of services (Bharat & Mahendra, 2007; Kober & Van Damme, 2004). Provision of HIV care for children depends on the ability and willingness of health workers to take every opportunity to identify

children at risk, and this is the basis of the IMCI/HIV guidelines. Some studies suggest that health workers lack skills and confidence to provide integrated HIV care (Bharat & Mahendra, 2007; Harries et al., 2007), and that poor attitudes to HIV-infected individuals can be linked to lack of knowledge and experience (MacPhail, Pettifor, Coates, & Rees, 2008; Smit, 2005). Inadequately trained health workers are more likely to report negative attitudes (Reis et al., 2005), and training in AIDS management can reduce fear of infection, and increase sympathy and willingness to provide care (Armstrong-Esther & Hewitt, 1990; Ezedinachi et al., 2002). Few health workers are trained in the specific communication skills for 'breaking bad news' that are required to initiate discussions about HIV. Health workers frequently find breaking serious news stressful and unpleasant (Ptacek & Ellison, 2000), and may fail to do so to protect their own emotional wellbeing (Fallowfield & Jenkins, 2004). Effective communication, when giving bad news, requires training, and this has been shown to improve skills and confidence in initiating such discussions (Back et al., 2007).

Disease-related stigma is a process whereby individuals with an illness are deemed undeserving of help, or assigned blame for the illness (Schulte, 2002). People living with HIV/AIDS (PLHA's) are often stigmatised because behaviours leading to infection are considered avoidable (Maman et al., 2009), and this is linked to other stigmas associated with risk behaviours like promiscuity, homosexuality and transactional sex (Simbayi et al., 2007). External stigma is behaviour from others which negatively changes the way individuals are treated; examples include gossiping and attaching negative terms to the person (Uys et al., 2005). Stigma may be related to fear of contagion, or of the suffering and death associated with the disease (Maman et al., 2009), and sets HIV-infected individuals apart from the community. Poor and judgemental attitudes of health workers towards PLHA's have been widely described (Greeff & Phetlhu, 2007; Sadob, Fawole, Sadoh, Oladimeji, & Sotiloye, 2006), including feeling that they deserve punishment (Adebajo, Bamgbala, & Oyediran, 2003) and that providing HIV treatment is a waste of resources (Dlamini et al., 2007). Discriminatory attitudes may be more common among nurses compared to doctors (Reis et al., 2005), particularly in South Africa where discrimination has been entrenched in the nursing profession, and the construction of nurses' identity has emphasised moral and intellectual superiority (Jewkes, Abrahams, & Mvo, 1998).

In South Africa, high HIV prevalence has profoundly affected health workers' environment. Fear of occupational HIV exposure may lead to implementation of non-rational and stigmatising techniques to prevent contamination (Reis et al., 2005), and fear of being stigmatised by association for working with AIDS patients, may make nurses reluctant to combat AIDS stigma (Greeff & Phetlhu, 2007; Uys et al., 2005). High HIV prevalence among health professionals, particularly nurses, increases stress and staff shortages (Connelly et al., 2007), and nurses frequently have to care for HIV-infected colleagues (Minnaar, 2005). This challenges an important coping strategy for people dealing with death, that of invulnerability, causing fear and lack of compassion for those afflicted, and health workers may distance themselves from the risk of infection by blaming the disease on identifiable 'out-groups' (Skinner & Mfecane, 2004). When implementing IMCI health workers identify HIV-positive women in their own communities, this may bring HIV/AIDS just 'too close to home'.

HIV infection particularly affects women; external stigma is experienced more by women, against whom most blaming descriptions applied to PLHA's are directed (Duffy, 2005). Thoughts and behaviours stemming from the persons own negative perception of themselves leads to internal stigma, with feelings of shame, guilt and self loathing (Vanable, Carey, Blair, & Littlewood, 2006), self-exclusion from services, and fear of disclosure (Greeff &

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Phetlu, 2007). This often leads to depression, particularly among women (Simbayi et al., 2007). Gender inequalities are entrenched in South Africa, where violence against women is commonplace (Pronyk et al., 2008); stigmatisation reinforces these power hierarchies and gender stereotypes (Holzemer et al., 2007). Women who have experienced intimate partner violence are at higher risk of HIV infection (Dunkle et al., 2004), and disclosure of HIV status often results in conflict, violence or abandonment (Medley, Garcia-Moreno, McGill, & Maman, 2004). Inequality and poverty particularly affect African women, who are often unable to make individual rational choices, and may, therefore, adopt the fatalism or denialism common among people in powerless conditions (Kalipeni, 2000). Negative attitudes of health workers and fears that confidentiality may not be respected may cause further anxiety and reluctance to disclose to health workers (MacPhail et al., 2008).

Thus, the context in which HIV-infected women and health workers find themselves impacts on health workers' willingness to help mothers and children access HIV care, and the mother's ability to seek care for herself and her child. This article describes the attitudes towards, and experiences of, implementation of routine checks for HIV in the context of IMCI implementation, from the perspective of both caregivers and nurses.

Methods

Study setting

The study was conducted in two provinces of South Africa, KwaZulu-Natal (KZN) and Limpopo, in April and May 2006. IMCI implementation began in 1998, and at the time of our study 1325 health workers had been IMCI trained in Limpopo and 1300 in KZN, comprising 47% and 32% of health workers seeing sick children in primary health care (PHC) clinics, respectively. Of 474 PHC clinics in Limpopo, 283 are implementing IMCI, and in KZN, IMCI is being implemented in 387 out of 604 clinics. All IMCI-trained health workers currently working in PHC clinics are nurses.

The antenatal HIV seroprevalence in 2006 was 20.7% in Limpopo and 39.1% in KZN (DOH, 2007).

Data collection methods

We conducted a total of 10 focus group discussions (FGDs), 5 with IMCI-trained nurses (3 in KZN and 2 in Limpopo) and 5 with mothers and caregivers (3 in KZN and 2 in Limpopo). Urban and rural districts were selected in each province by convenience sampling.

Discussions with nurses were conducted in English by an experienced researcher with the help of an observer taking notes, and were audio recorded. Participants were asked to describe their experiences and feelings related to implementation of the HIV/IMCI guideline, and any enabling factors or barriers that affected implementation. Discussions were open-ended and allowed participants to direct the discussion.

Discussions with caregivers were conducted in the local language, via an interpreter and with the help of an observer, and were audio recorded. Themes discussed included experiences of attending the clinic with the child, and their feelings about the care their children receive, particularly relating to the introduction of IMCI at the clinic. Caregivers were then asked more specifically about HIV, and discussed their experiences of being tested, and their attitudes and experiences of routine HIV-related questions in the consultation with a sick child.

Ethical approval was obtained from the Biomedical Research Ethics Committees of the University of KwaZulu-Natal Medical School, Durban, and WHO, Geneva.

Participants: IMCI-trained nurses

The study population consisted of IMCI-trained nurses in Limpopo and KZN. In each district, IMCI co-ordinators selected up to 10 IMCI-trained nurses who would contribute to a discussion on IMCI implementation. To ensure that they had relevant experience, participants were purposively selected on the basis that they were currently working in a PHC clinic, and had been trained since 2002, when HIV assessment for every child was introduced. Participants were informed in writing about the research and invited to participate. They were compensated for their transport costs and received refreshments. Written consent was obtained, and anyone not wishing to participate was free to refuse. Participants were assured that individual comments would remain anonymous.

Participants: carers of children under 5 years

Clinics implementing IMCI were selected in each district by convenience sampling. Caregivers of children under 5 years bringing their children to the clinic on the day of the FGD were requested to participate; this included mothers and other caregivers who cared for the child on most days. Participation was offered to all those eligible and waiting in the queue on the day of the FGD, and up to 10 mothers or caregivers, regardless of their HIV status, who volunteered to take part, were selected. All participants were informed about the study and gave written consent in their local language. Participants received refreshments, but there was no other incentive to participate.

Data analysis

All audio tapes were transcribed verbatim. Audio tapes from the FGDs with caregivers were translated into English. The transcriptions, together with the observation notes, were analyzed by two researchers independently. Major and minor themes were identified through manual content analysis of the transcripts, and differing interpretations were discussed in order to reach a consensus position.

Results

The results show contrasting attitudes between health workers and caregivers to the implementation of routine checks for HIV in children. Health workers frequently expressed negative attitudes, saying that such checks were unnecessary and unacceptable to mothers, that they lacked skills to implement HIV care, and were fearful of adverse reactions from mothers. However, mothers expressed consistently positive attitudes towards routine checks in their children, but acknowledged the importance of the health worker's approach in determining the acceptability of HIV testing.

Health worker perspectives: barriers to implementation

Attitudes of health workers

In every FGD, nurses expressed reservations and fears about discussing HIV with mothers, saying that it was painful to raise the topic, or describing it as 'embarrassing' or 'shocking'. Nurses reported that it was difficult to speak about HIV at every consultation, particularly if the mother had previously reported being HIV negative, and that mothers avoid clinics or health workers where IMCI is being implemented to avoid the HIV-related questions.

'You have to ask every mother that comes about the [HIV] status, it's so embarrassing. You ask, but it is so embarrassing, because after they go outside (they say) "I will never come back to this clinic: that

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nurse in that consulting room asked about HIV". She tells others outside there, so it's embarrassing' (Nurses FGD5).

In all FGDs, some nurses expressed the view that it was unacceptable to mothers for the nurse to ask about the HIV status or even to check the child, although the examination required is not specific to HIV. Nurses expressed fears about possible outcomes of routine checks for HIV; they were afraid they could be sued, that mothers would avoid coming to them in the future, or would make a complaint. There was apprehension about possible emotional reactions from the mother, like distress or anger, and the possibility of being assaulted or threatened was also raised in one focus group.

'Once you check the child for lymphadenopathy or anything, the mother says "so you are suspecting that my child is not well, but you didn't say anything". So you can end up in a court of law because she is assuming that you are suspecting the child of having HIV when she does not have HIV. Maybe the child is just having mumps, that makes the child to have a lump' (Nurses FGD4).

Many nurses were hostile to implementation of the HIV guideline, feeling that it was unnecessary to check every child, particularly if the child was well and had no obvious signs of HIV. Some nurses admitted that they did not routinely ask about HIV, and one said that the HIV component 'should be scrapped' (Nurses FGD5).

'No, I don't feel that we have to routinely do all children, because some of them they are healthy and good, and even if you assess the road to health chart they don't come as a regular client. Some they just come when there is an outbreak of flu' (Nurses FGD1).

Health workers did not overtly express stigma or discrimination towards HIV-infected mothers or children, but some judgemental attitudes were expressed, and at times HIV was associated with a particular racial or socioeconomic group.

'They [nurses] tell the [pregnant] women they have indulged themselves in unprotected sex and now it is easy for them because the government has put this PMICT program in action. So they must test [for HIV] because they have done this thing' (Nurses FGD4).

'We've got a lot of blacks living in [this area] now and they come to the clinic, but they are not like poor, or something, where you can say, "okay, that's a child I can suspect [of having HIV]"' (Nurses FGD1).

Recording of clinical findings on the patient record card

Concerns were frequently raised about recording the IMCI classification of 'suspected symptomatic HIV' on the child's card, particularly before the HIV status has been confirmed; the major concern was about legal liability. IMCI does not provide clear guidelines in this regard.

'According to South African what-what, there is something that says you cannot suspect someone is positive. So you cannot say that this child is positive, whereas the child has not tested, and you have to write on the card 'symptomatic of HIV' and they have not tested' (Nurses FGD4).

Inadequate training

Another strong theme identified was that nurses felt their training and knowledge of HIV was inadequate. Nurses described sometimes being unable to answer the mother's questions; this made them feel inadequate and they did not have anyone to refer to for advice. For example, giving co-trimoxazole prophylaxis to exclusively breastfed babies when mothers are told to give no other

foods or fluids, 'That is a bit contradictory...even for me, myself as a practitioner, I usually get confused but in front of the mother I shouldn't be... something must be done to explain to the practitioners' (Nurses FGD4). These uncertainties undermine the nurses' confidence when using the IMCI/HIV guideline and are a barrier to implementation.

In South Africa, a two week AIDS counselling course is required for practitioners to provide counselling for HIV testing, and some nurses believed that unless they had attended this course they were not trained to raise any issues around HIV or PMICT. Several said that they simply ask the mother to go to the HIV counsellor without explanation, because they are 'not allowed' or 'not covered' to talk about HIV without formal AIDS counselling training. Others check for HIV, but have to refer the mother elsewhere for the child to be tested.

'It [talking about HIV] is difficult and needs skills. Everyone should have done VCT [voluntary counselling and testing training] so that you have those skills. I am not transparent with the mother; I just say that there is somebody else who can examine the child' (Nurses FGD2).

Nurses recommended that IMCI include more information about HIV, that all IMCI-trained health workers be trained in HIV/AIDS counselling and PMICT, and that there be updates for IMCI-trained nurses. Nurses also suggested that increased supervision would improve implementation.

'If IMCI could have, on the part of suspected symptomatic HIV.., have more symptoms that we are going to look for.., some of the clinical features that the children present with, more of that, and how to treat them' (Nurses FGD 5).

Other barriers

Other barriers mentioned included that implementing the HIV guideline was time consuming, that mothers may need permission from other family members for HIV testing of the child, and that children come with multiple carers. IMCI does not provide clear guidelines about provision of care for a child who attends without the mother.

'You will try and explain that "you must come back monthly and take this treatment", but usually, most of them they won't comply. Because today it is granny bringing the child, and tomorrow it is aunt, that day it's the sister' (Nurses FGD4).

Services for HIV are often fragmented, so mothers and children have to see different health workers to receive all the services they need, leading to poor compliance.

'We have the PMICT follow-ups at our antenatal clinic on Fridays. Now the problem is, if those children present with any minor ailment, then they are sent up to us... then they refer them to the doctor...if they need to go on ARV's or whatever, but we are sending them up and down, up and down, that's how we do it' (Nurses FGD5).

Enabling factors for implementation

Nurses who use the HIV guidelines reported that mothers are usually willing to disclose their HIV status, and nurses gained confidence by seeing HIV-positive children get better with treatment.

'Once you put the child on bactrim [co-trimoxazole] you don't find them [attending] every week with a cough or cold, because before you even scold them "why are you here every week?"...but once you put the child on bactrim you are able to follow the child up' (Nurses FGD5).

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A well-functioning antenatal PMTCT program was a strong enabling factor for IMCI-trained nurses to implement the HIV guidelines, because the mother already understands the need for follow-up of the baby. Another enabling factor was support from other IMCI-trained nurses in the clinic, so that consistent information is given to mothers, and relevant information recorded on the card, although this was also used as a way of avoiding discussing HIV with the mother.

{mothers} knew their status during antenatal care, so it is easy from me... when I do IMCI because I don't even ask their status; I just peruse the card and I just see this is an HIV positive child' (Nurses FGD4).

Community health workers and support groups attached to the clinic made it easier for nurses providing HIV care.

'We've got quite a number of community health workers who are living with this community, who are teaching this community from their own environment, and when they [the community] come to the hospital ...they know everything about AIDS. And they know about this shared confidentiality so it has helped us a lot'(Nurses FGD1).

Perspective of caregivers

Attitudes of caregivers

In all focus groups, mothers consistently expressed positive attitudes towards routine checks for HIV for children attending the clinic, and HIV testing if appropriate. They felt strongly it was better to know the HIV status, so the child could receive treatment. Mothers were aware that they had a choice about HIV testing, and their child could not be tested without their consent. This was viewed positively because you would not have to be tested until you are 'ready'.

'It is better to treat early rather than when the baby is sick, sick, sick. So, I think I am happy that the sister checks my baby and tells me early how my child is. They give the treatment early rather than stay and know nothing' (Carers FGD1).

Although generally positive about checking for HIV, many women expressed fear, which at times made them reluctant to accept HIV testing or get the results. Mothers associated a positive HIV test in their child with being positive themselves.

'It is frightening, though still I will allow the nurse to check the signs. Why? Because if my child does have it, then automatically it says I also have it' (Carers FGD3).

However, some women did express concerns about HIV-related questions, which they saw as threatening and as implying that health workers think that they are HIV infected.

'What I don't like is, when I bring my child with diarrhoea, the nurses ask whether I was tested when I was pregnant. And I think they are judging my child to be HIV positive when they are talking to me' (Carers' FGD 4).

Mothers also expressed that the way the nurse approached the discussion was important in determining the acceptability of HIV testing. Although no experiences were described of stigma or discrimination from health workers, mothers worried about confidentiality, fearing that nurses may discuss their HIV status amongst themselves.

'The nurses have got different approaches; some explain really well and encourage you to go for testing, such that you feel that you should go for testing. Other nurses' approach makes you not to want to go for testing' (Carers FGD4).

'It will be a problem whereby I am entering the office and she is telling me that I am positive, without seeing my file. I will blame the nurse who treated me; it will give me impression that when they are together they do talk about our issues' (Carers FGD 3).

Recording of clinical findings on the patient record card

Mothers expressed concerns about how HIV test results are recorded, whether this should be on the clinic records or on the patient-held card. There was no predominant view on this, with some mothers saying that the result should be recorded on the card, and others concerned that this may be read by others. The consistent view was that the HIV status must be recorded somewhere, and it was important that this should be kept private.

'I wouldn't mind, it can be recorded on the child's card or even my card as long as it is not to be seen by everyone, but my family and the child's family only' (Carers FGD2).

Community attitudes

Mothers described how high levels of awareness of HIV in the community led to stigma and fear of disclosure; community members look at anyone who is sick, particularly with certain conditions like diarrhoea, and immediately assume that the person has HIV.

'People will just decide that the child is positive, even if they do not know that, and the child has not been tested. Because of that you are fearful and you don't want to go for help. And you end up not getting help.. it is the other mothers who we are sitting with in the waiting room [who decide the child is positive]' (Carers FGD4).

Mothers also felt that they could be judged or stigmatised by other community members attending the clinic if they received HIV services like follow-up or supplies of infant formula. PMTCT services separated from routine services were criticised as being stigmatising.

'There is also 'that door' that is known to everyone. Because there is only one health worker there, and it is known if you are seeing [that] sister it is because your child is HIV positive' (Carers FGD4).

The women mentioned that partners and fathers of their children were unwilling to practise safe sex or be tested for HIV. None of the women mentioned needing permission for their child to be tested, but they did express frustration and feelings of powerlessness in their relationships.

'The clinic does provide us with male condoms; our husbands refuse to use them and we can't force them to use them. Also, as a wife, you don't know the life he is living at his place of work' (Carers FGD3).

Discussion

This study shows that nurses are frequently unwilling to implement routine checks for HIV in children, despite general acceptance from mothers that this is necessary. Nurses are fearful that discussing HIV in a sick child consultation is unacceptable to mothers and could lead to an adverse or angry reaction, that they are vulnerable to legal action, and that they lack skills to care for HIV-infected children. The mothers' main concern was that their children should receive all the treatment and care they require, and mothers were, therefore, willing to accept routine HIV checks. However, the attitudes and approach of health workers were identified as important in determining the acceptability of such checks. Mothers also expressed concerns that receiving PMTCT

services could lead to unintentional disclosure of their HIV status to other community members attending the clinic, and that nurses might gossip among themselves.

Supportive and knowledgeable providers are crucial for HIV-positive people to access care, but our findings suggest that IMCI-trained nurses lack both communication skills and skills in HIV management to implement the HIV component of IMCI. Reluctance to initiate care for HIV-infected persons may be related to inadequate AIDS management training (Reis et al., 2005), and nurses in our study felt unsupported and vulnerable due to their lack of knowledge. They recommended that more HIV-related information be included in IMCI training, and that more supervision and support be provided in the workplace, including regular IMCI updates. Improved knowledge has been shown to improve confidence and willingness to provide care (Ezedinachi et al., 2002), and in the complex and changing field of HIV management, health workers need up-to-date knowledge to feel confident in their practise. HIV-related information in the IMCI guidelines should be reviewed and updated, training materials should be strengthened, and more ongoing support provided for IMCI practitioners after training. Although other approaches to HIV training could be considered, IMCI is an international strategy that is accepted as the gold standard for child health care throughout South Africa, and is a Department of Health priority. IMCI is, therefore, the best vehicle for provision of HIV care for children.

Any information that adversely changes a person's perspective of his or her future, can be considered to be bad news, and breaking bad news is stressful for health workers, with a common cause of this stress being fear of the patients' reaction (Ptacek & Ellison, 2000). Bringing the possibility of HIV infection into a consultation raises similar issues, and in our study nurses strongly expressed fears of adverse reactions from mothers, including anger, distress or even violence. This reflects a lack of skill and confidence in breaking of serious or unpleasant news. Nurses in high HIV-prevalence areas already face increasing workloads and stress, and may avoid distressing situations in order to protect their own wellbeing. South African health workers have traditionally been very authoritarian in their approach to patients (Jewkes et al., 1998), and mothers identified the approach of the health worker as an important determinant of the acceptability of routine checks for HIV. The need for specific skills and training in breaking bad news is widely acknowledged (Fallowfield & Jenkins, 2004), training in communication skills can improve health workers' approach to patients and willingness to speak about HIV (Back et al., 2007), and respect and good communication increases uptake of HIV services (Weiser et al., 2006). It has been assumed that AIDS counselling training provides health workers with all the required counselling skills, but the skills needed for counselling children and families, and for breaking of bad news, are distinct and go beyond those required for AIDS counselling. Training in the specific counselling and communication skills required when dealing with children and families in the context of severe or terminal illness would improve health workers' confidence, and the implementation of the HIV guidelines.

Health workers expressed concerns about their vulnerability to legal action. South African law takes a human rights approach, and legal action could be taken against a health worker for disclosing a person's HIV status without consent, or for refusing treatment, but not for checking a patient for HIV or for recommending an HIV test, which would be considered part of the duty of care (AIDS law project, 2003). However, health workers do require clear written policies and guidelines to support their practise if they are to feel confident, particularly with regard to the recording of HIV-related information on a child's medical record. Without appropriate record keeping, ongoing HIV care for children depends on the

mother disclosing her HIV status to the health worker at every visit, and this study highlights several reasons why this is unlikely to occur. Poor recording has been identified as a major barrier to accessing care for children (Ginsburg, Hoblitzelle, Sripitana, & Wilfert, 2007), but South African health workers still have no clear written policies to guide them.

Good record keeping was identified by nurses as an enabling factor in provision of HIV care for children, and mothers expressed willingness to have information recorded in their health records. Availability of accurate and complete records would improve follow-up and continuity of care, which is becoming more important as ongoing care for HIV-infected children on ARV's is increasingly being provided at primary care level. Facility-based records would ensure that health workers have access to relevant clinical information, but a system would be required to ensure that information is also available to clinicians at the district hospital who have an important role in clinical decision making. Electronic medical records could provide the solution; open source medical record systems have been shown to effectively improve continuity of care for HIV/AIDS in an African setting (Seebregts et al., 2009), and are now being recommended by WHO (World Health Organization, 2008).

In this study, no specific instances of discrimination, breaches of confidentiality, or stigma from health workers towards PLHA's were described, either by mothers or health workers, and both groups had positive attitudes towards provision of treatment to HIV-infected mothers and babies. Mothers did not identify fear of stigma from health workers as a barrier to care, but they did express some concern that nurses may discuss mothers' HIV status with each other. These findings contrast with other studies which have described care being withheld from PLHA's (Greeff & Phehlhu, 2007), health workers failing to respect confidentiality (MacPhail et al., 2008), and fear of stigma from health workers as a barrier to accessing services (Angotti et al., 2009). However, stigma from community members was identified as a barrier to seeking care, with mothers expressing concern that receiving PMTCT services may identify them as HIV positive. Such unintended disclosure has been shown to lead to stigmatisation (Greeff & Phehlhu, 2007), and has been identified as an important reason for poor infant follow-up in PMTCT programmes (Varga, Sherman, & Jones, 2006). Provision of PMTCT services and HIV care in a separate identifiable area of the clinic has been clearly expressed as a major barrier to accessing services, both in this study and elsewhere (MacPhail et al., 2008). Policy makers and health managers should urgently review organization of HIV services and improve their integration into routine care, so that mothers do not have to choose between accessing services and being labelled as HIV infected. In the past, privacy may not have been deemed necessary for consultations with children, this must also be reviewed to improve accessibility of PMTCT services.

Limitations to this study include that selection of health workers participating in FGDs by IMCI co-ordinators may have led to some bias, if participants felt they should express positive views about IMCI. FGDs with mothers were conducted on clinic premises, which may have made participants reluctant to describe incidents of discrimination or stigma. Mothers' FGDs were conducted via an interpreter, so the quality of the information is dependent on the interpretation of the translators.

Conclusion

Poor follow-up of HIV-exposed children and poor access to HIV care for children is a serious problem in South Africa. We found that health workers lack knowledge and skills, and do not receive the training, supervision and supporting policy guidelines

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they require, so that health workers who want to provide HIV care lack the skills and confidence to do so. Additional training on HIV management and communication skills is required to improve willingness of health workers to provide care, and improved integration of HIV care into routine services will make services more accessible.

References

- Adebajo, S. B., Bamgbala, A. O., & Oyediran, M. A. (2003). Attitudes of health care providers to persons living with HIV/AIDS in Lagos State, Nigeria. *African Journal of Reproductive Health*, 7(1), 103–112.
- AIDS law project. (2003). *HIV/AIDS and the law: A resource manual*. Johannesburg: AIDS Law Project and the AIDS legal network.
- Angotti, N., Bula, A., Gaydosh, L., Kimchi, E. Z., Thornton, R. L., & Yeatman, S. E. (2009). Increasing the acceptability of HIV counseling and testing with three C's: convenience, confidentiality and credibility. *Social Science & Medicine*, 68.
- Armstrong-Esther, C., & Hewitt, W. E. (1990). The effect of education on nurses' perception of AIDS. *Journal of Advanced Nursing*, 15(6), 638–651.
- Back, A. L., Arnold, R. M., Baile, W. F., Fryer-Edwards, K. A., Alexander, S. C., Barley, G. E., et al. (2007). Efficacy of communication skills training for giving bad news and discussing transitions to palliative care. *Archives of Internal Medicine*, 167(5), 453–460.
- Bharat, S., & Mahendra, V. S. (2007). Meeting the sexual and reproductive health needs of people living with HIV: challenges for health care providers. *Reproductive Health Matters*, 15(Suppl. 29), 93–112.
- Bradshaw, D. B. D., & Nannan, N. (2003). *What are the leading causes of death in South African children?* Medical Research Council Policy Brief 3 Capetown: Medical Research Council.
- Connelly, D., Veriava, Y., Roberts, S., Tsotetsi, J., Jordan, A., DeSilva, E., et al. (2007). Prevalence of HIV infection and median CD4 counts among health care workers in South Africa. *South African Medical Journal*, 97(2), 115–120.
- Department of Health. (2007). *Annual national health plan 2007/08*. Pretoria: National Department of Health: Republic of South Africa.
- Department of Health (DOH). (2007). *Antenatal survey 2006: National HIV and syphilis antenatal seroprevalence survey in South Africa 2006*. Pretoria: Department of Health.
- Dlamini, P. S., Kobi, T. W., Uys, L. R., Phetlhu, R. D., Chirwa, M. L., Naidoo, J. R., et al. (2007). Verbal and physical abuse and neglect as manifestations of HIV/AIDS stigma in five African countries. *Public Health Nursing*, 24(5), 389–399.
- Doherty, T. M., McCoy, D., & Donohue, S. (2005). Health system constraints to optimal coverage of the prevention of mother-to-child HIV transmission programme in South Africa: lessons from the implementation of the national pilot programme. *African Health Sciences*, 5(3), 213–218.
- Duffy, L. (2005). Suffering, shame, and silence: the stigma of HIV/AIDS. *Journal of the Association of Nurses in AIDS Care*, 16(1), 13–20.
- Dunkle, K. L., Jewkes, R. K., Brown, H. C., Gray, G. E., McIntyre, J. A., & Harlow, S. D. (2004). Gender-based violence, relationship power, and risk of HIV infection in women attending antenatal clinics in South Africa. *Lancet*, 363(9419), 1415–1421.
- Ezedinachi, E. N., Ross, M. W., Meremiku, M., Essien, E. J., Edem, C. B., Ekure, E., et al. (2002). The impact of an intervention to change health workers' HIV/AIDS attitudes and knowledge in Nigeria: a controlled trial. *Public Health*, 116(2), 106–112.
- Fallowfield, L., & Jenkins, V. (2004). Communicating sad, bad, and difficult news in medicine. *Lancet*, 363(9405), 312–319.
- Ginsburg, A. S., Hohlitzelle, C. W., Sripipatana, T. L., & Wilfert, C. M. (2007). Provision of care following prevention of mother-to-child HIV transmission services in resource-limited settings. *AIDS*, 21(18), 2529–2532.
- Gove, S. (1997). Integrated management of childhood illness by outpatient health workers: technical basis and overview. The WHO Working Group on Guidelines for Integrated Management of the Sick Child. *Bulletin of the World Health Organization*, 75(Suppl. 1), 7–24.
- Greiff, M., & Phetlhu, R. (2007). The meaning and effect of HIV/AIDS stigma for people living with AIDS and nurses involved in their care in the North West Province, South Africa. *Curationis*, 30(2), 12–23.
- Harries, J., Cooper, D., Myer, L., Bracken, H., Zweigenthal, V., & Ormer, P. (2007). Policy maker and health care provider perspectives on reproductive decision-making amongst HIV-infected individuals in South Africa. *BMC Public Health*, 7(1), 282.
- Holzemer, W. L., Uys, L., Makoae, L., Stewart, A., Phetlhu, R., Dlamini, P. S., et al. (2007). A conceptual model of HIV/AIDS stigma from five African countries. *Journal of Advanced Nursing*, 58(6), 541–551.
- Horwood, C., Liebeschuetz, S., Blaauw, D., Cassol, S., & Qazi, S. (2003). Diagnosis of paediatric HIV infection in a primary health care setting with a clinical algorithm. *Bulletin of the World Health Organization*, 81(12), 858–866.
- Horwood, C., Vermaak, K., Rollins, N., Haskins, L., Nkosi, P., & Qazi, S. (2009). An evaluation of the quality of IMCI assessments among IMCI trained health workers in South Africa. *PLoS ONE*, 4(6).
- Hosegood, V., Preston-Whyte, E., Busza, J., Moitse, S., & Timaeus, I. M. (2007). Revealing the full extent of households' experiences of HIV and AIDS in rural South Africa. *Social Science & Medicine*, 65(6), 1249–1259.
- Ioannidis, J. P., Taha, T. E., Kumwenda, N., Broadhead, R., Mtimalvalye, L., Miotti, P., et al. (1999). Predictors and impact of losses to follow-up in an HIV-1 perinatal transmission cohort in Malawi. *International Journal of Epidemiology*, 28(4), 769–775.
- Jewkes, R., Abrahams, N., & Mvo, Z. (1998). Why do nurses abuse patients? Reflections from South African obstetric services. *Social Science & Medicine*, 47(11), 1781–1795.
- Jones, S. A., Sherman, G. G., & Varga, C. A. (2005). Exploring socio-economic conditions and poor follow-up rates of HIV-exposed infants in Johannesburg, South Africa. *AIDS Care*, 17(4), 466–470.
- Kalipeni, E. (2000). Health and disease in southern Africa: a comparative and vulnerability perspective. *Social Science & Medicine*, 50(7–8), 965–983.
- Keabaetswe, P. M. (2007). Barriers to participation in the prevention of mother-to-child HIV transmission program in Gaborone, Botswana a qualitative approach. *AIDS Care*, 19(3), 355–360.
- Koher, K., & Van Damme, W. (2004). Scaling up access to antiretroviral treatment in southern Africa: who will do the job? *Lancet*, 364(9428), 103–107.
- MacPhail, C. L., Pettifor, A., Coates, T., & Rees, H. (2008). "You must do the test to know your status": attitudes to HIV voluntary counseling and testing for adolescents among South African youth and parents. *Health Education-Health Behavior*, 35(1), 87–104.
- Maman, S., Abler, L., Parker, L., Lane, T., Chirowodza, A., Ntongwisangu, J., et al. (2009). A comparison of HIV stigma and discrimination in five international sites: the influence of care and treatment resources in high prevalence settings. *Social Science & Medicine*, 68.
- Medley, A., Garcia-Moreno, C., McGill, S., & Maman, S. (2004). Rates, barriers and outcomes of HIV serostatus disclosure among women in developing countries: implications for prevention of mother-to-child transmission programmes. *Bulletin of the World Health Organization*, 82(4), 299–307.
- Minnaar, A. (2005). HIV/AIDS issues in the workplace of nurses. *Curationis*, 28(3), 31–38.
- Newell, M. L., Coovadia, H., Cortina-Borja, M., Rollins, N., Gaillard, P., & Dabis, F. (2004). Mortality of infected and uninfected infants born to HIV-infected mothers in Africa: a pooled analysis. *Lancet*, 364(9441), 1236–1243.
- Orne-Gliemann, J., Becquet, R., Ekouevi, D. K., Leroy, V., Perez, F., & Dabis, F. (2008). Children and HIV/AIDS: from research to policy and action in resource-limited settings. *AIDS*, 22(7), 797–805.
- Painter, T. M., Diaby, K. L., Matia, D. M., Lin, L. S., Sibailly, T. S., Kouassi, M. K., et al. (2004). Women's reasons for not participating in follow up visits before starting short course antiretroviral prophylaxis for prevention of mother to child transmission of HIV: qualitative interview study. *BMJ*, 329(7465), 543.
- Perez, F., Orne-Gliemann, J., Mukotekwa, T., Miller, A., Glenshaw, M., Mahomva, A., et al. (2004). Prevention of mother to child transmission of HIV: evaluation of a pilot programme in a district hospital in rural Zimbabwe. *BMJ*, 329(7475), 1147–1150.
- Pronyk, P. M., Harpham, T., Morison, L. A., Hargreaves, J. R., Kim, J. C., Phetla, G., et al. (2008). Is social capital associated with HIV risk in rural South Africa? *Social Science & Medicine*, 66(9), 1999–2010.
- Ptacek, J. T., & Ellison, N. M. (2000). Health care providers' perspectives on breaking bad news to patients. *Critical Care Nursing Quarterly*, 23(2), 51–59.
- Qazi, S. A., & Muhe, L. M. (2006). Integrating HIV management for children into the integrated management of childhood illness guidelines. *Transactions of the Royal Society of Tropical Medicine & Hygiene*, 100(1), 10–13.
- Reis, C., Heisler, M., Amowitz, L. L., Moreland, R. S., Mafeni, J. O., Anyamele, C., et al. (2005). Discriminatory attitudes and practices by health workers toward patients with HIV/AIDS in Nigeria. *PLoS Med*, 2(8), e246.
- Rollins, N., Little, K., Mzolo, S., Horwood, C., & Newell, M. L. (2007). Surveillance of mother-to-child transmission prevention programmes at immunization clinics: the case for universal screening. *AIDS*, 21(10), 1341–1347.
- Sadob, A. E., Fawole, A. O., Sadob, W. E., Oladimeji, A. O., & Sotiloye, O. S. (2006). Attitude of health-care workers to HIV/AIDS. *African Journal of Reproductive Health*, 10(1), 39–46.
- Schulte, A. (2002). Consensus versus disagreement in AIDS-related stigma: a comparison of reactions to aids and cancer patients. *Sociological Perspectives*, 45(1), 81–104.
- Seebregts, C. J., Mamlin, B. W., Biondich, P. G., Fraser, H. S., Wolfe, B. A., Jazayeri, D., et al. (2009). The OpenMRS implementers network. *International Journal of Medical Informatics*.
- Sherman, G. G., Jones, S. A., Coovadia, A. H., Urban, M. F., & Bolton, K. D. (2004). PMTCT from research to reality – results from a routine service. *South African Medical Journal*, 94(4), 289–292.
- Simbayi, L. C., Kalichman, S., Strebel, A., Cloete, A., Henda, N., & Mqeketo, A. (2007). Internalized stigma, discrimination, and depression among men and women living with HIV/AIDS in Cape Town, South Africa. *Social Science & Medicine*, 64(9), 1823–1831.
- Skinner, D., & Mfecane, S. (2004). Stigma, discrimination and the implications for people living with HIV/AIDS in South Africa. *Journal of Social Aspects of HIV/AIDS Research Alliance*, 1(3), 157–164.
- Smit, R. (2005). HIV/AIDS and the workplace: perceptions of nurses in a public hospital in South Africa. *Journal of Advanced Nursing*, 51(1), 22–29.
- UNICEF. (2008). *Children and AIDS. Third stocktaking report, 2008*. New York: UNICEF.
- Uys, L., Chirwa, M., Dlamini, P., Greiff, M., Kobi, T., Holzemer, W., et al. (2005). "Eating plastic," "winning the lotto," "joining the www" ...descriptions of HIV/AIDS in Africa. *Journal of the Association of Nurses in AIDS Care*, 16(3), 11–21.

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- Vanable, P. A., Carey, M. P., Blair, D. C., & Littlewood, R. A. (2006). Impact of HIV-related stigma on health behaviors and psychological adjustment among HIV-positive men and women. *AIDS and Behavior*, *10*(5), 473–482.
- Varga, C. A., Sherman, G. G., & Jones, S. A. (2006). HIV-disclosure in the context of vertical transmission: HIV-positive mothers in Johannesburg, South Africa. *AIDS Care*, *18*(8), 952–960.
- Violari, A., Cotton, M. F., Gibb, D. M., Babiker, A. G., Steyn, J., Madhi, S. A., et al. (2008). Early antiretroviral therapy and mortality among HIV-infected infants. *New England Journal of Medicine*, *359*(21), 2233–2244.
- Weiser, S. D., Heisler, M., Leiter, K., Percy-de Korte, F., Tlou, S., DeMonner, S., et al. (2006). Routine HIV testing in Botswana: a population-based study on attitudes, practices, and human rights concerns. *PLoS Med*, *3*(7), e261.
- World Health Organization. (2008). *World health report 2008: Primary health care, now more than ever*. Geneva: World Health Organization.
- World Health Organization & UNICEF. (2008). *Scaling up HIV-related prevention, diagnosis, care and treatment for infants and children: A programming framework*. Geneva: World Health Organization.

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An Evaluation of the Quality of IMCI Assessments among IMCI Trained Health Workers in South Africa

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Abstract

Background: Integrated Management of Childhood Illness (IMCI) is a strategy to reduce mortality and morbidity in children under 5 years by improving case management of common and serious illnesses at primary health care level, and was adopted in South Africa in 1997. We report an evaluation of IMCI implementation in two provinces of South Africa.

Methodology/Principal Findings: Seventy-seven IMCI trained health workers were randomly selected and observed in 74 health facilities; 1357 consultations were observed between May 2006 and January 2007. Each health worker was observed for up to 20 consultations with sick children presenting consecutively to the facility, each child was then reassessed by an IMCI expert to determine the correct findings. Observed health workers had been trained in IMCI for an average of 32.2 months, and were observed for a mean of 17.7 consultations; 50/77(65%) HW's had received a follow up visit after training. In most cases health workers used IMCI to assess presenting symptoms but did not implement IMCI comprehensively. All but one health worker referred to IMCI guidelines during the period of observation. 9(12%) observed health workers checked general danger signs in every child, and 14(18%) assessed all the main symptoms in every child. 51/109(46.8%) children with severe classifications were correctly identified. Nutritional status was not classified in 567/1357(47.5%) children.

Conclusion/Significance: Health workers are implementing IMCI, but assessments were frequently incomplete, and children requiring urgent referral were missed. If coverage of key child survival interventions is to be improved, interventions are required to ensure competency in identifying specific signs and to encourage comprehensive assessments of children by IMCI practitioners. The role of supervision in maintaining health worker skills needs further investigation.

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Introduction

In developing countries 9.7 million children under five years of age die every year [1], most deaths are from preventable and easily treatable diseases [2], and in a small number of developing countries [3]. It is estimated that over 60% of global child deaths could be prevented by available and affordable interventions [4], and their effective delivery is critical for achieving the Millennium Development Goal for child survival [5]. Integrated Management of Childhood Illness (IMCI) is a child survival strategy developed by the World Health Organisation (WHO) and United Nations Children's Fund (UNICEF) [6]. IMCI aims to improve coverage of essential child health interventions by improving case management skills of first level health workers, strengthening the health system for effective management of sick children, and promoting good community child care practices [7]. South Africa adopted IMCI as the standard of care for children in 1997, and is one of 43 African countries to do so [8].

IMCI case management training equips health workers with skills to manage children for a combination of illnesses, identify

those requiring urgent referral, administer appropriate treatments, and provide relevant information to child carers. WHO recommends that newly trained IMCI practitioners receive follow-up visits from IMCI supervisors, starting 4–6 weeks after training, to assist them in transferring their newly acquired skills to the workplace [9]. IMCI implementation has been shown to improve the quality of management of sick children [10,11,12], and IMCI trained health workers communicate better with caregivers [13].

However, previous reviews have not described healthworkers' assessments of children in detail, and have used the observed child as the unit of analysis. In this article we report the results of an evaluation of the performance of IMCI trained health workers, conducted in two provinces in South Africa. We undertook a large number of observations overall, and for each health worker, so we are able to use the health worker as the unit of analysis and describe in detail how health workers assess and classify sick children. This provides a comprehensive picture of IMCI implementation in routine clinical practice, from which we are able to identify gaps in implementation, and suggest solutions.

Methods

Study site and population

IMCI guidelines in South Africa were adapted to include a component for management of HIV infected children, and evaluation of this component was a primary objective of this study. IMCI trained health workers (HW's) working in first level health facilities in Limpopo and Kwazulu-Natal (KZN) provinces, South Africa, were randomly selected for inclusion in the study. Health workers without IMCI training were excluded. IMCI implementation began in 1998, and at the time of our study 1325 health workers had been trained in Limpopo Province and 1300 in KZN, comprising 47% and 32% of health workers seeing sick children in PHC clinics respectively.

Training and Data Collection

Two IMCI experts visited facilities to collect data in each province. They were trained in study methods for two weeks by the investigators (CH, KV); data collection tools and methodology were piloted in two health facilities. All IMCI experts had previously attended the 11 day IMCI training course and the IMCI facilitators' course, and were experienced IMCI course directors.

The consultation by the health worker was observed by one IMCI expert who recorded the activities and findings without intervening. Activities recorded included whether the health worker referred to the IMCI chart booklet during the consultation, as would be expected if IMCI was being implemented correctly. During an IMCI consultation, health workers assess first for general danger signs, they then assess the four main symptoms (cough or difficult breathing, diarrhoea, fever, ear pain) and nutritional status. A classification is then made for each main symptom present, according to the signs identified during the assessment of the child. Thereafter, the second IMCI expert assessed the same child independently, and these findings were considered to be the gold standard for analysis of health worker performance. If the management of the child was incorrect, this was changed by the second IMCI expert as appropriate. Each health worker was observed for 20 consultations with sick children aged 2–59 months presenting consecutively to the health facility, or for 3 days if 20 observations had not been completed in that time.

The IMCI experts used standardized data collection instruments to record data about health workers' previous training and supervision; assessments by the health worker and the IMCI expert; and resources available at the clinic to support IMCI implementation. To monitor quality during data collection, the principal investigator visited the teams at least monthly, and all completed forms were checked for quality and completeness.

Consent and ethical approval

Written informed consent was obtained from carers of children for observation of the consultation with the health worker, and for the second assessment of the child by the IMCI expert. Health workers and observed children were allocated codes and no identifying information was recorded.

The study was conducted in partnership with the South African Department of Health (DOH), and all first level health workers in the two provinces were informed by the DOH that a survey of child health practices was to be undertaken. Participants were not told ahead of time that they had been selected, or that IMCI in particular was being evaluated, and because they were employed by the DOH they were required to participate.

Ethical approval was obtained from the Biomedical Research Ethics Committees of the University of Kwazulu-Natal Medical School, Durban, and WHO, Geneva.

Sample Size

A major objective of this study was to assess implementation of the IMCI HIV component. The sample size calculation was based on the assumption that 80% (+/–10%) of health workers would correctly classify for HIV in all 20 cases they assessed, compared to the IMCI expert. The sample was calculated as 62 health workers. IMCI trained health workers were randomly selected from a list of all IMCI trained health workers in each province using computer generated random numbers [14]. Sampling was stratified by province with equal numbers of health workers selected from each province.

However, an interim analysis found that only 26% (+/–10%) of health workers had correctly classified all children, the sample was therefore recalculated and increased to 77 health workers. The results of the HIV implementation assessment are reported elsewhere.

Data management and analysis

Pre-coded data were double entered, cleaned and validated using Epi-info (version 6.04). Analysis was conducted using SPSS (version 13.0) and Stata (version 9). The proportion of health workers who referred to the chart booklet and how frequently, was used as an indicator of whether observed health workers were implementing IMCI. To determine the performance of observed health workers, their assessments were compared to those made by the IMCI experts, which were considered to be 'correct' for purposes of analysis. To assess the performance of each health worker during the period of analysis, the proportion of observed children correctly assessed for each main symptom was calculated for each health worker. Using the child as the unit of analysis, we then calculated the proportion of children with each main symptom who were assessed correctly, assessed incorrectly or not assessed at all, by observed health workers. We then calculated the proportion of children with each IMCI classification that were correctly classified by observed health workers, using the child as the unit of analysis. 95% confidence intervals were calculated for all performance indicators.

Results

The consultations of 77 IMCI trained health workers working in 74 primary health care clinics in KZN and Limpopo provinces were observed between May 2006 and January 2007. Each health worker was observed for a mean of 2.7 days and 17.7 consultations.

Training of observed health workers

All observed health workers were registered nurses with a minimum of 3 years nursing training, and had attended an 11 day IMCI training course, but most had no other special training in child health. The time since being trained in IMCI was an average of 32.2 months. Most health workers had received at least one follow up visit following IMCI training (table 1).

The average number of nurses on the staff establishment at clinics where we undertook our observations was 6, and on average 74% of these had been trained in IMCI. In 50/74 (67%) clinics visited, more than 60% of nurses were IMCI trained.

Performance of observed health workers during the observation period

31/77(40%) health workers referred to the IMCI chart booklet during every observed consultation, 35(45%) did so during some observed consultations, and only one health worker never referred to the chart booklet during the period of observation.

Table 1. Training of observed health workers.

Months since training in IMCI (n = 77)	Number (%)
1–11	12 (16)
12–23	10 (13)
24–35	22 (29)
36–47	16 (21)
48 or more	17 (22)
Additional training in child health	
None	55 (71)
IMCI facilitator	1 (1)
IMCI supervisor	1 (1)
Primary health care diploma ^a	7 (9)
Expanded programme of immunisation	10 (13)
Anti-retroviral treatment for children	1 (1)
Tuberculosis treatment for children	1 (1)
Number of IMCI follow-up visits	
0	27 (35)
1	34 (44)
2	13 (17)
3	3 (4)

^aOne year course includes paediatric module.
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During the period of observation, 9 (12%) health workers asked about three general danger signs (unable to drink or breastfeed, vomiting everything, and convulsions with this illness) in every child, and 14 (18%) asked about all four main symptoms in every child. 7/9 (78%) health workers who checked the danger signs in every child also checked all main symptoms in every child. Only 17 (22%) health workers plotted the weight of all children. Depending on the presenting complaints of children presenting to the facility, each observed health worker assessed children with different symptoms and signs. Table 2 shows the performance of each health worker in classifying the children assessed during the observation period.

No association was found between health worker performance and whether the health worker had received a follow up visit by a

supervisor, or the time since being trained in IMCI (data not shown). However the number of health workers in the sample was insufficient to exclude such an association.

Classification of observed children by health workers

During the 1357 observed consultations, health workers asked about three general danger signs in 795(58.6% CI: 49.8%–66.9%), and the four main symptoms in 815(60.1% CI: 51.0%–68.5%) children. Health workers did not ask about cough in 123(9.1% CI: 6.3%–12.9%) children, diarrhoea in 297(21.9% CI: 15.7%–29.6%) children, fever in 310(22.8% CI: 17.1%–29.8%) children, and ear problems in 409 (30.1% CI: 23.0%–38.3%) children. The performance of health workers in classifying observed children for each main symptom is shown in table 3.

Of 112 children assessed as having a severe classification or a danger sign by the IMCI expert, 52 (46.4% CI: 35.5%–57.7%) were also given a severe classification by the health worker. Health workers' performance in identifying each IMCI classification is shown in table 4.

Health workers either did not assess, or did not classify, for malnutrition in 567/1357(41.8% CI: 34.2%–49.8%) children (table 3), but the weight was plotted correctly on the growth chart in 1060/1357(78.1% CI: 72.9%–82.5%) children. The findings were explained to the mother in only 624(58.9% CI: 52.7%–64.8%) cases.

Feeding assessments

IMCI requires that all children under 2 years, and any who are low weight for age, should have a feeding assessment. Of 944 children required a feeding assessment according to these criteria, this was completed in 630 (66.7% CI: 60.1%–72.8%) children.

Discussion

Our findings show that IMCI is being widely implemented in clinics in South Africa several years into the expansion phase. Most clinics visited had good coverage with IMCI trained health workers, and despite the average time since training being almost three years, all but one health worker used the IMCI guidelines during observed consultations. However the IMCI assessment was not applied consistently and comprehensively, and activities not related directly to the presenting complaint were frequently omitted.

Table 2. Proportion of children with each main symptom assessed correctly by health workers' during the observation period.

Main symptom n = 77 ^a	No of observed health workers ^b	No of health workers who assessed >80% children correctly (%) (95% CI)	No of health workers who assessed 60–80% children correctly (%) (95% CI)	No of health workers who assessed <60% children correctly (%) (95% CI)
Cough or difficult breathing	77	9 (12) (6–21)	35 (46) (35–57)	33 (43) (32–54)
Diarrhoea/dehydration	72 ^c	20 (28) (18–40)	21 (29) (20–41)	31 (43) (32–55)
Fever	76 ^d	14 (18) (11–29)	9 (12) (6–22)	53 (70) (58–79)
Ear problem	64 ^e	10(16) (9–27)	5 (8) (3–18)	49 (77) (64–86)
Nutritional assessment (all children)	77	4 (5) (2–13)	10 (13) (7–23)	63 (82) (71–89)
Any severe classification	54 ^f	14 (26) (8–24)	3 (6) (5–20)	36 (68) (54–80)

^aUnit of analysis is the health worker.

^bObserved health workers saw a different number of children with each of the main symptoms.

^cExcludes 5 health workers who did not see any child with diarrhoea.

^dExcludes 1 health worker who did not see any child with fever.

^eExcludes 13 health workers who did not see any child with an ear problem.

^fExcludes 24 health workers who did not see a child with any severe classification.

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Table 3. Health worker (HW) performance in classifying children with each of the main symptoms.

N = 1357^a	Cough (%) n = 1076^b (95% CI)	Dehydration (%) n = 311^b (95% CI)	Fever (%) n = 789^b (95% CI)	Ear problem (%) n = 151^b (95% CI)	Malnutrition (%) n = 1212^c (95% CI)
Symptom not reported to HW ^d	38 (3.5) (2.4–5.1)	25 (8.0) (5.2–12.2)	125 (15.8) (12.5–19.9)	31 (20.5) (14.9–27.6)	n/a
HW did not ask about symptom	30 (2.8) (1.9–4.1)	14 (4.5) (2.4–8.2)	121 (15.3) (11.3–20.5)	21 (13.9) (8.7–21.5)	130 (10.7) (7.2–15.6)
HW asked about symptom and/or assessed child but did not classify	106 (9.8) (7.1–13.5)	46 (14.8) (10.9–19.7)	212 (26.9) (20.9–33.8)	22 (14.6) (9.6–21.5)	437 (36.1) (29.8–42.8)
Incorrectly classified by HW	245 (22.8) (20.3–25.4)	29 (9.3) (6.3–13.6)	1 (0.1) (0.0–0.9)	23 (15.2) (10.2–22.2)	177 (14.6) (11.2–18.6)
Correctly classified by HW	645 (59.9) (56.0–63.8)	195 (62.7) (56.6–68.4)	312 (39.5) (31.9–47.8)	51 (33.8) (26.0–42.5)	446 (36.8) (30.7–43.4)

^aUnit of analysis is the child.

^bA total of 1357 consultations were observed but different numbers of children presented with each main symptom.

^cExcluded 145 children where there was no chart available from the mother documenting weight for age.

^dCarer reported symptom to IMCI expert but not to the health worker when asked.

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More observations were done in this study, both in total and of each health worker, than previous IMCI evaluations, allowing us to describe health worker performance in more detail. Health workers performed best in assessing cough and dehydration, but even with these symptoms, only a small proportion of health workers assessed more than 80% of children correctly. The most common reason for health workers' not classifying correctly was failure to ask about the symptom or to make a classification at all, rather than making an incorrect classification. Few health workers consistently asked about all main symptoms, particularly later in IMCI assessment, indicating that incomplete assessments rather than simply lack of skills often leads to poor IMCI implementation.

Health workers' performance in identifying different classifications shows that health workers frequently fail to identify children with moderate or severe classifications, and perform best at identifying common, mild illnesses where no specific treatment is required. Less than half of severely ill children who required urgent referral to hospital were identified by IMCI trained health workers. Correct assessment of moderate or severe classifications depends on health workers' ability to identify specific signs, whereas mild classifications are usually based on the absence of these signs. For example, when assessing a child with a cough, identification of fast breathing or chest indrawing leads to a classification of pneumonia or severe pneumonia, whereas failure

Table 4. Proportion of classifications correctly identified by health workers.

Correct Classification (from IMCI expert)	Number of children with classification	Number correctly identified by health worker (%)	95% Confidence intervals
Cough or difficult breathing (n = 1076^a)			
Severe pneumonia or very severe disease	69	33(47.8)	34.6–61.4
Pneumonia	360	146(40.6)	34.1–47.4
Cough or cold	645	466(72.2)	67.4–76.7
Total	1074 ^b	645 (60.0)	56.0–63.8
Dehydration (n = 311^a)			
Severe dehydration	3	1(33.3)	4.1–85.5
Some dehydration	37	14 (37.8)	22.0–56.8
No visible dehydration	270	180 (66.7)	59.7–73.0
Total	310 ^c	195 (62.9)	56.6–68.4
Fever (n = 789^a)			
Suspected meningitis	11	4 (36.4)	12.5–69.5
Fever other cause	776	308 (39.7)	31.8–48.2
Total	787 ^b	312 (39.6)	31.9–47.8
Malnutrition (n = 1357^a)			
Severe malnutrition	18	5(27.8)	12.2–51.5
Not growing well	478	145(30.3)	24.1–37.4
Growing well	715	296 (41.4)	32.8–50.5
Total	1211 ^d	446 (36.8)	30.7–43.4

^adenominator different for each main symptom according to the number of observed children with that symptom.

^b2 missing,

^c1 missing,

^d1 missing, 145 could not be classified because there was no chart documenting weight for age.

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to identify these signs would lead to the mild classification of no pneumonia: cough or cold. It may be a lack of skills in identifying those specific signs required to make severe classifications that leads to poor performance, so those children most at-risk do not receive appropriate treatment.

Nutritional assessments were also poorly implemented; many children were not assessed for nutrition, most children with malnutrition were not identified, and feeding advice was frequently not given where indicated. Interventions and advice about nutrition, particularly promotion of breastfeeding and counselling about complementary feeding, have been shown to substantially improve child mortality [15]. Thus, failure to implement this aspect of IMCI will have a major impact on the potential for the IMCI strategy to improve child survival. A review of training materials and methods related to nutrition and identification of children with severe illnesses, could improve performance in these important areas of practise.

IMCI has been shown to improve care of children at first level [10,11,12], but poor adherence to IMCI guidelines has been repeatedly described [12,16,17,18]. If IMCI implementation is to achieve sufficient coverage to make a difference to child mortality, it is critical that strategies are developed to achieve and maintain high quality health worker performance. Our results suggest that strategies to encourage health workers to apply the IMCI assessment comprehensively, including the nutritional assessment, would lead to an improvement in health worker performance.

Our results also highlight the importance of health workers' achieving competency at identifying signs of severe disease during IMCI training. Previous evaluations have shown that health worker performance is adversely affected when the amount of clinical practice included in IMCI training is reduced [16], as may occur when training is decentralised. So interventions to improve health worker performance should include ways of ensuring that competency in identifying the severe signs used in the IMCI assessment is achieved and maintained. A formal assessment could be introduced for IMCI practitioners on completing the training, and regular updates for IMCI practitioners could ensure that these skills are maintained, as well as providing support for practitioners in the workplace. Other methods of improving implementation like awarding clinics 'IMCI excellent' accreditation could be used to motivate practitioners.

The strengths of this study are that we observed large numbers of health workers and for more consultations than previous evaluations of IMCI implementation, so that analysis could be done at the health worker level. All our IMCI experts were experienced IMCI facilitators, and able to provide a reliable gold standard. The influence of the observer's presence on health worker performance was minimised by the large number of observations conducted over several days, so subject bias was reduced by habituation. Limitations of the study include not evaluating health workers' ability to identify particular signs, or

treatments given to children, and no measure was taken of inter-rater reliability. We were also unable to determine reasons for poor performance in sufficient detail, including any relationships that may have existed between health worker performance and IMCI supervision, or time since training.

Further research is required to investigate the factors leading to poor health worker performance, which is frequently ascribed just to a lack of knowledge and skills. Health workers often find it difficult to transfer new skills to the work place, and to maintain these skills, especially as IMCI consultations take longer [19]. Implementing and sustaining IMCI follow up after training has been shown to be difficult in several previous evaluations of IMCI [11,12,16,20]. However, supervision has been shown to improve performance [11] and may also improve motivation and job satisfaction. The role of IMCI supervision in IMCI implementation and different models for provision of supervision should be investigated further.

In conclusion, IMCI can improve quality of care for sick children, and is being implemented in those countries where most child deaths occur. In our setting almost all IMCI trained health workers were using IMCI to assess children, but incomplete implementation means IMCI is failing to achieve maximum benefits for child survival. Improvements in training and supervision can go some way to addressing these problems, but further research is required to fully understand the determinants of health worker performance, both in the long and short term and strategies for maintaining IMCI skills over time should be evaluated. Effective solutions to the problem of scaling up IMCI, and other public health interventions, are needed to bridge the gaps between knowledge and practise, and to achieve universal coverage of critical interventions to improve child survival.

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Author Contributions

Conceived and designed the experiments: CMH KV SAQ. Performed the experiments: CMH KV LH PN. Analyzed the data: CMH KV NR LH PN SAQ. Wrote the paper: CMH KV NR LH PN SAQ.

References

- UNICEF (2007) State of the world's children 2008: child survival. New York: UNICEF.
- Bryce J, Bosch-Pinto C, Shibuya K, Black RE (2005) WHO estimates of the causes of death in children. *Lancet* 365: 1147–1152.
- Black RE, Morris SS, Bryce J (2003) Where and why are 10 million children dying every year? *Lancet* 361: 2226–2234.
- Jones G, Steketee RW, Black RE, Bhutta ZA, Morris SS (2003) How many child deaths can we prevent this year? *Lancet* 362: 65–71.
- Bryce J, Black RE, Walker N, Bhutta ZA, Lawn JE, et al. (2005) Can the world afford to save the lives of 6 million children each year? *Lancet* 365: 2193–2200.
- Tulloch J (1999) Integrated approach to child health in developing countries. *Lancet* 354 Suppl 2: S1116–S1120.
- Bryce J, Victora CG, Habicht JP, Black RE, Scherpbier RW (2005) Programmatic pathways to child survival: results of a multi-country evaluation of Integrated Management of Childhood Illness. *Health Policy Plan* 20 Suppl 1: i5–i17.
- WHO (2004) Child and adolescent health and development progress report 2002–2003. Geneva, ISBN 92 4 159223 0 ISBN 92 4 159223 0. pp 63–66.
- WHO (1999) Guidelines for follow up after training. World Health Organization.
- Amaral J, Gouws E, Bryce J, Leite AJ, Cunha AL, et al. (2004) Effect of Integrated Management of Childhood Illness (IMCI) on health worker performance in Northeast-Brazil. *Cad Saude Publica* 20 Suppl 2: S209–219.
- El Arifeen S, Blum LS, Hoque DM, Chowdhury EK, Khan R, et al. (2004) Integrated Management of Childhood Illness (IMCI) in Bangladesh: early findings from a cluster-randomised study. *Lancet* 364: 1595–1602.
- Armstrong Schellenberg JR, Adam T, Mshinda H, Masanja H, Kabadi G, et al. (2004) Effectiveness and cost of facility-based Integrated Management of Childhood Illness (IMCI) in Tanzania. *Lancet* 364: 1583–1594.

13. Gouws E, Bryce J, Habicht JP, Amaral J, Pariyo G, et al. (2004) Improving antimicrobial use among health workers in first-level facilities: results from the multi-country evaluation of the Integrated Management of Childhood Illness strategy. *Bull World Health Organ* 82: 509–515.
14. (1998–2009) *Random-org*.
15. Bhutta ZA, Ahmed T, Black RE, Cousens S, Dewey K, et al. (2008) What works? Interventions for maternal and child undernutrition and survival. *Lancet* 371: 417–440.
16. Pariyo GW, Gouws E, Bryce J, Burnham G (2005) Improving facility-based care for sick children in Uganda: training is not enough. *Health Policy Plan* 20 Suppl 1: i58–i68.
17. Arifeen SE, Bryce J, Gouws E, Baqui AH, Black RE, et al. (2005) Quality of care for under-fives in first-level health facilities in one district of Bangladesh. *Bull World Health Organ* 83: 260–267.
18. Rowe AK, Onikpo F, Lama M, Gokou F, Deming MS (2001) Management of childhood illness at health facilities in Benin: problems and their causes. *Am J Public Health* 91: 1625–1635.
19. Adam T, Manzi F, Schellenberg JA, Mgalula L, de Savigny D, et al. (2005) Does the Integrated Management of Childhood Illness cost more than routine care? Results from the United Republic of Tanzania. *Bull World Health Organ* 83: 369–377.
20. Huicho L, Davila M, Campos M, Drabek C, Bryce J, et al. (2005) Scaling up integrated management of childhood illness to the national level: achievements and challenges in Peru. *Health Policy Plan* 20: 14–24.

Research article

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Paediatric HIV management at primary care level: an evaluation of the integrated management of childhood illness (IMCI) guidelines for HIV

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Abstract

Background: Integrated Management of Childhood Illness (IMCI) is a WHO/UNICEF strategy to improve child survival in resource poor settings. South Africa adopted IMCI in 1997, and IMCI guidelines were adapted to include identification and management of HIV infected and exposed children. This study describes the validity of the IMCI/HIV algorithm when used by IMCI experts, the use of IMCI/HIV guidelines by IMCI trained health workers in routine clinical practice, and the burden of HIV among children under 5 years attending first level health facilities.

Methods: Seventy seven randomly selected IMCI trained health workers were observed in 74 health facilities in two provinces of South Africa. Consultations were observed with 1357 sick children; each child was reassessed by an IMCI expert to confirm the correct findings. Consent was requested for HIV testing of all children who attended with a parent or legal guardian. Positive rapid HIV tests were confirmed with HIV PCR in children aged less than 18 months. HIV positive children had a CD4 count and HIV clinical staging done.

Results: Of 1064 children with HIV results available, 76 (7.1% CI: 5.7% - 8.9%) children were confirmed HIV positive. IMCI experts using the HIV algorithm classified 54/76 (71.1% CI: 59.5%-80.9%) HIV positive children as suspected symptomatic HIV, and 15/22 remaining HIV positive children were identified as HIV exposed. Therefore, 69/76 (90.8% CI: 81.9-96.2) HIV infected children were identified by IMCI experts. No classification was made for HIV by observed health workers in 899/1357(66.2%) children.

906/1243(72.9%) mothers had been tested previously for HIV, of whom 221(24.4%) reported testing positive. Of 221 children therefore identified as HIV exposed, only 78(35.3%) had been tested for HIV within routine services.

Conclusion: The HIV algorithm is a valid tool for identifying HIV infected and exposed children when correctly and comprehensively implemented. However, it is not being used by IMCI trained health workers in routine practise, leading to a failure to implement life saving interventions.

Background

South Africa is among those countries worst affected by the HIV epidemic. In 2006, HIV sero-prevalence among pregnant women attending government antenatal clinics was 29.1% [1], and paediatric HIV disease has led to a reversal of the gains that had been achieved in reducing child mortality [2]. Despite the introduction of a programme for prevention of mother to child transmission of HIV (PMTCT) in South Africa, vertical transmission rates of 20.8% have been reported [3], and inadequate testing and follow-up of HIV exposed children is found in PMTCT programmes across the region [4,5]. Mortality among HIV infected children is high; over 50% of untreated African children die in the first 2 years of life [6]. Identification of HIV infected children and early initiation of antiretroviral treatment (ART) would substantially improve mortality [7], but despite availability of free ART, only a minority of children needing treatment receive it [8]. New guidelines from the World Health Organization (WHO) recommend that where virological testing is unavailable, ART should be initiated in children based on clinical diagnosis alone, and the HIV status confirmed as soon as possible [9]. It is, therefore, urgent that strategies are implemented to improve follow-up of HIV exposed children, increase early identification of children with symptomatic HIV, and improve access to ART for children.

Integrated management of childhood illness (IMCI) is a WHO/UNICEF strategy to improve child survival in resource poor settings [10], and South Africa is one of 43 African countries to adopt IMCI as the standard of care for children at primary level [11]. IMCI guidelines were adapted to include a validated HIV component to identify and manage HIV infected and exposed children. According to these guidelines, every mother bringing a sick child to a health facility is asked whether she has had an HIV test, and if she reports having tested HIV positive, the child is identified as *HIV exposed*. All children should also be routinely checked for common signs and symptoms found to be most predictive of HIV infection [12]. If three signs are present, the child is classified as *suspected symptomatic HIV* and the carer advised that the child should have an HIV test. These two components make up the HIV algorithm (figure 1), and IMCI includes guidelines for management of HIV infected and exposed children. The HIV/IMCI algorithm has been shown to be a valid tool for identification of children with symptomatic HIV infection [12], and may have a role in identifying those HIV exposed children most at risk of early death [13].

First level health workers are trained to use the IMCI/HIV guidelines during the 11-day IMCI case management course [14], a structured training course supported by comprehensive training materials developed by WHO/

UNICEF, and adapted for use in South Africa. Training materials relating to the HIV component were added, and participants learn the practical skills required during clinical sessions, but the overall duration of the training course was not increased. The IMCI/HIV algorithm provides a clear guideline for health workers to identify children for whom HIV testing is indicated, and its effective implementation is an important entry point to care at primary level for HIV infected and exposed children and their families in South Africa, and other high prevalence countries [15].

Previous reviews of IMCI implementation have shown that IMCI training improves health worker performance [16], but implementation of the HIV guidelines has not been evaluated previously. We conducted this study to determine how the IMCI/HIV guidelines are used by IMCI trained health workers, the validity of the HIV algorithm when used by expert IMCI practitioners and in routine clinical practice, as well as the burden of HIV disease among children under 5 years attending first level health facilities.

Methods

Study site and population

IMCI trained health workers working in first level health facilities in Limpopo and in Kwazulu-Natal (KZN) provinces, South Africa, were included in this study. IMCI training has been ongoing in both provinces since 1998, and at the time of the study 1325 health workers had been trained in Limpopo Province and 1300 in KZN. Limpopo province has a population of 5.5 million, and is predominantly rural, with high rates of poverty and poor access to basic services [17]. KZN has lower rates of poverty and several large urban centres, but almost 50% of the population still live in rural areas. With a population of 10 million, KZN is the most populous of South Africa's provinces [18]. Antenatal HIV sero-prevalence in 2006 was 39.1% and 21.5% in KZN and Limpopo respectively [1].

In order to evaluate routine IMCI implementation, all IMCI trained health workers currently working in a primary health care (PHC) clinics were eligible to participate. PHC clinics provide first level care to communities and this care is provided mainly by nurses. The district hospital provides support and referral care to PHC clinics in the surrounding area. Study participants were selected by a simple random sample, using computer generated random numbers <http://www.random.org>, from a list of all IMCI trained health workers working in PHC clinics in each of the two provinces. All observed health workers had attended an 11-day IMCI training course, which included the HIV component. All first level health workers were informed by the Department of Health that a survey of child health practices was to be undertaken, but

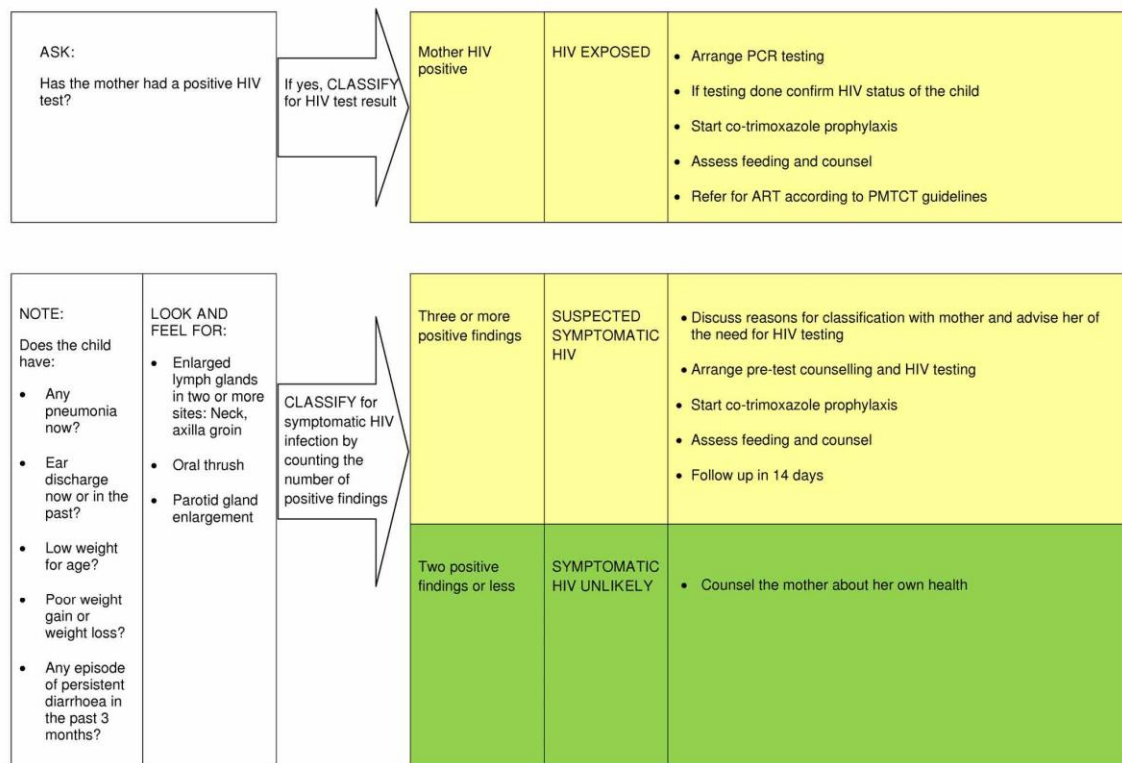


Figure 1
Current version of the HIV Algorithm, last updated in 2003.

observed health workers were not told beforehand that they had been selected, or that IMCI in particular was being evaluated.

Training and Data Collection

Data collection teams consisting of two expert IMCI practitioners and two study counsellors, trained in HIV counselling, were identified for each province. All IMCI experts were experienced IMCI facilitators. Data collection teams were trained by the investigators (CH, KV) for two weeks; this included a refresher of the IMCI/HIV guidelines (theory and clinical sessions) and training on HIV transmission, HIV testing, WHO clinical staging [19], and data collection, including storage and handling of blood samples. A pilot study was conducted in two health facilities, and data collection tools were adapted accordingly.

All sick children aged from 2 months up to 5 years attending the health facility were eligible to participate; consent was requested from carers by study counsellors (figure 2).

The consultation by the health worker was observed by an IMCI expert, who recorded the activities and findings without intervening. The same observer was used for all observations of a particular health worker. Thereafter, a second IMCI expert assessed the same child separately and recorded the findings, which were considered the gold standard for analysis of health worker performance. The second IMCI expert was blinded to the findings of the observed health worker. If an IMCI expert was known to the health worker then, if possible, that expert undertook re-assessments of observed children, and did not observe the health worker. No identifying information was recorded about observed health workers or PHC clinics visited. If the management of the child was incorrect, this was changed by the second IMCI expert to ensure all children received appropriate treatment. Each health worker was observed for up to 20 consultations with sick children presenting consecutively to the health facility, or for three days, whichever was shorter.

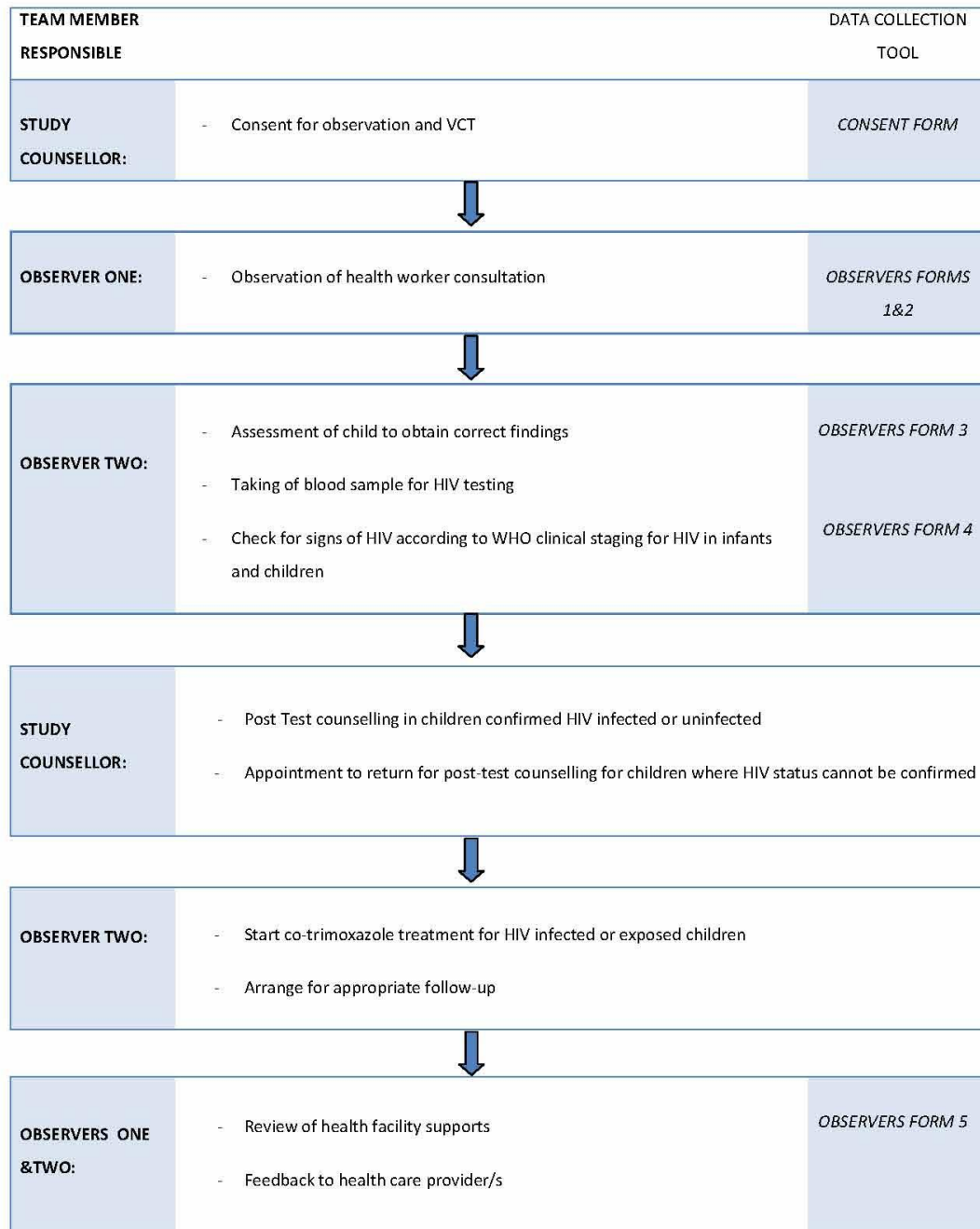


Figure 2
Flow of study participants through data collection process.

Data collection tools

Standardized data collection instruments were used to record the data. Interviews were conducted with health workers to find out about their training in child health, including IMCI. Resources available at the clinic were observed and recorded using a checklist; these included essential medicines and equipment, HIV counselling and testing supplies and services, numbers of children routinely tested for HIV, and whether privacy was available for consultations with children.

Observations were conducted using a standardized checklist based on the IMCI consultation; activities undertaken during the consultation were recorded, including whether relevant history and examination was undertaken, and whether appropriate counselling messages were given to the mother. On completion of the consultation, the observer reviewed the child's card and recorded all IMCI classifications made by the health worker. At no time did the observer interfere in the consultation; feedback was given to the health worker only when all observed consultations were complete. The findings of the IMCI expert who re-assessed the child were recorded on a standard IMCI recording form, which is widely used during training to record IMCI findings.

Teams were visited regularly by the principal investigator, and all completed questionnaires were checked to monitor quality during data collection.

Consent and ethical approval

Written informed consent was obtained from the carer by the study counsellor in the local language. Consent was requested for observation of the consultation, a second assessment of the child by an IMCI expert, and for HIV counselling and testing of the child. If the carer was not the legal guardian, consent was requested for observation only. If consent was obtained for HIV testing, pre- and post-test counselling was performed by study counsellors. If the child was known to be HIV infected, and this could be confirmed from the medical record, this was recorded without repeating the HIV test.

This study was conducted in partnership with the South African Department of Health and health workers selected were required to participate.

Each child was assigned a study number at enrolment; no names were recorded in the database, and results of HIV tests were linked to clinical data only after completion of the study. Ethical approval was obtained from the Biomedical Research Ethics Committees of the University of KwaZulu-Natal Medical School, Durban, and WHO, Geneva.

HIV testing

Children over 18 months of age were screened for HIV antibodies using the rapid test Determine™ HIV-1/2 (Abbott, Weisbaden, Germany). All positives were confirmed by a second HIV rapid test using the Smart Check™ HIV1/2 (World Diagnostics Inc, Miami, USA). In children aged below 18 months, if the screening HIV rapid test was positive, 50 µl of whole blood was collected by heel prick using a lancet, and dropped onto a filter paper for the dried blood spot (DBS). The filter paper was transported to Inkosi Albert Luthuli Central Hospital (IALCH) in Durban for PCR testing. The dried blood spots were tested for HIV-1 DNA using the HIV-1 DNA test, version 1.5 (Roche, Branchburg, USA). All children confirmed as HIV infected had 1-2 ml of blood taken in an EDTA tube (Vacuette, GreinerBio-one, Kremsmunster, Austria) which was sent to IALCH for CD-4 cell count; this was performed using the Panleucogated CD4 Epics® XL™ (Beckmancoulter, Galway, Ireland). All blood samples were discarded when HIV testing was complete.

Children under 18 months who could not have their HIV status confirmed immediately had post-test counselling and CD4 testing done by study staff at a follow-up visit. All HIV positive children were started on co-trimoxazole prophylaxis, and assessed for initiation of ART.

Sample Size

The estimated sensitivity of the IMCI/HIV algorithm when used by IMCI trained health workers compared to IMCI experts was used to calculate the sample size. Based on assumptions that 80% of observed children would be correctly classified for HIV with 10% precision at 95% confidence levels, it was calculated that 62 children classified as *suspected symptomatic HIV* by the expert IMCI practitioners should be sampled.

Health workers were observed for up to 20 consultations to increase the likelihood that every health worker would see at least one case of *suspected symptomatic HIV*. This was based on 2005 antenatal HIV sero-prevalence of 19.3% in the lower prevalence setting of Limpopo [20], and the assumption that one third of children born to HIV infected women become infected, so community prevalence was estimated to be 6.5% for the purpose of sample size calculation.

As the study progressed, it was evident that many health workers were not using the IMCI/HIV guidelines, and an interim analysis was conducted. The sensitivity of the health worker using the HIV algorithm, compared to the IMCI expert was only 26% at the mid-point of the study. Furthermore, the community prevalence in Limpopo was only 2.0%. The sample size was, therefore, recalculated

and an additional 15 IMCI trained health workers randomly selected in KZN.

Data management and analysis

Pre-coded data were double entered, cleaned and validated using Epi-info (version 6.04). Analysis was conducted using SPSS (version 13.0) and Stata (version 9.0). To determine the performance of the health workers, assessments by the health worker were compared to those of the IMCI expert, which were considered to be the gold standard for this purpose. To determine the validity of the HIV algorithm compared to the HIV test results, sensitivity, specificity, positive and negative predictive values, and likelihood ratios were calculated.

Results

Consultations of 77 IMCI trained health workers, in 74 primary level health facilities in KZN and Limpopo provinces, were observed between May 2006 and January 2007. Consent was obtained to observe 1357 consultations (figure 3), and each health worker was observed for a mean of 2.7 days (SD 0.68) and 17.7 consultations (SD 4.8). The average age of observed children was 19.6 months (SD 15.0), and 552 (40.7%) were under the age of one year. A total of 499 consultations were observed in Limpopo and 858 in KZN.

Training and supervision of observed health workers

All observed health workers were nurses, and the average time since IMCI training was 32.2 months (SD 18.4; range 3-88 months). The HIV algorithm was updated in 2003 to its current version (figure 1); 19/77 (24.7%) health workers had been trained on a previous version, of whom 8/19 (42.1%) had received specific training on the updated version. All observed health workers were using the current version of the IMCI guidelines.

Of the 77 observed health workers, 55 (71.4%) had no training related to child health, other than IMCI training. One health worker had been trained as an IMCI supervisor and one as an IMCI facilitator; 7 had a diploma in primary health care, which includes a paediatric module; and 4 had attended a short course related to paediatric care, including tuberculosis (1), antiretroviral treatment (1) and immunization (2). Training in HIV/AIDS counselling had been completed by 66/77 (85.7%) health workers.

It is recommended that new IMCI practitioners receive a follow-up visit 4-6 weeks after training to assist in transferring their skills to the workplace; 51 (66.2%) health workers had a follow-up visit by an IMCI supervisor since being trained, of these, 13 (25.5%) had received two visits and 3 (5.9%) three visits. There was no regular, ongoing IMCI supervision.

Facility supports for IMCI/HIV guidelines

Children were seen in a private area at 50 of 74 (67.6%) health facilities visited. Co-trimoxazole was available in 71 (95.9%) clinics and nevirapine syrup in 58 (78.4%). Although 39 (52.7%) clinics reported being able to do HIV PCR tests on children, only 24 (32.4%) had done any PCR tests in the past month, and 32 (41.6%) clinics had not tested any child under 5 years for HIV in the past month.

HIV results

HIV results were available for 1064 children; 1060 children tested during the study and 10 children reported HIV positive, less 6 children whose results were lost (figure 3). Of these, 76 children were found to be HIV positive, so that HIV prevalence among children attending primary health care clinics was 76/1064 (7.1% CI: 5.7% - 8.9%).

Mother's reported HIV status

Among 1243 children who attended the clinic with their parent or legal guardian, 906 (72.9%) mothers were reported to have had an HIV test, and 221 (24.4%) were reported as having tested HIV positive. 221 children were, therefore, identified as HIV exposed, of whom 78 (35.3%) had been tested for HIV by routine services.

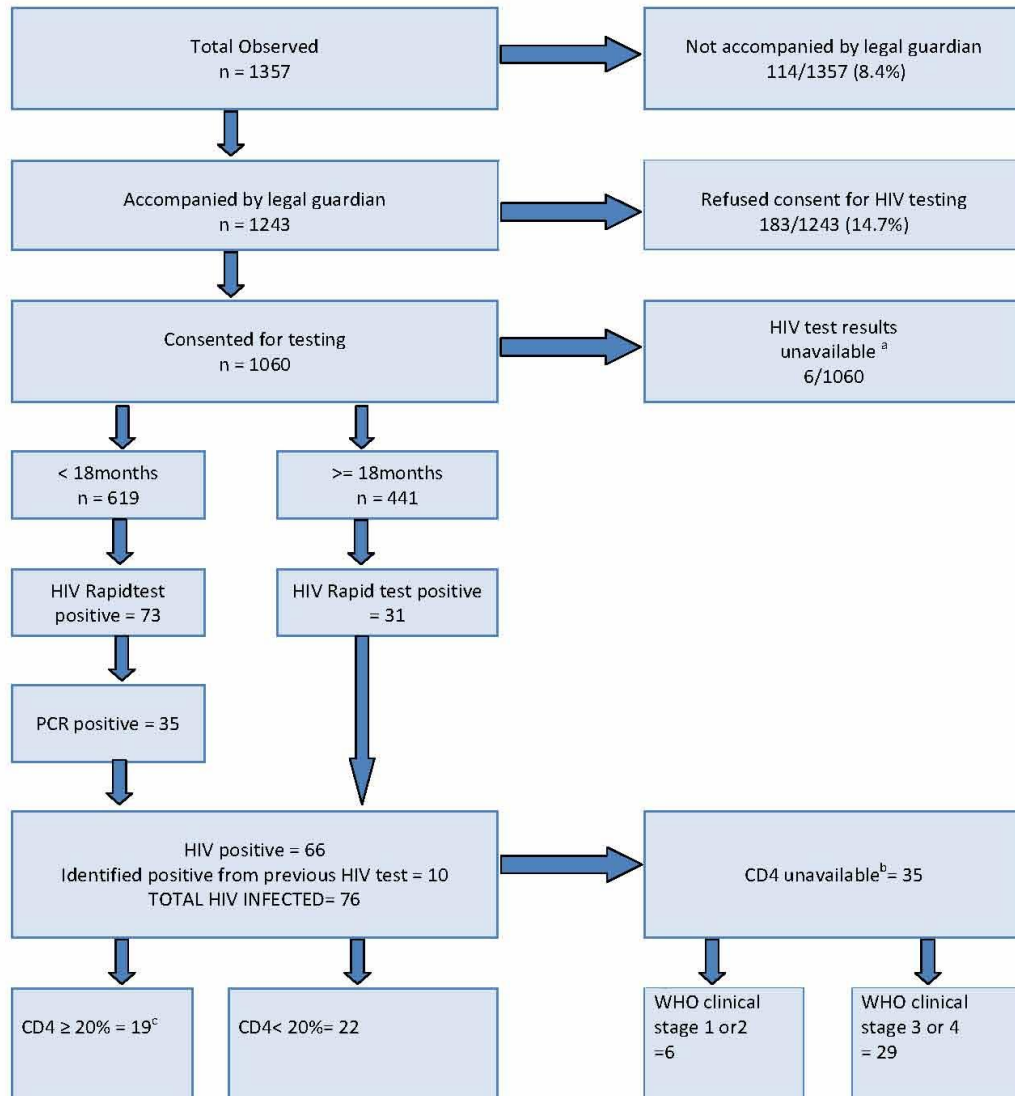
Among mothers of the 76 HIV positive children, 62 reported having had an HIV test, of whom 43 reported having a positive test, 17 reported testing negative, and 2 did not know the result.

Indications for anti-retroviral treatment

Of the 76 children confirmed HIV positive, one child was currently on ART. A CD4 count was performed by the study team on 40/75 of the remaining HIV positive children. ART was considered to be indicated in children with a CD4% < 20% and those who were WHO stage 3 or 4. When a CD4 result was unavailable, indication for ART was determined by WHO clinical staging alone. ART was indicated in 63/75 (84.0%) HIV infected children (table 1).

Performance of the HIV algorithm used by the IMCI expert compared to HIV test

Of 1064 children with an HIV test result available, 171 (16.1%) children were classified as *suspected symptomatic HIV* by the IMCI expert; 54 (71.1%) of whom were HIV positive (table 2). Of 22 HIV infected children with insufficient signs for a classification of *suspected symptomatic HIV*, 15 were identified as *HIV exposed*. So, when the HIV algorithm was fully implemented according to the existing IMCI guideline (figure 2), 69/76 (90.8%) HIV infected children were identified as either *suspected symptomatic HIV* or *HIV exposed* (table 2). Of 63 HIV infected children



^aResults unavailable for 6 children: 4 PCR and 1 ELISA result misplaced, 1 reported positive after first positive rapidtest.

^bNo CD4 result from children reported positive=10, died awaiting PCR result = 9, mother refused CD4 =9, missing results =7.

^cincludes one child on ARV's

Figure 3
Outcome of HIV testing for all study participants.

Table 1: Performance of the HIV algorithm in identifying those children where antiretroviral treatment (ART) is indicated

ART indicated (n = 76)	Number	% (95% CI)	Number Identified by algorithm ^a	Proportion identified by algorithm % (95% CI)
Indicated by CD4<20%	22	8.9 (19.0 - 41.2)	18	81.8 (59.4 - 93.3)
Indicated by WHO clinical stage 3 or 4	60	78.9 (67.4 - 87.2)	50	83.3 (70.0 - 91.5)
Total ART indicated	63	82.9 (71.2 - 90.5)	52	82.5 (69.4-90.8)
ART not indicated by CD4 count or clinical staging	6		1	
ART not indicated by clinical staging, CD4 not available	6		1	
Already on ART	1		0	
Total	76		54	71.1 (59.5 - 80.4)

^a classified as suspected symptomatic HIV

where ART was considered to be indicated, 52 (82.5%) were classified as *suspected symptomatic HIV* (table 1).

Use of the HIV guidelines by IMCI trained health workers compared to IMCI expert

Many health workers (31/77; 40.3%) did not classify for HIV in any child, and 9 did not classify any child correctly

for HIV. Although 3/77 health workers did classify for HIV in every child, no health worker classified every child correctly for HIV.

Health workers made a classification for symptomatic HIV in 428/1357 (31.5%) children; of these 342 (25.2%) were classified correctly as compared to the IMCI expert.

Table 2: Performance of the HIV algorithm compared to HIV test results

n = 1064 ^a	Classified as suspected symptomatic HIV	Identified as HIV exposed	Any HIV classification (either HIV exposed OR suspected symptomatic HIV)
#	171	201	313
# confirmed HIV positive	54	43	69
Sensitivity (95% CI)	71.1% (59.5% - 80.9%)	56.6% (44.7% - 67.9%)	90.8% (81.9% - 96.2%)
Specificity (95% CI)	88.1% (85.9% - 90.1%)	84.0% (81.6% - 86.2%)	75.3% (72.5% - 77.9%)
PPV (95% CI)	31.6% (24.7% - 39.15)	21.4% (15.9% - 27.7%)	22.0% (17.6% - 27.1%)
NPV (95% CI)	97.5% (96.3% - 98.4%)	96.2% (94.7% - 97.4%)	99.1% (98.1% - 99.6%)
Likelihood ratio + (95% CI)	5.99 (4.79 - 7.48)	3.54 (2.77 - 4.51)	3.67 (3.22 - 4.18)

^a comprises all children where an HIV test result is known

Among all observed children, 202 (14.9%) were classified as *suspected symptomatic HIV* by the IMCI expert; of these 37 (18.3%) were correctly classified by the health worker.

Health workers classified 84 children as *suspected symptomatic HIV*, including 28/76 (36.8% CI: 24.7% - 51.0%) HIV infected children. Health workers correctly identified 161/223 (72.6% CI: 65.3% - 79.3%) children classified as *HIV exposed* by the IMCI expert. It was not possible to determine the sensitivity and specificity of the HIV algorithm when used by the health worker compared to the HIV test, because 68.5% children were not classified for HIV.

Health workers management of suspected symptomatic HIV

Of 84 children classified as *suspected symptomatic HIV* by the health worker, 54 (64.3%) carers were advised of the need for HIV testing, co-trimoxazole prophylaxis was prescribed for 26 (31.0%) children, and feeding advice was given to carers of 36 (43.0%) children.

Discussion

This study shows that when the HIV algorithm is applied to all children by skilled IMCI practitioners it is an effective tool to identify HIV infected children, and its implementation could improve access to life saving treatments for HIV infected and exposed children. However, the HIV component of IMCI is frequently not implemented by IMCI trained health workers in routine clinical practice; few children classified as *suspected symptomatic HIV* by IMCI experts were correctly classified by health workers, and most children were not classified for HIV at all. Even when health workers made the classification of *suspected symptomatic HIV*, children were not tested for HIV and essential treatments were not initiated.

There are several possible reasons for poor implementation of HIV guidelines in our setting, IMCI training may not give health workers adequate skills, and some health workers were trained using a previous version of the HIV algorithm. HIV related stigma may make health workers reluctant to mention HIV during a consultation with a child [21], although the high uptake of HIV testing among our study participants suggests that most mothers want information about their child's HIV status. The low positive predictive value (PPV) of the HIV algorithm may also negatively affect implementation. It is important that health workers understand that the HIV algorithm is a screening tool, not a diagnostic test, and that most children identified by the HIV algorithm will test HIV negative. This should be clearly explained during IMCI training, and health workers trained in the appropriate counselling messages to give to a mother when advising her to take her child for HIV testing. If health workers do

not understand that such children will frequently test HIV negative and expect this outcome, they may lose confidence in the algorithm and be reluctant to use it. Similarly, if mothers who are advised to take their child for HIV testing do not get clear and appropriate messages, it may make routine checks for HIV in children unacceptable to communities.

Poor implementation of the HIV component may also be an aspect of poor implementation of IMCI overall. Although IMCI implementation has been shown to improve health worker performance [16,22], poor adherence to the guideline has been previously reported [23,24]. Reasons suggested for this include heavy workloads [25], additional time needed for an IMCI consultation [26], and lack of clinical supervision and support. Supportive supervision of IMCI trained health workers has been found to contribute to improvements in correct treatment and counselling [23], but our findings show that many IMCI trained health workers had not received a supervisory visit, and there was no ongoing IMCI supervision.

Poor implementation of the PMTCT program is also highlighted; despite many mothers reporting a positive HIV test, most HIV exposed children had not been tested, and many clinics were not testing any children under 5 years. Strengthening of PMTCT and its linkage with IMCI is required, together with improved access to HIV PCR testing for HIV exposed children. Comprehensive PMTCT implementation and early confirmation of HIV status of all exposed children may reduce the need for an algorithm to identify symptomatic HIV, but it will still have a role for children whose mothers do not disclose their status, and those whose mothers become infected during pregnancy and breastfeeding. In settings where virological testing is not readily available, the algorithm may play an important role in clinical decision making [13].

Despite poor implementation, we have shown that when the HIV algorithm is comprehensively applied to all children by skilled IMCI practitioners, a high proportion of HIV infected children are identified, confirming the findings of a previous validation study [12]. The HIV algorithm is an effective screening tool, and performs better in children where ART is indicated. However, although the sensitivity of the algorithm is above 90%, even in this high prevalence population the PPV is low, and would be even lower in a low HIV prevalence setting. In our population of children almost one third were identified as requiring an HIV test, and it is important to recognise that this represents a significant burden on the health system.

No previous studies have reported HIV prevalence and the burden of HIV disease among children under 5 in this set-

ting; our study shows that undiagnosed HIV infection is common in PHC clinics, and most of these children have advanced disease. Early initiation of ART improves mortality [7], and recommendations now suggest that ART should be initiated in children under 1 year as soon as the HIV status is confirmed [9]. Our findings strongly support the IMCI recommendation to check all children for possible HIV infection.

The strengths of this study include that the IMCI experts were all experienced IMCI facilitators, and able to provide a reliable gold standard. We were able to observe larger numbers of children and health workers than previous health facility surveys [23,27,28], and could, therefore, describe performance with the health worker as the unit of analysis. We were also able to test most enrolled children for HIV, and measure outcomes confidently. Health workers were not given notice of the study team's arrival, a large number of observations over several days reduced subject bias, and data collection tools were designed to minimise interaction between health worker and observer and reduce the chance of performance improving over time. Limitations of the study include: the observer's presence may have influenced health worker performance, some health workers may have 'learned' what was required during the observation period, and some IMCI experts and health workers may have known each other, all of which could have led to bias. In order to avoid interfering during the consultation, we did not evaluate health workers' performance in identifying specific signs, and because of poor implementation we were not able to determine the performance of the HIV algorithm in routine practise. In addition, the sensitivity of HIV rapid tests in children under 18 months has not been fully evaluated, and we were not able to obtain CD4 results for all HIV infected children.

Conclusion

In conclusion, IMCI has a potential to identify HIV infected and exposed children using the existing guidelines and to provide more and earlier access to care for many children. However, poor IMCI implementation is severely limiting this in routine practice. Further investigation is required to determine the reasons for poor health worker performance, and to provide evidence-based interventions to address poor IMCI implementation. Possible interventions could include strengthening IMCI training, IMCI updates to help maintain skills, as well as increased support and supervision. There is a high burden of HIV disease in PHC clinics and it is critical that these children access treatment if child mortality is to be reduced in South Africa.

Competing interests

The authors declare that they have no competing interests.

Authors' contributions

CH was the principal investigator for the study, designed the study, supervised data collection, and participated in the analysis of the data and writing of the paper. KV participated in the design of the data collection tools, oversaw data entry and participated in the data analysis and the writing of the paper. PN and LH participated in the data collection, analysis, and the planning and writing of the paper. NR and SQ advised on the design of the study, the analysis of the findings and the writing of the paper. All authors read and approved the final manuscript.

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References

1. Department of Health: **Antenatal survey 2006: National HIV and syphilis antenatal seroprevalence survey in South Africa 2006**. Pretoria: National Department of Health: Republic of South Africa; 2007.
2. Chopra M, Daviaud E, Pattinson R, Fonn S, Lawn JE: **Saving the lives of South Africa's mothers, babies, and children: can the health system deliver?** *Lancet* 2009, **374(9692)**:835-846.
3. Rollins N, Little K, Mzolo S, Horwood C, Newell ML: **Surveillance of mother-to-child transmission prevention programmes at immunization clinics: the case for universal screening.** *AIDS (London, England)* 2007, **21(10)**:1341-1347.
4. Sherman GG, Jones SA, Coovadia AH, Urban MF, Bolton KD: **PMTCT from research to reality--results from a routine service.** *South African medical journal = Suid-Afrikaanse tydskrif vir geneeskunde* 2004, **94(4)**:289-292.
5. Perez F, Orne-Gliemann J, Mukotekwa T, Miller A, Glenshaw M, Mahomva A, Dabis F: **Prevention of mother to child transmission of HIV: evaluation of a pilot programme in a district hospital in rural Zimbabwe.** *Bmj* 2004, **329(7475)**:1147-1150.
6. Newell ML, Coovadia H, Cortina-Borja M, Rollins N, Gaillard P, Dabis F: **Mortality of infected and uninfected infants born to HIV-infected mothers in Africa: a pooled analysis.** *Lancet* 2004, **364(9441)**:1236-1243.
7. Violari A, Cotton MF, Gibb DM, Babiker AG, Steyn J, Madhi SA, Jean-Philippe P, McIntyre JA: **Early antiretroviral therapy and mortality among HIV-infected infants.** *N Engl J Med* 2008, **359(21)**:2233-2244.
8. UNAIDS: **2006 Report on the global AIDS Epidemic.** Geneva: UNAIDS; 2006.
9. WHO technical reference group: **Report of the Paediatric HIV/ART Care Guideline Group Meeting.** Geneva: World Health Organization; 2008.

10. Gove S: **Integrated management of childhood illness by outpatient health workers: technical basis and overview. The WHO Working Group on Guidelines for Integrated Management of the Sick Child.** *Bulletin of the World Health Organization* 1997, **75(Suppl 1)**:7-24.
11. WHO: **Child and adolescent health and development progress report 2002-2003.** Geneva 2004:63-66.
12. Horwood C, Liebeschuetz S, Blaauw D, Cassol S, Qazi S: **Diagnosis of paediatric HIV infection in a primary health care setting with a clinical algorithm.** *BullWorld Health Organ* 2003, **81(12)**:858-866.
13. Iliff P, Ntozini R, Nathoo K, Piwoz E, Moulton L, Humphrey J: **Making a working clinical diagnosis of HIV infection in infants in Zimbabwe.** *Trop Med Int Health* 2008, **13(12)**:1459-1469.
14. World Health Organization: **Integrated management of childhood illness: field test of the WHO/UNICEF training course in Arusha, United Republic of Tanzania. WHO Division of Child Health and Development & WHO Regional Office for Africa.** *Bulletin of the World Health Organization* 1997, **75(Suppl 1)**:55-64.
15. Qazi SA, Muhe LM: **Integrating HIV management for children into the Integrated Management of Childhood Illness guidelines.** *Transactions of the Royal Society of Tropical Medicine & Hygiene* 2006, **100(1)**:10-13.
16. Gouws e, Bryce J, Habicht JP, Amaral J, Pariyo G, Schellenberg JA, Fontaine O: **Improving antimicrobial use among health workers in first-level facilities: results from the multi-country evaluation of the Integrated Management of Childhood Illness strategy.** *BullWorld Health Organ* 2004, **82(7)**:509-515.
17. Department of Health: **State of the province: Limpopo.** Pretoria: National Department of Health: Republic of South Africa; 2004.
18. Van Aardt CJ, Schacht A: **Demographic and statistical overview: 1994-2004.** Pretoria: Department of Social Development, Republic of South Africa; 2004.
19. World Health Organization: **Interim WHO Clinical Staging of HIV/AIDS and HIV/AIDS Case Definitions for Surveillance.** Geneva: World Health Organization; 2005.
20. Department of Health: **Antenatal survey 2005: National HIV and syphilis antenatal seroprevalence survey in South Africa 2005.** Pretoria: National Department of Health: Republic of South Africa; 2006.
21. Bharat S, Mahendra VS: **Meeting the sexual and reproductive health needs of people living with HIV: challenges for health care providers.** *Reproductive health matters* 2007, **15(29 Suppl)**:93-112.
22. Armstrong Schellenberg JR, Adam T, Mshinda H, Masanja H, Kabadi G, Mukasa O, John T, Charles S, Nathan R, Wilczynska K, et al.: **Effectiveness and cost of facility-based Integrated Management of Childhood Illness (IMCI) in Tanzania.** *Lancet* 2004, **364(9445)**:1583-1594.
23. Pariyo GVV, Gouws E, Bryce J, Burnham G: **Improving facility-based care for sick children in Uganda: training is not enough.** *Health policy and planning* 2005, **20(Suppl 1)**:i58-i68.
24. Horwood C, Vermaak K, Rollins N, Haskins L, Nkosi P, Qazi S: **An evaluation of the quality of IMCI assessments among IMCI trained health workers in South Africa.** *PLoS One* 2009, **4(6)**:e5937.
25. Rowe AK, Onikpo F, Lama M, Cokou F, Deming MS: **Management of childhood illness at health facilities in Benin: problems and their causes.** *American journal of public health* 2001, **91(10)**:1625-1635.
26. Adam T, Manzi F, Schellenberg JA, Mgalula L, de Savigny D, Evans DB: **Does the Integrated Management of Childhood Illness cost more than routine care? Results from the United Republic of Tanzania.** *Bulletin of the World Health Organization* 2005, **83(5)**:369-377.
27. Bryce J, Gouws E, Adam T, Black RE, Schellenberg JA, Manzi F, Victora CG, Habicht JP: **Improving quality and efficiency of facility-based child health care through Integrated Management of Childhood Illness in Tanzania.** *Health policy and planning* 2005, **20(Suppl 1)**:i69-i76.
28. Huicho L, Davila M, Campos M, Drabek C, Bryce J, Victora CG: **Scaling up integrated management of childhood illness to the national level: achievements and challenges in Peru.** *Health policy and planning* 2005, **20(1)**:14-24.

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Chapter 6: Discussion

The South African HIV/IMCI Effectiveness Study addresses a critical gap in the evidence base related to IMCI; that is, whether IMCI is an effective mechanism to provide HIV care to children. This study remains the only large-scale evaluation of IMCI undertaken in a high HIV prevalence setting. The findings are, therefore, relevant and important for those countries implementing IMCI where there is the greatest burden of paediatric HIV disease. This study was conducted over a large area where IMCI is well established, and provides important information about the sustainability of IMCI, which is not found elsewhere.

The study showed that, among children attending primary health care facilities, there were many with undiagnosed HIV infection and severe illness requiring referral to the district hospital. IMCI provided health workers with management guidelines for all common conditions with which children present to clinics in an HIV prevalent area (103).

Findings of FGDs showed that the 11-day IMCI case management training course was well received by participants. The various methods employed during training were perceived as empowering and informative, and the combination of practical and theoretical learning was valuable. IMCI facilitators were particularly praised for their knowledge and willingness to support slow learners. IMCI trained nurses frequently and strongly expressed increased confidence in managing sick children after IMCI training, and contrasted this with the uncertainty and fearfulness they had felt when caring for sick children before being trained. IMCI trained nurses expressed that the IMCI chart booklet was a useful desk aid that improved their confidence in implementing their new skills after training (104). During observations of sick child consultations, IMCI trained nurses frequently referred to the IMCI chart booklet, despite having been trained an average of more than two years previously. All but one of the nurses referred to the IMCI chart booklet during the observation period. The booklet was used inconsistently, however, with only 40% of observed nurses referring to it during every sick child consultation.

IMCI trained nurses expressed that the IMCI training was too short, and that some components of IMCI were inadequately covered during training. They expressed concerns that they were not given adequate skills in these areas; the HIV component, management of sick young infants, and support of breastfeeding, were particularly mentioned. Participants recommended that the duration of IMCI training be increased or the approach to training be changed, to allow more time for skills development. In support of this view, the survey showed that assessments for

HIV and nutritional status were frequently omitted, with only half of children having a nutritional assessment where indicated. Observations also showed that nurses frequently classified the child's illness incorrectly, and they performed worst when identifying seriously ill children requiring referral (105). Few observed nurses had any other training in child health, so IMCI training was their only opportunity to develop skills in management of sick children. Nurses considered follow-up after training, where an IMCI facilitator visits the newly trained IMCI practitioner in the workplace to provide support, as important to assist them to implement what they had learnt. However, they expressed that these visits were often delayed or did not happen at all. This was supported by the findings of the survey, which showed that observed health workers received little support in terms of follow-up after training, with most having had either one or no follow-up visits.

During FGDs, IMCI trained nurses expressed reluctance to implement the HIV component of IMCI. This appeared to be related, not to stigma towards HIV infected mothers and their children, but rather to nurses' concerns that they would be unable to deal with the mother's reaction to the suggestion that her child be tested for HIV. Nurses also expressed concerns about the legal implications of checking for HIV in children, fearing they may be vulnerable to legal action when recording HIV related findings on the child's clinic card, or when recommending HIV testing to the mother, or even when asking about previous HIV tests. IMCI trained nurses also expressed that they lacked skills to manage HIV infected children. They requested that additional HIV management training be included in IMCI, and that more nurses be trained in HIV/AIDS counselling (106). During the survey, over 85% of observed nurses had been trained in HIV/AIDS counselling, but, despite this, the HIV component was rarely implemented. Almost half of observed nurses did not classify any child for HIV, less than one-third of observed children received an HIV classification, and less than one quarter were correctly classified for HIV. Coverage of HIV related interventions, like HIV testing and provision of co-trimoxazole prophylaxis, was consequently poor. However, the IMCI/HIV algorithm itself performed well in identifying HIV infected children when used by IMCI experts, showing that the HIV component could be an effective tool for improving access to care (107).

The most striking finding from the observations was that most health workers assessed only presenting symptoms and did not implement IMCI comprehensively. Analysis of health worker performance over the period of observation shows that poor IMCI implementation was due to both poor skills and poor adherence to the IMCI guidelines. All health workers asked the carer about all four main symptoms, or all three danger signs, during at least some observed consultations, showing that they were aware of this requirement and had skills to implement it. However, only a minority of health workers implemented these basic IMCI processes during every

observed sick child consultation. Causes of poor adherence to IMCI guidelines must be understood, and interventions put in place to address them, if IMCI implementation is to be improved. In addition, poor health worker performance due to lack of skills was demonstrated by the high proportion of incorrect classifications made by health workers. In particular, less than half of sick children with a severe classification, requiring urgent referral, were correctly identified. These children would have been sent home, placing them at high risk of serious morbidity and mortality. Therefore, interventions are also required to improve health worker skills and to maintain these skills over time.

IMCI trained nurses identified several barriers to IMCI implementation. First among these was that IMCI implementation took longer than routine care, causing delays and longer waiting times for children. This was a particular challenge given the shortage of staff at clinics, and nurses reported that at times this resulted in only some parts of the IMCI guidelines being implemented. Lack of support from colleagues who were not IMCI trained, was raised as another barrier to implementation. Non-IMCI trained staff members may not understand the terminology associated with IMCI or why IMCI consultations take longer. Nurses felt unsupported if doctors at the referral hospital did not understand the IMCI classifications and did not accept their referrals. In contrast, support of IMCI trained colleagues was an enabling factor for IMCI implementation. Another barrier identified was that inconsistencies could arise in practice if some sick children attending the clinic are seen by a non-IMCI trained health worker. This inconsistency may be unacceptable to mothers and undermine IMCI implementation, particularly when treatments not recommended by IMCI, for example cough syrup, are provided by non-IMCI trained health workers. In the comparative survey, there was high coverage of IMCI training among nurses working in the facilities visited, with an average of about three-quarters of nurses on the staff establishment being IMCI trained, and more than two-thirds of clinics visited had reached 'IMCI saturation', defined as more than 60% of nurses trained in IMCI.

Overall, the SA HIV/IMCI Effectiveness Study focuses in more detail on health worker performance in IMCI implementation than previous studies, using both qualitative and quantitative methods to define and explore health worker performance and identify reasons for poor performance. This study provided new information about the burden of disease at PHC level in a high HIV prevalence setting, which can guide health planners and support interventions to improve IMCI implementation. Since this study was conducted, IMCI practitioners working in PHC clinics have played an increasingly central role in HIV management in South Africa, given the urgent need to increase ART coverage among HIV infected children and adults. It is fair to say that the IMCI/HIV algorithm has been a work in progress since its earliest 1998 version, adapting frequently to changes in the policy environment as the emphasis has shifted from identification of

symptomatic HIV infected children to identification of pre-symptomatic children. Today, IMCI provides an important opportunity to link PMTCT and ART programmes, which are often implemented as vertical programmes, to an integrated programme for child health. It also provides an important entry to HIV care for the mother of an HIV exposed child. New adaptations to the SA IMCI guidelines, revised in 2010, include guidelines for nurse-initiated ART for children, based on the WHO 2010 revised PMTCT and Paediatric Antiretroviral Therapy guidelines (28, 108). Additional interventions include nevirapine syrup during breastfeeding for HIV exposed infants, and early ART initiation in HIV infected infants. IMCI remains at the centre of HIV management for children in South Africa, and within the rapidly changing field of HIV management, the results of the current study remain extremely relevant. Future iterations of IMCI will need to reflect the most current evidence and changes in global recommendations.

6.1 Why do health workers fail to implement IMCI?

The SA HIV/IMCI Effectiveness Study and the IMCI-MCE both demonstrated sub-optimal IMCI implementation. The causes of this poor performance can be divided into two closely linked and overlapping components; first, poor adherence to the guidelines and, second, inadequate health worker skills. **Poor adherence to the IMCI guidelines** can be defined as the failure to implement IMCI, or some components of IMCI, after having been trained. The findings of our study indicate that health workers fail to adhere to the IMCI process, as set out in the guidelines, even when they have the skills to do so. This is demonstrated by their ability to correctly implement IMCI activities during some, but not all, observed consultations. **Inadequate health worker skills** remain an important cause of poor health worker performance, and can be defined as the inability of health workers to implement IMCI correctly because they lack the required skills. So, even when IMCI trained nurses adhered to the guideline, they frequently failed to make a correct assessment and, as a result, to provide correct interventions. Inadequate skills and poor adherence are closely linked; poor skills are an important reason for poor adherence.

This finding is not uncommon; there is widespread evidence, in many settings, of the failure of health workers to adhere to guidelines or to implement cost effective interventions (109). Health workers are the key to the success of any health programme, and they must have, not only knowledge and skills to implement the proposed intervention, but also the willingness to do so.

6.1.1 Adherence to guidelines

Detailed analysis of health worker performance in this study shows that, in most cases, health workers did implement some components of IMCI. However, IMCI implementation was not comprehensive, but was patchy, inconsistent and incomplete. For example, all nurses checked for general danger signs in some children, but very few asked these questions consistently during all sick child consultations. Nurses did not lack the skills to check for danger signs but rather, in some children, they simply did not do so. Similarly, few health workers asked about all main symptoms in all children or plotted the weight of every child, but most did so for some children.

When classifying the main symptoms, observed health workers were able to classify correctly approximately 60% of children presenting with cough or diarrhoea, but the proportion of children with fever, HIV and malnutrition who were correctly classified was less than 40%. However, when this finding is examined in more detail, most children who were not correctly classified were not actually incorrectly classified either, but rather *not classified at all*. This was because the health worker either did not ask about the symptom, or asked about the symptom but did not do an assessment, or assessed the symptom but did not classify. This suggests it was incomplete assessment and, therefore, lack of adherence to the guideline, rather than just lack of skills, which led to poor IMCI implementation

Poor implementation of IMCI profoundly undermines its ability to have an impact on child mortality. HIV is the most frequent killer of South African children, but our study showed that assessments for symptomatic HIV were rarely done by IMCI trained health workers and, as a result, coverage of HIV interventions was low. Similarly, malnutrition is an important contributing factor to childhood morbidity but most children with low weight or poor weight gain were not identified by IMCI trained health workers. No nutrition classification was made in almost half of all children, and only two-thirds of children who required a feeding assessment received one. The result reveals a lost opportunity to provide appropriate treatments and counselling that could have improved the outcomes for these children.

Poor adherence to guidelines, including IMCI guidelines, has been shown in several other studies (65, 110-113). However, few studies have been conducted to evaluate approaches to changing professional behaviour in response to new knowledge, especially in developing countries (109). It is often assumed that poor health worker practises are simply due to poor skills, so attempts to improve programme implementation have tended to focus on training to improve skills. It is now increasingly recognised that determinants of health worker practises are far more complex. In a study in Benin, conducted prior to starting IMCI implementation, reasons for poor quality of care for sick children were examined. Predictors of correct performance included pre-

service training, in-service training for diarrhoea, longer consultation times, lower caseloads, and having an inpatient service at the health facility. Children with a higher temperature were more likely to receive an unnecessary injection, and younger children were more likely to receive an antibiotic. However, factors like exposure to supervision and availability of drugs were not associated with any of the performance indicators. The authors concluded that health worker performance is a complex set of behaviours influenced by many possible factors (114).

This complexity is echoed in several other studies of health worker performance. An assessment of factors influencing adherence to fever treatment guidelines in the Central African Republic showed that provision of correct treatment was associated with the child presenting with a high fever, and with the caregiver reporting the fever as the presenting complaint, but not with either in-service training or supervision (115). In Morocco, adherence to IMCI guidelines was better among female health workers compared to males, and for children who were younger, attending with multiple problems, and attending the health facility with their mother (110). Therefore, factors affecting adherence to treatment guidelines can be categorised broadly as being related to health worker, patient or environment factors, as well as to the complexity and clarity of the guidelines themselves.

Health worker factors include skills and knowledge, perceived self-efficacy and motivation, as well as beliefs and attitudes about the practises recommended by the programme, and how well these fit in with the existing values of the practitioner. It is important for health workers to recognise the sources of new knowledge and practise as being authoritative, and that the programme is perceived as credible. Information about a new practice should flow as freely through other channels of influence as it does through the educational route. The manager, supervisor, visiting doctor, as well as other opinion leaders, must support the new intervention, or risk undermining the chances that health workers' will adopt the new practise. Previous experiences in using the guidelines and fear of a bad clinical outcome can also influence health workers' practise (109, 116). In a study in Tanzania, for example, health workers frequently failed to give IMCI recommended treatments to severely ill children, and omitted to refer such children, making the decision that treatment and referral was unnecessary. Health workers expressed disagreement with the IMCI guidelines, and confidence in their ability to manage many severely ill children without referral. Certain parenteral drugs recommended by IMCI were rarely given to severely ill children because health workers had strong perceptions that these drugs were toxic and unnecessary (113).

Several studies have shown that higher cadres of health worker are less likely to adhere to guidelines. For example, in Kenya, nursing aides adhered more closely to guidelines than nurses and clinical officers (93). In Bangladesh, non-professional IMCI-trained village health workers

performed as well as nurses in managing sick children, and contributed considerably to the overall success of IMCI in intervention areas (67). A study in Benin showed lower adherence to guidelines among higher cadres of health workers, so much so that there was a dose response relationship in the odds of making an error: the more advanced the training the greater the chance of making an error (114). A possible explanation is that higher cadres of health workers were more aware of other treatment options, and that physicians, in particular, were more confident in their ability to 'know better' than the guidelines and, therefore, to override them.

Even if training provides health workers with all the necessary skills to implement a new guideline, it is unlikely that they will simply replace their existing practises with the new ones. Rather, they will adapt their practise to include some elements of the new guideline. Health workers are not passive actors who simply comply with instructions, and we cannot assume that they are motivated and competent. Rather, they are individuals operating in a dynamic environment where they face constant changes, and they adapt their practise to satisfy personal and professional values and goals (116). Models of behaviour change suggest that change occurs gradually over time, so it is unlikely that a new behaviour, like IMCI implementation, will be comprehensively adopted at one time. In order to achieve the high coverage required, the change process for a health worker from pre-IMCI practitioner to IMCI practitioner needs to be managed and supported.

The new IMCI approach needs to be internalised by the health workers and embedded into the work of the clinics, so that it becomes normal practise (117). IMCI is an innovative approach to the management of sick children, and requires extensive changes to established behaviours. Health workers refer to algorithms, make a classification using unfamiliar terminology rather than making a diagnosis, no stethoscopes or auroscopes are used, and many recommended treatments are changed. It is easier to encourage a small change, like substituting one drug for another, than to take a completely different approach to patient management as is required by IMCI. So, the process of normalising IMCI as part of routine clinic processes may be difficult, and this may negatively impact on the ability and willingness of health workers to change their practise. The findings of this study suggest that although the process of making IMCI, including the HIV component, 'the norm' has started, it has not yet fully occurred in our setting.

Patient factors influencing adherence to IMCI guidelines may include patient expectations. In our study, the expectation of mothers was raised as a barrier to implementation, with nurses reporting that patients expected to receive certain treatments that are no longer recommended by IMCI. This was unacceptable to some child carers, and undermined the willingness of health workers to implement IMCI recommendations, particularly if such treatments were provided by non-IMCI trained health workers at the same clinic. A policy decision needs to be made about

which treatments are recommended for sick children, and this policy should be implemented consistently by both IMCI trained and non-IMCI trained health workers.

The **environment at the health facility** and how the programme relates to the organisation in which it is set, also impacts on implementation. The clinic environment is important for creating readiness for behaviour change and facilitating the change. Change is a complex process and requires careful planning, good leadership and commitment, which can then be codified in policies and rules. Managers should provide leadership in this process to develop the right climate for enhancing performance of health workers. An enabler to IMCI implementation, identified by health workers in this study, was the support from colleagues at the clinic who were also IMCI trained. Those countries participating in the IMCI-MCE that achieved the highest levels of quality of care were those that achieved very high levels of training coverage. In Uganda, there was a consistent trend towards improved quality of care with higher levels of IMCI training coverage (65). Therefore, peer support could be a strong tool that clinic managers could use to assist newly IMCI trained health workers. Conversely, where other staff at the clinic did not understand IMCI, this was identified as a barrier to implementation.

Another enabling factor mentioned by our FGD participants, that assisted them in implementing IMCI after completing their training, was the use of the IMCI chart booklet as a desk aid. Several studies have shown that job aids are associated with improved adherence to guidelines, although it is unclear whether the availability of a job aid may be an indicator of a more motivated health worker. A study in Kenya showed that children treated in a consulting room with a malaria treatment wall-chart were more likely to receive the recommended malaria treatment. Health workers who were in possession of the guideline were more likely to adhere to it, but in-service malaria training alone, without possession of the guidelines, was not associated with improved performance (93). Therefore, job aids could be used to strengthen IMCI implementation.

In this study, longer consultation times for IMCI was the barrier to IMCI implementation that was identified most frequently and consistently by discussants in all FGDs, as leading to delays and queues for waiting children. Longer consultation times were identified as a reason for incomplete IMCI assessments because this was the only way to complete all sick children consultations before the end of the day. This finding was not unexpected. Longer consultation times have been reported in several studies of IMCI implementation, because more tasks are undertaken during an IMCI consultation due to the comprehensive nature of the assessment (73). In Brazil, a continuous observation time and motion study showed IMCI trained health workers were spending an additional 1.5 minutes on average per consultation, longer than their counterparts in the comparison group. However, health workers in IMCI sites spent longer with patients over 5 years of age as well, suggesting that health workers in intervention sites may have been more motivated

or better managed (73). Similarly, in Tanzania, health workers in IMCI districts spent longer with children, but this was because less time was spent on administrative tasks, and not because they spent less time with other patients (72).

We did not measure consultation time in our study, but in South Africa, addition of the HIV component is likely to further increase consultation time. If health workers are being asked to undertake additional tasks when they are already fully occupied, then existing activities must be reduced or additional staff employed. Checking for HIV in a child is stressful as well as time consuming, and given the very real shortage of staff at health facilities, consultation time is likely to be a major barrier to comprehensive IMCI implementation. Innovative methods of saving time in the consultation, without reducing quality of care, need to be identified and tested. Information could be provided to mothers in other ways, such as by task shifting or using job aids. For example, counselling tasks could be undertaken by an appropriately trained lay counsellor working with the health worker, or written counselling aids could be provided to mothers about specific topics like HIV, nutrition or how to take medication. Strengthening well-child services, so that more promotive and preventive IMCI tasks are shifted to that setting, could also reduce the pressure on the sick child consultation. Improved record keeping could reduce repetition of counselling tasks and improve efficiency of IMCI implementation.

6.1.2 Health worker skills

Most health workers were unable to perform all IMCI activities correctly. Incorrect classifications were made because health workers did not have the required skills for correct assessment and classification. This is demonstrated most clearly in the assessment of severe classifications, where fewer than half of severely ill children requiring urgent referral, were correctly classified. Correct classification of such children is the component of IMCI that relies most on clinical skills. Making a 'severe classification' in IMCI depends on the ability of the health worker to identify a severe sign, like chest indrawing, lethargy, very slow skin pinch, or neck stiffness. These signs are relatively uncommon and it is unlikely that IMCI training will provide enough clinical practice to give health workers the skills to recognise these signs reliably. Although videos and other learning tools are used during training, this does not replace clinical experience. Most observed health workers had no other training in child health care and relied entirely on IMCI training to provide them with these skills. It is important that IMCI trained health workers have the opportunity to develop all the necessary skills, either during or after the training, to ensure that competency is reached. Objective structured clinical examinations (OSCEs) have been successfully used to assess clinical skills and demonstrate improvements in low income settings (118).

6.1.2.1 IMCI training

The qualitative evaluation of IMCI training showed that the methods used during the 11-day IMCI training course were well received, and IMCI trained nurses strongly expressed that their skills and confidence in managing sick children improved. IMCI training is supported by extensive training materials, using a variety of teaching methods, as well as by reinforcing skills with practical sessions in the inpatient and outpatient setting. IMCI trained nurses expressed that these different methods were helpful, improved understanding of the course content, and facilitated integration between theory and practise. WHO guidelines for conducting IMCI training include clear recommendations for the duration of training, the ratio of facilitators to participants, as well as tools for assessing and managing course participants during training. This model of using well developed training materials (developed by an international agency and adapted for use in the local area), as well as skilled and trained facilitators, was recognised as beneficial by participants. Participants particularly praised the IMCI facilitators for their dedication and willingness to support slow learners.

However, it was frequently expressed by our FGD participants that the training time was inadequate to learn all the skills required, particularly in HIV management, management of sick young infants, and nutritional counselling, particularly breastfeeding. A recent study, exploring the challenges of achieving high IMCI training coverage in Kenya and Tanzania, echoed this finding. Participants frequently expressed reluctance to shorten the IMCI course due to concerns about training quality, saying that the course is already too short (119). A survey conducted by WHO in 2007 suggested that, while physicians performed just as well in IMCI regardless of the duration of training, non-physicians received more benefit from the longer 11-day training, with the result that participants in the shorter course rated themselves as less skilled post-training compared to those trained for 11 days (62). In Uganda, auxiliary workers trained during the expansion phase of IMCI, when the quality of the IMCI training course was reduced, with fewer facilitators and less clinical practise, performed less well than those trained in the early phase of IMCI implementation (65). A systematic review showed that, based on the limited evidence available, the standard 11-day training was more effective than the short training, although this difference may be small (59). Our findings demonstrate that IMCI skills were not sufficient, even after 11-day training, and that skills were not maintained over time. This is likely to be exacerbated in South Africa because the HIV component was added without increasing the duration of the course.

In many countries it has been a challenge to reach sufficient IMCI training coverage to achieve impact with IMCI interventions. The demands of implementing IMCI case management training have been far greater than expected by WHO, so that training has been difficult to sustain after the introductory phase (60). In many settings it has been difficult to achieve the recommended

60% coverage of IMCI trained health workers (61), particularly during the expansion phase, and this has been a limiting factor for rolling out IMCI in several countries (119,120). A survey of 24 countries, conducted by WHO, showed that because of pressure to scale up, all countries offered shortened IMCI courses ranging from 3-10 days. These shorter courses offered less individual feedback, fewer exercises and less clinical practise (62). Reasons given for reducing training duration were that the cost of the 11-day training is too high and keeps health workers away from their clinics for too long, and the need for the course to be residential adds substantially to the cost (119). The course is also logistically difficult to organise because several venues (classroom, PHC clinics, and hospital ward) are required, as well as skilled facilitators. Despite this, in the Tanzania MCE study, training costs were similar in IMCI districts compared to non-IMCI districts because, instead of a single integrated IMCI training course, non-IMCI districts conducted a variety of training sessions on immunisation, malaria and diarrhoea management (72). Another major limitation is the overall reduction in funding support for IMCI in recent years, compared to, for example, funding support for EPI, which has remained fairly constant over the same time period (119). Budgeting policies at local level will determine the priority that IMCI training receives in the expansion phase, once training is decentralised, and IMCI may have to compete with other priority programmes for very limited funding.

The improvements in quality of care on which the confidence around IMCI efficacy is based, was demonstrated using IMCI practitioners who attended 11 days of case management training. It is uncertain whether such improvements would have been demonstrated with shorter training. IMCI training needs to be strengthened, rather than weakened, and innovative training approaches for IMCI should be developed and evaluated.

6.1.2.2 How can IMCI training be improved?

Pre-service training is one practical approach to improving IMCI training coverage. IMCI training is included in the syllabus for medical and nursing training in many countries. However, pre-service training has been criticised as being inadequate for effective development of skills, by both health workers and health managers, in Kenya and Tanzania (119). It is questionable whether health workers trained in IMCI during their basic training will be effective IMCI practitioners some years later, when the time comes to practise IMCI. Further evaluation is required, and perhaps a short 'refresher course' could be developed to update IMCI trained health workers who are returning to practise after a period working in another clinical field.

Innovative approaches for IMCI in-service training could include modular training, where participants attend one day per week, allowing time for reading and clinical practise between modules. An increased amount of self-learning would reduce the amount of repetition and

classroom time. Participants could complete a case log to increase the amount of clinical practise undertaken outside of the formal clinical practise sessions. Longer clinical practise sessions could be undertaken at a large central facility, giving participants more opportunity to assess seriously ill children and to identify signs of severe illness. A decentralised computer-based course could also provide some of the solutions, in settings where this is feasible, but would need to be combined with a strong component of supervised clinical practise. The IMCI Computerised Adaptation and Training Tool (ICATT) has been developed by WHO, and provides innovative software to assist with IMCI adaptation. ICATT-based courses are now being conducted in several countries (121). Ideally, a variety of training approaches should be developed, with supporting materials, which could be tailored to suit the situation in the local area. All novel approaches to training should be rigorously evaluated.

These new approaches include a stronger emphasis on self-learning, so it will be important to ensure that participants undertake the self-learning tasks and achieve clinical competency. An assessment could be developed to assess competency of IMCI practitioners prior to completing the course, with particular emphasis on identification of signs of severe illness and HIV. This should be done in a supportive way, aimed at identifying gaps in the skills and knowledge of new IMCI practitioners, in order to provide additional training or clinical practise to fill these gaps. A similar process could be used to ensure that health worker competency is maintained over time, and could be combined with a process of regular updates, whenever the IMCI guidelines change. Regular updates are particularly important for the HIV component, because of the frequent changes to PMTCT and paediatric HIV management guidelines. Given the poor quality of IMCI implementation, such an assessment of competency could be considered for all IMCI training participants, including those who attended the established 11-day course.

A structured process for transferring newly acquired skills to the workplace is needed. The current approach is for IMCI trained health-workers to receive a follow-up visit in the workplace after completing training. In our study, participants stated that, although follow-up after training was helpful, it was frequently delayed or did not happen at all, and this model of supervision has been difficult to sustain in any IMCI country (60). Peer support has been identified as an enabler for IMCI implementation, so an alternative process could be developed and evaluated, where the new IMCI practitioner works as an 'IMCI intern', with additional support and mentoring provided by other IMCI trained colleagues. Mentoring tools could be developed to assist mentors in their role, and this process would serve to improve the competency of mentors as well as the mentees. During this intern period, newly trained IMCI practitioners could be given a smaller patient load, which would acknowledge that they are now practising a more comprehensive assessment and assist them to develop their skills with less time pressure.

6.2 Supervision

Training alone is not enough to achieve good quality, sustained health worker skills and to ensure adherence to guidelines (65, 93, 122). Clinical supervision is recognised as a key support for health worker performance and has been shown to be effective in improving performance (122). A randomised controlled trial, conducted in Zimbabwe, showed that supervision resulted in significant improvements in the use of standard treatment guidelines compared to training alone (123). Health managers are usually supportive of supervision, and supervisors are generally in place in all health systems. Therefore, well-conducted health worker supervision could be a mechanism for providing professional development and improving health workers' job satisfaction, thereby increasing motivation (116). However, little specific research has been conducted to examine the mechanisms and challenges of providing on-going high quality supervision (124).

In this study, focus group discussants expressed that follow-up after training, as recommended by IMCI, was an enabler for IMCI implementation. However, among our observed health workers over a quarter had not received even a single follow-up visit, and there was no on-going clinical supervision. Supervision systems face many challenges. Supervisors are frequently poorly skilled, spend inadequate time on supervisory activities, and mainly focus on administrative rather than clinical activities. Difficulties with sustainability of IMCI supervision is a common finding in many IMCI studies. For example, supervision systems were explicitly addressed in the IMCI-MCE, and various approaches were developed to overcome barriers to on-going supervision and to integrate IMCI supervision with general supervision. Despite this, supervision could not be sustained in any MCE site (60).

In Benin, in order to strengthen the sustainability of IMCI, an innovative package of support was designed and introduced for health workers after training. This package of support included a system for IMCI supervision, as well as job aids and non-financial incentives. This was evaluated in a controlled study to see whether this package of support (additional support) improved health worker performance compared to IMCI with usual support. The findings of this study showed increased odds of a child receiving correct treatment in the group receiving additional support, and supervision was associated with improved health care quality in a dose-response relationship. Strikingly, the control IMCI group with usual support showed no significant effect of IMCI training, demonstrating that training was only effective when combined with on-going support and supervision (122). However, even in the intervention sites, only 29% of scheduled supervisory visits actually occurred, and despite encouragement from the study team, it was not possible to sustain supervisory activities. Reasons given by supervisors for failing to undertake planned

supervisory visits included poor co-ordination, ineffective management, a lack of training, a lack of motivation, transport problems and lack of commitment to IMCI (124).

In Niger, a study exploring performance of IMCI trained health workers used a quality improvement methodology to give feedback to health workers about their performance. Researchers assessed performance and gave feedback at district and facility level about the compliance of observed health workers with IMCI standards. They then initiated discussions with the district management team and managers in-charge of clinics to discuss areas of poor compliance and possible reasons for this. As a result, there were initial improvements in health worker performance, particularly in areas of low compliance, but these improvements were not sustained and there was a gradual deterioration in compliance over the duration of the study (125).

Strengthening IMCI supervision requires a complex process of health system change. This must be integrated with existing supervision systems, and be combined with strengthening of supervisors' skills, if it is to be sustainable. Clinical supervision and support is particularly important for primary health care, where health workers may work in isolated areas, with little access to on-going professional development. Effective, sustainable mechanisms for implementing clinical supervision for health workers need to be developed and evaluated, and the characteristics of successful supervision programmes must be defined. Clinical skills of supervisors are also often poor. Hence, on-going training or mentoring to develop and support supervisors' skills could improve quality of supervision. Experienced clinicians could be recruited as supervisors, if their clinical and facilitation skills are recognised and rewarded. Separating the functions of clinical and administrative supervision could improve the efficiency of clinical supervisors in supporting clinical care, and electronic learning could provide good quality materials to support clinical practise in some settings.

6.3 Implementation of the HIV component

Effective IMCI implementation is key to achieving the high coverage of interventions for HIV care that are required to improve child mortality in South Africa. High coverage of PMTCT interventions has been achieved in the antenatal period (33,126), and significant improvements in mother-to-child transmission have been achieved (127). However, follow-up of HIV infected mothers and their children in the post-natal period has been identified as a weakness of the PMTCT programme (128, 129), and coverage of key postnatal interventions for HIV exposed babies, like co-trimoxazole and HIV PCR testing, have been found to be low (126). HIV management is a complex and constantly evolving field, further complicated by issues of stigma and confidentiality. Providing care and treatment for HIV presents particular challenges to health workers, and the HIV pandemic in South Africa has changed the environment in which health workers provide care for patients. HIV care was a strong focus of this study and, although the issues of poor IMCI implementation discussed also apply to HIV care, the particular challenges related to provision of HIV care warrant a separate discussion. Scaling up of services and improving ART access for HIV infected mothers and their infants depends on health workers working at PHC level. However, unless these health workers are adequately trained, skilled and motivated they may become a constraint to scaling up of services (130). In this study we showed that the HIV component of IMCI was not being implemented by health workers in routine practise. Only one quarter of observed children were correctly classified for HIV; the poorest implementation of any single component of IMCI. A small study conducted recently in Zambia showed similar poor implementation of the HIV component of IMCI (131).

Health workers operate in a challenging environment, and nowhere is this more true than in the field of HIV management. This is because, first, HIV/AIDS has profoundly affected the workplace in which health workers find themselves, and they may feel overwhelmed by an illness that makes their efforts seem futile, or feel defeated by overwork and stress (132). Although health workers treat disease, in most circumstances they are rarely touched by it (133). However, HIV infected mothers and children are often of a similar age and background to health workers and their own children. This challenges an important coping strategy of people dealing with death and disease, that of denying vulnerability, and might lead to fear and lack of compassion for those afflicted (134). Second, health workers face complex management challenges daily, where they cannot rely on their basic training to provide them with the information needed to provide a good quality service. New information rapidly becomes obsolete, and patients and health managers have ever-increasing demands and expectations.

Participants in our FGDs expressed reluctance to implement the HIV component of IMCI. They mentioned several barriers to checking for HIV in all children, saying it was difficult to raise the

topic of HIV because it was ‘embarrassing’, unnecessary, and unacceptable to mothers, and they were apprehensive about the consequences of doing so. Nurses were also apprehensive that they lacked skills to care for HIV infected mothers and children. This contrasted strongly with the views of child carers and mothers, who were supportive of routine checks for HIV in children. They recognised that routine checks were necessary, and that it was important for them to know their child’s HIV status to ensure their child had access to all available treatments.

6.3.1 HIV/IMCI training

Training was identified as a strong theme in the FGDs. Nurses felt that their training and knowledge in the field of HIV management was inadequate. They did not have anyone to refer to for advice, which made them feel uncertain and vulnerable in dealing with HIV- related issues, and fearful of being asked questions that they would be unable to answer. They suggested that more information be included in the IMCI guidelines about HIV management, and that more nurses be trained in AIDS counselling.

Supportive and knowledgeable health workers are crucial for HIV positive people to access care. Respect and good communication from health workers increases uptake of HIV services (135). Our findings show that IMCI trained nurses lacked both the communication skills, and skills in HIV management, to implement the HIV component of IMCI. Studies have suggested that health workers frequently do wish to provide integrated HIV services, but lack the skills and confidence to do so (130, 136). Health workers with inadequate training in AIDS management are more likely to report negative attitudes to HIV infected patients (137). Training can decrease fear of occupational infection, and increase sympathy and willingness to provide care for HIV infected individuals (138). In our study, almost all observed health workers had been trained in HIV/AIDS counselling, but implementation of the HIV/IMCI component remained extremely poor.

There is another dimension to the counselling skills required for implementation of the HIV component. HIV/AIDS counselling training is designed to give health workers skills to provide information and counselling before and after HIV testing, for an individual who intends to have an HIV test. Initiating a discussion about HIV with a mother who may not know her own status, or that of her child, requires slightly different skills, that are more related to the skill of ‘breaking bad news’. Any information that adversely changes a person’s perceptions of their future can be considered bad news, and breaking such news is always stressful for health workers. A common reason for this stress is fear of the patient’s reaction (139), as expressed by nurses in this study. Nurses were fearful of the mother’s reaction if her child was checked for HIV: that mothers would be angry, make a complaint, be violent or take legal action against them, or avoid them in future and go elsewhere for care. Nurses working in high HIV prevalence areas already face increasing

workloads and stress, and may avoid such distressing situations to protect their own wellbeing. Nurses stated that it was easier to implement the HIV component when the mother's HIV status was already recorded on the card, so it was not necessary to ask. Effective communication, particularly when giving bad news, requires training and on-going evaluation to ensure success, and training in communication skills has been shown to improve skills and confidence in this area (140).

6.3.2 Attitudes of health workers

Disease related stigma can be described as a process whereby individuals with an illness are deemed undeserving of help and support, leading to reduced social status. Friends and family may choose to withdraw from the patient, deny help, or assign blame for the illness (141). People with HIV are ascribed responsibility for their illness because the behaviours leading to infection are considered avoidable. Stigma is inextricably meshed with other stigmas associated with risk behaviours like promiscuity, homosexuality and transactional sex. Poor attitudes of health workers towards managing HIV infected patients has been reported in several settings (137, 142, 143), with health workers reporting negative feelings towards people living with HIV/AIDS (PLWAs), leading to poor patient care. Health workers have been shown to have judgemental attitudes towards PLWAs, feeling that they are to blame for their illness and deserve punishment (142). Some health workers reported refusing treatment for HIV infected patients, feeling such treatment is a waste of resources (137). AIDS is also associated with health workers being fearful of occupational infection, with incorrect perceptions of risk, and using non-rational techniques to prevent contamination, and, therefore, in effect implementing stigmatising practises (137,143). The high prevalence of HIV infection among health professionals in South Africa, particularly nurses (144), may also lead to reluctance to initiate discussions about HIV. In effect, the issue of HIV infection in the community is just 'too close to home'. Health workers may, therefore, stigmatise HIV and blame contraction of the disease on characteristics normally associated with 'outgroups', like promiscuity or prostitution, to distance themselves from the risk of HIV affecting themselves and their own family (134).

However, in striking contrast to such findings elsewhere, in the current study stigma and fear of infection were not mentioned, either directly or indirectly, by any participants in the focus groups. Both nurses and carers of children expressed positive attitudes towards provision of HIV care to mothers and babies. However, carers did mention that the attitude of nurses when raising the issue of HIV testing was an important determinant of the acceptability of HIV testing. It is likely that health workers were aware that HIV-related stigma is considered unacceptable and may have avoided any suggestion of negative attitudes towards HIV patients during the FGDs. However, it is

likely that carers would have raised the issue if they had seen or heard of stigmatising practises. So it appears that overt stigmatising practises are not prevalent in clinics, although it is possible that poor implementation of HIV/IMCI guidelines was related to subtle stigma, which was difficult to identify during our FGDs.

6.3.3 Attitudes of community members

In our study, carers did express fear of stigma, not from the nurses working at the clinic, but rather from other community members attending the clinic. Stigma towards HIV infected individuals has been widely described in South African communities (135, 141, 145, 146). High levels of knowledge about HIV in communities have been found in South Africa, but knowledge does not seem to reduce stigma. Many of those with high levels of knowledge still display beliefs that people with AIDS are dirty or should be ashamed (145). This contrasts with the findings in our study, which suggested that community support services and community health workers teaching communities about HIV and improving community awareness, made it easier to implement the HIV component.

In this study, carers expressed fears that attending the clinic could lead to unintended disclosure of a positive HIV status to other community members at the clinic, or that health workers would not respect their confidentiality and would discuss their HIV status among themselves. Carers stated that some community members ‘just look’ at a child that is ill and decide the child has HIV, even when this may not be true. Such unintended disclosure has been shown to result in stigma(147), and has been associated with a lack of willingness to seek care (148). Most people living with HIV have experienced stigma in a variety of ways, with women being the most vulnerable to stigma, and depression is particularly common among women (146). HIV services separated from routine services was described by participants in FGDs as being particularly stigmatising, and such stigma can negatively impact on the willingness of mothers or carers to seek care for themselves and their child.

6.4 Health system constraints: scaling up of IMCI

Several constraints to scaling up IMCI have been identified, including poor adherence to IMCI guidelines, poor health worker skills, perceived high costs of training, inadequate budget allocations for IMCI, lack of sustained supervision and weak referral systems. It is widely recognised that strong health systems are necessary for implementation of effective and sustainable programmes, including IMCI (149). Weak health systems are likely to experience constraints to IMCI implementation, like poor drug supply, inadequate infrastructure, and high staff turnover. In those countries with the worst health status, health systems are often too weak to deliver the volume and quality of services required to meet the MDGs (150). Countries with the mortality levels and cause of death profile that would most require the benefits of IMCI implementation, frequently lacked the basic health system infrastructure and support to deliver it (60).

Going to scale with complex health interventions may lead to a reduction in quality. IMCI does provide a mechanism to effectively deliver public health interventions, but our study and others show that it is challenging to maintain quality as IMCI is scaled up. Ideally, both quality and coverage should be at high levels, but in reality, trade-offs are often made that compromise the potential public health benefits. In countries where early successes were shown, governments committed to implementing IMCI throughout their countries in a short timeframe, and working under pressure meant shortcuts were taken with training, health system development, and supervision (86). The biggest obstacle to IMCI implementation was the cost and resources required for training in the expansion phase (151). After initial sharp increases in health worker training, the number of training courses being offered declined, making it difficult to achieve coverage of training, and supervision systems could not be sustained. In general, the pace of IMCI implementation was slower than anticipated, and the health systems and community components were frequently either weak or not implemented at all. As a result, many countries were not able to move to the levels of coverage required to impact on child survival (60), and expected improvements in health and nutritional status of the children were not achieved, even when many health workers had been trained (86). Ten years after implementation of IMCI, many African countries are still only implementing IMCI in less than 50% of districts (152).

This highlights the difficult choice of whether to deliver a small number of critical interventions at high coverage, or to select an integrated approach like IMCI and deliver a broader range of effective interventions at one time. Vertical approaches use planning, staffing, management and funding systems that are separate from other services, whereas horizontal approaches work through existing health system structures. Combined delivery and integration of interventions can lead to greater efficiency and cost-effectiveness, with potential synergies of interventions in the

face of co-morbidity. IMCI emphasizes provision of a broader package of services that share a common delivery mechanism and/or target population. However, in fragile health settings, or countries with minimal infrastructure, there may be a place for programmes delivering a limited number of interventions (86). It is not clear whether achieving high coverage of a few selected interventions will be more efficient than reaching lower coverage with a broader range of interventions. Vertical programmes have been able to reach large numbers of children, even in settings where health systems were weak, and there may still be a place for this approach (89). Although IMCI is integrated at point of delivery, optimal implementation is achieved when there is actually a mixture of horizontal and vertical approaches, combining a horizontal approach at lower levels with a vertical approach at higher levels (86).

IMCI has also suffered because of the inability to rapidly demonstrate impact, and maintain stakeholder and funder support. Funding agencies are increasingly requiring quantitative evaluations of public health programmes and their impact, to meet demands for accountability (91). Vertical programmes like Malaria, TB or EPI have been shown to be better funded and monitored than IMCI. To improve this situation, accessible evidence of the cost-effectiveness of IMCI programme implementation is required (149).

6.4.1 Health systems support for IMCI implementation

The model on which IMCI is based needs to be broadened to encompass different approaches for different health system settings. It is clear that a 'one size fits all' does not work and, although the IMCI model could be said to address issues of service delivery appropriately, IMCI planners did not sufficiently address other aspects of the health system like human resources issues, supervision and equitable coverage of interventions (60). For example, IMCI countries should have a range of training approaches to choose from, which can be tailored to the local situation, all supported by tools and clear guidelines for implementation, and most importantly, all evidence-based. Staff turnover has been a serious impediment to sustained implementation of IMCI case management, and it was not possible to achieve sufficient coverage of IMCI trained workers in health facilities in many areas (60). However, it has been shown in a several studies that performance of a lower cadre of health worker is similar to, or better than, professional health workers (65, 67, 153). Serious considerations should be given to developing and evaluating different models of task shifting.

There remains a major and unacceptable gap between the knowledge of diseases, and implementation of that knowledge in low- and middle-income countries. Health systems research accounts for a small proportion of global research funding, and there is still little research into how

to effectively translate knowledge into practise in low-income settings, and enhance the use of clinical guidelines like IMCI. A major research priority should be how to scale up such interventions effectively. Directed and innovative research is needed to analyse underlying causes of poor implementation, and understand the characteristics of the health systems environment that will sustain accessible and high quality care. We need to know the characteristics of delivery strategies that can achieve and maintain high delivery coverage of interventions, which health system strengthening strategies are effective, and what delivery strategies are most effective in health systems with different characteristics (89). From this information, evidence-based solutions can be developed, aimed towards achieving equitable access to interventions (154).

6.5 Strengths and limitations of the SA HIV/IMCI Effectiveness Study

6.5.1 Strengths

The focus of the SA HIV/IMCI effectiveness study was to undertake a robust performance evaluation of IMCI to provide information that is relevant and useful to policy makers, with the aim of improving the effectiveness of IMCI. In summary, the study had the following particular strengths:

- The study provides data to fill several gaps in IMCI research, including: description of the disease profile of children at PHC level in a high HIV prevalence area; effectiveness of the HIV component of IMCI; evaluation of IMCI case management training; and barriers to implementation of IMCI in the workplace, with particular focus on provision of HIV care by IMCI trained nurses.
- The mixed methods approach allows the presentation of a more comprehensive picture of IMCI implementation, drawing on the advantages of both qualitative and quantitative data sources.
- The study was conducted over a large area and was able to provide a true picture of IMCI effectiveness in routine practise.
- All IMCI trained health workers seeing sick children in PHC clinics were included in the sampling frame for observations, and study participants were randomly selected in each province.
- All IMCI experts were experienced IMCI facilitators and practitioners, and were able to provide a gold standard for health worker performance.
- Most participating children had an HIV test to provide an accurate estimate of HIV prevalence among children attending primary level facilities.

- The study was conducted in partnership with important role players in IMCI implementation, both in the SA Department of Health and at WHO. We, therefore, had good access to these decision-makers when disseminating the findings and recommendations.
- The large number of observations conducted for each health worker in our study was a major strength of the methodology. This was the largest number observations of sick child consultations undertaken at a single point in any IMCI evaluation. This meant that the health worker could be used as the unit of analysis, allowing detailed analysis of each health worker's performance over the observation period, to develop a detailed, specific picture of gaps in IMCI implementation and to identify reasons for these gaps. Although the IMCI-MCE was a large study overall, at single sites and at particular time points the numbers of children observed was relatively small. In all IMCI-MCE sites, observations were conducted over a single day with the child as the unit of analysis, and the facility rather than the health worker was selected to participate. So, it was possible to determine the proportion of observed children who received particular assessments and interventions, but not to evaluate the performance of any individual health worker in undertaking particular IMCI activities (65-67, 71).
- The large number of observations in our study also allowed the assessment of health workers' performance in identifying severely ill children, whereas the IMCI-MCE used scenarios for this purpose. This study, therefore, demonstrated that the ability of health workers to identify signs of serious illness in practise was an important overall determinant of health worker performance.
- All study participants were IMCI trained, and could reasonably be expected to complete the IMCI management process as set out in the guidelines. It was, therefore, appropriate to assess observed health workers against a set standard of performance in IMCI implementation, using adherence to the assessment and classification process as indicators of health worker performance.
- No composite indicators were used. The analysis described the performance of each health worker in correctly assessing and classifying each main symptom, and undertaking key activities and interventions. Thus, gaps in health worker skills and performance were clearly shown, including which conditions were correctly assessed, and classified, and which components of IMCI were most frequently omitted or implemented incorrectly. The indicators of health worker performance in this study differed from those used in the IMCI-MCE and in the standard WHO health facility survey.

- This study did not use a randomised design, as this was not feasible for an already established service delivery approach. However, the methods used conferred more external validity and provided information about the IMCI implementation in routine conditions.

6.5.2 Measures taken to reduce bias

A detailed, standard operating procedures (SOP) guided study staff on how to conduct the study, and a number of particular measures were put in place to minimise bias:

- FGDs were conducted by an external researcher not involved in IMCI implementation or training.
- FGD participants were told that all individual comments would be kept confidential. No managers or IMCI co-ordinators from the Department of Health were present during FGDs.
- This study was conducted in partnership with the Department of Health to assess child health care in the two provinces, so all selected health workers participated in the observations; there were no refusals.
- Observed health workers were not notified beforehand that they had been selected to participate or informed when the research team would visit. Instead, all PHC clinics were sent a general information letter to inform them that a study of child health care, rather than IMCI in particular, was being undertaken. This minimised the opportunity for observed health workers to prepare for the visits.
- Observer bias was minimised by the long period of observation for each health worker, so that observed health workers became used to having observers present.
- As far as possible, the study was arranged to avoid IMCI experts knowing the observed health workers or having been involved in their training or supervision. IMCI experts undertook data collection only in districts where they had not conducted training. If an IMCI expert did know the selected health worker, he/she would operate as the gold standard, and not as the observer.
- Health workers operating as the gold standard, and reassessing children to determine the correct findings, were blinded to the findings of the health worker.
- Data collection tools were designed to minimise interaction between the observer and the health worker during the consultation, to reduce observer bias and prevent the observed health workers 'learning' what was being assessed over the period of observation.
- All feedback to health workers on their performance during the period of observation was given only after completion of all observations.

6.5.3 Limitations

Some of the limitations to the study methodology were:

- Provinces selected for participation in the study were chosen on the basis that they were at the forefront of IMCI implementation in South Africa. This may have led to selection bias.
- FGDs with carers of children were held on the clinic premises, because this was most convenient for participants, but this may have led to some bias if carers felt that they should not criticise care they received at the clinic.
- FGD participants were working in a single district (nurses) or were in the queue at the same clinic (child carers), so they may have known each other, making it difficult for them to reveal personal experiences around HIV during the discussion.
- Participants for FGDs with IMCI trained health workers were purposively selected by district IMCI co-ordinators, on the basis that they would be able to contribute to a discussion about IMCI implementation. This may have undermined their willingness to criticise IMCI training if participants had the perception that feedback might be given to the district, or that researchers wanted to hear positive information about IMCI.
- The absence of a control group means that we are unable to establish whether IMCI implementation leads to improved performance compared to routine care, but this was not the research question for this study.
- The presence of the observer may have influenced the practise of the health workers during the period of observation.
- We did not assess the impact of IMCI implementation on child outcomes, including mortality.
- IMCI experts were IMCI facilitators who had been involved in IMCI training and implementation in the same province where they were collecting data. They may have been reluctant to assess IMCI practitioners negatively, as they may have been invested in the success of the IMCI strategy. However, at the time the study was conducted, the IMCI experts were no longer directly involved in IMCI training or implementation.
- To minimise interruptions during the consultation, and to prevent health workers 'learning' what was being assessed over the long period of observation, we did not assess health workers' performance in identifying particular signs. Therefore, we cannot directly determine the performance of health workers in assessing these signs, although this can be inferred from the classifications made.
- Language limitations in Limpopo (three different local languages: Sesotho, Venda and Setswana) meant that it was not always possible to avoid IMCI experts working in their own districts in this province, since observers had to speak the local language. This may have led to bias if IMCI experts observed consultations with health workers who were known to them.

- We were not able to obtain CD4 counts on all HIV infected children because of problems of loss to follow-up of children found to be HIV infected by HIV-PCR.
- We did not have the statistical power to determine whether there were relationships between the performance of health workers and the number of supervision visits or the time since IMCI training. This was not a primary outcome of the study.

Chapter 7: Conclusions and recommendations

7.1 Conclusions

In conclusion, the HIV/IMCI Effectiveness study has shown that the IMCI training approach and case management guidelines could be an effective mechanism to deliver HIV services to children. However, poor adoption and implementation severely limits IMCI effectiveness in routine practise. In order to strengthen IMCI implementation, it is necessary to develop and test interventions to improve and maintain health worker performance.

The study raises a number of important questions around IMCI case management training and implementation.

Is IMCI training alone adequate to produce trained IMCI practitioners who will implement IMCI comprehensively? I believe this question is clearly answered by this study, and others referenced in this discussion. IMCI training alone will not provide the solution to achieving universal coverage of child survival interventions.

It is not reasonable to expect that an 11-day training course will produce all the knowledge, skills and motivation for a health worker to implement IMCI comprehensively in the workplace and to continue to do so, without support, far into the future. No matter how comprehensive and well conducted the training! The architects of IMCI did not expect that it would - case management training was intended to be part of a broader strategy for child survival. Lessons have been learnt from the experiences and research related to IMCI implementation, and now is the time to act on these lessons.

The question for health planners, policy makers and decision makers involved in IMCI is, therefore: ***how truly committed are Governments and Departments of Health to providing good quality child health care and reducing child mortality?*** If providing a single training course, using IMCI or any other approach, is all that Departments of Health are prepared to do, it will not be possible to achieve the goal of providing the high quality, integrated, comprehensive child health care required to achieve MDG4. If, on the other hand, the survival of our children is a real priority

for health planners and budget managers, then IMCI provides a very firm base to build on, and to provide the comprehensive range of interventions required.

How many available resources are Governments and Departments of Health prepared to invest to achieve this? Addressing the issues raised by this study and others, requires a strong commitment to invest resources in IMCI. Resources are required to change the behaviour of existing IMCI practitioners, make IMCI 'the norm' in all clinics, ensure competency of practitioners, and develop strong systems for clinical supervision for maintaining and updating health worker skills. Innovative solutions are required to strengthen IMCI case management training and supervision going forward, and it is necessary to evaluate these solutions. It is not acceptable that funding for IMCI is being reduced year-on-year. All those who have been involved in IMCI implementation, and believe that IMCI has gone a long way towards providing a solution for improving child survival, need to advocate for an IMCI revival before 2015 is upon us.

Last, we need to remember that IMCI is a three-pronged approach and, although high quality case management is critically important, health systems strengthening and community empowerment, are inextricably linked to it, and are required for the overall success of the IMCI strategy.

7.2 Recommendations

A broad range of recommendations have been identified throughout this discussion. These are summarised here.

7.2.1 Strengthening IMCI implementation

7.2.1.1 IMCI management

Advocacy is needed to increase resources allocation to IMCI, and to revitalise IMCI as a key priority for Departments of Health in South Africa and elsewhere. Advocacy for IMCI at district level should encourage decision-makers in IMCI districts (visiting doctors, district paediatric specialists for example), to provide consistent messages in support of IMCI.

There should be a **clear national strategy for strengthening IMCI**, in South Africa and other IMCI countries, to address these research findings, and improve overall coverage and quality of IMCI implementation. There is a need to institutionalise IMCI at national, provincial and district levels with adequate planning and budgeting, and to co-ordinate the three components of IMCI to capitalise on the synergies between these components.

IMCI functions best when combining horizontal approach for implementation at primary health care level, with a vertical management approach at district and national levels. **Dedicated national and provincial IMCI focus people** should be appointed to co-ordinate and oversee planning and implementation, and to provide momentum to the process of scaling-up IMCI.

Managers at clinic and sub-district level need to provide leadership in the change process, and provide the right climate for enhancing performance of health workers. Change requires careful planning and good leadership. A training course for managers at grass-roots level to support IMCI could be developed and evaluated.

7.2.1.2 IMCI implementation

Strategies need to be developed to encourage *comprehensive* implementation. This should include a workable approach to **on-going clinical supervision** for IMCI practitioners with support and feedback on performance. This would assist in maintaining IMCI skills over time. Innovative ways to **improve adherence to IMCI guidelines** can be developed and tested. One example is eIMCI, where a PDA (palm-top computer or personal digital assistant) is used to prompt health workers to implement IMCI guidelines.

Supervision strategies should be complemented with mechanisms to ensure **competency of IMCI practitioners**. These could include regular assessments of clinical skills, IMCI accreditation and strategies for reinforcing implementation. Examples include audit and feedback on performance (similar to follow-up after training), quality improvement, and use of accreditation.

Regular **IMCI updates** at district or sub-district level could provide peer support and encouragement for IMCI practitioners, as well as assist in maintaining IMCI skills over time. This would be particularly important for the HIV component, as guidelines for HIV management are complex and change frequently.

A system of accreditation of the clinic, a '**Certificate of IMCI Excellence**', could be used as an additional incentive to improve practises. There should be a defined set of evaluation criteria, and the accreditation process could be conducted by an outside body, at defined intervals, for re-accreditation.

Consistency of prescribing practise is vital. Inconsistent prescribing practises are undermining IMCI implementation at clinics. There are clear guidelines about recommended treatments according to IMCI, and these should be provided to non-IMCI trained health workers who see sick children to ensure that they are adhered to. Where possible, treatments not recommended by IMCI, like cough syrups, should not be available at PHC clinics.

With regard to **transferring of new IMCI skills into the workplace**, attention should be paid to encouraging the change in practise that is required after IMCI training. For example, an 'IMCI internship' could be introduced, where newly trained IMCI health workers are mentored in the workplace, and assisted in implementing their new skills.

Models of task shifting should be developed for different settings, either by shifting case management in its entirety to a lower cadre of health worker, or by shifting certain tasks to auxiliary health workers working in partnership with the professional health worker. These models should be evaluated.

Shortage of staff is a real problem in PHC clinics. **Dedicated IMCI trained health workers**, who see all sick children, could be used to ensure that all children receive the care recommended by IMCI.

7.2.1.3 More research is needed to...

Generate knowledge about the complex **determinants of health worker performance**, and to evaluate ways to change health worker behaviour, improve performance, and 'normalise' IMCI into routine and everyday clinic work.

With regard to long consultation times, further research could determine how the time during the consultation is spent and evaluate innovative methods of providing information/ services to mothers that could cut down consultation time.

All approaches to **improving and maintaining health workers skills** should be adequately field tested and evaluated, including their cost-effectiveness, to define the measures, or combinations of measures, that could most effectively maintain health workers skills and improve coverage of child survival interventions.

7.2.2 IMCI Training

Dedicated budget lines should be allocated for IMCI training, so that this is on-going, and does not get side-lined by other priority programmes.

Training for IMCI needs to be reviewed and more innovative methods of training should be developed and evaluated. For example, distance learning approaches could be used to cover the theoretical components, whereas residential training should focus more on clinical practise. Computer based learning is being developed, and this should be strengthened and evaluated.

Outcomes for **different durations of training** need to be evaluated in those countries where the IMCI training has been shortened.

A **refresher course for IMCI practitioners** returning to the management of sick children at PHC level, after a period of working in another clinical area, could assist with updating practitioners.

7.2.2.1 More research is needed...

to **evaluate the different training approaches** being developed. Different training approaches should be co-ordinated at WHO level, rather than on an ad hoc basis from country to country. All training methods and content should be evaluated, and outcomes should be compared to

determine the best training method for a given situation. In this way, countries would have multiple training resources to call on, which can be adapted to the local situation.

7.2.3 Health systems strengthening

Capacity in health systems research is required in countries. Both technical expertise and expertise in working with policy makers to develop relevant research agendas is required.

7.2.3.1 More research is needed...

To demonstrate the **cost-effectiveness** of the IMCI strategy, thereby increasing the attractiveness to funders of supporting IMCI implementation.

To assist in scaling up and sustaining interventions. The distinction between effective interventions and delivery strategies is essential and the knowledge base for designing, implementing and sustaining effective service delivery needs to be strengthened.

There is a need for **assessments and comparisons of different delivery systems** for public health interventions.

References

1. Ahmad OB, Lopez AD, Inoue M. The decline in child mortality: a reappraisal. *Bulletin of the World Health Organization*. 2000;78(10):1175-91.
2. Barros FC, Victora CG, Scherpbier R, Gwatkin D. Socioeconomic inequities in the health and nutrition of children in low/middle income countries. *Rev Saude Publica*. 2010;44(1):1-16. Epub 2010/02/09.
3. Victora CG, Wagstaff A, Schellenberg JA, Gwatkin D, Claeson M, Habicht JP. Applying an equity lens to child health and mortality: more of the same is not enough. *Lancet*. 2003;362(9379):233-41.
4. Black RE, Morris SS, Bryce J. Where and why are 10 million children dying every year? *Lancet*. 2003;361(9376):2226-34.
5. United Nations. United Nations Millenium Declaration. In: Office of the United Nations Commissioner for Human Rights. New York: United Nations, 2000.
6. UNICEF, World Health Organization, World Bank, UN Population Division. Levels and trends in child mortality report 2010. New York: 2010.
7. You D, Jones G, Hill K, Wardlaw T, Chopra M. Levels and trends in child mortality, 1990-2009. *Lancet*. 2010;376(9745):931-3. Epub 2010/09/21.
8. Jones G, Steketee RW, Black RE, Bhutta ZA, Morris SS. How many child deaths can we prevent this year? *Lancet*. 2003;362(9377):65-71.
9. Bhutta ZA, Chopra M, Axelson H, Berman P, Boerma T, Bryce J, et al. Countdown to 2015 decade report (2000-10): taking stock of maternal, newborn, and child survival. *Lancet*. 2010;375(9730):2032-44. Epub 2010/06/24.
10. Walker N, Schwartzlander B, Bryce J. Meeting international goals in child survival and HIV/AIDS. *Lancet*. 2002;360(9329):284-9.
11. Nannan N, Timaeus IM, Laubscher R, Bradshaw D. Levels and differentials in childhood mortality in South Africa, 1977-1998. *Journal of biosocial science*. 2007;39(4):613-32. Epub 2006/11/17.
12. Black RE, Cousens S, Johnson HL, Lawn JE, Rudan I, Bassani DG, et al. Global, regional, and national causes of child mortality in 2008: a systematic analysis. *Lancet*. 2010;375(9730):1969-87. Epub 2010/05/15.

13. Murray CJ, Laakso T, Shibuya K, Hill K, Lopez AD. Can we achieve Millennium Development Goal 4? New analysis of country trends and forecasts of under-5 mortality to 2015. *Lancet*. 2007;370(9592):1040-54. Epub 2007/09/25.
14. WHO. Achieving Health Equity: From root causes to fair outcomes. World Health Organization, 2006.
15. UNICEF. The state of the worlds children 2009: maternal and newborn health. New York: UNICEF, 2008.
16. Bradshaw D BD, Nannan N. What are the leading causes of death among South African Children? MRC Policy Brief. 2003;No 3.
17. SA Department of Health, Medical Research Council. South African Demographic and Health Survey, 2003. . Pretoria: 2007.
18. Bryce J, Boschi-Pinto C, Shibuya K, Black RE. WHO estimates of the causes of death in children. *Lancet*. 2005;365(9465):1147-52.
19. UNICEF. Children and AIDS: A stocktaking report. New York: UNICEF, 2007.
20. Newell ML, Coovadia H, Cortina-Borja M, Rollins N, Gaillard P, Dabis F. Mortality of infected and uninfected infants born to HIV-infected mothers in Africa: a pooled analysis. *Lancet*. 2004;364(9441):1236-43.
21. Tonwe-Gold B, Ekouevi DK, Viho I, Amani-Bosse C, Toure S, Coffie PA, et al. Antiretroviral treatment and prevention of peripartum and postnatal HIV transmission in West Africa: evaluation of a two-tiered approach. *PLoS medicine*. 2007;4(8):e257. Epub 2007/08/24.
22. Giuliano M, Guidotti G, Andreotti M, Pirillo MF, Villani P, Liotta G, et al. Triple antiretroviral prophylaxis administered during pregnancy and after delivery significantly reduces breast milk viral load: a study within the Drug Resource Enhancement Against AIDS and Malnutrition Program. *J Acquir Immune Defic Syndr*. 2007;44(3):286-91. Epub 2006/12/06.
23. Mphatswe W, Blanckenberg N, Tudor-Williams G, Prendergast A, Thobakgale C, Mkhwanazi N, et al. High frequency of rapid immunological progression in African infants infected in the era of perinatal HIV prophylaxis. *AIDS*. 2007;21(10):1253-61. Epub 2007/06/05.
24. Lallemand M, Jourdain G, Le Coeur S, Mary JY, Ngo-Giang-Huong N, Koetsawang S, et al. Single-dose perinatal nevirapine plus standard zidovudine to prevent mother-to-child transmission of HIV-1 in Thailand. *N Engl J Med*. 2004;351(3):217-28. Epub 2004/07/13.
25. Jackson JB, Musoke P, Fleming T, Guay LA, Bagenda D, Allen M, et al. Intrapartum and neonatal single-dose nevirapine compared with zidovudine for prevention of mother-to-child transmission of HIV-1 in Kampala, Uganda: 18-month follow-up of the HIVNET 012 randomised trial. *Lancet*. 2003;362(9387):859-68. Epub 2003/09/19.

26. Chintu C, Bhat GJ, Walker AS, Mulenga V, Sinyinza F, Lishimpi K, et al. Co-trimoxazole as prophylaxis against opportunistic infections in HIV-infected Zambian children (CHAP): a double-blind randomised placebo-controlled trial. *Lancet*. 2004;364(9448):1865-71. Epub 2004/11/24.
27. UNICEF. Children and AIDS: Fifth stocktaking report, 2010. New York: UNICEF, 2010.
28. World Health Organization. Antiretroviral drugs for treating pregnant women and preventing HIV infections in infants: recommendations for a public health approach 2010 Geneva: World health organization, 2010.
29. Chopra M, Daviaud E, Pattinson R, Fonn S, Lawn JE. Saving the lives of South Africa's mothers, babies, and children: can the health system deliver? *Lancet*. 2009;374(9692):835-46. Epub 2009/08/28.
30. Bradshaw D, Groenewald P, Laubscher R, Nannan N, Nojilana B, Norman R, et al. Initial burden of disease estimates for South Africa, 2000. *South African medical journal* 2003;93(9):682-8.
31. Tomlinson M, Chopra M, Sanders D, Bradshaw D, Hendricks M, Greenfield D, et al. Setting priorities in child health research investments for South Africa. *PLoS medicine*. 2007;4(8):e259.
32. Bradshaw D, Dorrington R. Child mortality in South Africa--we have lost touch. *South African medical journal*. 2007;97(8):582-3. Epub 2007/10/24.
33. Bradshaw D, Chopra M, Kerber K, Lawn JE, Bamford L, Moodley J, et al. Every death counts: use of mortality audit data for decision making to save the lives of mothers, babies, and children in South Africa. *Lancet*. 2008;371(9620):1294-304. Epub 2008/04/15.
34. Chopra M, Lawn JE, Sanders D, Barron P, Karim SS, Bradshaw D, et al. Achieving the health Millennium Development Goals for South Africa: challenges and priorities. *Lancet*. 2009. Epub 2009/08/28.
35. Abdool Karim SS, Churchyard GJ, Abdool Karim Q, Lawn SD. HIV infection and tuberculosis in South Africa: an urgent need to escalate the public health response. *Lancet*. 2009;374(9693):921-33. Epub 2009/08/28.
36. Dorrington RE JL, Bradshaw D, and Daniel T. The Demographic Impact of HIV/AIDS in South Africa. National and Provincial Indicators for 2006. Capetown: Centre for Actuarial Research, 2006.
37. Department of Health. Antenatal survey 2005: National HIV and syphilis antenatal seroprevalence survey in South Africa 2005. Pretoria: National Department of Health: Republic of South Africa, 2006.
38. South Africa National Department of Health. 2009 National antenatal sentinel HIV and syphilis seroprevalence survey. Pretoria: SA National Department of Health, 2010.
39. The World Bank. World Development Report: Investing in Health. New York: The World Bank, 1993.

40. Bryce J, Black RE, Walker N, Bhutta ZA, Lawn JE, Steketee RW. Can the world afford to save the lives of 6 million children each year? *Lancet*. 2005;365(9478):2193-200.
41. Tulloch J. Integrated approach to child health in developing countries. *Lancet*. 1999;354 Suppl 2:SII16-SII20.
42. UNICEF. The state of the worlds children 2008: child survival. New York: UNICEF, 2008.
43. Sazawal S, Black RE. Meta-analysis of intervention trials on case-management of pneumonia in community settings. *Lancet*. 1992;340(8818):528-33. Epub 1992/08/29.
44. WHO. Integrated management of the sick child. *Bulletin of the World Health Organ*. 1995;73(6):735-40.
45. Claeson M, Gillespie D, Mshinda H, Troedsson H, Victora CG. Knowledge into action for child survival. *Lancet*. 2003;362(9380):323-7.
46. Victora C, Adam T, Bryce J, Evans DB. Chapter 63: Integrated Management of the Sick Child. In: Jamison T, Brenan JG, Measham AR, editors. *Disease Control Priorities in Developing countries*. New York: Oxford University Press; 2006. p. 1177-92.
47. Campbell H, Gove S. Integrated management of childhood infections and malnutrition: a global initiative. *Archives of disease in childhood*. 1996;75(6):468-71. Epub 1996/12/01.
48. Kinney MV, Kerber KJ, Black RE, Cohen B, Nkrumah F, Coovadia H, et al. Sub-Saharan Africa's mothers, newborns, and children: where and why do they die? *PLoS medicine*. 2010;7(6):e1000294. Epub 2010/06/25.
49. Gove S. Integrated management of childhood illness by outpatient health workers: technical basis and overview. *The WHO Working Group on Guidelines for Integrated Management of the Sick Child. Bulletin of the World Health Organization*. 1997;75 Suppl 1:7-24.
50. Lambrechts T, Bryce J, Orinda V. Integrated management of childhood illness: a summary of first experiences. *Bulletin of the World Health Organization*. 1999;77(7):582-94.
51. Winch PJ, Leban K, Casazza L, Walker L, Percy K. An implementation framework for household and community integrated management of childhood illness. *Health policy and planning*. 2002;17(4):345-53. Epub 2002/11/09.
52. World health organization. *Child and adolescent health and development progress report 2009*. Geneva: World health organization, 2010 ISBN 92 4 159223 0.
53. Kalter HD, Burnham G, Kolstad PR, Hossain M, Schillinger JA, Khan NZ, et al. Evaluation of clinical signs to diagnose anaemia in Uganda and Bangladesh, in areas with and without malaria. *BullWorld Health Organ*. 1997;75 Suppl 1:103-11.
54. Weber MW, Kellingray SD, Palmer A, Jaffar S, Mulholland EK, Greenwood BM. Pallor as a clinical sign of severe anaemia in children: an investigation in the Gambia. *Bulletin of the World Health Organization*. 1997;75 Suppl 1:113-8.

55. Zucker JR, Perkins BA, Jafari H, Otieno J, Obonyo C, Campbell CC. Clinical signs for the recognition of children with moderate or severe anaemia in western Kenya. *Bulletin of the World Health Organization*. 1997;75 Suppl 1:97-102.
56. Simoes EA, Desta T, Tessema T, Gerbresellassie T, Dagne M, Gove S. Performance of health workers after training in integrated management of childhood illness in Gondar, Ethiopia. *Bulletin of the World Health Organization*. 1997;75 Suppl 1:43-53.
57. Kolstad PR, Burnham G, Kalter HD, Kenya-Mugisha N, Black RE. The integrated management of childhood illness in western Uganda. *Bulletin of the World Health Organization*. 1997;75 Suppl 1:77-85.
58. World Health Organization. Integrated management of childhood illness: field test of the WHO/UNICEF training course in Arusha, United Republic of Tanzania. WHO Division of Child Health and Development & WHO Regional Office for Africa. *Bulletin of the World Health Organization*. 1997;75 Suppl 1:55-64.
59. Rowe AK, Rowe SY, Holloway KA, Ivanovska V, Muhe L, Lambrechts T. Does shortening the training on Integrated Management of Childhood Illness guidelines reduce its effectiveness? A systematic review. *Health policy and planning*. 2011. Epub 2011/04/26.
60. Bryce J, Victora CG, Habicht JP, Black RE, Scherpier RW. Programmatic pathways to child survival: results of a multi-country evaluation of Integrated Management of Childhood Illness. *Health policy and planning*. 2005;20 Suppl 1:i5-i17.
61. Bryce J, Victora CG, Habicht JP, Vaughan JP, Black RE. The multi-country evaluation of the integrated management of childhood illness strategy: lessons for the evaluation of public health interventions. *American journal of public health*. 2004;94(3):406-15.
62. Goga AE, Muhe LM, Forsyth K, Chopra M, Aboubaker S, Martines J, et al. Results of a multi-country exploratory survey of approaches and methods for IMCI case management training. *Health Res Policy Syst*. 2009;7:18. Epub 2009/07/21.
63. World Health Organization. Multicountry Evaluation Integrated Management of Childhood Illness. 2012 [3/01/12]; Available from: <http://www.who.int/imci-mce/>.
64. Gouws e, Bryce J, Habicht JP, Amaral J, Pariyo G, Schellenberg JA, et al. Improving antimicrobial use among health workers in first-level facilities: results from the multi-country evaluation of the Integrated Management of Childhood Illness strategy. *Bulletin of the Health Organization*. 2004;82(7):509-15.
65. Pariyo GW, Gouws E, Bryce J, Burnham G. Improving facility-based care for sick children in Uganda: training is not enough. *Health policy and planning*. 2005;20 Suppl 1:i58-i68.

66. Armstrong Schellenberg JR, Adam T, Mshinda H, Masanja H, Kabadi G, Mukasa O, et al. Effectiveness and cost of facility-based Integrated Management of Childhood Illness (IMCI) in Tanzania. *Lancet*. 2004;364(9445):1583-94.
67. Arifeen SE, Hoque DM, Akter T, Rahman M, Hoque ME, Begum K, et al. Effect of the Integrated Management of Childhood Illness strategy on childhood mortality and nutrition in a rural area in Bangladesh: a cluster randomised trial. *Lancet*. 2009;374(9687):393-403. Epub 2009/08/04.
68. El Arifeen S, Blum LS, Hoque DM, Chowdhury EK, Khan R, Black RE, et al. Integrated Management of Childhood Illness (IMCI) in Bangladesh: early findings from a cluster-randomised study. *Lancet*. 2004;364(9445):1595-602.
69. Bryce J, Victora CG. Ten methodological lessons from the multi-country evaluation of integrated Management of Childhood Illness. *Health policy and planning*. 2005;20 Suppl 1:i94-i105.
70. Bryce J, Gouws E, Adam T, Black RE, Schellenberg JA, Manzi F, et al. Improving quality and efficiency of facility-based child health care through Integrated Management of Childhood Illness in Tanzania. *Health policy and planning*. 2005;20 Suppl 1:i69-i76.
71. Amorim DG, Adam T, Amaral JJ, Gouws E, Bryce J, Victora CG. Integrated Management of Childhood Illness: efficiency of primary health in Northeast Brazil. *Rev Saude Publica*. 2008;42(2):183-90. Epub 2008/04/01.
72. Adam T, Manzi F, Schellenberg JA, Mgalula L, de Savigny D, Evans DB. Does the Integrated Management of Childhood Illness cost more than routine care? Results from the United Republic of Tanzania. *Bulletin of the World Health Organization*. 2005;83(5):369-77.
73. Adam T, Amorim DG, Edwards SJ, Amaral J, Evans DB. Capacity constraints to the adoption of new interventions: consultation time and the Integrated Management of Childhood Illness in Brazil. *Health policy and planning*. 2005;20 Suppl 1:i49-i57.
74. Victora CG, Huicho L, Amaral JJ, Armstrong-Schellenberg J, Manzi F, Mason E, et al. Are health interventions implemented where they are most needed? District uptake of the integrated management of childhood illness strategy in Brazil, Peru and the United Republic of Tanzania. *Bulletin of the World Health Organization*. 2006;84(10):792-801.
75. Gouws e, Bryce J, Pariyo G, Armstrong SJ, Amaral J, Habicht JP. Measuring the quality of child health care at first-level facilities. *Social Science and Medicine*. 2005;61(3):613-25.
76. UNICEF. The state of the worlds children 2011: adolescence an age of opportunity. New York: UNICEF; 2011; Available from: <http://www.unicef.org/sowc/>.

77. World Health Organization. IMCI Adaptation Guide. Geneva: World Health Organization 2002. Available from:
http://www.who.int/child_adolescent_health/documents/pdfs/imci_adaptation_guide_1a.pdf.
78. South Africa National Department of Health. 2000 National HIV and syphilis seroprevalence survey of women attending public antenatal clinics in South Africa. Pretoria: SA Department of Health, 2000.
79. Qazi SA, Muhe LM. Integrating HIV management for children into the Integrated Management of Childhood Illness guidelines. Transactions of the Royal Society of Tropical Medicine & Hygiene. 2006;100(1):10-3.
80. World health organization. Acquired immunodeficiency syndrome. Weekly epidemiology record. 1986;6(1):69-73.
81. World health organization: Regional office for Africa. Consultative meeting on HIV adaptation in IMCI: 16-18 August 2000 Durban, South Africa. Harare: World Health Organisation: Regional office for Africa, 2000.
82. Horwood C, Liebeschuetz S, Blaauw D, Cassol S, Qazi S. Diagnosis of paediatric HIV infection in a primary health care setting with a clinical algorithm. Bulletin of the World Health Organization. 2003;81(12):858-66.
83. Lulseged S MY, Qazi S, Mason E. . Validation of the HIV component of the Integrated management of Childhood Illness in Addis Ababa, Ethiopia. Communicable Diseases Bulletin for the African Region. 2004;2(3):9-10.
84. World Health Organization. IMCI chart booklet for high HIV settings. Geneva: World Health Organization; 2008. Available from:
http://www.who.int/child_adolescent_health/documents/9789241597388/en/index.html.
85. SA National Department of Health. Integrated Management of Childhood Illness: national report of South African health facility survey. Pretoria: Department of Health, 2001.
86. Victora CG, Hanson K, Bryce J, Vaughan JP. Achieving universal coverage with health interventions. Lancet. 2004;364(9444):1541-8.
87. Binkin N, Chopra M, Simen-Kapeu A, Westhof D. Do improvements in outreach, clinical, and family and community-based services predict improvements in child survival? An analysis of serial cross-sectional national surveys. BMC Public Health. 2011;11:456. Epub 2011/06/11.
88. Lewin S, Lavis JN, Oxman AD, Bastias G, Chopra M, Ciapponi A, et al. Supporting the delivery of cost-effective interventions in primary health-care systems in low-income and middle-income countries: an overview of systematic reviews. Lancet. 2008;372(9642):928-39. Epub 2008/09/16.

89. Bryce J, el Arifeen S, Pariyo G, Lanata C, Gwatkin D, Habicht JP. Reducing child mortality: can public health deliver? *Lancet*. 2003;362(9378):159-64.
90. Statistics South Africa. Mid year population estimates 2011. Pretoria: Statistics South Africa, 2011.
91. Habicht JP, Victora CG, Vaughan JP. Evaluation designs for adequacy, plausibility and probability of public health programme performance and impact. *Int J Epidemiol*. 1999;28(1):10-8. Epub 1999/04/09.
92. de Zoysa I, Habicht JP, Pelto G, Martines J. Research steps in the development and evaluation of public health interventions. *Bulletin of the World Health Organization*. 1998;76(2):127-33. Epub 1998/07/02.
93. Zurovac D, Rowe AK, Ochola SA, Noor AM, Midia B, English M, et al. Predictors of the quality of health worker treatment practices for uncomplicated malaria at government health facilities in Kenya. *Int J Epidemiol*. 2004;33(5):1080-91. Epub 2004/07/17.
94. Lindelow M, Serneels P. The performance of health workers in Ethiopia: results from qualitative research. *Social science & medicine (1982)*. 2006;62(9):2225-35. Epub 2005/11/29.
95. Kitzinger J. Qualitative research. Introducing focus groups. *BMJ*. 1995;311(7000):299-302. Epub 1995/07/29.
96. Victora CG, Habicht JP, Bryce J. Evidence-based public health: moving beyond randomized trials. *American journal of public health*. 2004;94(3):400-5. Epub 2004/03/05.
97. Franco LM, Franco C, Kumwenda N, Nkhoma W. Methods for assessing quality of provider performance in developing countries. *Int J Qual Health Care*. 2002;14 Suppl 1:17-24. Epub 2003/02/08.
98. Department of Health. State of the province: Limpopo. Pretoria: National Department of Health: Republic of South Africa, 2004.
99. Department of Health. Antenatal survey 2006: National HIV and syphilis antenatal seroprevalence survey in South Africa 2006. Pretoria: National Department of Health: Republic of South Africa, 2007.
100. Van Aardt CJ, Schacht A. Demographic and statistical overview: 1994-2004. Pretoria: Department of Social Development, Republic of South Africa 2004.
101. World Health Organization. Interim WHO Clinical Staging of HIV/AIDS and HIV/AIDS Case Definitions for Surveillance. Geneva: World Health Organization, 2005.
102. Boyatzis RE. Transforming qualitative information: thematic analysis and code development. California: Sage, Thousand Oaks; 1998.

103. Horwood C, Butler LM, Vermaak K, Rollins N, Haskins L, Nkosi P, et al. Disease profile of children under 5 years attending primary health care clinics in a high HIV prevalence setting in South Africa. *Trop Med Int Health*. 2011;16(1):42-52. Epub 2010/11/26.
104. Horwood C, Voce A, Vermaak K, Rollins N, Qazi S. Experiences of integrated management of childhood illness(IMCI) training and implementation in South Africa; a qualitative evaluation of the IMCI case management training course. *BMC Pediatr*. 2009;9(1):62. Epub 2009/10/03.
105. Horwood C, Vermaak K, Rollins N, Haskins L, Nkosi P, Qazi S. An evaluation of the quality of IMCI assessments among IMCI trained health workers in South Africa. *PLoS One*. 2009;4(6):e5937. Epub 2009/06/19.
106. Horwood C, Voce A, Vermaak K, Rollins N, Qazi S. Routine checks for HIV in children attending primary health care facilities in South Africa: attitudes of nurses and child caregivers. *Social science & medicine (1982)*. 2010;70(2):313-20. Epub 2009/10/27.
107. Horwood C, Voce A, Vermaak K, Rollins N, Qazi S. Routine checks for HIV in children attending primary health care facilities in South Africa: Attitudes of nurses and child caregivers. *Social science & medicine (1982)*. 2009. Epub 2009/10/27.
108. World Health Organization. Antiretroviral therapy for infants and children towards universal access: recommendations for a public health approach- 2010 revision. Geneva: World Health Organization, 2010.
109. Haines A, Kuruvilla S, Borchert M. Bridging the implementation gap between knowledge and action for health. *Bulletin of the World Health Organization*. 2004;82(10):724-31; discussion 32.
110. Naimoli JF, Rowe AK, Lyaghfour A, Larbi R, Lamrani LA. Effect of the Integrated Management of Childhood Illness strategy on health care quality in Morocco. *Int J Qual Health Care*. 2006;18(2):134-44. Epub 2006/01/21.
111. Eriksen J, Tomson G, Mujinja P, Warsame MY, Jahn A, Gustafsson LL. Assessing health worker performance in malaria case management of underfives at health facilities in a rural Tanzanian district. *Trop Med Int Health*. 2007;12(1):52-61. Epub 2007/01/09.
112. Osterholt DM, Onikpo F, Lama M, Deming MS, Rowe AK. Improving pneumonia case-management in Benin: a randomized trial of a multi-faceted intervention to support health worker adherence to Integrated Management of Childhood Illness guidelines. *Hum Resour Health*. 2009;7:77. Epub 2009/08/29.
113. Walter ND, Lyimo T, Skarbinski J, Metta E, Kahigwa E, Flannery B, et al. Why first-level health workers fail to follow guidelines for managing severe disease in children in the Coast Region, the United Republic of Tanzania. *Bulletin of the World Health Organization*. 2009;87(2):99-107. Epub 2009/03/11.

114. Rowe AK, Onikpo F, Lama M, Deming MS. Risk and protective factors for two types of error in the treatment of children with fever at outpatient health facilities in Benin. *Int J Epidemiol.* 2003;32(2):296-303. Epub 2003/04/26.
115. Rowe AK, Hamel MJ, Flanders WD, Doutizanga R, Ndoyo J, Deming MS. Predictors of correct treatment of children with fever seen at outpatient health facilities in the Central African Republic. *Am J Epidemiol.* 2000;151(10):1029-35. Epub 2000/06/15.
116. Rowe AK, de Savigny D, Lanata CF, Victora CG. How can we achieve and maintain high-quality performance of health workers in low-resource settings? *Lancet.* 2005;366(9490):1026-35.
117. Atkins S, Lewin S, Ringsberg KC, Thorson A. Provider experiences of the implementation of a new tuberculosis treatment programme: a qualitative study using the normalisation process model. *BMC health services research.* 2011;11:275. Epub 2011/10/19.
118. Nelson BD, Ahn R, Fehling M, Eckardt MJ, Conn KL, El-Bashir A, et al. Evaluation of a novel training package among frontline maternal, newborn, and child health workers in South Sudan. *International journal of gynaecology and obstetrics.* 2012 Nov;119(2):130-5.
119. Mushi HP, Mullei K, Macha J, Wafula F, Borghi J, Goodman C, et al. The challenges of achieving high training coverage for IMCI: case studies from Kenya and Tanzania. *Health policy and planning.* 2011;26(5):395-404. Epub 2010/11/05.
120. Huicho L, Davila M, Campos M, Drasbek C, Bryce J, Victora CG. Scaling up integrated management of childhood illness to the national level: achievements and challenges in Peru. *Health policy and planning.* 2005;20(1):14-24.
121. World health Organization. *Child and adolescent health and development progress report 2009.* Geneva: World Health Organization, 2010 ISBN 92 4 159223 0.
122. Rowe AK, Onikpo F, Lama M, Osterholt DM, Rowe SY, Deming MS. A multifaceted intervention to improve health worker adherence to integrated management of childhood illness guidelines in Benin. *American journal of public health.* 2009;99(5):837-46. Epub 2009/03/21.
123. Trap B, Todd CH, Moore H, Laing R. The impact of supervision on stock management and adherence to treatment guidelines: a randomized controlled trial. *Health policy and planning.* 2001;16(3):273-80. Epub 2001/08/31.
124. Rowe AK, Onikpo F, Lama M, Deming MS. The rise and fall of supervision in a project designed to strengthen supervision of Integrated Management of Childhood Illness in Benin. *Health policy and planning.* 2010;25(2):125-34. Epub 2009/11/20.
125. Kelley E, Geslin C, Djibrina S, Boucar M. Improving performance with clinical standards: the impact of feedback on compliance with the integrated management of childhood illness algorithm in Niger, West Africa. *Int J Health Plann Manage.* 2001;16(3):195-205.

126. Horwood C, Haskins L, Vermaak K, Phakathi S, Subbaye R, Doherty T. Prevention of mother to child transmission of HIV (PMTCT) programme in KwaZulu-Natal, South Africa: an evaluation of PMTCT implementation and integration into routine maternal, child and women's health services. *Trop Med Int Health*. 2010. Epub 2010/06/22.
127. Horwood C, Vermaak K, Butler L, Haskins L, Phakathi S, Rollins N. Elimination of paediatric HIV in KwaZulu-Natal, South Africa: large-scale assessment of interventions for the prevention of mother-to-child transmission. *Bulletin of the World Health Organization*. 2012;90(3):168-75. Epub 2012/03/31.
128. Jones SA, Sherman GG, Varga CA. Exploring socio-economic conditions and poor follow-up rates of HIV-exposed infants in Johannesburg, South Africa. *AIDS Care*. 2005;17(4):466-70. Epub 2005/07/23.
129. Doherty TM, McCoy D, Donohue S. Health system constraints to optimal coverage of the prevention of mother-to-child HIV transmission programme in South Africa: lessons from the implementation of the national pilot programme. *Afr Health Sci*. 2005;5(3):213-8. Epub 2005/10/26.
130. Bharat S, Mahendra VS. Meeting the sexual and reproductive health needs of people living with HIV: challenges for health care providers. *Reproductive health matters*. 2007;15(29 Suppl):93-112.
131. Mugala N, Mutale W, Kalesha P, Sinyinza E. Barriers to implementation of the HIV guidelines in the IMCI algorithm among IMCI trained health workers in Zambia. *BMC Pediatr*. 2010;10:93. Epub 2010/12/21.
132. Smit R. HIV/AIDS and the workplace: perceptions of nurses in a public hospital in South Africa. *Journal of advanced nursing*. 2005;51(1):22-9.
133. Bosk CL, Frader JE. AIDS and its impact on medical work: the culture and politics of the shop floor. *The Milbank quarterly*. 1990;68 Suppl 2:257-79.
134. Skinner D, Mfecane S. Stigma, discrimination and the implications for people living with HIV/AIDS in South Africa. *SAHARA J*. 2004;1(3):157-64. Epub 2007/07/03.
135. Weiser SD, Heisler M, Leiter K, Percy-de Korte F, Tlou S, DeMonner S, et al. Routine HIV testing in Botswana: a population-based study on attitudes, practices, and human rights concerns. *PLoS medicine*. 2006;3(7):e261.
136. Harries J, Cooper D, Myer L, Bracken H, Zweigenthal V, Orner P. Policy maker and health care provider perspectives on reproductive decision-making amongst HIV-infected individuals in South Africa. *BMC Public Health*. 2007;7(1):282.

137. Reis C, Heisler M, Amowitz LL, Moreland RS, Mafeni JO, Anyamele C, et al. Discriminatory attitudes and practices by health workers toward patients with HIV/AIDS in Nigeria. *PLoS medicine*. 2005;2(8):e246.
138. Ezedinachi EN, Ross MW, Meremiku M, Essien EJ, Edem CB, Ekure E, et al. The impact of an intervention to change health workers' HIV/AIDS attitudes and knowledge in Nigeria: a controlled trial. *Public health*. 2002;116(2):106-12.
139. Ptacek JT, Ellison NM. Health care providers' perspectives on breaking bad news to patients. *Crit Care Nurs Q*. 2000;23(2):51-9. Epub 2002/02/21.
140. Back AL, Arnold RM, Baile WF, Fryer-Edwards KA, Alexander SC, Barley GE, et al. Efficacy of communication skills training for giving bad news and discussing transitions to palliative care. *Archives of internal medicine*. 2007;167(5):453-60.
141. Schulte A. Consensus versus Disagreement in AIDS Related Stigma: A Comparison of Reactions to AIDS and Cancer Patients sociological perspectives. 2002;45(1):81-104.
142. Adebajo SB, Bamgbala AO, Oyediran MA. Attitudes of health care providers to persons living with HIV/AIDS in Lagos State, Nigeria. *African journal of reproductive health*. 2003;7(1):103-12.
143. Sadob AE, Fawole AO, Sadoh WE, Oladimeji AO, Sotiloye OS. Attitude of health-care workers to HIV/AIDS. *African journal of reproductive health*. 2006;10(1):39-46.
144. Connelly D, Veriava Y, Roberts S, Tsotetsi J, Jordan A, DeSilva E, et al. Prevalence of HIV infection and median CD4 counts among health care workers in South Africa. *South African medical journal*. 2007;97(2):115-20.
145. Kalichman SC, Simbayi LC. HIV testing attitudes, AIDS stigma, and voluntary HIV counselling and testing in a black township in Cape Town, South Africa. *Sexually transmitted infections*. 2003;79(6):442-7.
146. Simbayi LC, Kalichman S, Strebel A, Cloete A, Henda N, Mqeketo A. Internalized stigma, discrimination, and depression among men and women living with HIV/AIDS in Cape Town, South Africa. *Social Science & Medicine (1982)*. 2007;64(9):1823-31.
147. Greeff M, Phetlhu R. The meaning and effect of HIV/AIDS stigma for people living with AIDS and nurses involved in their care in the North West Province, South Africa. *Curationis*. 2007;30(2):12-23. Epub 2007/08/21.
148. Varga CA, Sherman GG, Jones SA. HIV-disclosure in the context of vertical transmission: HIV-positive mothers in Johannesburg, South Africa. *AIDS Care*. 2006;18(8):952-60. Epub 2006/10/03.

149. Ahmed HM, Mitchell M, Hedt B. National implementation of Integrated Management of Childhood Illness (IMCI): policy constraints and strategies. *Health Policy*. 2010;96(2):128-33. Epub 2010/02/24.
150. Travis P, Bennett S, Haines A, Pang T, Bhutta Z, Hyder AA, et al. Overcoming health-systems constraints to achieve the Millennium Development Goals. *Lancet*. 2004;364(9437):900-6. Epub 2004/09/08.
151. Goga AE, Muhe LM. Global challenges with scale-up of the integrated management of childhood illness strategy: results of a multi-country survey. *BMC Public Health*. 2011;11:503. Epub 2011/06/29.
152. Geslin C, Ketsela T. Integrated Management of Childhood Illness implementation and scaling up in four selected countries in the African Region. *Communicable Diseases Bulletin for the African Region*. 2007;3(2):5-9.
153. Rowe AK, Onikpo F, Lama M, Cokou F, Deming MS. Management of childhood illness at health facilities in Benin: problems and their causes. *American journal of public health*. 2001;91(10):1625-35.
154. Sanders D, Haines A. Implementation research is needed to achieve international health goals. *PLoS medicine*. 2006;3(6):e186. Epub 2006/05/30.

Appendix 1

Research

Diagnosis of paediatric HIV infection in a primary health care setting with a clinical algorithm

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Objective To determine the validity of an algorithm used by primary care health workers to identify children with symptomatic human immunodeficiency virus (HIV) infection. This HIV algorithm is being implemented in South Africa as part of the Integrated Management of Childhood Illness (IMCI), a strategy that aims to improve childhood morbidity and mortality by improving care at the primary care level. As AIDS is a leading cause of death in children in southern Africa, diagnosis and management of symptomatic HIV infection was added to the existing IMCI algorithm.

Methods In total, 690 children who attended the outpatients department in a district hospital in South Africa were assessed with the HIV algorithm and by a paediatrician. All children were then tested for HIV viral load. The validity of the algorithm in detecting symptomatic HIV was compared with clinical diagnosis by a paediatrician and the result of an HIV test. Detailed clinical data were used to improve the algorithm.

Findings Overall, 198 (28.7%) enrolled children were infected with HIV. The paediatrician correctly identified 142 (71.7%) children infected with HIV, whereas the IMCI/HIV algorithm identified 111 (56.1%). Odds ratios were calculated to identify predictors of HIV infection and used to develop an improved HIV algorithm that is 67.2% sensitive and 81.5% specific in clinically detecting HIV infection.

Conclusions Children with symptomatic HIV infection can be identified effectively by primary level health workers through the use of an algorithm. The improved HIV algorithm developed in this study could be used by countries with high prevalences of HIV to enable IMCI practitioners to identify and care for HIV-infected children.

Keywords HIV infections/diagnosis; Acquired immunodeficiency syndrome/diagnosis; Child care; Primary health care; Delivery of health care, Integrated; Physicians; Algorithms; Comparative study; South Africa (*source: MeSH, NLM*).

Mots clés HIV, Infection/diagnostic; SIDA/diagnostic; Puériculture; Cuidados del niño; Programme soins courants; Distribution intégrée soins; Médecin; Algorithme; Etude comparative; Afrique du Sud (*source: MeSH, INSERM*).

Palabras clave Infecciones por VIH/diagnóstico; Síndrome de inmunodeficiencia adquirida/diagnóstico; Atención primaria de salud; Entrega integrada de atención de salud; Médicos; Algoritmos; Estudio comparativo; Sudáfrica (*fuentes: DeCS, BIREME*).

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Voir page 862 le résumé en français. En la página 862 figura un resumen en español.

يمكن الاطلاع على الملخص بالعربية في صفحة ٧٠٦

Introduction

Over 10.9 million deaths occur annually in children aged <5 years in developing countries (1); most deaths are caused by preventable and easily treated childhood diseases (2). Appropriate management of these conditions is one of the most cost-effective interventions to reduce the global burden of disease (3). The Integrated Management of Childhood Illness (IMCI) was developed by WHO and United Nations Children's Fund (UNICEF) to improve survival rates in children (2); it uses an algorithmic approach to provide guidelines for the diagnosis

and management of sick children at the primary care level (4). The clinical signs on which the IMCI guideline is based (5–8) and its ability to help health workers identify and appropriately treat sick children have been assessed previously (9–11). IMCI has been adopted as a worldwide strategy for improving paediatric care in resource-poor settings, and since its introduction in 1995, it has been implemented in 37 African countries and 102 countries worldwide (12).

The existing IMCI guideline recommends referral for children with severe or recurrent illnesses, such as those that are

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common in patients with HIV/AIDS; however, the specific identification and management of HIV/AIDS was not included in this guideline. In South Africa, HIV/AIDS is the leading cause of death in children, and it has reversed improvements in childhood mortality made over recent decades (13). Care for children with HIV/AIDS is putting a strain on health services (14) and increasingly is being shifted to the primary care level. Primary care health workers could provide the ongoing care that these children need, but such workers urgently need to gain appropriate skills. IMCI must now include the specific management of HIV infection as a major cause of morbidity and mortality in children (15).

In KwaZulu-Natal Province, South Africa, the prevalence of human immunodeficiency virus (HIV) is very high: 36.2% of women who attended government antenatal clinics in 2000 were HIV-positive (16). An algorithm for identification of children with HIV therefore was incorporated into IMCI. If a child is identified as possibly having HIV infection, IMCI includes guidelines for HIV serotesting and ongoing supportive management of paediatric HIV/AIDS. Antiretroviral drugs are not available currently for treatment of HIV infection in South Africa. This algorithm also has been adapted for use by several other African countries, but it was never evaluated formally. We report an evaluation of an HIV algorithm for identification of children with symptomatic HIV infection and show how data from this study was used to improve the algorithm.

Participants and methods

IMCI/HIV algorithm

IMCI comprises a series of guidelines for assessment and treatment of common childhood conditions that are important causes of morbidity and mortality (2). The health worker assesses the child through history and examination and classifies the child as needing referral, specific medical treatment, or advice on home management.

Screening questions were added to the routine assessment of every child to alert the health worker to the fact that a child might be at risk of HIV infection. If any screening questions were answered positively, the child was also assessed for symptomatic HIV infection (Fig. 1). This assessment was based on local clinical experience (17–20) and WHO clinical case definitions for paediatric acquired immunodeficiency syndrome (AIDS) (21).

Participants

The study was carried out in the paediatric outpatient department at Ngwelezane hospital in KwaZulu-Natal from January to April 2001. This is a district hospital, and approximately 200 children are seen weekly in the outpatient department; most of these are referred by the 19 outlying clinics. HIV counselling and testing is available with routine hospital services and is requested by clinicians where indicated, but it may not be easily accessible because of a shortage of counsellors. Long-term follow-up care is provided for a small number of HIV-infected children in the hospital outpatient department, but very little follow-up care is provided by first-level clinics.

All children aged 2–59 months who attended the paediatric outpatient department during working hours were considered for enrolment in the study. Children of known HIV serostatus and follow-up cases were excluded. For logistical reasons, the number of children enrolled each day was limited to 14.

Sample size was calculated with the formula used to compare two proportions (22, 23), on the basis of assumptions that the seroprevalence of HIV in the study population was 20% and that the sensitivity of diagnosis by the paediatrician would be 80% compared with an HIV test. We wanted to recognize a deviance of 15% between the doctor and the algorithm, at a 5% level of significance. The sample size thus calculated was 138 children confirmed as HIV-infected, so that the total sample required was 690.

Consent and ethical approval

Before a child was enrolled, written consent was obtained with a detailed consent form for participation in the study and for anonymous HIV testing. Mothers were given the option to participate in the study without being given the HIV result, because we anticipated that if there was no clinical indication for testing, mothers might not wish to know the HIV status of their child. Consent was accepted from mothers, fathers, and grandparents, and the child was excluded if no appropriate family member was present. Consent was obtained in a confidential setting by a Zulu-speaking AIDS counsellor who was not involved in the care of the child. The advantages of knowing the HIV result were explained, and if the child was accompanied by the mother (or legal guardian, if the mother was dead), same day voluntary counselling and testing of the child were offered. If these were accepted, open HIV testing was done through routine hospital services, with the results and post-test counselling given by our study counsellor. Open testing was not offered to other family members to safeguard the mother's confidentiality. The paediatrician also advised mothers to have HIV counselling and testing wherever there was a clinical indication. All children who were identified as infected with HIV — either because the mother wished to know the HIV status of the child or because there was a clinical indication for testing — were offered all available treatments for HIV. Available treatments were prophylaxis for *Pneumocystis carinii* (recently renamed *Pneumocystis jirovecii*) pneumonia, treatment for concurrent illnesses, and regular follow-up. Children with clinical HIV infection where the mother refused open testing were offered the same treatment and follow-up. Carers of children who returned for HIV results were given post-test counselling before treatment was initiated by hospital staff and not the study staff. These results were not linked in any way to the study data.

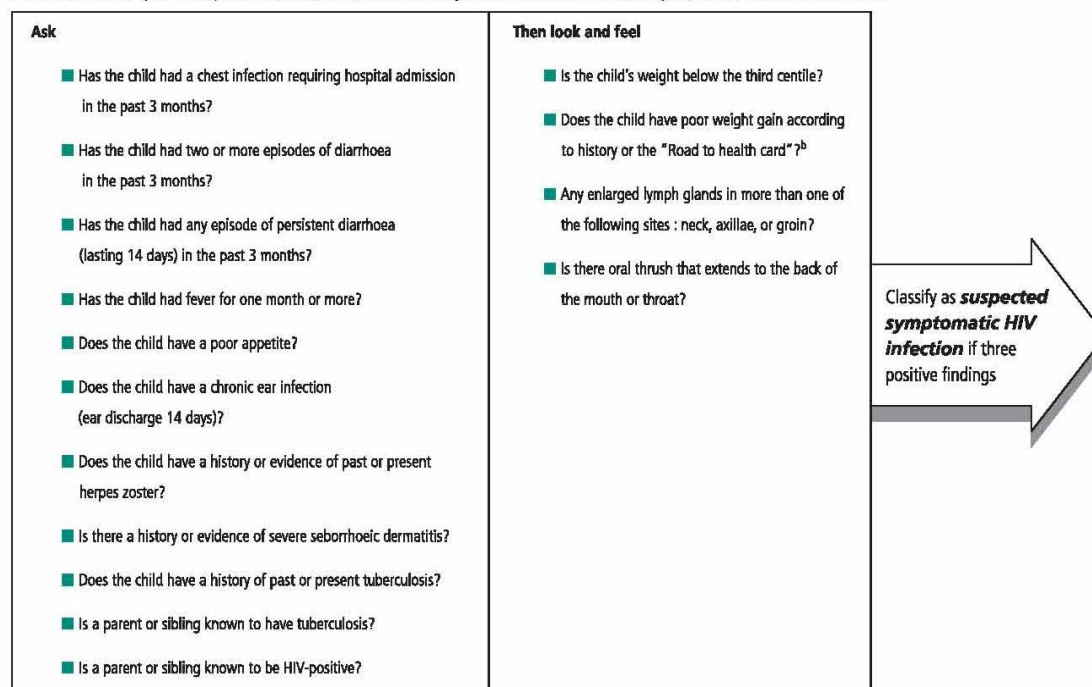
Each child was assigned a study number at the time of enrolment, and their name was not recorded in the database. Results of HIV tests were linked only to clinical data after completion of the study. Ethical approval was obtained from the Ethics Committee of the University of Natal Medical School and from WHO Secretarial Committee on Research Involving Human Subjects (SCRIHS).

Evaluation of the HIV algorithm

Each child was assessed by an IMCI practitioner with the HIV algorithm (Fig. 1). Clinical findings and HIV classification were recorded. The child then had a clinical assessment by a paediatrician; this was standardized with a structured data collection tool that detailed the history and examination. The paediatrician recorded an opinion as to whether the child had HIV infection and the reasons for this decision, with reference to the Centres for Disease Control and Prevention (CDC) criteria for paediatric HIV (24). The paediatrician's assessment allowed the performance of the HIV algorithm to be compared with the best possible clinical assessment. The HIV test provided an objective standard for both clinical assessments. The principal outcome measure from

Fig. 1. Original HIV algorithm

If the answer was "yes" to any HIV-related question^a asked during the assessment **consider symptomatic HIV infection**



^a " Screening questions" asked during the routine assessment of every child.

^b "Road to health card" showing weight for age.

WHO 03.203

each assessment was whether the child had suspected symptomatic HIV infection. IMCI and paediatrician's assessments were made separately, without any contact between the IMCI practitioner and the paediatrician.

Two IMCI practitioners and two paediatricians made the assessments. The IMCI practitioners were a professional nurse and a primary care doctor, who both were experienced IMCI trainers. The study paediatricians both had worked for more than three years in a setting with a high prevalence of HIV. The paediatricians and IMCI practitioners assessed the same patients from a sample of one in 20 enrolled patients to allow measurement of interobserver variation.

HIV testing

HIV testing was done after completion of both clinical assessments. Blood spots were collected from all children with a capillary blood sample, dried on filter paper, and labelled with the study number and age of the child. Initial HIV-1 testing was performed on dried blood spots with two different serological assays: a broad-based HIV-1/HIV-2 enzyme-linked immunosorbent assay (ELISA) (Vironstika HIV-1 IMPVD; Organon Teknika, Durham (NC), USA) and then a confirmatory ELISA (Murex Wellcozyme HIV 1+2 GACELISA; Murex Corporation, Dartford, England). To differentiate between infants who were infected with HIV-1 and those who carried maternal HIV-1 antibodies, we tested all antibody-positive dried blood spots for the presence of virus with the NucliSens HIV-1 RNA QT kit (Organon Teknika, Durham (NC), USA) adapted for use with dried blood spot samples. These techniques have been shown to be reliable for the study of subtype C viruses in Africa (25–27).

Analysis

Results were precoded and double entered into EpiInfo software (version 6.04). The data were validated and analysed in Epi-Info and SPSS software (version 10.0). The sensitivity, specificity, positive and negative predictive values, and likelihood ratios were calculated for the paediatrician and IMCI assessments. We calculated 95% confidence intervals for proportions with the exact binomial method and compared results by means of a χ^2 test. Confidence intervals for likelihood ratios were calculated with the method of Simel et al. (23). Diagnostic odds ratios were calculated to identify variables significantly associated with HIV infection. Stepwise logistic regression was used to identify the most useful independently significant predictors of HIV infection.

A model developed in Microsoft Excel was used to calculate the validity of alternative algorithms on the study population with these independent predictors of HIV. Different combinations of screening and scoring variables were entered into the model, which then calculated the validity for each. In this way, possible improvements to the HIV algorithm were evaluated. We calculated weighted kappa statistics, which measure the agreement between observers beyond random agreement and take the degree of disagreement into account, for the comparison between the two observers (28).

Results

Study participants and HIV prevalence

Overall, 690 children were enrolled into the study. Only 22 (3.2%) of carers of the children who were asked to participate refused permission. We noted a very high uptake of voluntary

counselling and testing: of 555 children accompanied by the mother, 353 (63.6%) asked to know the result of their child's HIV test. In total, 198 children were found to be infected with HIV, which shows a 28.7% prevalence of HIV in the overall study sample. Table 1 shows the age of the participants and age-related seroprevalence.

Evaluation of HIV algorithm

Table 2 shows a comparison of the validity of the HIV algorithm and the paediatrician in identifying HIV infection. The paediatrician performed better in all aspects; however, the IMCI practitioner and paediatrician made the same decision about the child's HIV status in 561 (81.3%) children ($\kappa = 0.52, P < 0.001$) (28). Of the 46 children correctly identified by the paediatrician but not by the IMCI practitioner, 30 had splenomegaly, hepatomegaly, or parotid enlargement (signs not included in the initial HIV algorithm), whereas the others had a variety of features. The validity of the algorithm did not change significantly when analysed for different age categories. When the IMCI/HIV algorithm was used, of 111 children identified as HIV-infected by the IMCI practitioner, 71 (64%) would have been referred according to the IMCI guideline without inclusion of the HIV component.

Interobserver agreement

In total, 42 children were assessed by both IMCI practitioners. In seven children, a difference in the HIV classification was noted, which gave an agreement of 83.3% ($\kappa = 0.51, P < 0.001$) (28). All differences were in the interpretation of a history of poor weight gain from the carer.

Both paediatricians also assessed 42 children; in only three was a difference in the diagnosis of HIV infection noted, which gave a 92.9% agreement ($\kappa = 0.73, P < 0.001$).

Development of an improved HIV algorithm

Signs and symptoms used to develop the improved algorithm were chosen from those identified as significant independent predictors of HIV infection. The signs considered for inclusion were those that were clinically relevant, widely applicable, and practical to teach during IMCI training (Table 3). For this reason, the design of the improved algorithm may not have been the most statistically sensitive or specific.

Oral thrush in children was associated strongly with HIV infection. Any severity of thrush was a more sensitive predictor than severe thrush alone (25.8% vs 8.1%), with little difference in specificity or positive predictive value. Lymph nodes in two or more sites, as used in IMCI, had a similar association with HIV (odds ratio (OR) = 4.6, 95% confidence interval (CI) = 3.2–6.5) compared with WHO's definition of three sites (OR = 3.6, 95%

Table 1. Prevalence of HIV infection in children enrolled in the study, by age group

Age group (months)	Children	Children infected with HIV
2–11	226	85 (37.6) ^a
12–23	169	48 (28.4)
24–35	106	28 (26.4)
36–47	117	23 (19.7)
48–59	72	14 (19.4)
All ages	690	198 (28.7)

^a Values in parentheses are percentages.

CI = 2.5–5.1) (21), but the former was a more sensitive predictor of HIV infection (60.1% vs 42.9%).

Various combinations of screening questions and clinical features were tested with the model to maximise the sensitivity and specificity of the improved algorithm. Although the sensitivity could be improved by doing the full assessment for HIV on every child, this would be time consuming and might be unacceptable to health workers. We therefore included a screening step that comprised four simple and sensitive screening questions to be asked for every child (Fig. 2). With this combination of screening questions, 92.4% of HIV-infected children in our study population would have had the full assessment for symptomatic HIV infection (Table 4).

By using these screening questions and additional clinical features of HIV, we developed an improved algorithm (Fig. 2) that would identify symptomatic HIV infection in our study population with a sensitivity of 67.2% and a specificity of 81.5% (Table 4). When the screening questions were omitted and every child was assessed, the performance of the algorithm in our population did not improve significantly. Similarly, hepatomegaly and splenomegaly were not independent predictors of infection with HIV in this population, so their inclusion in the algorithm did not improve its performance (Table 4). Application of WHO's case definition for paediatric AIDS to our population was very specific but not sensitive in identifying HIV-positive children (Table 4) (21).

Discussion

This is the first study to evaluate a tool for primary level healthcare workers to identify symptomatic HIV infection in children. The algorithm performed with reasonable sensitivity and specificity compared with a paediatrician. The paediatricians provided the best performance that can be expected of a clinical assessment, as not all children with a positive laboratory HIV test are symptomatic. We also used the clinical data collected on these

Table 2. Validity of paediatrician and original IMCI/HIV algorithm in identification of HIV-infected children

Variable	Method of identification		Comparison	
	Paediatrician	HIV algorithm	χ^2 test	P-value
Sensitivity (%)	71.7 (64.9–77.9) ^a	56.1 (48.8–63.1)	10.5	0.001
Specificity (%)	90.4 (87.5–92.9)	85.0 (81.5–88.0)	6.9	0.009
Positive predictive value (%)	75.1 (68.3–81.1)	60.0 (52.6–67.1)	9.8	0.002
Negative predictive value (%)	88.8 (85.7–91.4)	82.8 (79.2–86.0)	7.5	0.006
Likelihood ratio positive	7.47 (4.83–11.55)	3.74 (2.63–5.33)		

^a Values in parentheses are 95% confidence intervals.

children to develop an improved HIV algorithm with a higher sensitivity and specificity when applied to our population. This improved algorithm is simpler than the initial algorithm, and its performance is close to that of an experienced paediatrician (Fig. 2). We also described the clinical features that, if found in children who present to a health facility in an area of high prevalence of HIV, are most strongly predictive of HIV infection.

This algorithm is a critical step towards provision of adequate services for HIV-infected children in South Africa and settings where HIV/AIDS is a public health problem. Primary health workers in clinics could provide the continuing care and support needed for these children and their families. As most countries in sub-Saharan Africa are currently implementing IMCI, this HIV algorithm and accompanying management guidelines are an important step towards giving health workers the skills they need (12). Although many of the children identified as infected with HIV would have been referred to hospital according to IMCI guidelines that do not take HIV status into account, most children in our sample had been referred already. Even in this hospital-based sample, 36% of children identified as possibly being infected with HIV would not have been referred, and this is likely to be higher in a primary care setting. Referral does not ensure that a diagnosis is made at the hospital and, more importantly, is unlikely to be communicated to primary care level. Implementation of the HIV algorithm by primary health workers will raise awareness and allow follow-up to be provided at this level.

The limited interventions available to HIV-infected children in resource-poor settings like South Africa, where antiretroviral drugs are not available, has been used to argue against early identification of these children. Effective interventions, including treatment of intercurrent infections, cotrimoxazole prophylaxis for *Pneumocystis jiroveci* pneumonia, and support for families isolated by the stigma of HIV are available. These can only be implemented if health workers identify children infected with HIV. As additional treatments become available for these children and their families, these can be integrated into the IMCI management guidelines. Increased identification of children infected with HIV may increase awareness

of the extent of the problem at all levels of the health system and encourage policy changes towards improving the availability of treatment.

Identification of HIV-infected people and promotion of behaviour change are the major challenges of any HIV prevention programme. Early diagnosis and implementation of care for children of HIV-infected mothers may be a way of positively engaging these mothers to promote wider education messages about AIDS. The level of uptake of voluntary counselling and testing by mothers of children enrolled in our study was very high (63.6%), which suggests that, with appropriate counselling, mothers do want to know their own and their children's HIV status. During our study, the increase in HIV testing resulted in many mothers being identified as infected with HIV, and a mothers' support group has now been set up. Health workers are reluctant to talk about HIV with patients and have a perception that it is not acceptable to do so, but our study suggests that in a confidential setting, discussion of HIV may be well received and can result in mobilisation of communities. All health workers need skills to discuss and manage HIV/AIDS-related problems on a day-to-day basis in areas with a high prevalence of HIV.

Our study had a number of strengths. When we evaluated the algorithm, we were able to recruit a large sample size and to determine reliably the HIV status of all enrolled children. Viral loads were determined in all children to confirm HIV infection. The IMCI practitioners who collected data in the study were very experienced and highly motivated, so the data was accurate and complete. Considerable experience has been gained in the use of the initial HIV algorithm, which was introduced in KwaZulu-Natal Province in 1998.

Our findings also have some limitations. The HIV algorithm may perform differently in a primary level facility, in which there will be fewer cases of HIV/AIDS. This evaluation was made in a hospital setting in an area of high prevalence of HIV, because resources were not available to obtain the large sample that would have been needed at the primary care level. Similarly, the performance of the algorithm will be different in countries with lower prevalences of HIV. Our practitioners were experienced

Table 3. Validity of single clinical features in predicting HIV infection in children aged 2–59 months

Sign ^a	Sensitivity (%)	Specificity (%)	Positive predictive value (%)	Likelihood ratio positive	Bivariate diagnostic odds ratio ^b
History of weight loss	72.2	51.4	37.4	1.49	2.8 (1.9–3.9)
Lymphadenopathy (any palpable nodes in two sites)	60.1	74.8	49.0	2.39	4.5 (3.2–6.3)
Weight below third percentile	53.0	83.5	56.5	3.22	5.7 (4.0–8.3)
Pneumonia this visit ^c	47.4	71.3	40.0	1.66	2.3 (1.6–3.2)
Any diarrhoea in past three months	47.0	72.2	40.4	1.69	2.3 (1.6–3.2)
Any persistent diarrhoea in past three months	13.1	97.0	63.4	4.30	4.8 (2.5–9.3)
Ear discharge (ever)	33.3	86.6	50.0	2.49	3.2 (2.2–4.8)
Splenomegaly	27.3	98.6	88.5	19.20	26.0 (11.6–58.3)
Hepatomegaly	26.3	96.8	76.5	8.08	10.6 (5.9–19.1)
Oral thrush (any)	25.8	97.8	82.3	11.50	15.2 (7.7–29.9)
Parotid enlargement	7.6	99.0	75.0	7.43	8.0 (2.9–22.3)

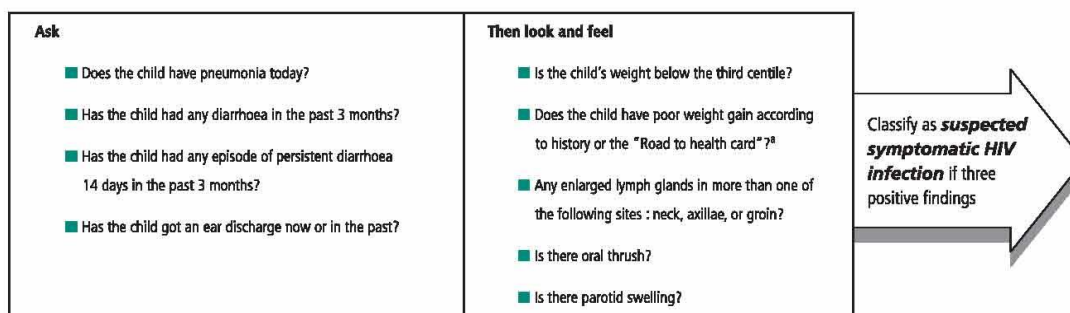
^a Presence of signs are based on the findings of the paediatrician.

^b Values in parentheses are 95% confidence intervals.

^c Pneumonia as defined in IMCI guidelines and identified by IMCI practitioner.

Fig. 2. Improved HIV algorithm

If the child has pneumonia today, **or**
 the mother gives a history that the child has lost weight, **or**
 the child has had persistent diarrhoea now or in the past three months, **or**
 the child has ever had an ear discharge,
consider symptomatic HIV infection:



^a "Road to health card" showing weight for age.

WHO 03.204

Table 4. Validity of improved HIV algorithm and WHO clinical criteria for paediatric AIDS applied to study population

Variable	Sensitivity (%)	Specificity (%)	Positive predictive value (%)	Likelihood ratio positive
Screening questions only	92.4	31.5	35.2	1.35
Improved HIV algorithm with screening questions ^a	67.2	81.5	59.4	3.63
Improved HIV algorithm applied to all children ^b	70.1	80.1	58.6	3.52
Improved HIV algorithm with hepatomegaly and splenomegaly included ^a	71.5	80.5	59.5	3.65
Improved HIV algorithm with four points used to classify	35.4	94.3	71.4	6.21
WHO clinical criteria for paediatric AIDS ^c	8.5	98.7	68.0	6.54

^a Classification on basis of three positive findings.

^b Full assessment applied to all children; no screening questions used.

^c Major signs: weight loss or abnormally slow growth, chronic diarrhoea >1 month, and prolonged fever >1 month; minor signs: generalized lymphadenopathy, oropharyngeal candidiasis, repeated common infections, persistent cough, generalized dermatitis, and confirmed maternal HIV infection (22).

and highly motivated and therefore were likely to perform better than those working in routine clinical practice.

These findings relate to a particular population and may not all be generalizable to other settings in Africa. The validity of the HIV algorithm may be affected if it is implemented in areas in which the clinical features we identified as predictive of HIV infection are more prevalent in the general population. For example, rates of malnutrition are lower in South Africa than other African countries, and this may reduce the predictive value of signs related to malnutrition. Hepatomegaly and splenomegaly may not be useful predictors of HIV infection in a population in which malaria is prevalent. In recognition that disease profiles vary, generic IMCI guidelines are intended to be adapted for local conditions, so our HIV algorithm will be used differently in other settings. At a workshop in Harare in June 2001, WHO adopted a generic HIV algorithm based on our data, which can be adapted and incorporated into IMCI in countries with prevalence of HIV >2% (29).

Adaptations to the HIV algorithm also may be made according to availability of resources in countries that intend to implement the algorithm. In South Africa, if a child has suspected

HIV infection, an HIV test would be recommended to confirm the diagnosis. In many countries, HIV testing is not available at the primary care level, so management decisions may need to be based on the algorithm alone. To make the improved HIV algorithm more specific for use in this setting, the number of clinical features used to classify a child suspected as being infected with HIV could be increased from three to four. In this way, the specificity and positive predictive value of the algorithm can be increased and, although this results in a lower sensitivity (Table 5), children missed by a more specific algorithm may be identified later, as the disease progresses. A significant rate of false positives still exists, and this cannot be avoided entirely with a clinical diagnosis. Children may be exposed to unnecessary stigma and follow-up, but all children with these clinical features are vulnerable and could benefit from extra care. Countries that intend to use the algorithm in this way, without the support of HIV tests, would need to develop training materials to give health workers the counselling skills needed to explain this to mothers. The HIV algorithm is only the first step towards ongoing management of paediatric HIV infection. Health workers need to use the algorithm and facilities for diagnosis and follow-up of

identified children must be available at primary level. This may severely limit implementation in many resource-poor settings.

Conclusion

Health workers at the primary care level can identify children with symptomatic HIV infection through the identification of simple signs taught within IMCI. We developed an improved HIV algorithm that is evidence based and can be recommended for use in settings with a high prevalence of HIV. Further research is being undertaken to validate the algorithm in other clinical settings and to assess its use and acceptability among primary care practitioners. WHO's current clinical definitions of paediatric AIDS (21) have not been evaluated formally, and these may be reviewed as a result of this data. As implementation of

this algorithm will result in earlier diagnosis of children infected with HIV, we also suggest further evaluation of the interventions recommended for these children. ■

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Résumé

Algorithme clinique pour le diagnostic de l'infection à VIH chez l'enfant dans les services de soins de santé primaires

Objectif Déterminer la validité d'un algorithme utilisé par les agents des soins de santé primaires pour repérer les enfants présentant une infection à VIH symptomatique. Cet algorithme est appliqué en Afrique du Sud dans le cadre de la prise en charge intégrée des maladies de l'enfant (PCIME), stratégie visant à réduire la morbidité et la mortalité infantiles en améliorant les soins de santé primaires. Le SIDA étant l'une des principales causes de mortalité chez l'enfant en Afrique australe, le diagnostic et la prise en charge des infections à VIH symptomatiques ont été ajoutés à l'algorithme actuel de la PCIME.

Méthodes Au total 690 enfants de la consultation externe d'un hôpital de district d'Afrique du Sud ont été vus par un praticien appliquant l'algorithme pour le VIH, puis par un pédiatre. La charge virale du VIH a ensuite été déterminée pour chaque enfant. La validité de l'algorithme pour la détection de l'infection à VIH symptomatique a été comparée avec celle du diagnostic clinique

par le pédiatre et avec les résultats du test de dépistage. L'algorithme a été amélioré par le recueil minutieux des données cliniques.

Résultats Au total, 198 enfants (28,7 %) étaient infectés par le VIH. Le pédiatre en a identifié correctement 142 (71,7 %) et l'algorithme VIH/PCIME a permis d'en trouver 111 (56,1 %). Les odds ratios ont été calculés pour déterminer les facteurs prédictifs de l'infection à VIH et utilisés pour améliorer l'algorithme et atteindre, pour le dépistage clinique, une sensibilité de 67,2 % et une spécificité de 81,5 %.

Conclusion L'utilisation d'un algorithme permet aux agents des soins de santé primaire de repérer efficacement les enfants présentant une infection à VIH symptomatique. L'algorithme amélioré mis au point dans cette étude pourrait être utile dans les pays à forte prévalence du VIH et permettre aux praticiens appliquant la PCIME de repérer et de soigner les enfants infectés.

Resumen

Diagnóstico de la infección infantil por VIH con un algoritmo clínico en un entorno de atención primaria

Objetivo Determinar la validez de un algoritmo usado por los trabajadores de salud del nivel de atención primaria para identificar a los niños con infección por VIH sintomática. Este algoritmo de detección del VIH se está aplicando en Sudáfrica como parte de la Atención Integrada a las Enfermedades Prevalentes de la Infancia (AIEPI), estrategia que aspira a mejorar la morbilidad y la mortalidad en la niñez mejorando la atención en el nivel de atención primaria. Dado que el SIDA es una importante causa de muerte en la niñez en el África meridional, se decidió añadir el diagnóstico y el manejo de la infección sintomática por VIH al algoritmo de AIEPI que se venía empleando.

Métodos En total, 690 niños que acudieron al departamento de pacientes ambulatorios de un hospital de distrito de Sudáfrica fueron evaluados mediante el algoritmo VIH y por un pediatra. Todos los niños fueron sometidos luego a la prueba de carga viral del VIH. La validez del algoritmo como medio de detección de la infección sintomática por VIH se contrastó con el diagnóstico clínico realizado por un pediatra y con el resultado de una prueba

del VIH. El algoritmo fue mejorado utilizando diversos datos clínicos más detallados.

Resultados De todos los niños incluidos en el estudio, 198 (28,7%) estaban infectados por el VIH. El pediatra identificó correctamente a 142 niños (71,7%) infectados, mientras que el algoritmo AIEPI/VIH identificó a 111 (56,1%). Las razones de posibilidades calculadas para identificar los factores predictivos de la infección por VIH se utilizaron para desarrollar un algoritmo mejorado del VIH, que detecta la infección clínica mediante una sensibilidad del 67,2% y una especificidad del 81,5%.

Conclusión El personal de salud del nivel primario puede identificar eficazmente a los niños con infección sintomática por VIH utilizando un algoritmo desarrollado al efecto. El algoritmo mejorado desarrollado en este estudio podría ser utilizado por los países con alta prevalencia del virus, donde los especialistas de AIEPI podrían así identificar y atender a los niños infectados por el VIH.

ملخص

تشخيص العدوى بفيروس العوز المناعي البشري لدى الأطفال في مواقع الرعاية الصحية الأولية باستخدام خوارزمية سريرية

المدرسين مصابون بالعدوى بفيروس العوز المناعي البشري وقد استطاع طبيب الأطفال كشف ١٤٢ حالة تشكل (٧١,٧%) من بين الأطفال المصابين بالعدوى بفيروس العوز المناعي البشري، فيما أمكن باستعمال خوارزمية كشف العدوى بفيروس العوز المناعي البشري في مبادرة التدبير العلاجي المتكامل لأمراض السطفولة كشف ١١١ حالة تشكل (٥٦,١%) من بين الأطفال المصابين بفيروس العوز المناعي البشري. وكانت نسب الأرجحية قد حسبت لكشف عوامل التنبؤ بعدوى فيروس العوز المناعي البشري، وقد استخدمت لإعداد خوارزمية كشف العدوى بفيروس العوز المناعي البشري ذات حساسية تعادل ٦٧,٢% وذات نوعية في ٨١,٥% من الحالات التي تم كشفها سريريًا لإصابتها بعدوى فيروس العوز المناعي البشري.

الاستنتاج: يمكن كشف عدوى الأطفال بفيروس العوز المناعي البشري المصحوبة بالأعراض بشكل فعال من قِبَل العاملين في الرعاية الصحية الأولية إذا استخدموا خوارزمية. والخوارزمية المحسنة المعتمدة في هذه الدراسة لكشف العدوى بفيروس العوز المناعي البشري يمكن أن تستخدم في بلدان أخرى تعاني من معدلات انتشار عالية للعدوى بفيروس العوز المناعي البشري، وهذا ما يمكن للممارسين في مبادرة التدبير العلاجي المتكامل لأمراض الطفولة من كشف الأطفال المصابين بالعدوى بفيروس العوز المناعي البشري وتقديم الرعاية لهم.

الهدف: تقييم صلاحية خوارزمية استخدامها العاملون في مستوى الرعاية الصحية الأولية لكشف العدوى بفيروس العوز المناعي البشري المصحوبة بأعراض. وقد استخدمت هذه الخوارزمية في جنوب أفريقيا كجزء من مبادرة التدبير العلاجي المتكامل لأمراض الأطفال، وهي استراتيجية تهدف لتحسين معدلات المراضة والوفيات لدى الأطفال عن طريق تحسين الرعاية على مستوى الرعاية الصحية الأولية. ولما كان الإيدز هو السبب الأول لوفيات الأطفال في جنوب أفريقيا، فإن تشخيص ومعالجة العدوى بفيروس العوز المناعي البشري المصحوبة بأعراض قد أضيفتا إلى مبادرة التدبير العلاجي المتكامل لأمراض الأطفال.

الطريقة: لقد تم تقييم ٦٩٠ طفلاً ممن راجعوا القسم الخارجي في إحدى مستشفيات مناطق جنوب أفريقيا باستخدام خوارزمية العدوى بفيروس العوز المناعي البشري من قِبَل طبيب أطفال. ثم أُجري هؤلاء الأطفال معايرة للحمل الدموي من فيروس العوز المناعي البشري، وتمت مقارنة صلاحية كشف العدوى بفيروس العوز المناعي البشري المصحوبة بأعراض بكل من التشخيص السريري لطبيب الأطفال ونتائج اختبار فيروس العوز المناعي البشري. وقد استعملت المعطيات السريرية المفصلة في تحسين الخوارزمية.

الموجودات: وجد أن ١٩٨ طفلاً يشكلون (٢٨,٧%) من بين الأطفال

References

- Murray CJL, Lopez AD Mathers CD, Stein C. The global burden of disease 2000 project: aims, methods and data sources. Evidence and information for Policy (EIP). Geneva: World Health Organization; 2001. Available from: URL: http://www3.who.int/whosis/discussion_papers/discussion_papers.cfm (accessed on 14 October 2003).
- World Health Organization Division of Diarrhoeal and Acute Respiratory Disease Control. Integrated management of the sick child. *Bulletin of the World Health Organization* 1995;73:735-40.
- World Bank. *World development report 1993: investing in health*. New York: Oxford University Press; 1993.
- Gove S. Integrated management of childhood illness by outpatient health workers: technical basis and overview. *Bulletin of the World Health Organization* 1997;75 Suppl 1:7-24.
- Bern C, Zucker JR, Perkins J, Otieno J, Oloo AJ, Yip R. Assessment of potential indicators for protein-energy malnutrition in the algorithm for integrated management of childhood illness. *Bulletin of the World Health Organization* 1996;75 Suppl 1:87-96.
- Kalter HD, Burnham G, Kolstad PR, Hossain M, Shillinger JA, Khan NZ, et al. Evaluation of clinical signs to diagnose anaemia in Uganda and Bangladesh, in areas with and without malaria. *Bulletin of the World Health Organization* 1996;75 Suppl 1:103-11.
- Weber MW, Kellingray SD, Palmer A, Jaffar S, Mulholland EK, Greenwood BM. Pallor as a clinical sign of anaemia in children: an investigation in the Gambia. *Bulletin of the World Health Organization* 1996;75 Suppl 1:113-8.
- Kalter HD, Shillinger JA, Hossain M, Burnham G, Saha S, de Wit V, et al. Identifying sick children requiring referral to hospital in Bangladesh. *Bulletin of the World Health Organization* 1997;75 Suppl 1:65-75.
- Simois EAF, Desta T, Gerbresellassie T, Dagnew M, Gove S. Performance of healthworkers after training in the integrated management of childhood illnesses in Gondar, Ethiopia. *Bulletin of the World Health Organization* 1997;75 Suppl 1:43-53.
- Kolstad PR, Burnham G, Kenya-Mugisha N, Black RE. The integrated management of childhood illness in western Uganda. *Bulletin of the World Health Organization* 1996;75 Suppl 1:77-85.
- Weber MW, Mulholland EK, Jaffar S, Troedsson H, Gove S, Greenwood BM. Evaluation of the algorithm for the integrated management of childhood illnesses in an area with seasonal malaria in the Gambia. *Bulletin of the World Health Organization* 1996;75 Suppl 1:25-32.
- World Health Organization Department of Child and Adolescent Health and Development. *Annual report 2000*. Geneva: World Health Organization; 2000. Available from: URL: <http://www.who.int/child-adolescent-health/> (accessed on 11 September 2002).
- Medical Research Council of South Africa. *South African demographic and health survey 1998. Preliminary report*. Pretoria: Medical Research Council of South Africa; 1999. Available from: URL: <http://www.mrc.ac.za/researchreports/demographicsurvey.htm> (accessed on 14 October 2003).
- Zwi KJ, Pettifor JM, Soderlund N. Paediatric hospital admissions at a South African urban regional hospital: the impact of HIV, 1992-1997. *Annals of Tropical Paediatrics* 1999;19:135-42.
- Oluwole D, Mason E, Costello A. Management of childhood illness in Africa. *BMJ* 2000;320:594-5.
- Health Systems Research and Epidemiology, Department of Health. *National HIV and syphilis sero-prevalence survey of women attending public antenatal clinics in South Africa 2000*. Pretoria: Department of Health; 2001. Available from: URL: <http://www.doh.gov.za/facts/index.html> (accessed on 1 September 2002).
- Bobat R, Moodley D, Coutsooudis A, Coovadia H, Gouws E. The early natural history of vertically transmitted HIV-1 infection in African children from Durban, South Africa. *Annals of Tropical Paediatrics* 1998;18:187-96.
- Jeena PM, Coovadia HM, Thula SA, Blythe D, Buckels NJ, Chetty R. Persistent and chronic lung disease in HIV-1 infected and uninfected African children. *AIDS* 1998;12:1185-93.
- Bobat R, Coovadia H, Moodley D, Coutsooudis A. Mortality in a cohort of children born to HIV-1 infected women from Durban, South Africa. *South African Medical Journal* 1999;89:646-8.
- Spira R, Lepage P, Msellati P, Van de Perre P, Leroy V, Simonon A, et al. Natural history of human immunodeficiency virus type 1 infection in children: a five year prospective study in Rwanda. *Pediatrics* 1999;104:e56.
- World Health Organization. Acquired immunodeficiency syndrome (AIDS). *Weekly Epidemiology Record* 1986;61:69-73.
- Arkin CF, Wachtel MS. How many patients are necessary to assess test performance? *JAMA* 1990;263:275-8.
- Simel DL, Samsa GP, Matchar DB. Likelihood ratios with confidence: sample size estimation for diagnostic test studies. *Journal of Clinical Epidemiology* 1991;44:763-70.

Research

24. Centers for Disease Control. 1994 revised classification system for human immunodeficiency virus infection in children less than 13 years of age. *Morbidity and Mortality Weekly Report* 1994;(No. RR-12):1-10.
25. Biggar RJ, Janes M, Pilon R, Miotti P, Taha ET, Broadhead R, et al. Viral levels and CD4/CD8 counts in untreated African infants infected with human immunodeficiency virus type 1. *Journal of Infectious Disease* 1999;180:1838-43.
26. Taha ET, Hoover DR, Broadhead RL, van der Hoven L, Liomba GN, Kumwenda NK, et al. Association of HIV-1 load and CD4+ lymphocyte with mortality in untreated African children older than one year. *AIDS* 2000;14:453-9.
27. Broadbent R, Biggar RM, Janes M, Kumwenda N, Taha ET, Cassol S. Viral levels in newborn African infants undergoing primary HIV-1. *AIDS* 2001;15:1311-3.
28. Cohen J. A coefficient of agreement for nominal scales. *Educational and Psychological Measurement* 1960;20:37-46.
29. World Health Organization, Regional Office for Africa. *Report on the Workshop on Adaptation of IMCI Guidelines to include HIV/AIDS. Harare 18 to 23 June 2001*. Available from: URL:// http://www.who.int/child-adolescent-health/New_Publications/HIV/report_HIV_Harare.htm (accessed 9 October 2003).

Appendix 2

Focus Group Discussion Guide **IMCI trained health workers**

- Please tell me about your experiences of IMCI case management training?
- The IMCI training course includes training on identifying and managing children with HIV. How did you experience this part of the training?
- How well prepared do you feel to identify and manage children with suspected HIV?
- What experiences have you had using the guidelines for identifying children with HIV infection?
- What, if anything, could be changed in the IMCI training that would help you identify and care for children with HIV?
- How do you feel when you have to tell a mother that her child needs an HIV test?
- Please tell me about experiences that you have had when you follow up children with HIV infection.
- How do you feel about implementing follow-up for PMTCT and asking mothers about their HIV status?
- What things do you think have helped you to implement the HIV components of IMCI?
- What things have made it difficult for you to implement the HIV component of IMCI?

Appendix 3

Focus Group Discussion Guide **Carers of children under 5 years**

- Please tell me about your experiences bringing your child to this clinic
- Nurses in this clinic who care for sick children follow a guideline called IMCI; this may have led to some changes in the care of sick children in this clinic. What do you know about IMCI?
- What things do you think are good about the way that sick children are looked after in this clinic?
- What things do you think could be better about the way sick children are looked after at the clinic?
- How would you feel if the nurse asked you about your HIV status when you bring your child to the clinic?
- What have been your experiences of nurses asking about your HIV status when they see your child in this clinic?
- How do you feel about nurses at the clinic routinely checking sick children for signs of HIV infection?
- What experiences have you had with nurses talking about HIV or checking your child for HIV when you come to the clinic because the child is sick?
- How do you feel about nurses at the clinic sending children for HIV testing if there are signs of HIV infection found during the examination of the child?
- What are your feelings about children with HIV infection coming to the clinic regularly for follow-up care?

Appendix 4

An Evaluation of the South African HIV Adaptations to the Integrated Management of Childhood Illness. Ref E214/05

Dr Christiane Horwood
Centre for Rural Health
University of KwaZulu-Natal

Consent for health care providers participating in focus group discussions

Part 1- Information Sheet

Introduction

The Integrated Management of Childhood Illness (IMCI) case management training was introduced in South Africa in 1997 with the support of WHO and UNICEF. Since then, IMCI has been implemented throughout the country, and thousands of health care providers have been trained. Newly adapted IMCI guidelines and training materials were introduced in 2002. The guidelines were adapted to take account of changes in management of children at clinics in South Africa and the lessons learnt so far from IMCI implementation. This is a research study commissioned by the Department of Health (DoH) and the World Health Organisation (WHO) to find out about implementation of the IMCI guidelines at clinics in South Africa.

Purpose of the research

The DoH has requested that we assess the implementation of the new IMCI guidelines. One of the ways of doing this is to talk to IMCI trained health care workers and find out how they experienced the IMCI training and how they are implementing the IMCI case management guidelines.

What will happen in the focus group discussion?

You have been selected to take part in a discussion about IMCI training and implementation because we feel that your experience with IMCI can help us to understand how IMCI is being implemented and why. You will be in a group of other IMCI trained health workers from around this district and you will be asked about your experiences in attending IMCI training and in implementing the IMCI approach after you completed your training. We will ask you about things

that have been difficult about implementing IMCI and why this was. You will also be asked whether anything was helpful to you in implementing IMCI. In this way, we hope to identify factors that are barriers to IMCI implementation in clinics and what could be done to improve this. We hope that this information can help us to improve IMCI training and implementation, and that this will lead to improvements in care for children at clinics. There will be a number of similar discussions held in Limpopo and in KZN, in order to get as many views as possible.

The discussion will be conducted by specially employed researchers from the University of KZN, and there will be no one attending from DoH management. The discussion will be audio-recorded and information will be transcribed afterwards. No one will be identified by name on the tape and this information is confidential and will be kept by the researchers. Tapes will be stored at the university by the researchers until publication of the research results, and no-one except the researchers will have access to the tapes. The tapes will be destroyed after two years. It is possible that you will share private information during the discussion. We will ask you and the other people in the group not to repeat what was said in the group, but you should know that we cannot stop members of the group from sharing things which should be kept confidential. A report will be written for the DoH about the outcome of the discussions, this report will cover all the discussions on this topic held in the two provinces and will not identify which group or individual made any particular statement. No names of any participants will appear on the report. When the report is completed, you will receive feedback about the findings and a copy of the report.

We, therefore, request your consent to participate in a focus group discussion. This discussion will take about 45 minutes and you will be released from work in order to attend. You will be expected to come to the venue using your own transport and you will be given some money (R50) to compensate for this, as well as refreshments at the end of the discussion. There will be no payment for participating in the discussion. This research study will take place over the next six months, but you are asked to participate only for the discussion today. You will not be asked to participate further in the future.

Right to refuse or withdraw

We would be grateful for you assisting by participating in this research but if you do not want to participate, you are free to refuse or withdraw at any time and this will not affect your job in any way.

If you have any comments or complaints about this research please contact either:

Dr Christiane Horwood, who is in charge of the project

Phone: 031 260 1569

Or

Professor A Dhai or Ms C Borreson

Research Ethics Committee, Nelson R Mandela School of Medicine, University of Kwazulu-Natal

Phone: 031 260 4495

An Evaluation of the South African HIV Adaptations to the Integrated Management of Childhood Illness. Ref: E214/05

Part 2: Certificate of consent

I have been invited to participate in research about implementation of IMCI. I understand that I will participate in a discussion with other IMCI trained health workers. I am aware that there will be no benefit to me personally and I will be paid only for my travel expenses. I have been given the name and address of a researcher who I can contact.

I have read the above information and had the opportunity to ask questions about it. Any questions that I asked have been answered to my satisfaction. I consent voluntarily to participate in this study and understand that I have the right to withdraw from the discussion at any time without affecting my job in any way

Print name: _____

Signed: _____

Date: _____

I have accurately read or witnessed the accurate reading of the consent form to the potential participant, and the individual has had the opportunity to ask questions. I confirm that the individual has given consent freely.

Print name of researcher: _____

Signature of researcher: _____

Date: _____

Appendix 5

An Evaluation of the South African HIV Adaptations to the Integrated Management of Childhood Illness. Ref E214/05

Dr Christiane Horwood
Centre for Rural Health
University of KwaZulu-Natal

Consent for carers of children under 5 years participating in focus group discussions

Part 1- Information Sheet

Introduction

The Integrated Management of Childhood Illness (IMCI) is a way of caring for sick children coming to clinics, and was started in South Africa in 1997. IMCI is being practised at many clinics, including this one. Health workers are trained to use particular steps when looking after sick children and providing treatment. The purpose of using IMCI is to improve the care given to all sick children. This is a research study commissioned by the Department of Health (DoH) and the World Health Organisation (WHO) to find out about implementation of the IMCI guidelines at clinics in South Africa.

Purpose of the research

The Department of Health (DoH) has requested that we do research to see how well IMCI is being practised in clinics. One of the ways of doing this is to talk to mothers who bring their children to clinics where IMCI is being practised and ask them how they feel about the care that they and their children receive from the health care workers who look after children.

What will happen during the focus group discussion?

We are asking you to participate in a discussion about the care you have received when you have come to this clinic with your child. If you agree you will be in a group of other people who brought a child to the clinic today and you will be asked about your experiences at the clinic. You will be asked about things that are good about the care that you have received and why you think they are good. You will also be asked about any things that have happened when you come to the clinic that you think could be better and why. There will be a number of similar discussions held in Limpopo and in KZN provinces so we can get as many views from mothers as possible. We hope

that the information that we hear from you and the other people taking part in these discussions will help us to find out about problems in caring for children at clinics, so that we can improve care at this clinic and at other clinics in the area.

The discussion will be conducted by specially employed researchers from the University of KZN, and there will be no one attending who works at any clinic in this area. The discussion will be audio-recorded so that researchers can remember everything that was said, but no-one will be identified by name on the tape. Tapes will be stored at the university by the researchers until publication of the research results. The information on the tape is confidential and no one except the researchers will have access to the tapes. The tapes will be destroyed after two years. Whatever you say during the discussion is private and will not be repeated to anyone working at this clinic and your name will not be recorded. A report will be written for the Department of Health about the outcome of the discussions. This report will be about all the discussions on this topic held in the two provinces and not just in this clinic. The report will not mention which person or group made any particular statement. No names of anyone taking part will appear on the report. When the report is completed, feedback will be given at this clinic. There will be a notice about when this feedback is to be given and you will be invited to attend. This research study will take place over the next six months but you are asked only to participate for the discussion today, you will not be asked to participate further after today.

Risks

We, therefore, request your consent to participate in a discussion with other mothers attending the clinic today. This discussion will take about 45 minutes, so it may cause you some delay in leaving the clinic. You will not be paid anything for taking part, but you will get refreshments at the end. We will make sure that, after the discussion is finished, your child is seen straight away so that the delay is as short as possible. It is possible that you will share private information during the discussion. We will ask that you and the other people in the group not repeat what was said in the group, but you should know that we cannot stop members of the group from sharing things which should be kept private.

Right to Refuse or Withdraw

We would be grateful for your assistance in participating in this research, but you can refuse now or at any time during the discussion, and this will not affect the care that your child receives in any way.

If you have any comments or complaints about this research please contact either:

Dr Christiane Horwood, who is in charge of the project

Phone: 031 260 1569

Or

Professor A Dhai or Ms C Borreson

Research Ethics Committee, Nelson R Mandela School of Medicine, University of Kwazulu-Natal

Phone 031 260 4495

An Evaluation of the South African HIV Adaptations to the Integrated Management of Childhood Illness. Ref: E214/05

Part 2: Certificate of consent

I have been invited to participate in research about implementation of IMCI. I understand that I will participate in a discussion with other carers bringing their children to the clinic today. I have been informed that there are minimal risks, but there may be some delay in my leaving the clinic. I am aware that there will be no benefit to me personally and I will be given refreshments, but will receive no payment. I have been given the name and address of a researcher who I can contact.

I have read the above information and have had the opportunity to ask questions about it. Any questions that I asked have been answered to my satisfaction. I consent voluntarily to participate in this study and understand that I have the right to withdraw from the discussion at any time without in any way affecting my medical care

Print name: _____

Signed: _____

Date: _____

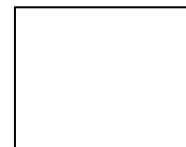
If illiterate:

I have witnessed the accurate reading of the consent form to the potential participant, and the individual has had the opportunity to ask questions. I confirm that the individual has given consent freely.

Print name of Witness _____

Signed _____ AND

Date _____



Thumbprint of participant

I have accurately read or witnessed the accurate reading of the consent form to the potential participant, and the individual has had the opportunity to ask questions. I confirm that the individual has given consent freely.

Print name of researcher _____

Signature of researcher _____ **Date:** _____

Appendix 6

An Evaluation of the South African HIV Adaptations to the Integrated Management of Childhood Illness. Ref: E214/05

Dr Christiane Horwood
Centre for Rural Health
University of KwaZulu-Natal

Consent for carers of children under 5 years to observation and HIV Testing

Part 1- Information Sheet

We are a team from the University of KwaZulu-Natal and we are doing a survey on all the children who come to the clinic. This form explains the survey so that you can decide if you are willing for your child to take part. The counsellor will explain all the information to you. If you are not sure about anything, please ask any questions that you have before you decide whether you want your child to take part. This is a research study commissioned by the Department of Health (DoH) and the World Health Organisation (WHO) to find out about implementation of the IMCI guidelines at clinics in South Africa.

What is the survey about?

Many children in KwaZulu-Natal are ill because of HIV and AIDS. We want to know how many children coming to clinics are infected with HIV, and whether the nurses seeing children at clinics are able to recognise HIV infected children and give them the correct treatments. We will be observing over one thousand children coming to clinics all around Kwazulu-Natal and Limpopo. This will help us to plan services and improve treatment for children with HIV/AIDS in the future.

What will happen during the survey?

In order to find out this information, we are asking all mothers or carers bringing children to the clinic today for permission to observe the consultation with the nurse. There will be an observer present who will watch what happens when the nurse is seeing your child. The observer will write down what the nurse does, but will not be part of the consultation. When the nurse is finished, you will be asked to go into another room where a second observer will ask you some questions and check your child again.

We would then like to test your child for HIV infection. We are asking all parents bringing a child to the clinic today for permission to do an HIV test on their child, so it does not mean that we think your child has HIV. You will receive counselling before this test is done to be sure that you understand about HIV testing and what the results will mean. If you agree for your child to be tested after you have heard all the information, the blood will be taken using a drop of blood obtained from a finger prick. This may hurt for a few seconds but is not very painful for the child.

The counsellor will tell you that you are free to refuse to take part in the survey at any time and this will not affect the care that your child will receive at the clinic in any way. If you decide you do not want your child to have an HIV test, you can refuse to have the sample taken at any time and this will not affect the care your child will receive.

This research study will take place over the next six months, but you are asked to agree to being observed today. You will not be asked to participate in any way in the future.

Why should I have my child tested?

If your child is infected, then treatment is now available for children with HIV. Children with HIV come to the clinic with the same illnesses as other children or they may have no symptoms at all. If your child is infected, your child will become sick in the future and sometimes these children die very quickly before they can get treatment. If you give permission for your child to have the HIV test today, and you do find out that he/she is infected, there are treatments that can be started immediately which will help to prevent your child from getting sick in the future. We will also arrange that your child is checked by a doctor who can decide whether your child needs any other treatment, like treatment with antiretroviral drugs. If they get the right treatment, children with HIV can live long and healthy lives. Many children are not HIV infected; so if you have ever worried about your child having HIV you may be very glad to know for sure that he/she is not infected.

What about the results of the test?

When the test has been done you will see the counsellor again. She will tell you the results of the test, explain to you what they mean, and answer any questions that you may have. You will have as much time as you like with the counsellor so that all your questions can be answered. Before you leave the clinic, you will be given any treatment that you need for your child and another appointment if this is necessary.

Sometimes it is not possible to get final results on the same day and, in this situation, the counsellor will make a plan for you to come on another day to get the results.

What are the risks of participating?

If you find out that your child is HIV positive this may have some negative consequences. The counsellor will discuss these with you in detail before you decide whether to have your child tested. Of course, it is very distressing for you and for your family if you find out that your child has a serious illness, and the counsellor will discuss with you how you may deal with this if your child does test HIV positive.

What happens to the information collected in the survey?

If your child takes part in the study, he/she will be given a number and the information about your child's illness and your child's HIV test will be recorded by the researchers using only this number to identify your child. Your child's name will not be recorded anywhere and no information will be recorded about your child that could be used to identify him/her.

The result of your child's HIV test will be given to you by the counsellor. If the test is positive we would recommend that we start your child on treatment straight away, and arrange an appointment for your child to see a doctor where more tests can be done to decide if your child needs more treatment. This means that other health workers will need to know that your child is HIV positive so that he/she can get treatment and follow-up appointments. The counsellor will discuss this with you further.

The information about all the children that we observe in the survey will be summarised and a report will be published in a medical journal, but there will no way to identify an individual child. The information will help nurses and doctors who look after sick children in South Africa to develop guidelines and to plan services for children infected with HIV. The information will also be used in other parts of Africa. The knowledge that we get from

this study will be shared with you before it is published. No confidential information will be shared at any time, but a summary of the results will be posted in all clinics where observations were done. The nursing staff will also receive feedback about the results, so if you want to know any more about the results please ask one of the nurses at the clinic.

Right to Refuse or Withdraw

It is important that you know that you have the right to refuse to participate in the survey, and your child will receive all the usual treatments from the clinic without any difference in the care that you will receive. You can decide to withdraw from the survey at any time during the observations or examination and your child's treatment will not be affected.

If you have any comments or complaints about this research please contact either:

Dr Christiane Horwood, who is in charge of the project

Phone: 031 260 1569

Or

Professor A Dhai or Ms C Borreson

Research Ethics Committee, Nelson R Mandela School of Medicine, University of Kwazulu-Natal

Phone 031 260 4495

An Evaluation of the South African HIV Adaptations to the Integrated Management of Childhood Illness. Ref: E214/05

Part 2 Certificate of consent

I have been invited to have my child take part in a survey at the clinic today. This will mean that an observer will be present when my child sees the nurse and, after seeing the nurse, we will be seen by a second observer who will ask some questions and examine my child again. If I agree, a sample of blood will be taken using a finger prick and this will be tested for HIV. I am aware that if my child is found to be HIV infected this may allow him/her to receive beneficial treatments, but may also have some adverse consequences. I understand that I will receive no payment for participating in the study.

I have read the foregoing information or it has been read to me. I have had the opportunity to ask questions about it and any questions that I have asked have been answered to my satisfaction. I consent voluntarily for my child to participate in the study and understand that I have the right to withdraw my child from the study at any time without in any way affecting either my child's or my own medical care.

*I consent to being observed during the consultation with the nurse

*I consent to having counselling so that my child is tested for HIV and I will receive the result of the test

*Delete as applicable

Print name of participant: _____

Signed: _____

Date: _____

If illiterate:

I have witnessed the accurate reading of the consent form to the potential participant, and the individual has had the opportunity to ask questions. I confirm that the individual has given consent freely.

Print name of Witness _____

Signed _____ OR

Date _____



Participant Thumbprint

I have witnessed the accurate reading of the consent form to the parent or guardian of the potential participant, and the individual has had the opportunity to ask questions. I confirm that the individual has given consent freely

Print name of Counsellor _____

Signed _____

Date _____

Appendix 7

HEALTHWORKER FORM - FORM ONE

1.1	HW STUDY NUMBER		1.2	Facility number	
1.3	Date		1.4	Completed by	
2.1	Have you ever been trained as an HIV/AIDS counsellor? <i>If no, skip to q2.3</i>			Yes 1	No 2
2.2	If yes, when did you attend HIV/AIDS counselling course?			Month	Year
2.3	Have you ever been trained in breastfeeding? <i>If no, skip to q2.7</i>			Yes 1	No 2
2.4	If yes, which breastfeeding course did you attend?				
2.5	When did you attend a breastfeeding course?			Month	Year
2.6	How many days was the breastfeeding course? <i>Record number of days</i>				
2.7	Have you attended any training on HIV and Infant feeding? <i>If no, skip to q2.11</i>			Yes 1	No 2
2.8	If yes, which HIV and Infant feeding course did you attend?				
2.9	When did you attend the HIV and Infant feeding course?			Month	Year
2.10	How many days was the HIV and Infant feeding course? <i>Record number of days</i>				
2.11	Have you been trained in IMCI? <i>If no, skip to the q2.23</i>			Yes 1	No 2
2.12	When were you trained in IMCI?			Month	Year
2.13	If this was before September 2002: Have you ever been updated to the changes to the IMCI guideline that have been implemented since you were trained?			Yes 1	No 2
2.14	How long was the update that you received? <i>Record number of days</i>				
2.15	What is the date on the last chart booklet you were given?			Month	Year
2.16	Have you been trained as an IMCI facilitator? <i>If no, skip to the q2.18</i>			Yes 1	No 2
2.17	If yes, when did you attend facilitator training?			Month	Year
2.18	Have you ever been trained as an IMCI supervisor? <i>If no, skip to the q2.20</i>			Yes 1	No 2
2.19	If yes, when did you attend supervision training?			Month	Year
2.20	Have you <u>ever</u> been visited by a supervisor who has observed you seeing children? <i>If no, skip to the q2.23</i>			Yes 1	No 2
2.21	If yes, how many times have you been observed by an IMCI supervisor? <i>Record number of times</i>				
2.22	When was the last time you had this type of supervision?			Month	Year
2.23	Is there any other training in child health that you have received? (for example EPI, Neonatal resuscitation)			Yes 1	No 2
2.24	If yes, what training and when were you trained?				

Appendix 8

HW Observation Form- Form Two

HW study No

Child study No

ADMINISTRATIVE DETAILS

1.1	Clinic number			
1.2	Observer's Name			
1.3	Date of examination			
1.4	Did the health worker refer to the chart booklet during the consultation?	Not at all ¹	Once or twice ²	Referred regularly ³
1.5	Age of the child (in months)			
1.6	Presenting complaints			

DANGER SIGNS

2.1	Is the child able to drink or breastfeed?	Asked ¹	Did not ask ⁻¹	Not sure ⁻²
2.2	Does the child vomit everything?	Asked ¹	Did not ask ⁻¹	Not sure ⁻²
2.3	Has the child had convulsions during the illness?	Asked ¹	Did not ask ⁻¹	Not sure ⁻²
2.4	Is the child lethargic or unconscious?	Checked ¹	Did not check ⁻¹	Not sure ⁻² Not applicable ⁻³

COUGH AND DIFFICULT BREATHING

3.1	Does the child have cough or difficult breathing?	Asked ¹	Did not ask ⁻¹	Not sure ⁻²
<i>If no cough or difficult breathing, did not ask or not sure, skip to diarrhoea</i>				
3.2	For how long?	Asked ¹	Did not ask ⁻¹	Not sure ⁻²
3.3	Counted breaths per minute	Checked ¹	Did not check ⁻¹	Not sure ⁻²
3.4	Chest in-drawing	Checked ¹	Did not check ⁻¹	Not sure ⁻²
3.5	Stridor	Checked ¹	Did not check ⁻¹	Not sure ⁻²
3.6	Cough classification	None made ⁰	Severe pneumonia or very severe disease ¹	Pneumonia ² Cough or cold ³
3.7	Wheeze	Checked ¹	Did not check ⁻¹	Not sure ⁻²
<i>If no wheeze, did not ask or not sure, skip to diarrhoea</i>				
3.9	Has the child had a wheeze before this illness?	Asked ¹	Did not ask ⁻¹	Not sure ⁻²
3.10	Does the child have a frequent cough at night?	Asked ¹	Did not ask ⁻¹	Not sure ⁻²
3.11	Has the child has a wheeze for more than one week?	Asked ¹	Did not ask ⁻¹	Not sure ⁻²
3.12	Is the child a known asthmatic?	Asked ¹	Did not ask ⁻¹	Not sure ⁻²
3.13	Wheeze classification	None made ⁰	Recurrent wheeze ¹	Wheeze first episode ²

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HW Observation Form- Form Two

HW study No

Child study No

DIARRHOEA

4.1	Does the child have diarrhoea?	Asked ¹	Did not ask ⁻¹	Not sure ⁻²
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If no diarrhoea, did not ask or not sure, skip to fever

4.2	For how long?	Asked ¹	Did not ask ⁻¹	Not sure ⁻²
4.3	If more than 14 days, has the child lost weight?	Asked ¹	Did not ask ⁻¹	Not sure ⁻² Not applicable ⁻³
4.4	Is there blood in the stools?	Asked ¹	Did not ask ⁻¹	Not sure ⁻²
4.5	Is the child lethargic or unconscious?	Checked ¹	Did not check ⁻¹	Not sure ⁻² Not applicable ⁻³
4.6	Is the child restless and irritable?	Checked ¹	Did not check ⁻¹	Not sure ⁻²
4.7	Is there sunken eyes?	Checked ¹	Did not check ⁻¹	Not sure ⁻²
4.8	Offered the child fluid		Offered ¹	Did not offer fluid ⁻¹
4.9	Pinched the skin of the abdomen	Checked ¹	Did not check ⁻¹	Not sure ⁻²
4.10	Diarrhoea classification #1	None made ⁰	Diarrhoea with severe dehydration ¹	Diarrhoea with some dehydration ² No visible dehydration ³
4.11	Diarrhoea classification #2	None made ⁰	Not more than 14 days ¹	Severe persistent diarrhoea ² Persistent diarrhoea ³
4.12	Diarrhoea classification #3	None made ⁰	No blood in the stool ¹	Severe dysentery ² Dysentery ³

FEVER

5.1	Does the child have a fever?	Asked ¹	Did not ask ⁻¹	Not sure ⁻²
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If no fever, did not ask or not sure, skip to ear problem

5.2	For how long?	Asked ¹	Did not ask ⁻¹	Not sure ⁻²
5.3	If more than 7 days, has the fever been present every day	Asked ¹	Did not ask ⁻¹	Not sure ⁻² Not applicable ⁻³
5.4	Stiff neck or bulging fontanelle	Checked ¹	Did not check ⁻¹	Not sure ⁻²
5.5	Fever/ meningitis classification	None made ⁰	Suspected meningitis ¹	Fever other cause ²

5.5	Is there a malaria risk?	Asked ¹	Did not ask ⁻¹	Not sure ⁻²
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If no malaria, did not ask or not sure, skip to ear problem

5.6	Malaria classification	None made ⁰	Suspected severe malaria ¹	Malaria ²	Possible malaria ³	Fever other cause ⁴
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EAR PROBLEM

6.1	Does the child have an ear problem?	Asked ¹	Did not ask ⁻¹	Not sure ⁻²
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If no ear problem, did not ask or not sure, skip to malnutrition

6.2	Is there ear pain?	Asked ¹	Did not ask ⁻¹	Not sure ⁻²
6.3	Is there an ear discharge?	Asked ¹	Did not ask ⁻¹	Not sure ⁻²

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HW Observation Form- Form Two

HW study No

Child study No

6.4	For how long?	Asked ¹	Did not ask ⁻¹	Not sure ⁻²		
6.5	Pus draining from the ear	Checked ¹	Did not check ⁻¹	Not sure ⁻²		
6.6	Tender swelling behind the ear	Checked ¹	Did not check ⁻¹	Not sure ⁻²		
6.7	Ear problem classification	None made ⁰	Mastoiditis ¹	Acute ear infection ²	Chronic ear infection ³	No ear infection ⁴

MALNUTRITION

7.1	Has the child lost weight?	Asked ¹	Did not ask ⁻¹	Not sure ⁻²		
7.2	Plot weight on growth chart	Plotted and explained to mother ¹	Plotted and did not explain to mother ²	Not plotted ⁻¹	Plotted incorrectly ⁻²	Not sure ⁻³
7.3	Curve on growth chart	Assessed and explained to mother ¹	Assessed and did not explain to mother ²	Could not assess ³	Not assessed ⁻¹	Not sure ⁻²
7.4	Malnutrition classification	None made ⁰	Severe malnutrition ¹	Not growing well ²	Growing well ³	

FEEDING ASSESSMENT

7.5	Not indicated ¹	Indicated but not assessed ²	Assessed ³	Assessed but not indicated ⁴		
7.6	Feeding method	Breast only ¹	Formula ²	Mixed ³ (breast + other food/fluids)	Older than 2 years ⁴	Not asked ⁻¹

Breast feeding (asked the following)

7.7a	How many times do you breastfeed?	Obtained information ¹	Information not obtained ⁻¹	Not sure ⁻²
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If no breast feeding skip to formula feeding

7.7b	Do you breastfeed during the night?	Obtained information ¹	Information not obtained ⁻¹	Not sure ⁻²
7.7c	Does the baby take any other food or fluids?	Obtained information ¹	Information not obtained ⁻¹	Not sure ⁻²
7.7d	What other food or fluids?	Obtained information ¹	Information not obtained ⁻¹	Not sure ⁻²
7.7e	How many times per day?	Obtained information ¹	Information not obtained ⁻¹	Not sure ⁻²
7.7f	What do you use to feed the child?	Obtained information ¹	Information not obtained ⁻¹	Not sure ⁻²

Formula feeding (asked the following)

7.8a	What replacement milk are you giving	Obtained information ¹	Information not obtained ⁻¹	Not sure ⁻²
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If no formula feeding skip to HIV History

7.8b	How many times during the day and night?	Obtained information ¹	Information not obtained ⁻¹	Not sure ⁻²
7.8c	How much are you giving at each feed?	Obtained information ¹	Information not obtained ⁻¹	Not sure ⁻²
7.8d	How is the milk prepared?	Obtained information ¹	Information not obtained ⁻¹	Not sure ⁻²
7.8e	How is the milk being given?	Obtained information ¹	Information not obtained ⁻¹	Not sure ⁻²
7.8f	How are you cleaning the utensils?	Obtained information ¹	Information not obtained ⁻¹	Not sure ⁻²

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HW Observation Form- Form Two

HW study No

Child study No

HIV test history

8.1	Has the mother had a positive HIV test?	Asked ¹	Obtained from notes ²	Did not ask ¹	Not sure ⁻²
8.2	Has the child had a positive HIV test?	Asked ¹	Obtained from notes ²	Did not ask ¹	Not sure ⁻²
8.3	Is the child taking co-trimoxazole?	Asked ¹	Obtained from notes ²	Did not ask ¹	Not sure ⁻²

HIV infection

9.1	Enlarged lymph nodes in more than one site: Neck, groin, armpit?	Checked ¹	Did not check ¹	Not sure ⁻²
9.2	An episode of persistent diarrhoea past 3 months	Asked ¹	Did not ask ¹	Not sure ⁻²
9.3	A history of ear discharge in the past	Asked ¹	Did not ask ¹	Not sure ⁻²
9.4	Oral thrush	Checked ¹	Did not check ¹	Not sure ⁻²
9.5	Parotid enlargement	Checked ¹	Did not check ¹	Not sure ⁻²
9.6	HIV classification	None made ⁰	Suspected symptomatic HIV ¹	Symptomatic HIV unlikely ²

SUSPECTED SYMPTOMATIC HIV or Mother HIV positive

If HIV not assessed or suspected skip the following sections

10.1	Who is the carer?	Mother ¹	Father ²	Legal guardian ³	Other carer ⁴	Did not ask ¹
10.2	Explained need for HIV test			Yes ¹	No ²	Not sure ⁻²
10.3	Offered counselling and testing			Yes ¹	No ²	Not sure ⁻²
10.4	If yes, care provider arranged HIV counselling and testing	To be done immediately by the IMCI trained healthworker ¹		To be done immediately by a counsellor at the clinic ²		
		To be done on another day at the clinic ³		To be done elsewhere ⁴	The carer refused counselling and testing ⁵	
		Other				

HIV related Health worker interventions

10.5	Co-trimoxazole prophylaxis	Yes ¹	No ²	Not sure ⁻²	
10.6	Multivitamin supplements	Yes ¹	No ²	Not sure ⁻²	Not applicable ⁻³
10.7	A follow-up date to be seen at the clinic once the VCT has been done	Yes ¹	No ²	Not sure ⁻²	Not applicable ⁻³
10.8	Pain relief	Not indicated ⁰	Yes ¹	No ²	Not sure ⁻²
10.9	Advised the carer about support groups in the community	Yes ¹	No ²	Not applicable ⁻³	Not sure ⁻²
10.10	Advised the carer about feeding	Yes ¹	No ²	Not sure ⁻²	
10.11	Any additional advice that was given				
10.12	Any inappropriate or incorrect advice				
10.13	Counselled mother about her own health	Yes ¹	No ²	Not sure ⁻²	

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Appendix 9

Expert IMCI Practitioner Recording Form- Form 3

HW study No

Child study No

ADMINISTRATIVE DETAILS

1.1	Clinic number	
1.2	Observer's Name	
1.3	Date of examination	
1.4	Age of the child (in months)	
1.5	Presenting complaints	

DANGER SIGNS

2.1	Is the child able to drink or breastfeed?	Yes ¹	No ²
2.2	Does the child vomit everything?	Yes ¹	No ²
2.3	Has the child had convulsions during the illness?	Yes ¹	No ²
2.4	Is the child lethargic or unconscious?	Yes ¹	No ²
2.5	Is there a danger sign present?	Yes ¹	No ²

COUGH AND DIFFICULT BREATHING

3.1	Does the child have cough or difficult breathing?		Yes ¹	No ²
<i>If no cough or difficult breathing skip to diarrhoea</i>				
3.2	For how long? (Record number of days)			
3.3	Counted breaths in one per minute (record number of breaths)			
3.4	Fast breathing		Yes ¹	No ²
3.5	Chest in-drawing		Yes ¹	No ²
3.6	Stridor		Yes ¹	No ²
3.7	Cough classification	Severe pneumonia or very severe disease ¹	Pneumonia ²	Cough or cold ³
3.7	Wheeze		Yes ¹	No ²

If no wheeze skip to diarrhoea

3.9	Has the child had a wheeze before this illness?		Yes ¹	No ²
3.10	Does the child have a frequent cough at night?		Yes ¹	No ²
3.11	Has the child has a wheeze for more than one week?		Yes ¹	No ²
3.12	Is the child a known asthmatic?		Yes ¹	No ²
3.13	Wheeze classification	Recurrent wheeze ¹	Wheeze first episode ²	

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Expert IMCI Practitioner Recording Form- Form 3

HW study No

Child study No

DIARRHOEA

4.1	Does the child have diarrhoea?	Yes ¹	No ²
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If no diarrhoea, skip to fever

4.2	For how long? (record number of days)			
4.3	If more than 14 days, has the child lost weight?	Yes ¹	No ²	Not applicable ³
4.4	Is there blood in the stools?	Yes ¹	No ²	
4.5	Is the child lethargic or unconscious?	Yes ¹	No ²	
4.6	Is the child restless and irritable?	Yes ¹	No ²	
4.7	Is there sunken eyes?	Yes ¹	No ²	
4.8	Offered the child fluid	Drinking poorly ¹	Drinking eagerly thirsty ²	Drinking normally ³
4.9	Pinched the skin of the abdomen	Went back very slowly	Went back slowly ²	Went back normally ³
4.10	Diarrhoea classification #1	Diarrhoea with severe dehydration ¹	Diarrhoea with some dehydration ²	No visible dehydration ³
4.11	Diarrhoea classification #2	Not more than 14 days ¹	Severe persistent diarrhoea ²	Persistent diarrhoea ³
4.12	Diarrhoea classification #3	No blood in the stool ¹	Severe dysentery ²	Dysentery ³

FEVER

5.1	Does the child have a fever?	Yes ¹	No ²
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If no fever skip to ear problem

5.2	For how long? (Record number of days)			
5.3	If more than 7 days, has the fever been present every day	Yes ¹	No ²	Not applicable ³
5.4	Stiff neck or bulging fontanelle	Yes ¹	No ²	
5.5	Fever/ meningitis classification	Suspected meningitis ¹	Fever other cause ²	
5.5	Is there a malaria risk?	Yes ¹	No ²	

If no malaria skip to ear problem

5.6	Malaria classification	Suspected severe malaria ¹	Malaria ²	Possible malaria ³	Fever other cause ⁴
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EAR PROBLEM

6.1	Does the child have an ear problem?	Yes ¹	No ²
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If no ear problem skip to malnutrition

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Expert IMCI Practitioner Recording Form- Form 3

 HW study No

 Child study No

6.2	Is there ear pain?	Yes ¹	No ²
6.3	Is there an ear discharge?	Yes ¹	No ²
6.4	For how long? (Record number of days)		
6.5	Pus draining from the ear	Yes ¹	No ²
6.6	Tender swelling behind the ear	Yes ¹	No ²
6.7	Ear problem classification	Mastoiditis ¹	Acute ear infection ²
		Chronic ear infection ³	No ear infection ⁴

MALNUTRITION

7.1	Has the child lost weight?	Yes ¹	No ²
7.2	Plot weight on growth chart	Very low weight ¹	Low weight ²
		Normal or above ³	
7.3	Curve on growth chart	Losing weight ¹	Poor gain ²
		Good weight gain ³	Could not assess ⁴
7.4	Malnutrition classification	Severe malnutrition ¹	Not growing well ²
		Growing well ³	

FEEDING ASSESSMENT

7.5a	Feeding method <i>If younger than 1 year skip to 8.1</i>	Breast only ¹	Formula ²	Mixed ³ (Breast + other foods/fluids)	Older than 1 year ⁴
7.5b	If older than 1 year		Solids and breastmilk ¹	Solids, no breastmilk ²	Older than 2 years ³

HIV TEST HISTORY

8.1	Has the mother had an HIV test? <i>If no or does not know skip to 8.3</i>	Yes ¹	No ²	Not known ³
8.2a	What was the result? <i>If negative or not known skip to 8.3</i>	Positive ¹	Negative ²	Not known ³
8.2b	If positive has the child been given co-trimoxazole to take every day?	Yes ¹	No ²	Not known ³
8.3	Has the child had an HIV test? <i>If no or does not know skip to HIV infection</i>	Yes ¹	No ²	Not known ³
8.2	What was the result?	Positive ¹	Negative ²	Not known ³

HIV INFECTION

9.1	Pneumonia today	Yes ¹	No ²
9.2	Enlarged lymph nodes in more than one site: Neck, groin, armpit?	Yes ¹	No ²
9.3	An episode of persistent diarrhoea now on in past 3 months	Yes ¹	No ²
9.4	A history of ear discharge now or in the past	Yes ¹	No ²
9.5	Weight is below the third centile	Yes ¹	No ²
9.6	Oral thrush	Yes ¹	No ²
9.7	There is poor weight gain	Yes ¹	No ²
		Could not assess ³	
9.8	Parotid enlargement	Yes ¹	No ²
9.9	HIV classification	Suspected symptomatic HIV	Symptomatic HIV unlikely

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Expert IMCI Practitioner Recording Form- Form 3

HW study No

Child study No

HIV RESULTS

9.10	HIV test done:	Yes ¹	No ²	
	<i>If no, skip to end</i>			
9.12	First rapid test:	Positive ¹	Negative ²	
9.13	Second rapid test:	Positive ¹	Negative ²	
9.14	PCR:	Positive ¹	Negative ²	Not indicated ³
9.15	CD4(Record number):			Not indicated ³

Appendix 10

CLINICAL SIGNS FOR WHO STAGING- FORM FOUR

HW CODE				CHILD CODE			
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COMPLETE THIS FORM FOR ALL CHILDREN WHO HAVE A POSITIVE RAPIDTEST RESULT

1.1	Completed by:		1.2	Date	
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ASK THE MOTHER					
2.1	Has your child had mouth sores in the last 6 months? If no or does not know, skip to q2.3	Yes 1	No 2	Do not know 3	
2.2	If yes, how many times has your child been treated for mouth sores in the last 6 months?	Record number			
2.3	Has your child lost weight? (Weighs less now than s/he did before)	Yes 1	No 2	Do not know 3	
2.4	Has your child <u>ever</u> had shingles?	Yes 1	No 2	Do not know 3	
2.5	Does your child <u>often</u> have ear infections, throat infections or bad colds? If no or does not know, skip to q2.7	Yes 1	No 2	Do not know 3	
2.6	If yes, how many times has your child come to the clinic with an ear infection or cold in the last 6 months?	Record number			
2.7	Has your child <u>ever</u> had diarrhoea that lasted for 2 weeks or longer? If no or does not know, skip to q2.10	Yes 1	No 2	Do not know 3	
2.8	If yes, how many times has this happened in the last six months?	Record number			
2.9	When was the last time?				
2.10	Has your child had a fever for one month or longer? (ever or last 6 months?) If no or does not know, skip to q2.12	Yes 1	No 2	Do not know 3	
2.11	If yes, what was the reason for this?				
2.12	Has your child <u>ever</u> been treated for TB? If no or does not know, skip to q2.15	Yes 1	No 2	Do not know 3	
2.13	If yes, was it pulmonary TB or extrapulmonary TB?	Pulmonary TB 1		Extrapulmonary TB 2	
2.14	Site of extrapulmonary TB	TB Meningitis 1	Miliary TB 2	Abdomen 3	Spine 4
2.15	Has your child <u>ever</u> had to go to hospital with pneumonia? If no or does not know, skip to q2.18	Yes 1	No 2	Do not know 3	
2.16	If yes, how many times has this <u>ever</u> happened?	Record number			
2.17	When was the last time?				
2.18	Has your child ever been in hospital for any other reason? If no or does not know, skip to q3.1	Yes 1	No 2	Do not know 3	
2.19	If yes what was the problem? Check on the card for the diagnosis or ask the mother	Meningitis 1	Empyema 2	Bone infection 3	Joint infections 4
		Other, please specify the details			

Form 4: 05.05.06 1

CLINICAL SIGNS FOR WHO STAGING- FORM FOUR

HW CODE		CHILD CODE		
CHECK THE LYMPH NODES				
3.1	Does the child have palpable lymph nodes in the groin? If no or does not know, skip to q3.3	Yes 1	No 2	Not sure 3
3.2	If yes, which side of the groin? (left / right / both)	Left 1	Right 2	Both 3
3.3	Does the child have palpable lymph nodes in the axillae? If no or does not know, skip to q3.5	Yes 1	No 2	Not sure 3
3.4	If yes, which side of the axillae ? (left / right / both)	Left 1	Right 2	Both 3
3.5	Does the child have palpable lymph nodes in the neck? If no or does not know, skip to q3.7	Yes 1	No 2	Not sure 3
3.6	If yes, which side of the neck? (left / right / both)	Left 1	Right 2	Both 3
CHECK THE WEIGHT				
3.7	Is the weight below the third centile?	Yes 1	No 2	Not sure 3
3.8	Is the weight below the marasmus line?	Yes 1	No 2	Not sure 3
3.9	Is there documented loss of body weight?	Yes 1	No 2	Not sure 3
CHECK THE MOUTH				
3.10	Does the child have angular cheilitis?	Yes 1	No 2	Not sure 3
3.11	Does the child have oral hairy leukoplakia?	Yes 1	No 2	Not sure 3
3.12	Does the child have redness around the edges of the gums? (may be associated with bleeding gums)	Yes 1	No 2	Not sure 3
3.13	Does the child have severe gum disease? (severe pain, spontaneous bleeding and loosening of the teeth)	Yes 1	No 2	Not sure 3
3.14	Does the child have oral thrush? If no or does not know, skip to q3.17	Yes 1	No 2	Not sure 3
3.15	If yes, is the thrush extensive- reaching to the back of the throat?	Yes 1	No 2	Not sure 3
3.16	Does the thrush interfere with the child's swallowing?	Yes 1	No 2	Not sure 3
3.17	Does the child have any other mouth sores? If no or does not know, skip to q3.19	Yes 1	No 2	Not sure 3
3.18	If yes, are these ulcers?	Yes 1	No 2	Not sure 3
CHECK THE SKIN				
3.20	Does the child have papular pruritic eruptions?	Yes 1	No 2	Not sure 3
3.21	Does the child have seborrhoeic dermatitis?	Yes 1	No 2	Not sure 3
3.22	Does the child have extensive molluscum contagiosum?	Yes 1	No 2	Not sure 3
3.23	Does the child have fungal nail infection?	Yes 1	No 2	Not sure 3
3.24	Has the child had herpes simplex infection (cold sores) for more than one month?	Yes 1	No 2	Not sure 3
3.25	Does the child have extensive warts?	Yes 1	No 2	Not sure 3
3.26	Does the child have parotid enlargement?	Yes 1	No 2	Not sure 3
3.27	Does the child have visible severe wasting?	Yes 1	No 2	Not sure 3
3.28	Does the child have hepatosplenomegaly?	Yes 1	No 2	Not sure 3

Form 4: 05.05.06 2

Appendix 11

FACILITY REVIEW – FORM FIVE

1.1	Form completed by			
1.2	Date of visit		1.3	Facility number

All of the following statistics are for the *last full calendar month* that is the last completed month

2.1	What was the last full calendar month?		
2.2	How many children under 5 years have been seen in this facility in the last month? (available from routine clinic stats)		
2.3	How many children were immunised in this clinic in the past month?		
2.3	How many sick children under 5 years have been seen in this facility in the last month? (if possible)		Do not know
2.4	How many sick children under 1 year have been seen in this facility in the last month? (If possible)		Do not know
2.5	How many children under 5 years have been tested for HIV in the past month? (available from the counsellors VCT register)		
2.6	How many children under 5 years have been tested for HIV in the past month? (available from the counsellors PMTCT register)		
2.7	Total number of children under 5 years tested in the past month		
2.8	How many of these children have received their results?		
2.9	How many children under 5 years have tested HIV positive in the last month?		
2.10	How many pregnant women attended for a first antenatal visit in the past month?		
2.11	How many pregnant women have been tested for HIV in the past month?		
2.12	How many of these women have received their results?		
2.13	How many pregnant women tested HIV positive in the past month?		
2.14	How many women enrolled in the PMTCT program in the last month?		
2.15	How many children under 1 year were given a months supply of cotrimoxazole in the past month?		Do not Know ³
2.16	How many HIV exposed children came for follow-up?		Do not Know ³
2.17	Is this clinic doing PCR testing on HIV exposed children at 6 weeks?	Yes 1	No 2
2.18	How many children have had a PCR test in the past month?		
2.19	Can children be referred from this clinic for assessment for ARV treatment?	Yes 1	No 2
2.20	How many children have been referred for ARV treatment in the past month? (if available)		Do not Know ³

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FACILITY REVIEW – FORM FIVE

2.21	How many professional nurses are currently working in this clinic?		
2.22	How many professional nurses have been trained in IMCI?		
2.23	How many professional nurses have had AIDS counselling training?		
2.24	How many professional nurses have been trained in HIV and Infant feeding? (3-day course)		
2.25	How many full-time lay counsellors working in this clinic?		
2.26	How many part-time lay counsellors working in this clinic?		
2.27	How many counsellors provide counselling to carers of children for HIV testing of the child?		
2.28	How many counsellors have been trained in HIV and infant feeding counselling?		
Observe the facility:			
3.1	Are sick children routinely seen in a private area?	Yes 1	No 2
3.2	Are PMTCT services rendered in a separate place to other services?	Yes 1	No 2
3.3	Is nevirapine syrup in stock at the clinic?	Yes 1	No 2
3.4	Is cotrimoxazole syrup in stock at the clinic?	Yes 1	No 2
3.5	Is infant formula in stock?	Yes 1	No 2
3.6	Is infant formula stored where mothers attending the clinic can see it?	Yes 1	No 2
3.7	Are there facilities for demonstrating safe formula feeding? <i>If no, skip to q3.9</i>	Yes 1	No 2
3.8	If yes, are the facilities for demonstrating formula feeding in a private area?	Yes 1	No 2
3.9	Are there support groups for mothers of children with HIV infection in the area served by this clinic?	Yes 1	No 2